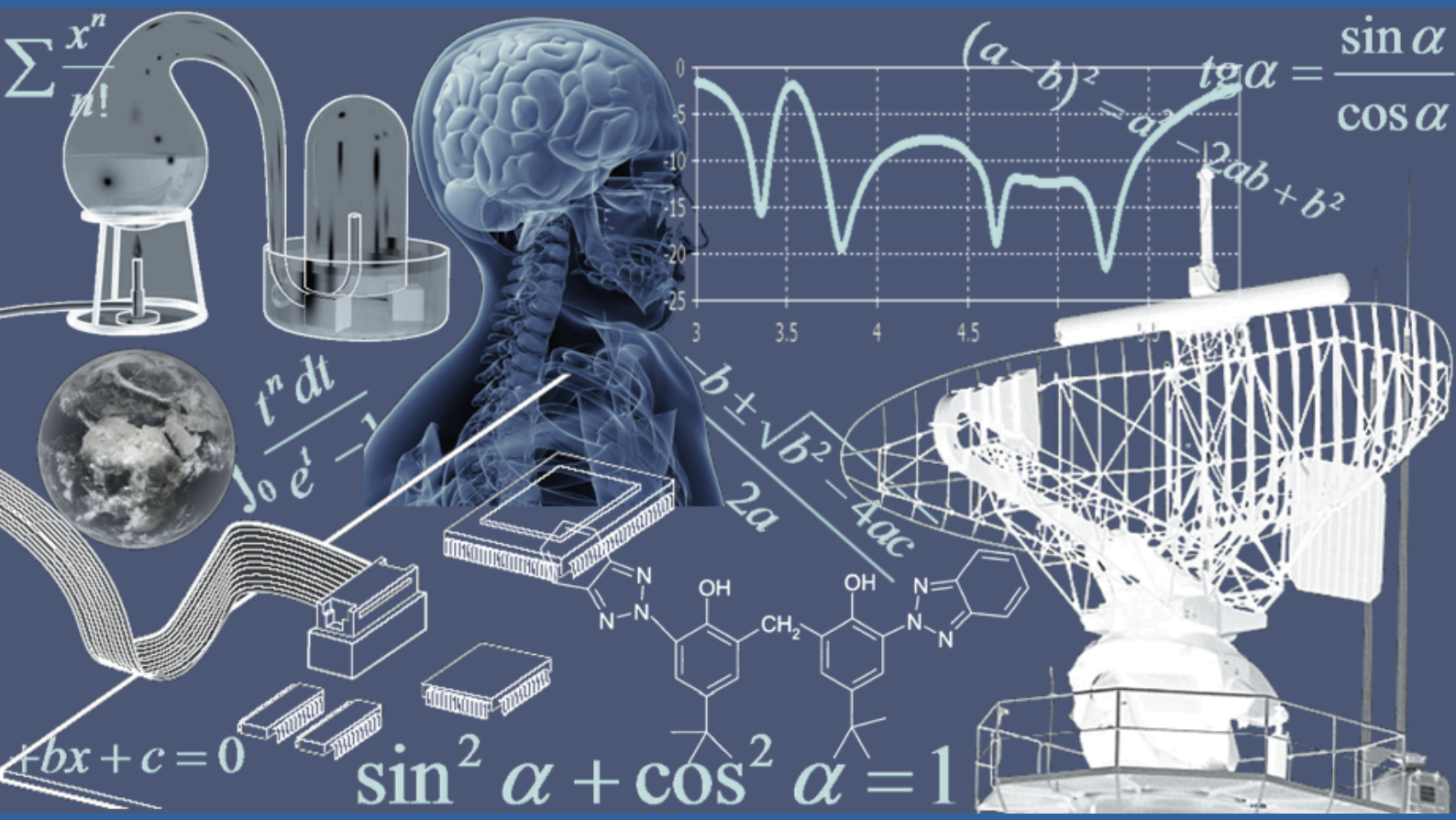
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Table of Contents

A Study on Historical Transformation of the Urban Integration Core of Khulna City, Bangladesh 1410-1417

Istiaque Ahmed, Khandaker Asif Mahmud, and Shaila Islam

Valorisation de l'essence aromatique du Thym (Thymus vulgaris L.) en aromathérapie anti-infectieuse 1418-1431

Mohamed Nadjib Boukhatem, Mohamed Amine Ferhat, Abdelkrim Kameli, Fairouz Saidi, Houria Taibi, and Teffahi Djamel

BER Performance of SFBC - OFDM System with Frequency Domain Equalization for the Nakagami MIMO Fading Channel 1432-1437

Nikita Chalotra, Anshul Sharma, and Divneet Singh Kapoor

Etude de commercialisation de la filière légumes dans la ville de Niamey 1438-1446

Hassoumi Djibo

Electronic and Optical Properties of Reactive Orange 16 azo dye 1447-1454

Hayat Anouar, Elhassan Anouar, Abderrahim El Hourch, and Kacem El Kacemi

COMPARATIVE ANALYSIS OF APPROPRIATENESS OF DRUG INFORMATION GIVEN IN PEDIATRIC FORMULARIES AVAILABLE IN INDIA. Running title: ANALYSIS OFPEDIATRIC FORMULARIES AVAILABLE IN INDIA 1455-1461

Dr. Sneha Agarwal, Dr. Ajita Pillai, and Dr. Bharti N. Karelia

Effet du type de matière grasse alimentaire sur quelques paramètres biochimiques, de croissance et de la semence chez le Canard de Barbarie 1462-1469

F. Djitie Kouatcho, F. C. Nana Nsee, F. Ngoula, J. R. Kana, and A. Teguia

Seismic Performance Assessment of Masonry Infilled Steel Frame Structures 1470-1484

Saim Raza, Muhammad Khubaib Ilyas Khan, Furqan Munir, Waleed Anwar, and Saad Hassan

Effect of Variation of Number of Bays on the Seismic Vulnerability of Masonry Infilled Steel and Reinforced Concrete (RC) frame Structures 1485-1495

Muhammad Khubaib Ilyas Khan, Saim Raza, and Furqan Munir

Identification des Tiques (Acarina-Ixodidae) Parasites des Bovins au Sud-Kivu, République Démocratique Du Congo 1496-1503

Alphonse Bisusa Muhimuzi, B.E. Ombeni, Bisusa Willy Chishibanji, and M.B. Masunga

Virtual Machine Consolidation Challenges: A Review 1504-1516

Amany Abdelsamea, Elsayed E. Hemayed, Hesham Eldeeb, and Hanan Elazhary

La dégradation environnementale et les stratégies de survie dans les campagnes du Nord-Cameroun 1517-1525

Anselme Wakponou and Richard Atimniraye Nyéladé

Performance externe des industries de transformation au Maroc et normes qualité 1526-1532

Rabah Kissami and El Mokhtar Zbair

Screening of Taxillus Tomentosus Ethanolic Extract for Nootropic and Antistress Activity in Rats 1533-1544

S. Silpa, Jamal Uddin, and V. L. Jaya Sekhar

Refusal on Qiyas and Implications for Development Contemporary Islamic Law (Study on the Ibn Hazm Critics to Qiyas) 1545-1553

A. A. Miftah

Factors Affecting Competitiveness of Kenyan Cut Flower in the International Market: A Case Study of Cut-Flower Firms in Nakuru County 1554-1565

Jackline K. Moriasi, Josephine Rotich, Benard Odero Asienyo, and Evelyn Mongina Okao

Étude in silico des effets inhibitrices des Oleuropein, Kaempferol, et Quercetin sur le Protéine VP30 de Ebola Virus 1566-1573

Yassine Kasmi

Study on Cytotoxic Activity of Clerodendrum inerme and Caesalpinia crista by Brine Shrimp Lethality Bioassay 1574-1580

Md. Jalal Uddin, Md. Shamim Akhter, Kazi Mohammed Didarul Islam, and Md. Morsaline Billah

Filter design based on rectangular waveguides 1581-1588
Ahmed Faize, El Mehdi Stouti, Taoufik Ragani, and Salma Gaou

Pictorial Reading Strategy and the Learning of Proverbs and Riddles among Primary School Pupils 1589-1593
Cecilia Omobola Odejobi, H.O. Ajayi, and C.F. Olokunlade

Control Strategy for Safe Descent of Power Assisted Wheelchair on Declining Road Using Regenerative Braking 1594-1603
Mrs. Neha D. Garade, Prof. Mrs. Trupti Wagh, and Dr. Mrs. P. Malathi

Cycle de vie de l'entreprise et veille stratégique 1604-1611
Mohamed Jaouadi

Nutritional and Microbial Analysis of Melon (Citrullus colocynthis Linn) Cake and its Components - A Traditional Snack in South - South Nigeria 1612-1617
Rose U. B. Ebana, Comfort Aloysius Etok, and Uwem Okon Edet

Quelques dimensions d'incohérence de la politique commerciale du Maroc avec ses politiques sectorielles internes 1618-1635
Rachid Hasnaoui and Cheklekbire Malainine

The Response of Al- Quran against to the Previous Scriptures 1636-1644
DR. H. Hadri Hasan

Sentiment Analysis Using Fuzzy Logic 1645-1652
Kashyap Bhansali, Amit Doshi, and Lakshmi Kurup

Towards a socioconstructivist and collaborative Learning Design approach to modeling pedagogical contents used in e-learning: Implementation and experimentation 1653-1668
Abderrahim El Mhouti, Azeddine Nasseh, and Mohamed Erradi

Dynamics of a Nonlinear Automatic Door Closing Torsional Mechanism 1669-1678
Galal A. Hassaan

L'implication des populations riveraines condition essentielle à la gestion durable de la Réserve de Biosphère de la Comoé (RBC) 1679-1695
TKM. Gauze, J. Biemi, and K. Soro

Impact de la Mecreka dans la vie socio-économique et culturelle des agents du Centre de Recherche en Sciences Naturelles (CRSN/Lwiro), RD Congo 1696-1705
Félix Mugisho Maroyi, Théos Badose Musimwa, Willy Chishibanji Bisusa, and Buzenga Matembera

Euclidean distance and HAC methods coupled to FT-MIR spectroscopy as chemometric tool for the authentication of the virgin olive oil 1706-1713
Ilham Houlali, Mohamed Gouskir, Mohammed Boutalline, Abdelouahed Ait Ider, Rachid Bouhdadi, Amine Moubarik, Belaid Bouikhalene, Hassan Chaair, and Mohamed Mbarki

Spatial resource allocation: multi task, multi competences case 1714-1722
Mustapha Ouardouz and Abdes Samed Bernoussi

Elaboration d'un logiciel de simulation du nombre de plateaux théoriques dans une colonne de distillation continue 1723-1734
Abdelkader Hadj Seyd, Touhami Lanez, and Boufatah Babaia

Risk of water erosion in coastal watersheds north of Tetuan (Internel Rif, northern Morocco): Evidences from GIS-based spatial approach 1735-1751
Noaman Akalai, Rachid Hlila, Mohamed El Imran, and Chakib Darraz

Contribution de la géophysique à l'étude structurale et à l'identification des aquifères de fissures dans le Département de Dabakala (Centre-Nord Côte d'Ivoire) 1752-1769
Kouassi Eric Germain Kouakou, Bi V. H. N'guessan, Boko Célestin Sombo, Marc Youan Ta, Derving Baka, and Konan Emmanuel Kouadio

Design of A Compact, Low-Profile, Elliptical Patch UWB Antenna and Performance Analysis in Vicinity of Human Layered Tissue Model for Wireless Body Area Network (WBAN) Applications 1770-1781
Md. Ashif Islam Oni and M. Tanseer Ali

Morphometric Characterization and Molecular Identification of Different Cattle in Some Selected Regions of Bangladesh 1771-1797

Md. Ashrafuzzaman Sapon, Md. Shamim Hossain, and Dr. T.N. Nahar

Epidémiologie de la schistosomiase et des géohelminthiases dans l'Arrondissement de Kékem (Ouest-Cameroun) 1782-1790

Esther Nana Dankoni and L.A. Tchuem Tchuenté

Synthesis of some new substituted azetidinonyl and thiazolidinonyl quinazolon-4(3H)-ones as potential non-steroidal anti-inflammatory and analgesic agents 1798-1813

Deepak Kumar, Roshan Lal, and Sarita Rani

The Relationship between food and cancer 1814-1830

Malika Ghouari

Heavy Metal Contamination Profile of Four Selected Seafoods Harvested on Itu River in the Niger Delta Region of Nigeria 1831-1835

Uwem Okon Edet and Bassey Okon Edet

Synthesis and Optimization of PVA based paper lamination adhesives 1836-1841

Ruhul Amin, Rashedul Alam Adnan, and Md. Rubaiyat Islam

Interaction and association between genetic mutations and clinical risk factors in developing ischemic stroke in Moroccan population 1842-1849

Khalid Balar, Ilham Slassi, Bouchra El Moutawakil, Mariame El Messal, Mustapha El Alaoui Faris, Mohamed Yahyaoui, Saadia Aidi, Ahmed Adlouni, Rachida Habbal, and Sellama Nadifi

Behavioral explanation of beta variation: French market case 1850-1859

Mouna Boujelbene Abbes, Amen Aissi, and Abderrazak Ellouze

Forms of Intimate Partner Violence among Women in the Informal Sector in Nakuru Municipality, Kenya 1860-1867

Lynette A. Onyando, Dolphine A. Odero-Wanga, and Rose A. Mwonya

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A Study on Historical Transformation of the Urban Integration Core of Khulna City, Bangladesh

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ABSTRACT: Khulna is the third largest thriving city of Bangladesh and surrounded by picturesque countryside, winding rivers, and a host of development centers. Since partition of British India in 1947, the city has been growing up as an important complex of trade, commerce and industries. This paper aims to relate the historical transformation of the morphology of the concern city by analyzing the spatial expansion. History reveals that the city arose as a market town on the bank of river Bhairab. At the very beginning of the paper, the Integration core has been tried to identify by analyzing the Master Plan of 1961. After identifying the initial urban core, the Master plan of 1993 & 2009 has been analyzed respectively by using Space Syntax, tool that simulates the likely social effects of urban designs, which has been done with axial analysis. It has been observed that the main Integration Core was initiated by the side of the river bank area as the river transports were the main catalysts for the City. Then with the time it shifted to the Dak-Bangla more/node, and now it has been found that the main vibrant nodal point is the Shib-Bari node.

KEYWORDS: Urban Morphology, Integrated Core, Spatial Expansion, Space Syntax, Axial Analysis.

1 INTRODUCTION

Being the 3rd largest city in Bangladesh, Khulna is often referred to as Industrial City, which is considered as one of the important industrial and commercial areas of the country. The city originated as a market town and array of administration. After the independence, a 'Five-Year Road Plan' was proposed by the government, which had 5,000 miles as a target road. Eventually, 2,000 miles of road was added to the already existing 600 miles by 1951, where we can see emphasizes were given to the water system. The CBD (Central Business District) of Khulna city was found beside the bank of the river Bhairab since the first master plan worked out in 1961. Now it has been determined "Dak-Bangla more/node". But in accordance with the spatial growth with expanding roads, integration core has been linearly shifted. The shift has been obvious from water to road and community to government. Road-based urbanism is still prioritized over water-based urbanism in the Khulna Master Plan. With Calcutta, trade of various goods like sugarcane and tobacco, was developed based on river route during early days. Khulna was declared a municipality in 1884, in 1985 became a railway link, in 1961 district headquarters, and a city corporation in 1984. And during the 1960s industrialization took place.

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1.1 OBJECTIVES

- Identifying the integration core of Khulna City.
- Analyzing the change of the most Integration Route.

1.2 RESEARCH QUESTION

- According to land use what are the economic hubs of the city of Khulna?
- What are the integrated cores of the city?

1.3 EXPECTED OUTPUT

- According to land use what are the economic hubs of the city of Khulna?
- What are the integrated cores of the city?

2 METHODOLOGY

This study has been done with the secondary data and map based because there was no trustworthy resource for the primary data. So, the physical configuration has been emphasized. In terms of expansion of the city and urban rural linkage, the domain of the study of the most integrated route is very concentrated. The current study attempts to trace the pattern of integrated core in Khulna city with most economic hub, with the map of Master Plan (1961), Master Plan (1993) and Master Plan (2009) condition. There were some limitations which made impedance in efficient conducting the study in question:

- This research has been conducted on the secondary materials
- No field survey was taken place.

2.1 CONCEPTUAL FRAMEWORK

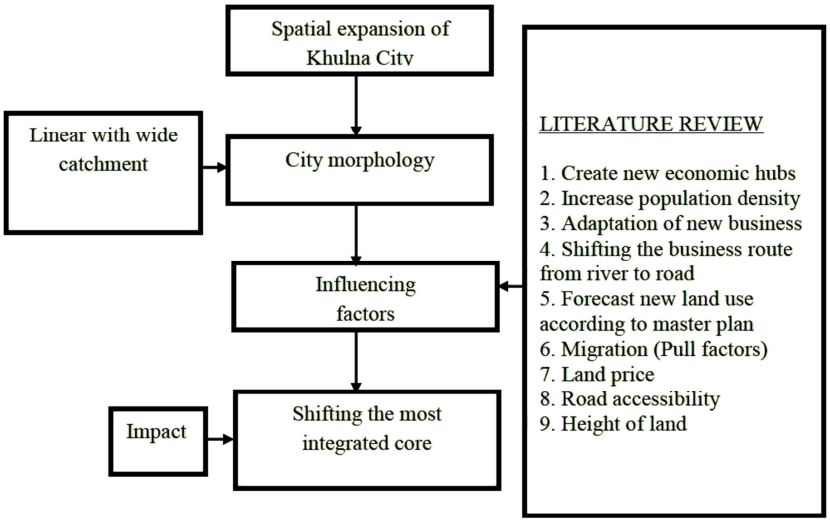


Fig. 1. The Conceptual Framework

Other factors which have great impact such as Migration, Social security, Community services facilities, Economic activities were excluded as the study dealt with only the spatial factors.

2.2 DATA COLLECTION

It is quite obvious that, in any research work, determining a methodology is very much crucial. In general words, a method is a particular procedure to accomplish or approach something and a methodology is a system of methods, a broad framework of systematically arranged various methods and techniques devised to conduct any research work or study. As there was no authentic or verified primary data available, in this particular research work only secondary data has been

collected and used. Like Strategic plan, Spatial growth of Khulna city (KDA), Master plan on land use zoning, Structure plan, and Khulna city corporation ward map, Road map 2009 from Khulna city corporation (KCC) and from literature review demographic, geographical, economical and historical data are collected.

2.3 METHODOLOGICAL FRAMEWORK OF THE STUDY

The detail methodological framework which has been followed to conduct the study is illustrated below where from the very beginning of the problem identification to final paper presentation can be clearly understood.

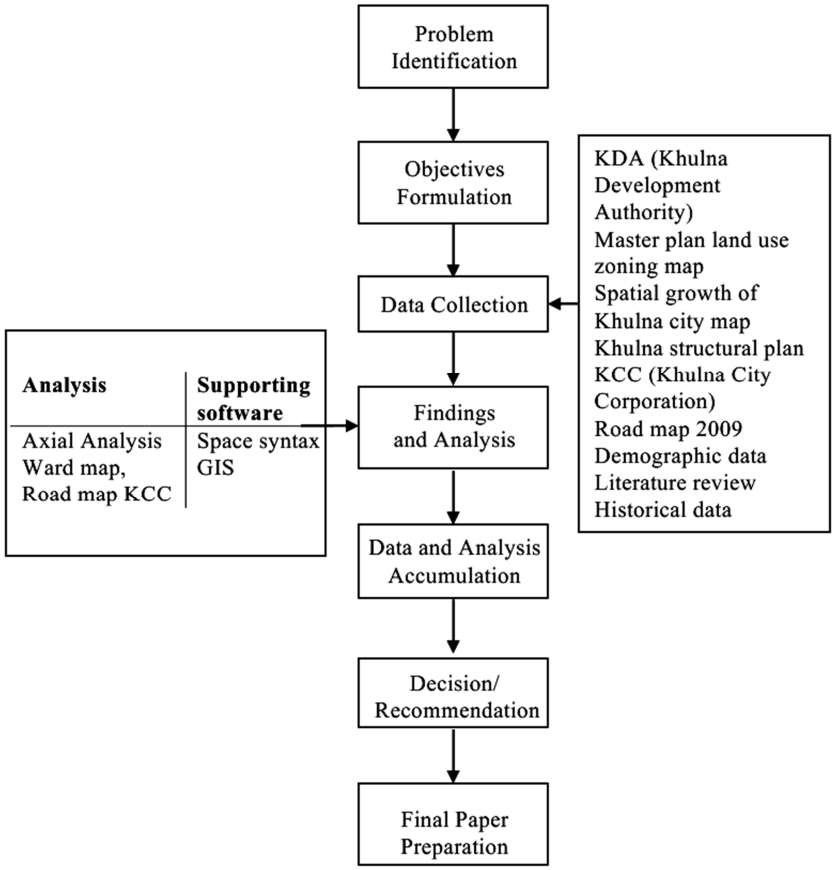


Fig. 2. The Methodological Framework of Study

3 FINDINGS AND ANALYSIS

3.1 CITY DIAGNOSIS

- It is located in the south-west region of Bangladesh with a number of growth centers.
- A good navigable river.
- Economical hub and tourism base of the area.
- Flood-free flat land for development.
- A regional capital with a substantial hinterland.
- Port facilities.
- An existing industrial base.
- Easy accessibility by road.

3.2 PLANNING ISSUES

- Geo-physical condition controls the physical shape of Khulna City. The planning options must respect such circumstances.

- The linkages of Khulna City with other towns and growth centers can make it a most important city in the region.
- Evolution of infrastructure with economic hub - Borobazar (From historical time), Shib-bari node/more (Current town), Zeropoint (Master plan projection), Khalishpur (Industrial area) and the emerging development of Noapara.
- More investment opportunities to be created.
- Institutional strengthening for growth management.
- All the economic hubs has established on the basis of the migrated people of the surrounding hinterland and bus stoppages.

3.3 LAND USE ZONING

According to the master plan, Khulna city was originated from the bank of the river Bhairab. Its development started from south-east portion at the pre-colonial period and "Boro-bzar" was the main CBD and steel now, but city center has been shifted at "Shib-bari node" and "Khalishpur" for industrialization to the north.

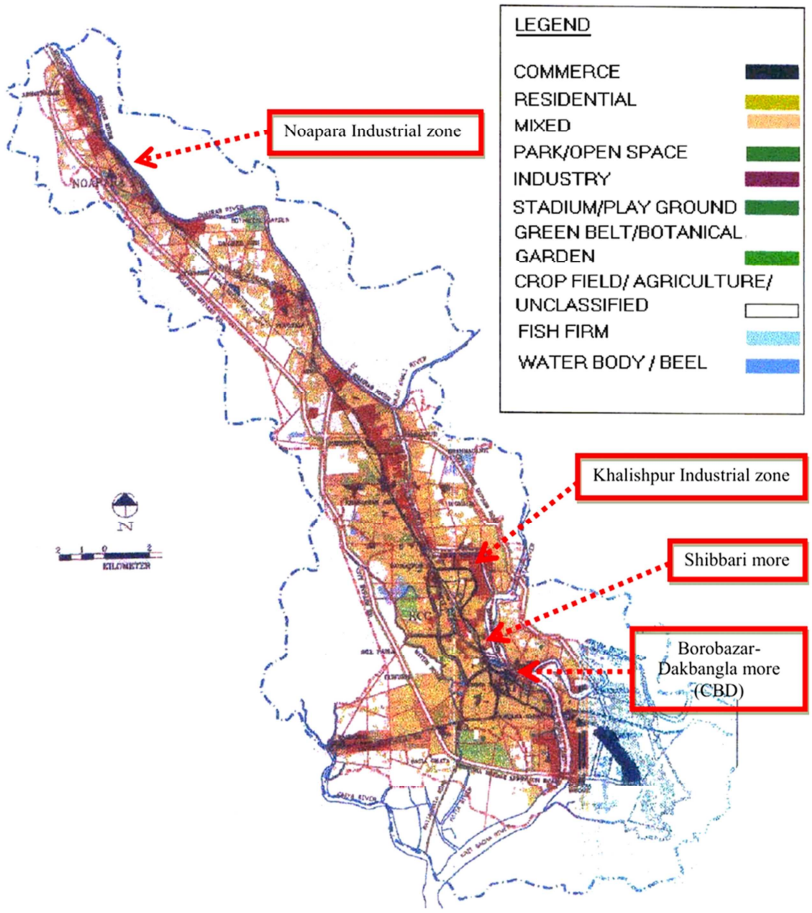


Fig. 3. Khulna Master Plan Land Use Zoning 2010-11 by KDA

- Borobazar-Dakbangla Node/More (CBD): River based trade & commerce shaped the city economy of Khulna. And that is why the city evolved around the river bank locally named "Boro Bazaar", the big market place. The frequent change of the city shaped Boro Bazaar as a mixed use zone rather merely commercial or business zone. For last decade, just to meet the demand of rapid urbanization process Boro Bazaar faced compact unplanned development along with the river side.
- Shib-bari Node/More: Shib-bari node has been developed as a new economic hub. That's why the vibrancy is mentionable here & the top for the present. All the commercial buildings, the Shopping Malls, a 4 star hotel named The City Inn & many other urban institutions have been developed here.
- Khalishpur Industrial Zone: Some prominent industries were established at Khalishpur industrial zone at the Pakistan period by East Pakistan Govt. sector. Then river route was used to transfer their raw materials and finished goods of

those industries. These were mainly jute, newsprint, hardboard mills and beside these industries a significant economic hub was established with markets, bazzar etc. After 1971, road network became prominent to these mills and others commercial sectors for time saving which reached an enormous scale by 2009. So, it is obvious that, the growth pattern of road is directly related with the city economy of Khulna. “Space syntax” shows the transformation of the integrated core has been shifted because of the economic growth of Khulna City.

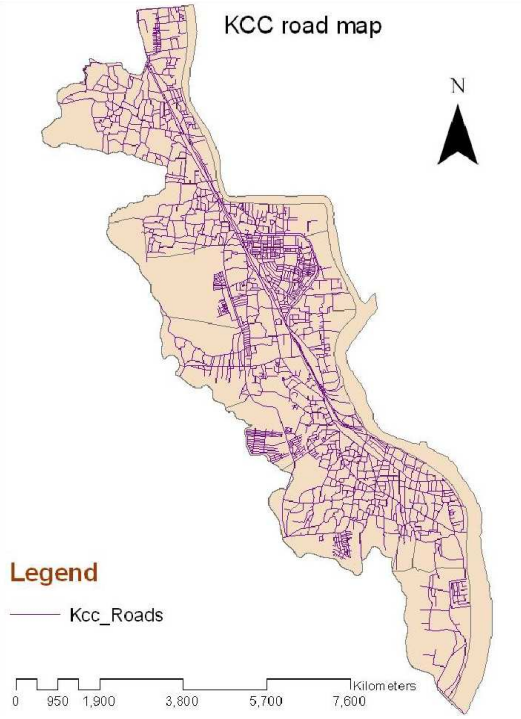


Fig. 4. Existing GIS Road Map of KCC Area, 2009

3.4 ANALYSE THE CHANGE OF THE MOST INTEGRATED ROUTE

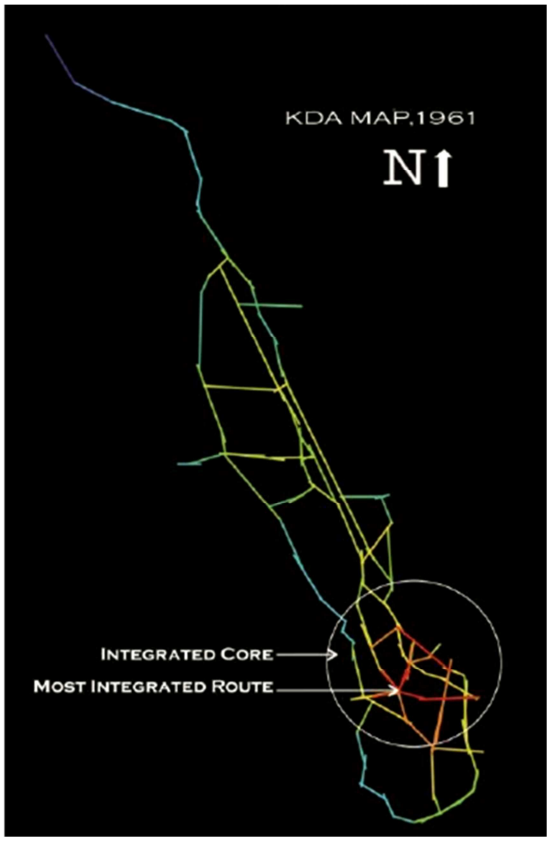


Fig. 5. Axial Analysis of Khulna City Master Plan, 1961

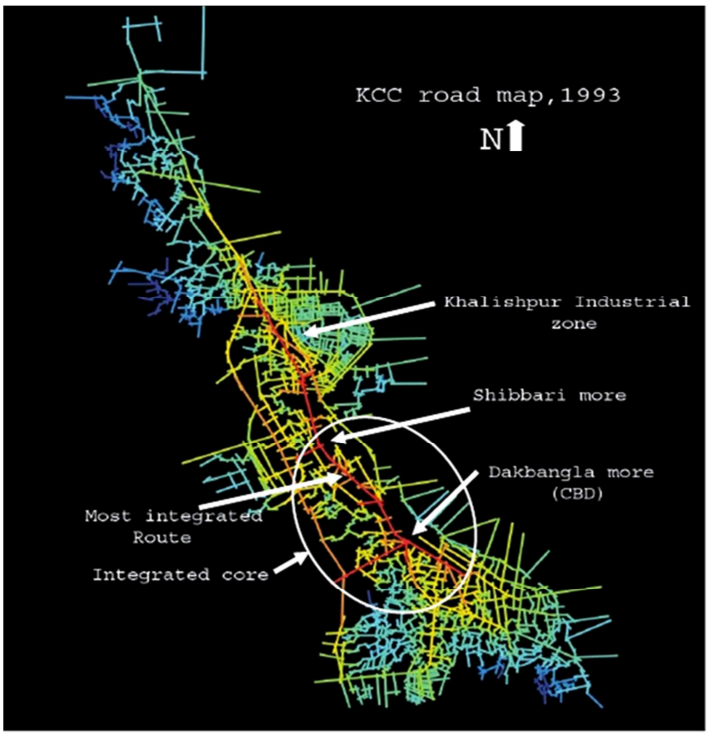


Fig. 6. Axial Analysis of Khulna City Master Plan, 1993

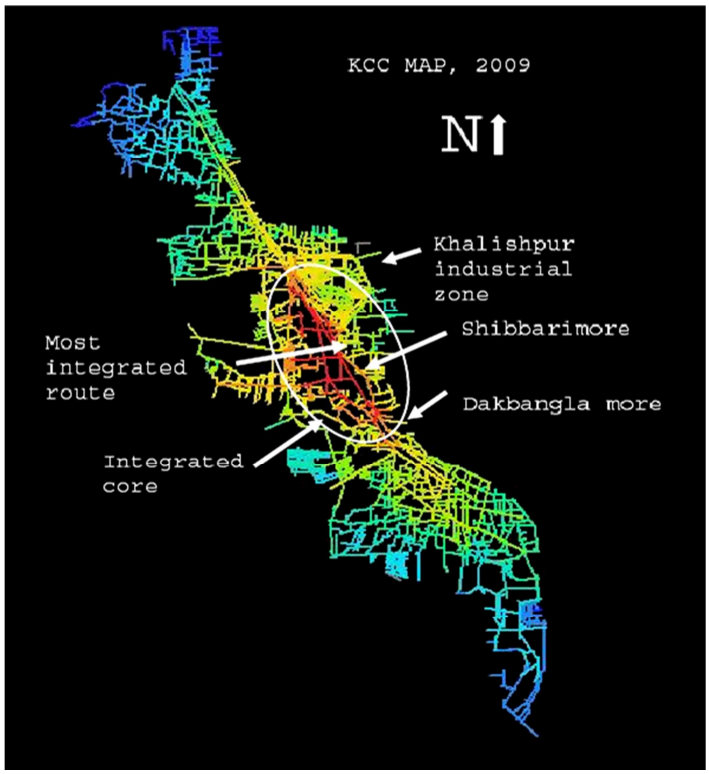


Fig. 7. Axial Analysis of Khulna City Master Plan, 2009

From the Axial Line Analysis it is evident that, the city integrated core, which is running to the north, has shifted from "Dak-bangla" to "Shib-bari node". In the past, Dak-bangla was important for its commercial potentiality and still now it bears the same. At the same time adjacent part of Shib-bari, which is the "Khalishpur industrial area" came out as a new integrated core. As city commerce is going to be established based on the "Jessore road", it has got the similar kind of importance. Here the analysis has been considered on the basis of Global theme (R= n), as the economy of the city is a broad idea.

4 OBSERVATIONS & FINDINGS

As it is clear from the above axial analysis, we can say, Khulna city is heading through a linear way and nearest hinterland are getting attracted for the economic purposes. Also the expansion is going from south-east to north-west, and the economy is heading towards the north. On this basis, it can be predicted that, "Noapara", the second industrial zone, will be the next integration core. Because of the linear city, some roads may be proposed vertically. At the vertical (West side) portion of the linear city, few growth centers and economic hubs may be initiated.

5 CONCLUSION

Mainly Khulna City expanded with its economic growth. Getting the backup strength from the activities in the city periphery, it can be observed that the city is expanding rapidly towards the fringe areas. In the western side of Khulna city the main priority on housing development is Khulna-Jessore by-pass and Khulna University areas. Recently, Khulna City Corporation (KCC) has decided to expand its boundary which will leave an impact in further urban growth. As the business activities are flourishing in the north and north western part, it is very essential to take any initiatives regarding the urban transformation pattern.

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Valorisation de l'essence aromatique du Thym (*Thymus vulgaris* L.) en aromathérapie anti-infectieuse

[Potential application of Thyme (*Thymus vulgaris* L.) essential oil as antibacterial drug in aromatherapy]

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ABSTRACT: To the best of the our knowledge, no methodical reports comparing antibacterial effect (in liquid and vapour phase) of the *Thymus vulgaris* L. essential oil (TVEO) are available. In the present work, we investigated the antibacterial activity of TVEO in order to deduce the opportunity of using TVEO as an antibacterial drug. The extraction of TVEO was obtained by steam distillation. Chemical composition of the TVEO was determined by Gas Chromatography. A total of thirteen compounds were identified. Carvacrol (83.8%) was the major component, followed by cymene (8.15%) and terpinene (4.96%). Antibacterial action of the TVEO against 23 clinically isolated bacterial strains was determined by using agar disc diffusion and vapour diffusion methods at different doses. By disc diffusion method, TVEO showed potent antimicrobial activity against Gram-positive bacteria more than Gram-negative strains and antibiotic discs. The Diameter of Inhibition Zone (DIZ) varied from 25 to 60 mm for *S. aureus*, *B. subtilis* and *E. coli*. However, the results obtained by both agar diffusion and vapour diffusion methods were different. Significantly higher antibacterial effect was observed in the vapour phase at lower doses. *S. aureus* and *B. subtilis* were the most susceptible strains to the oil vapour. Therefore, smaller doses of EO in the vapour phase can be inhibitory to pathogenic bacteria. There is growing evidence that TVEO in vapour phase are effective antiseptic systems and appears worthy to be considered for practical uses in the treatment of human infections or as air decontaminants in hospital. TVEO has considerable antibacterial activity deserving further investigation for clinical applications. Also whilst the mode of action remains mainly undetermined, this experimental approach will need to continue.

KEYWORDS: *Thymus vulgaris*, Antimicrobial drugs, Disc Diffusion, Vapour diffusion, Essential oil, Carvacrol.

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RESUME: L'objectif assigné à notre travail consiste à valoriser la fraction aromatique d'une plante médicinale, le Thym (T*hymus vulgaris* L.), en aromathérapie anti-infectieuse. L'extraction de l'essence aromatique de la partie aérienne fraiche de la plante a été effectuée à échelle industrielle par entrainement à la vapeur d'eau. La détermination de la composition chimique de l'huile essentielle (HE) du Thym, faite par Chromatographie gazeuse-Spectrométrie de masse (CG-SM), a révélé la présence de 13 composés représentant un taux de 85,71%. Le composé majoritaire est le carvacrol avec un taux de (83.8%), suivie par le cymène (8.15%) et *l* terpinène (4.96%). L'étude de l'activité antibactérienne de l'HE a été accomplie par deux méthodes différentes (Aromatogramme et Microatmosphère), sur un large spectre de souches (7 bactéries à Gram+ et 16 à Gram-). En aromatogramme, la fraction terpénique a présenté une activité antibactérienne modérée sur *S. aureus*, *B. subtilis* et *E. coli* avec des Diamètre des Zones d'Inhibition (DZI) variant entre 25 et 60 mm pour la dose de 20 µL. En microatmosphère, l'HE s'est avérée bactériostatique sur un nombre élevé de germes bactériens. Par conséquent, cette fragrance peut servir au traitement et à la désinfection de l'air dans les hôpitaux. Aussi, les souches *S. aureus* et *B. subtilis* ont manifesté une sensibilité majeure avec une inhibition quasi-totale. L'utilisation de cette essence pour lutter contre les infections bactériennes parait pleinement justifiée et laissent entrevoir des perspectives d'application dans le domaine pharmaceutique.

MOTS-CLEFS: *Thymus vulgaris*, Antibactériens, Aromatogramme, Microatmosphère, Huile essentielle, Carvacrol.

1 INTRODUCTION

La thérapeutique des infections microbiennes humaines se base principalement sur l'usage des antibiotiques (ATB) et antifongiques. La prescription, à grande échelle, et parfois inappropriée, de ces agents, a entrainé la sélection des souches résistantes d'où l'importance d'orienter les recherches vers de nouvelles voies et surtout vers les végétaux qui ont toujours constitué une source d'inspiration de nouveaux médicaments [1], [2], [3], [4]. Produites comme métabolites secondaires par les plantes aromatiques, les huiles essentielles (HE) sont toujours utilisées comme substances aromatisantes en parfumerie, en cosmétique ou comme agents antimicrobiens en médecine populaire, en aromathérapie et en industrie alimentaire [5], [6]. Face au problème soulevé depuis plusieurs années par la résistance des bactéries, la seule alternative fiable à l'usage des ATB semble être celle des HE. Connue de façon empirique depuis des siècles, leur efficacité anti-infectieuse a été scientifiquement démontrée *in vitro* et *in vivo* [7], [8]. De nombreuses études traitent de l'activité antimicrobienne des essences aromatiques, qu'elles soient citées dans des ouvrages, dans des journaux spécialisés de microbiologie ou présentées lors de congrès d'aromathérapie scientifique. De nombreux travaux, essentiellement de laboratoire, sont venus renforcer ces résultats, expliquer les modes d'actions de certains de leurs composants. Depuis, l'utilisation de ces molécules terpéniques s'est développée jusqu'à devenir depuis plus d'une vingtaine d'années, une sérieuse alternative à la médecine des ATB dans les pathologies infectieuses [1], [9].

L'étude de ces essences aromatiques est toujours d'une brûlante actualité malgré son ancienneté et les développements exponentiels de domaines tels que la pharmacognosie et la microbiologie. Cela tient principalement au fait que le règne végétal est une source présumée inépuisable d'une immense variété de médicaments potentiels, tout en étant accessible, y compris dans les pays en voie de développement. De plus, cette science évolue et s'affine sans cesse avec l'amélioration des instruments d'investigation et de l'accès à l'information scientifique [10]. Cette dernière perspective permet d'élargir le champ de valorisation des Plantes Aromatiques et Médicinales (PAM), (autrefois restreint du point de vue économique, à l'extraction de molécules olfactives), par l'exploitation des nombreuses et diverses activités biologiques, substantiellement évoquées par la médecine traditionnelle et corrélées à certains types de structures chimiques [11], [12], [13], [14].

En outre, l'Algérie, de par sa position géographique, jouit de plusieurs facteurs de pédogenèse et de grandes variations climatiques à laquelle s'ajoutent les ressources hydriques, tous favorables au développement des cultures intensives des PAM. De même, rares sont les cultures des plantes à parfum qui ont fait l'objet d'études scientifiques très approfondies [12] [15]. Malheureusement, le thym, de la famille des Lamiacées, est un exemple éloquent d'espèce qui n'échappe pas à cette règle. Toutes ces considérations nous ont amené à envisager des possibilités de valorisation de la fraction terpénique des thyms odorants en aromathérapie anti-infectieuse, en vue d'offrir une alternative aux ATB. Ce dernier travail fait apparaître des molécules « aromatiques des activités biologique et pharmacologique intéressantes [16], [17], [18], [19].

De ce fait, l'objectif assigné à notre travail consiste à étudier le pouvoir antibactérien de l'essence du Thym, au demeurant très peu exploitée dans les domaines bioactives » issues d'une plante à parfum, le thym (*Thymus vulgaris* L.), référencée par la médecine traditionnelle et supposant ainsi pharmaceutiques et agro-alimentaire malgré ses immenses potentialitées thérapeutique et antiseptique [20], [21]. Aussi, plusieurs méthodes microbiologiques et approches techniques ont été examinées lors de cette étude. L'évaluation de l'activité inhibitrice de l'essence en phases liquide (aromatogramme)

et vapeur (microatmosphère) a été effectuée en comparaison avec des ATB. En outre, la composition chimique de l'huile a été déterminée par Chromatographie en phase Gazeuse couplée à la Spectrométrie de Masse (CG-SM) afin d'établir le profil chromatographique et le chémotype de l'essence de cette plante à parfum.

2 MATERIEL ET METHODES

2.1 MATÉRIEL VÉGÉTAL ET HUILE ESSENTIELLE

L'huile essentielle de Thym (*Thymus vulgaris*) a été fournie auprès de la société « Extral-Bio® » de production des huiles essentielles et cosmétiques Bio, sise à Chiffa (Blida, Algérie). L'HE a été extraite à partir de la parie aérienne fraiche de la plante (tige et feuilles) au mois de Mai 2012. En outre, l'identification botanique de la plante a été faite antérieurement au niveau du conservatoire du Jardin d'Essais d'El-Hama (Alger). Le procédé d'extraction utilisé est l'entrainement à la vapeur d'eau conduit à échelle industrielle (**Figure 1**). Dans la distillerie Extral-Bio®, les huiles sont extraites, par distillation sous pression à la vapeur d'eau, des feuilles et des branches terminales dans un système classique d'extraction constitué par :

- Un alambic en acier inoxydable, de capacité de 2000 litres, qui comporte une grille pour la matière première ; le chauffage de l'alambic se fait par la vapeur provenant d'une chaudière ;
- Un chapiteau où circule le mélange vapeur eau-essence pour aller vers la partie suivante ;
- Un réfrigérant ou condenseur à serpentin horizontal avec une légère inclinaison ;
- Un essencier ou un vase florentin où l'HE se sépare de l'hydrolat par différence de densité.

Autrement dit, un alambic de 2 m^3 de volume utile aurait la capacité de charge de 600 kg de matériel végétal. La vapeur condensée obtenue conduit à deux phases :

- une phase huileuse (HE) qui est séparée de l'eau par simple décantation et à laquelle on ajoute du sulfate de magnésium ($MgSO_4$) pour éliminer les traces d'eau. La quantité d'HE obtenue est alors pesée pour le calcul du rendement.
- une phase aqueuse (eau aromatique ou hydrolat) qui contient une quantité non négligeable d'essence, soit sous forme solubilisée ou sous forme de fines gouttelettes dispersées.

Aussi, l'HE est certifiée « 100 % naturelle » car n'ayant été additionnée ou mélangée à aucun solvant organique durant la phase de production. Elle est aussi certifiée « Biologique » car provenant d'une culture de Thym où aucuns engrais ou pesticides chimiques n'ont été appliqués durant la phase de culture. L'essence a été conservée dans des flacons stériles teintés, à 4 °C et à l'abri de l'air et de la lumière, pendant toute la durée de notre travail et ce pour éviter d'éventuels phénomènes d'oxydation ou de contamination.

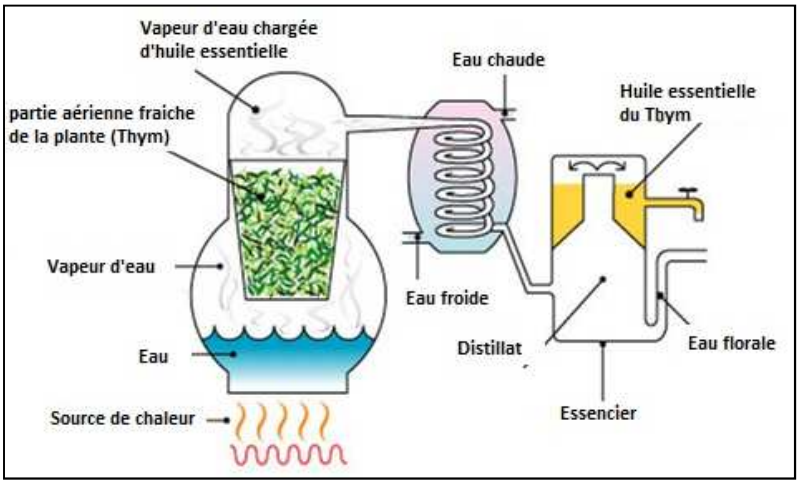


Fig. 1. Schéma de distillation des huiles essentielles à échelle industrielle par entrainement à la vapeur d'eau.

2.2 SOUCHES MICROBIENNES ÉTUDIÉES

Pour mettre en évidence le pouvoir antibactérien de la fraction aromatique distillée du thym, un total de 23 souches microbiennes ont été utilisées (7 bactéries à Gram+ et 16 à Gram-) (**Tableau 1**). Certaines souches sont de référence ATCC (American Type Culture Collection) lors que d'autres ont été isolées cliniquement. Toutes les souches ont été isolées et identifiées au niveau du laboratoire de bactériologie de l'hôpital de Boufarik et celui du laboratoire d'hygiène de Blida

(Algérie). Ces bactéries ont été conservées et maintenues en vie, par des repiquages continus, sur des milieux de culture adéquats.

Tableau 1 : Souches bactériennes utilisées pour l'évaluation de l'activité antimicrobienne.

Souches bactériennes	Origine	Souches bactériennes	Origine
Bactéries à Gram +		**Bactéries à Gram -**	
Stapthylococcus aureus	ATCC 6538	*Pseudomonas aeruginosa* (Pa1)	ECBU
Staphylococcus aureus (Sa1)	ECBU	*Pseudomonas aeruginosa* (Pa2)	ATCC 9027
Staphylococcus aureus (Sa2)	Pus	*Pseudomonas aeruginosa* (Pa3)	ECBU
Staphylococcus aureus (Sa3)	ECBU	*Escherichia coli* (Ec1)	ATCC 4157
Staphylococcus aureus (Sa4)	Hémoculture	*Escherichia coli* (Ec2)	ECBU
Enterococcus sp.	Hémoculture	*Escherichia coli* (Ec3)	Infection urinaire
Bacillus subtilis	ECBU	*Escherichia coli* (Ec4)	ECBU
		Klebsiella pneumoniae (Kp1)	Pus
		Klebsiella pneumonia (Kp2)	Infection urinaire
		Klebsiella terrigena	ECBU
		Proteus mirabilis	ECBU
		Citrobacter sp.	ECBU
		Serratia sp.	Pus
		Acinetobacter baumanii	Hémoculture
		Salmonella typhi (St1)	Coproculture des selles
		Salmonella typhi (St2)	Coproculture des selles

ATCC : American Type Culture Collection ; ECBU: Examen cytobactériologique des urines.

2.3 MILIEUX DE CULTURE

Suivant les méthodes employées et selon les souches en question, nous avons utilisé des milieux de culture solides, en l'occurrence la gélose Trypticase Soja Agar (TSA) et Muller-Hinton (MHA) pour les bactéries. Aussi, des milieux de culture sélectifs ont été utilisés (gélose Chapman et gélose Hecktoen). Tous ces milieux de culture proviennent de l'Institut Pasteur d'Algérie (IPA, Alger) et de l'unité Antibiotical de Saidal (Médéa). Et afin de mener une étude comparative du pouvoir antibactérien de l'essence du Thym odorant avec des produits de références, des disques d'Antibiotiques (ATB) (Bio-Rad, France) ont été utilisés comme témoins positifs. Les ATB utilisés sont les suivants : Kanamycine (K, 30 µg), Triméthoprime (TMP, 5 µg), Ticarcilline (TIC, 75 µg), Chloramphénicol (C, 30 µg), Acide Fusidique (FA, 10 µg), Erythromycine (E, 15 µg), Ampicilline (AMP, 10 µg), Ciprofloxacine (CIP, 5 µg), Céfotaxime (CTX, 30 µg), Acide nalidixique (NA, 30 µg), Rifampicine (RA, 5 µg), Imipénème (IMP, 10 µg), Gentamicine (GM, 10 µg), Oxacilline (OX, 5 µg), Céfoxitine (FOX, 30 µg), Vancomycine (VA, 30 µg) et Tétracycline (TE, 30 µg).

2.4 DETERMINATION DE LA COMPOSITION CHIMIQUE DE L'HUILE ESSENTIELLE

L'élaboration du profil chromatographique de l'essence aromatique distillée du Thym a été réalisée selon les normes AFNOR (NF ISO 11024-1 : 1999). Les analyses chromatographiques ont été effectuées sur un Chromatographe en Phase Gazeuse (CPG) à régulation électronique de pression, de type Hewlett Packard (série HP 6890, Palo Alto, Californie, USA), équipé d'une colonne capillaire HP-5MS (30 m x 0.25 mm) avec une épaisseur de film de 0.25 µm, un détecteur FID réglé à 280 °C et un injecteur *split-splitless*. Le mode d'injection est *split*. Le gaz utilisé est l'azote avec un débit de 1.7 $mL.min^{-1}$. La température de la colonne est programmée de 45 à 240 °C à raison d'une montée de 2 $°C.min^{-1}$. L'appareil est piloté par un système informatique de type « HP Chem Station », gérant le fonctionnement de l'appareil et permettant de suivre l'évolution des analyses chromatographiques. L'identification des constituants a été réalisée en se basant sur leurs Indices de Kovats (IK) et sur la Chromatographie en Phase Gazeuse couplée à la Spectrométrie de Masse (CG-SM). Cette dernière est réalisée sur un CPG de type Hewlett-Packard (série HP 6890) couplé avec un Spectromètre de Masse (série HP 5973). La fragmentation est effectuée par impact électronique sous un champ de 70eV. La colonne utilisée est une colonne capillaire HP-5MS (30 m x 0.25 mm), l'épaisseur du film est de 0.25 µm. La température de la colonne est programmée de 45 à 240 °C à raison de 2 $°C.min^{-1}$. Le gaz vecteur est l'hélium dont le débit est fixé à 1.2 $mL.min^{-1}$. Le mode d'injection est *split* (rapport de fuite : 1/20). L'appareil est relié à un système informatique gérant une bibliothèque de spectre de masse (Wiley7, NIST 2002). L'identification des constituants est basée sur la comparaison de leurs spectres de masse (CG/SM) respectifs avec les spectres de la bibliothèque et de la bibliographie [22] et sur la base de calcul des Indices de Rétention (IR). L'IR d'un composé A est

indépendant du débit, de la longueur de la colonne et de la quantité injectée. L'IR d'un composé A dépend de la phase stationnaire et de la température. Les IR sont calculés comme suit :

$$\mathbf{IR} = 100\mathrm{n} + \left[\frac{\mathrm{TR\ c} - \mathrm{TR\ n}}{\mathrm{TR}\ (n+1) - \mathrm{TR\ n}}\right] \mathrm{x}\ 100$$

n : Nombre d'atomes de carbone de l'alcane élué avant le composé ;
TR c : Temps de Rétention du composé ;
TR n : Temps de Rétention de l'alcane à n atomes de carbone élué avant le composé ;
TR (n+1) : Temps de Rétention de l'alcane à n+1 atomes de carbone élué après le composé.

2.5 EVALUATION DE L'ACTIVITE ANTIBACTERIENNE *IN VITRO*

La recherche de l'activité antibactérienne consiste à estimer le degré d'inhibition de la croissance des germes soumis à l'essence aromatique du Thym. Pour cela, deux méthodes qualitatives ont été examinées lors de ce screening antibactérien.

2.5.1 METHODE DE L'AROMATOGRAMME (TECHNIQUE EN MILIEU SOLIDE)

Cette méthode, adoptée par certains auteurs [23], [24], [25], est la technique que nous avons utilisée pour évaluer, dans un premier temps, l'activité antibactérienne de l'HE. Elle est basée sur une technique utilisée en bactériologie médicale, l'antibiogramme. Cette méthode repose sur le pouvoir migratoire des HE sur un milieu solide à l'intérieur d'une boîte Pétri. Elle nous permet de mettre en évidence l'effet antibactérien de l'HE et en déduire ainsi la résistance ou la sensibilité de ces bactéries vis-à-vis de cet extrait aromatique. Dans cette méthode (**Figure 2**), nous avons utilisé des disques de 9 mm de diamètre (Antibiotica-Testblattchen, Schleicher & Schuell, D-3354, Dassel, Allemagne). Ces disques sont mis dans un tube à essai, stérilisés à l'autoclave, puis stockés à une température ambiante. Le disque sera déposé au centre d'une boite Pétri contenant un milieu gélosé préalablement ensemencé par une souche bactérienne. L'étude du pouvoir antibactériien par cette technique est identique à celui de l'antibiogramme. La seule différence réside dans le remplacement des antibiotiques (ATB) par des extraits aromatiques. Dans notre étude, nous avons testé l'activité inhibitrice de l'HE en imprégnant les disques, séparément, par 3 doses croissantes à savoir 20, 40 et 60 µL d'HE par disque. Ceci a été fait dans le but d'apprécier l'action « dose-dépendante » de l'HE sur l'inhibition de la croissance des germes bactériens. De même, la suspension microbienne a été standardisée à 10^8 UFC.mL^{-1} (0.5 Mc Farland pour les bactéries) et bien homogénéisée (vortex) avant son ensemencement sur le milieu gélosé adéquat (TSA ou MHA). Chaque boite Pétri est ensuite fermée et incubée dans l'étuve à température adéquate (37 °C pendant 24-48h). L'essence diffuse à partir du disque au sein de la gélose et y détermine un gradient de concentration. Les bactéries croissent sur toute la surface de la gélose sauf là où elles rencontrent une concentration d'essence aromatique suffisante qui inhibe leur croissance. A la sortie de l'étuve, l'absence de la croissance bactérienne se traduit par un halo translucide autour du disque et dont le Diamètre de la Zone d'Inhibition (DZI) est mesuré et exprimé en millimètres (mm). Plus le DZI est grand, plus la souche est sensible à l'HE. Ainsi, la souche microbienne sera classée comme étant sensible, intermédiaire ou résistante vis-à-vis de l'HE**.** Aussi et pour chaque souche microbienne, des témoins positifs ont été réalisés en appliquant, dans les mêmes conditions citées précédemment, des disques d'ATB qui vont servir comme référence afin de comparer leur pouvoir antibactérien avec notre échantillon d'HE. A cet effet, plusieurs disques d'ATB ont été utilisés.

2.5.2 METHODE EN PHASE VAPEUR (MICROATMOSPHERE)

Nous avons utilisé cette méthode dans le but d'apprécier les propriétés bactéricide de la phase volatile de l'HE. Cette méthode (**Figure 3**) est rarement citée car les auteurs qui se sont penchés spécifiquement sur l'activité de la phase gazeuse sont encore peu nombreux [25]. La différence entre cette méthode et l'aromatogramme réside principalement dans la position du disque imprégné. Ce dernier est déposé au centre du couvercle de la boîte Pétri, renversée pendant la durée de l'expérience. Celui-ci n'est donc plus en contact avec le milieu gélosé. De la même manière que l'aromatogramme, nous avons appliqué 3 doses croissantes en HE. En 1er lieu, une quantité de 20 µL d'HE a été déposée sur un disque de papier filtre de 9 mm de diamètre. Dans le 2ème essai, un disque de 20 mm a été imprégné par 40 µL d'HE alors que pour le dernier, un disque de 30 mm a été chargé par 60 µL d'HE. Le diamètre du disque diffère selon la quantité d'HE à imprégner afin d'obtenir un bon étalement et, par conséquent, une meilleure évaporation de l'HE. La préparation de l'inoculum, l'ensemencement, l'incubation et la lecture des résultats ont été menés de la même manière que la première méthode (Aromatogramme). La boîte est fermée avec le couvercle en bas et mise à l'étuve à température adéquate. Il se produit alors une évaporation des substances qui, en contact avec les germes ensemencés sur la gélose, va inhiber leur croissance. A la sortie de l'étuve,

l'absence de la croissance bactérienne se traduit par une zone translucide sur la gélose, de contour plus ou moins nette et à tendance circulaire. Une boîte de contrôle, réalisée pour chaque expérience, est une boite ensemencée dont le disque déposé au centre de la gélose n'est pas imbibé d'HE. Une autre boite témoin est ensemencée dans les conditions de l'expérience, sans disque. Elle nous renseigne sur l'homogénéité du tapis bactérien.

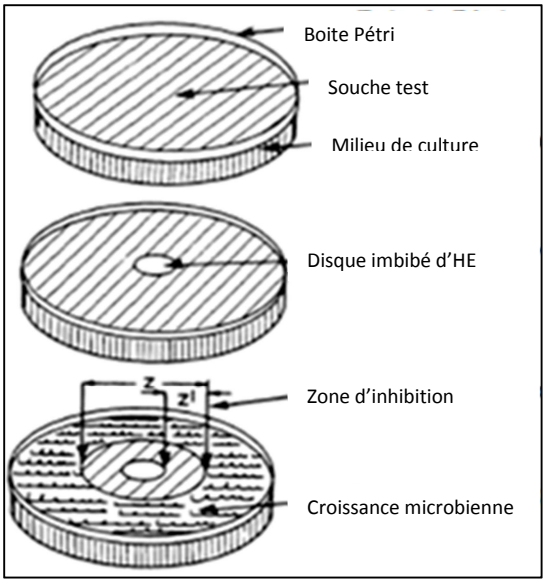


Fig. 2. Illustration de l'aromatogramme [26]

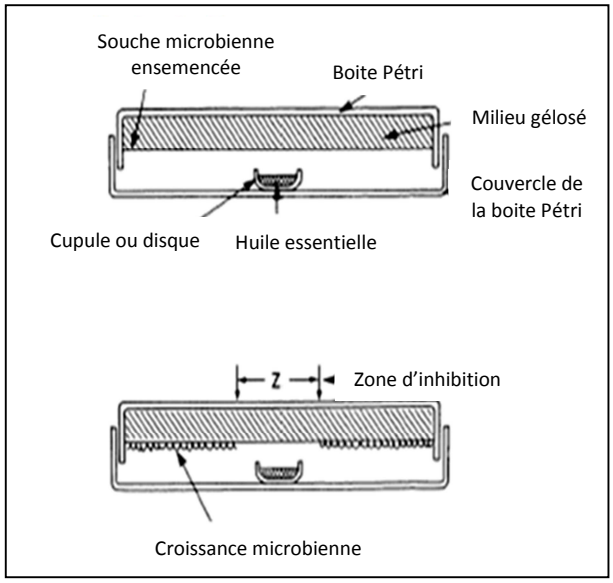


Fig. 3. Illustration de la méthode de Microatmosphère [26]

3 RESULTATS ET DISCUSSION

3.1 ETUDE ANALYTIQUE DE L'HUILE ESSENTIELLE

3.1.1 CARACTÉRISTIQUES ORGANOLEPTIQUES

Les propriétés organoleptiques et chimiques constituent un moyen de vérification et de contrôle de la qualité de l'HE. Nos essais sont déterminés selon un protocole précis et obéissent à des normes édictées par l'AFNOR. Les paramètres organoleptiques de notre HE du Thym sont en accord avec ceux répertoriés dans les normes en vigueur [27] (**Tableau 2).**

Tableau 2 : Propriétés organoleptiques de l'essence aromatique du Thym

Caractéristiques organoleptiques	Notre étude (2014)	**AFNOR** [27]
Aspect	Liquide mobile	Liquide mobile
Couleur	Brun clair	Couleur traditionnellement allant du brun au brun-rouge
Odeur	Caractéristique, aromatique et légèrement épicée	Odeur caractéristique aromatique, phénolique (thymol) avec un fond légèrement épicé

3.1.2 DETERMINATION DU PROFIL CHROMATOGRAPHIQUE DE L'HUILE ESSENTIELLE

« Le chemin qui mène de la plante à ses constituants purs est très long » [10]. Cette affirmation démontre, à elle seule, l'importance d'une prise en charge rationnelle du matériel végétal dès qu'il a été sélectionné pour une investigation phytochimique approfondie. L'huile essentielle du Thym, extraite à échelle industrielle par entrainement à la vapeur sous pression, a été analysée d'abord par Chromatographie en Phase Gazeuse avec un Détecteur d'Ionisation à Flamme (CPG-FID) afin de déterminer son profil chromatographique. Pour une identification plus exhaustive des composés aromatiques, l'HE a été analysée par Chromatographie Gazeuse couplée à la Spectrométrie de Masse (GC/MS). Les résultats de cette analyse sont consignés dans le **Tableau 3**. Les différents composés ont été listés selon leurs Indices de Rétention (IR). Au total, 13 composés ont été détectés. L'essence aromatique du Thym est composée majoritairement du carvacrol (83.8%). D'autre

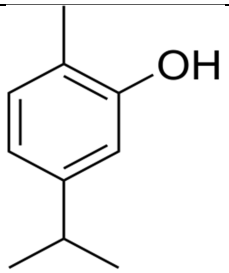
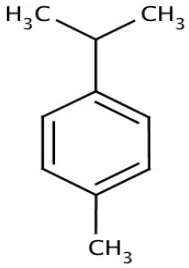
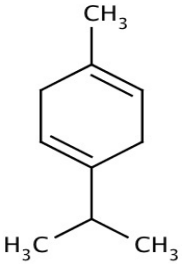
part, la teneur des autres composés varie entre (0.01 – 0.28%) sauf pour *para*-cymène (8.15%), linalool (1.44%) et *gamma*-terpinène (4.96%) (**Tableau 4**). La composition chimique de l'huile essentielle du Thym révèle que celle-ci est caractérisée par de très fortes teneurs en monoterpènes oxygénés (85.52%) que alors les monoterpènes hydrocarbonés sont présents en faibles quantités (13.5%).

Tableau 3 : Composition chimique de l'huile essentielle du Thymus vulgaris.

N°	Composés	%	IR
	Monoterpènes hydrocarbonés	**13,5**	
1	*α*-Terpinène	0,28	1019
2	*p*-Cymène	8,15	1028
3	*trans*-Ocimène	0,11	1052
4	*γ*-Terpinène	4,96	1065
	Monoterpènes Oxygénés	**85,52**	
5	Linalool	1,44	1123
6	Terpin-4-ol	0,05	1179
7	Thymol	0,23	1302
8	Carvacrol	83,8	1318
	Sesquiterpènes	**0,13**	
9	Aromadendrène	0,06	1439
10	*α*-Humelène	0,03	1454
11	*γ*-Cadinène	0,01	1513
12	*δ*-Cadinène	0,03	1542
	Autres composés oxygénés	**0,19**	
13	Carvacrol méthyle éther	0,19	1282
	Composés Oxygénés totaux	**85,71**	
	Composés non Oxygénés totaux	**13,63**	

EVE : Entrainement à la vapeur d'eau ; RI : Indice de Rétention sur colonne apolaire HP-5MS.

Tableau 4. Structure chimique des composés majoritaires identifiés dans l'essence aromatique du Thymus vulgaris.

Structures			
Nomenclatures	Carvacrol	*p*-cymène	*γ*-terpinène
Synonymes	2-methyl-5-(propan-2-yl) phenol	4-Isopropyltoluene	4-methyl-1-(1-methylethyl)-1,4-cyclohexadiene
Formules moléculaires	$C_{10}H_{14}O$	$C_{10}H_{14}$	$C_{10}H_{16}$

Des résultats similaires aux nôtres ont été rapportés par plusieurs auteurs [19], [21]. Ces derniers indiquent que l'essence aromatique du Thym odorant présente un taux élevé en phénol. Ils exposent aussi que des monoterpènes hydrocarbonés (*p*-cymène et terpinène) sont également présents avec une quantité appréciable.

Par ailleurs, d'autres résultats sont en totale contradiction avec les nôtres [18], [28]. Des travaux de recherche ont montré que la composition chimique des HE est très fluctuante. En effet, elle dépend d'un grand nombre de facteurs d'ordre naturel (génétique, localisation, maturité, sol et climat) ou technologiques (mode de culture ou d'extraction). Du lieu où poussent les

Lamiacées dépendra la composition biochimique de leur essence et déterminera donc le chémotype, la spécificité de l'huile et les propriétés thérapeutiques. Tous ces paramètres étant influencés par les conditions édaphiques et climatiques ainsi que les pratiques culturales [11], [18], [29]. Toutes ces observations montrent les difficultés que l'on peut rencontrer lors de la préparation et de la conservation des métabolites secondaires volatiles. Aussi, pour assurer la qualité de celles-ci, il est donc nécessaire de définir et de contrôler tous les paramètres depuis la culture du végétal jusqu'à l'obtention du produit final [10].

3.2 SCREENING ANTIBACTÉRIEN DE L'HUILE ESSENTIELLE

L'activité antibactérienne de l'HE du Thym a été réalisée, *in vitro,* sur des souches bactériennes de référence ou isolées cliniquement. Au total, 23 bactéries ont été étudiées (7 à Gram+ et 16 à Gram-). Les résultats de ce screening sont rapportés dans les **Tableau 5.** A noter que le diamètre du disque (9 mm) a été inclus dans le calcul de la zone d'inhibition.

Tableau 5 : Résultats de l'activité antibactérienne de l'huile essentielle du Thym

	Méthodes microbiologiques						
	Aromatogramme			**Microatmosphère**			**Disques d'antibiotiques (ATB)**
	Quantité HE (µL/disque)			**Quantité HE (µL/disque)**			
Bactéries	**20**	**40**	**60**	**20**	**40**	**60**	
DZI pour les bactéries à Gram -							
E. coli ATCC (Ec1)	30	40	45	55	65	70	C = R; E = R; FA = R
E. coli (Ec2)	32	46	49	50	60	65	K = 14; TIM = R; TIC = R
E. coli (Ec3)	30	45	52	40	43	44	K = 15; TIM = R; TIC = R
E. coli (Ec4)	35	43	53	40	52	70	C = R; E = R; FA = R
K. pneumoniae (Kp1)	32	44	48	31	35	39	TIC = 14 ; AMP = R ; CIP = 40
K. pneumoniae (Kp2)	25	51	53	11	26	29	AMP = R ; CIP = R ; CTX = R
K. terrigena	35	47	50	42	44	50	C = 25; E = 28; FA = R
S. typhi (St1)	33	34	40	33	49	53	C = R; E = R; FA = R
S. typhi (St2)	40	60	69	37	47	50	AMP = 30; CTX = 30; NA = 28
A. baumanii	10	16	16	-	-	-	C = R; E = R; FA = R
P. aeruginosa (Pa1)	-	-	-	-	-	-	C = 10; E = R; FA = R
P. aeruginosa (Pa2)	10	12	12	-	-	-	C = 10; E = R; FA = R
P. aeruginosa (pa3)	-	-	-	-	-	-	RA = 18; IPM = 13 ; GM = 23
Serratia sp.	26	27	27	50	60	65	C = R; E = R; FA = R
Citrobacter sp.	25	35	30	25	27	45	C = 19; E = R; FA = R
P. mirabilis	31	35	39	35	54	56	C = 19; E = R; FA = R
DZI pour les bactéries à Gram +							
S. aureu (ATCC)	60	65	68	53	66	72	TIC = 18; OX = R; FOX = 18
S. aureus (Sa1)	42	43	45	46	54	85	C = 25; E = R; FA = 20
S. aureus (Sa2)	38	68	70	37	45	52	C = 22; E = R; FA = 17
S. aureus (Sa3)	26	27	24	50	60	64	C = 20; E = R; FA = 22
S. aureus (Sa4)	40	60	66	37	47	52	TIC = 20; VA = 19; CIP = 22
Enterococcus sp.	30	35	44	22	36	46	E = 20; TE = R; FA = R
B. subtilis	35	37	45	33	55	70	C = 20; E = 29; FA = 18

(-) Aucune zone d'inhibition ; R : Résistant ; HE : Huile Essentielle ; DZI : Diamètre des Zones d'Inhibition en mm (Diamètre du disque, 9 mm, a été inclus dans le calcul de la DZI). ATCC : American Type Culture Collection ; Les antibiotiques suivants ont été utilisés comme témoins positifs : Kanamycine (K, 30 µg), Triméthoprime (TMP, 5 µg), Ticarcilline (TIC, 75 µg), Chloramphénicol (C, 30 µg), Acide Fusidique (FA, 10 µg), Erythromycine (E, 15 µg), Ampicilline (AMP, 10 µg), Ciprofloxacine (CIP, 5 µg), Céfotaxime (CTX, 30 µg), Acide nalidixique (NA, 30 µg), Rifampicine (RA, 5 µg), Imipénème (IMP, 10 µg), Gentamicine (GM, 10 µg), Oxacilline (OX, 5 µg), Céfoxitine (FOX, 30 µg), Vancomycine (VA, 30 µg) et Tétracycline (TE, 30 µg).

3.2.1 AROMATOGRAMME

L'essence du Thym présente, *in vitro*, une bonne activité inhibitrice sur la croissance de certaines bactéries. En phase liquide, l'HE a exhibé (**Figure 5**) une activité antibactérienne importante notamment sur les bactéries à Gram+ où les DZI oscillent entre 26 et 60 mm pour les disques imprégnés de 20 µL, entre 27 et 68 mm pour le disque imprégné de 40 µL et entre 24 et 70 mm pour un disque imprégné de 60 µL d'HE. Concernant les témoins positifs (disques ATB), les DZI varient selon les espèces. Il est à noter que l'activité bactériostatique de l'HE, à la dose de 20 µL, parait supérieure à celle des ATB (*S.aureus* (Sa1) = 42 mm vs Chloramphénicol (C, 30 µg) = 25 mm ; *B. subtilis* = 35 mm vs Acide Fusidique (FA, 10 µg) = 18 mm). Les DZI obtenus avec l'HE sont largement supérieurs à ceux obtenus avec les antibiotiques de référence où ils ne dépassent pas, dont les meilleurs des cas, 29 mm. Les bactéries à Gram- ont présenté une certaine inhibition vis-à-vis de l'action antibactérienne de l'essence du thym, mais cette activité demeure inférieure comparativement aux Gram+. *Kebsiella*

terrigena semble être l'espèce la plus sensible avec des DZI de 37, 47 et 50 mm pour les trois doses croissantes utilisées. En revanche, *Pseudomonas aeruginosa* est le germe microbien le plus résistant car aucune inhibition n'a été constatée et ce quelques soit la dose utilisée. Cette résistante n'est pas surprenante et a été confirmée par plusieurs études antérieures [7], [30]. Les bactéries à Gram+ sont les souches les plus sensibles, notamment dans le cas de *Staphylococcus aureus* où les DZI sont comprises entre 24 et 70 mm pour les différentes doses.

Dans le même sillage, nous avons remarqué qu'il y a une certaine différence de sensibilité entre les bactéries à Gram+ et à Gram-. Ceci est en totale adéquation avec la majorité des travaux antérieurs [31]. Ces derniers confirment que les Gram+ sont plus sensibles à l'action antimicrobienne de l'HE que les Gram-. En fait, les Gram- possèdent une résistance intrinsèque aux agents biocides, qui est en relation avec la nature de leur paroi bactérienne. Chez les bactéries à Gram+, le peptidoglycane est très épais et associé à des protéines pariétales exposées et à des structures polyosidiques (acides lipoteichoïques et acides teichoïques). Par contre chez les bactéries à Gram-, le peptidoglycane est très fin et associé à une enveloppe externe complexe définissant un espace périplasmique. Cette membrane externe est une bicouche lipidique asymétrique hydrophobe constituée de phospholipides, de protéines (porines) et lipopolysaccharides (LPS). L'espace périplasmique est rempli d'enzymes qui dégradent les substances complexes pour qu'ils puissent traverser la membrane cytoplasmique, et inactivent les produits chimiques toxiques (antibiotiques). La résistance des bactéries à Gram- aux glycopeptides et aux macrolides est due à l'incapacité de ces molécules à franchir la membrane externe. En revanche, de rares publications rapportent qu'il n'existe aucun lien apparent, ni aucune corrélation entre l'activité inhibitrice des essences aromatiques et la nature de la paroi bactérienne [26].

Des résultats similaires aux nôtres ont été rapportés par Dorman et Deans [7]. Les auteurs de cette étude ont examiné les activités antibactériennes des HE du poivre noir, du clou de girofle, de la noix de muscade, d'origan et du thym contre 25 bactéries de genres différents. L'objectif était également de tenter de déterminer les composants présents dans les HE susceptibles d'être responsables de leur activité antibactérienne. Les résultats ont confirmé ceux de travaux antérieurs et mis en valeur l'activité antibactérienne de ces HE, y compris celle du Thym. En outre, les auteurs de cette étude n'ont détecté aucune relation entre la nature de la paroi et la sensibilité du germe vis-à vis des HE.

Dans notre étude, l'activité inhibitrice de l'HE du thym vis-à-vis des souches bactériennes pourrait être due à la présence de plusieurs éléments (carvacrol et terpinène) connus pour leur activité bactéricide. La plupart des composés chimiques des HE sont dotés de propriétés antimicrobiennes, mais ce sont les composés volatils majeurs qui présentent les propriétés inhibitrices les plus importantes, en particulier les phénols [7]. Guarda et al. [32] ont démontré que la nature antimicrobienne des HE est en rapport avec leur fort contenu phénolique en particulier en thymol et carvacrol. Ils ont prouvé que plus les teneurs en phénols sont élevées, plus les huiles sont efficaces. Pinto et al. [17] ont rapporté que les espèces du genre *Thymus*, qui contiennent une quantité importante en phénols, présentent un large spectre d'activité sur les germes bactériens et fongiques. Le mode d'action du carvacrol a été bien étudié sur *Bacillus cereus*. Ce composé pénètre dans la bicouche lipidique et se positionne entre les chaînes d'acides gras. Cette déformation de la structure augmente la fluidité membranaire, aboutissant à une modification de la perméabilité passive. Chez les bactéries exposées au carvacrol, on observe une diminution de l'ATP intracellulaire, mais aussi une diminution du potentiel membranaire. En plus de limiter la croissance, le carvacrol est capable d'inhiber la production de toxines diarrhéiques chez *B. cereus*. Deux hypothèses ont été présentées : soit l'exportation active des toxines hors de la cellule est impossible à cause du manque d'ATP ou de la diminution de la force protomotrice, soit le faible taux d'ATP restant est utilisé par la bactérie pour survivre [33]. D'une manière générale, l'action des molécules terpéniques au niveau microbien (**Figure 4**) se déroule en trois phases [5]:

- Attaque de la paroi bactérienne, provoquant une augmentation de la perméabilité puis la perte des constituants cellulaires ;
- Acidification de l'intérieur de la cellule, bloquant la production de l'ATP et la synthèse des composants de structure ;
- Destruction du matériel génétique, conduisant à la mort de la cellule bactérienne.

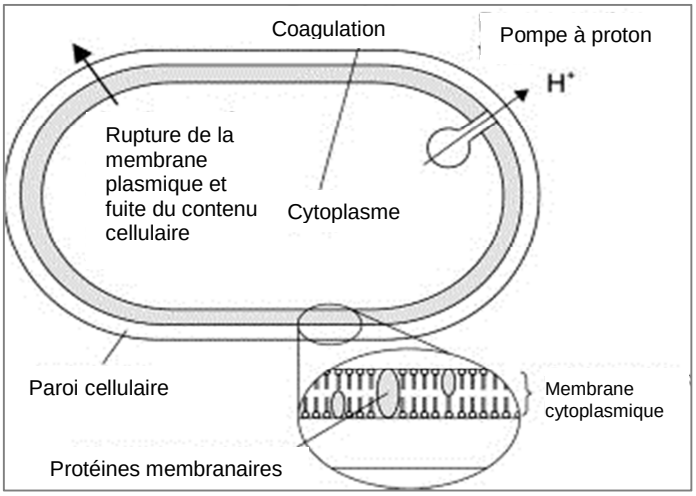


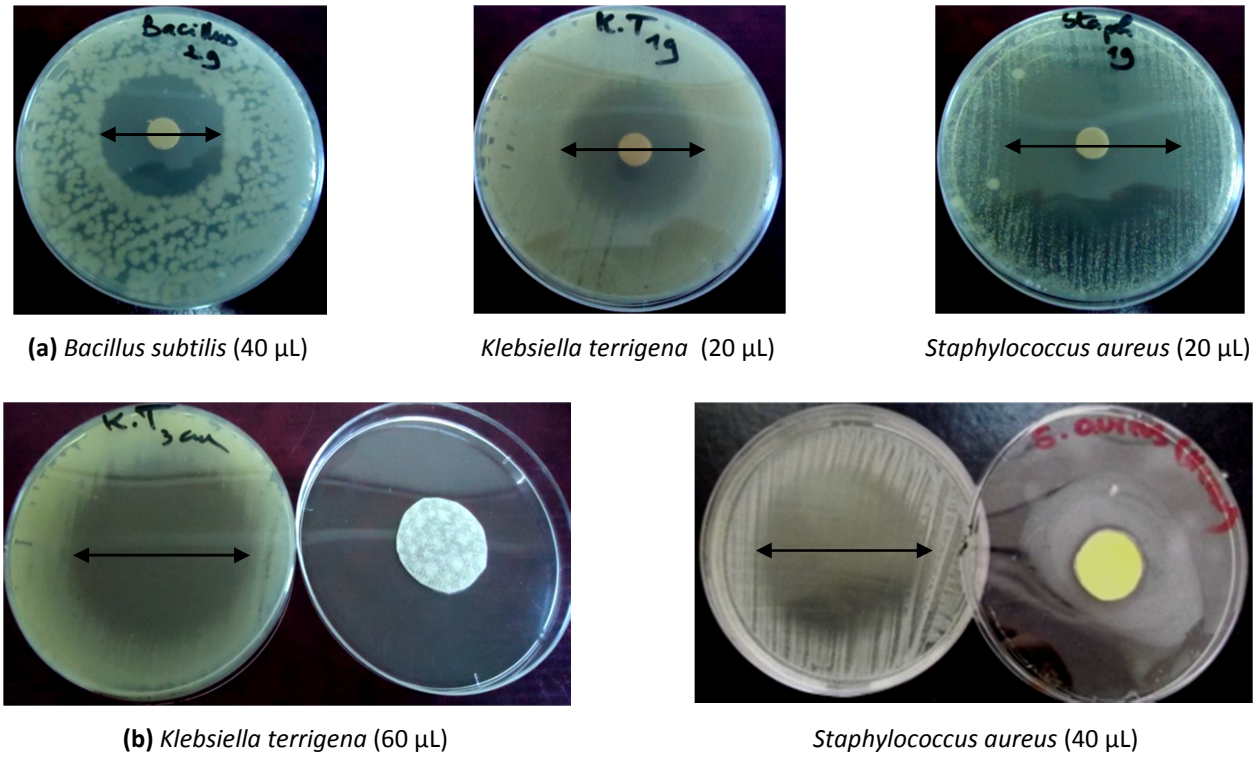
Fig. 4. Mécanisme d'action des huiles essentielles au niveau microbien [5].

Le carvacrol possède aussi un large spectre d'activité, étendu à l'adultération des aliments ou des champignons pathogènes, des levures et des microorganismes pathogènes humains, animaux et végétaux, des biofilms bactériens y compris lors de résistance aux antibiotiques. Cette activité a été attribuée à ses effets considérables sur les propriétés structurales et fonctionnelles de la membrane cytoplasmique [34]. Les cibles préférées du carvacrol sont *Staphylococcus aureus* et *S. epidermidis.* Cependant, les interactions entre les différents constituants d l'huile peuvent également affecter leur activité. Par exemple, l'efficacité de l'HE de Thym contre *S. aureus* et *P. aeruginosa* est due à une synergie entre ses principaux constituants : le carvacrol et le thymol [35]. Une autre interaction synergique a été mise en évidence entre le carvacrol et son précurseur, le *p*-cymène, sur *B. cereus*. Le *p*-cymène semblerait faciliter la pénétration intracellulaire du carvacrol en potentialisant ainsi son action [33]. De cette manière, la valeur d'une HE tienne à son "Totum", c'est à dire dans l'intégralité de ses composants et non seulement à ses composés majoritaires [36].

Par ailleurs, l'efficacité avérée de la fraction terpénique du Thym odorant en aromathérapie anti-infectieuse a suscité l'intérêt de plusieurs industriels. A cet égard, plusieurs formulations cosmétiques, à visée antiseptique, ont été mises au point et brevetées [37], [38]. D'ores et déjà, ces résultats et autres travaux [8], [20] laissent entrevoir la réalité de l'action anti-infectieuse de la fraction aromatique du Thym.

3.2.2 MICROATMOSPHÈRE

En phase vapeur, l'HE du Thym s'est avérée très efficace notamment sur les bactéries à Gram+ avec des DZI qui varient entre 22 à 85 mm pour les trois doses utilisées (**Figure 5**). Les Gram- ont été aussi inhibés mais à un faible degré par rapport aux Gram+. *Pseudomonas aeruginosa* est la souche la plus résistante car aucune zone d'inhibition n'a été détectée. *Escherichia coli, Staphylococcus aureus* et *Bacillus subtillis* sont les espèces qui ont présenté la plus grande sensibilité avec des DZI comprises entre 33 et 55 mm pour la dose de 20 µL, entre 43 et 66 mm pour la dose de 40 µL et entre 44 et 85 mm pour la dose de 60 µL d'HE. A noter que cette action antibactérienne est « dose-dépendante ».



(a) *Bacillus subtilis* (40 µL) *Klebsiella terrigena* (20 µL) *Staphylococcus aureus* (20 µL)

(b) *Klebsiella terrigena* (60 µL) *Staphylococcus aureus* (40 µL)

Fig. 5. Effet antibactérien de l'essence aromatique de Thymus vulgaris : a) aromatogramme ; b) microatmosphère

Le pouvoir antimicrobien de la phase gazeuse des terpènes n'est pas surprenant du moment que plusieurs travaux ont été publiés en ce sens mais la littérature scientifique reste peu prolixe [23], [24], [39]. A l'heure actuelle, nous pouvons affirmer, sans conteste, qu'il existe des centaines de publications et autres travaux publiés qui mettant en exergue le potentiel antimicrobien des extraits végétaux aromatiques en phase liquide. Cependant, ce nombre ne dépasse pas, au mieux, une vingtaine d'articles de recherche ou revues de synthèse (Review) qui mettent en évidence l'effet bactériostatique de ces produits volatils en microatmosphère. En thérapie, la fraction terpénique du Thym pourra trouver une place comme désinfectant atmosphérique en milieu hospitalier afin de lutter contre les infections nosocomiales et les contaminations aéroportées, ainsi que pour le contrôle de l'hygiène de l'air des systèmes de climatisation, entraînant un effet bénéfique au niveau de la qualité de l'air. Rappelons pour mémoire que, ancêtres des CLIN hospitaliers modernes (Comité de Lutte contre les Infections Nosocomiales), dès le XVI^{e} siècle et jusqu'à la fin du XIX^{e} siècle, ce sont médecins, « parfumeurs et fumigateurs », qui sont chargés de la désinfection des locaux et de l'hygiène hospitalière [13]. En plus de leurs actions bactéricide et fongicide, les essences terpéniques ont la particularité d'avoir des effets psychophysiologiques bénéfiques. Bien conduite, la diffusion atmosphérique devient un procédé idéal visant à la protection et à la prévention contre les infections nosocomiales et les pathologies hivernales [39].

3.2.3 ETUDE COMPARATIVE : AROMATOGRAMME VS MICROATMOSPHÈRE

A la lecture comparative entre les résultats obtenus par les deux méthodes, aromatogramme et microatmosphère, il en ressort que la différence n'est pas importante en terme d'inhibition pour les souches bactériennes. Cependant quelques exceptions ont été signalées où la phase vapeur est plus active que la phase liquide (**Figure 6**). C'est le cas notamment de *S. aureus* (Sa1) dont le DZI en microatmosphère (85 mm, 60 µL) semble être supérieur à celui de l'aromatogramme (43 mm).

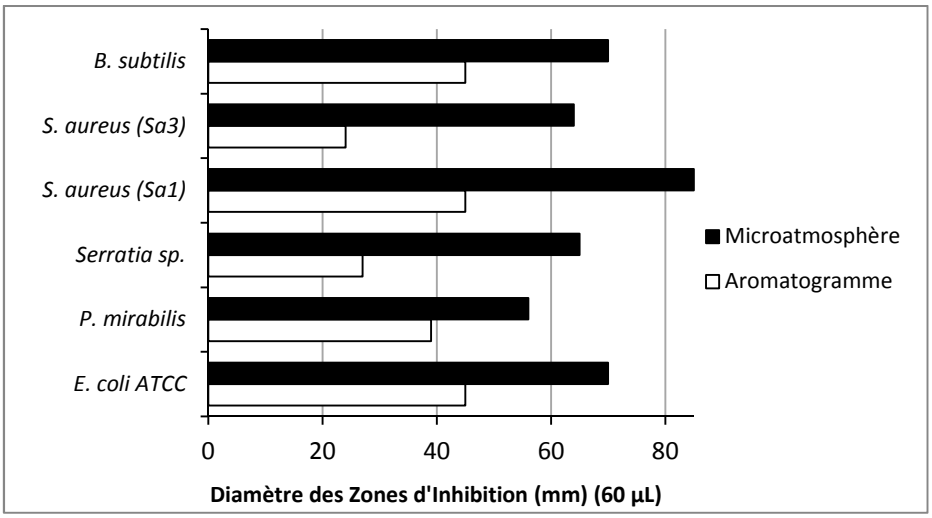


Fig. 6. Etude comparative de l'activité antibactérienne de l'essence du Thym : aromatogramme vs microatmosphère

A la lecture de la littérature scientifique, il apparait que la microatmosphère et très peu documentée. En effet, rares sont les articles qui traitent de cette méthode. Les études réalisées par Tyagi et Malik [23] et Boukhatem et al. [24] ont mis en exergue la supériorité de l'action inhibitrice de la phase vapeur par rapport à la phase liquide. Ceci a été confirmé notamment sur les Gram+ et les souches fongiques. Cette activité peut s'expliquer par le fait qu'en contact direct, les HE diffusent mal en milieu gélosé à cause de leur non miscibilité et, par conséquent, un contact réduit entre le germe et l'HE. Par contre et en microatmosphère, l'HE est très volatile et, de ce fait, il y aura une bonne diffusion sur une gélose ensemencée préalablement [39], [40]. En revanche et pour d'autres germes bactériens, c'est la phase liquide qui présente une certaine efficacité par rapport à la vapeur, notamment pour la dose de 60 µL par disque. C'est l'exemple de *Salmonella thyphi* (St2) où les DZI notés sont de l'ordre de 69 mm en aromatogramme et de 50 mm en microatmosphère.

4 CONCLUSION

En se basant sur les résultats du screening antibactérien, l'activité inhibitrice de l'essence du Thym pourrait être due à l'effet combinatoire de ses phases vapeur et liquide. Dans tous les cas, cette action inhibitrice de la croissance bactérienne parait supérieure à celle des ATB utilisés comme référence, notamment pour les bactéries à Gram+. Les résultats obtenus sont très prometteurs pour l'utilisation de la fraction aromatique du Thym, comme principe actif, dans des préparations galéniques à visée antiseptique ou pour lutter contre les infections microbiennes aéroportées. Et afin d'améliorer la compréhension des altérations cellulaires observées, un travail plus approfondi, impliquant les molécules actives majoritaires devra être entrepris. En définitive, l'objectif premier de notre travail a été atteint puisque nous avons contribué à la valorisation de la fraction aromatique du Thym en aromathérapie anti-infectieuse.

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BER Performance of SFBC - OFDM System with Frequency Domain Equalization for the Nakagami MIMO Fading Channel

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ABSTRACT: The extension of orthogonal frequency division multiplexing (OFDM) with Multiple input multiple output (MIMO) in Wireless communication is nostrum to fading. This brilliant combination has potential to expedient high data rate requirements and high performance over various impugning channels i.e. Time selective and Frequency selective. This paper presents the Nakagami Multiple input multiple output (MIMO) fading channel simulation and the comparison of BER performance of the frequency domain equalizers i.e. Decision feedback and maximum likelihood detection (ML). The result is provided for two transmitter and two receiver, 16 QAM modulation. The simulation result shows that the high diversity gain stability can be acquired by using the domain equalizers for SFBC-OFDM in Nakagami frequency selective fading channel. The implementation of domain equalizers for SFBC-OFDM system for the arbitrary values of m minimizes the intersymbol interference (ISI). Ml is the best coding for minimizing the error probability.

KEYWORDS: Nakagami-m fading channel, SFBC-OFDM system, Frequency domain equalization, QAM.

1 INTRODUCTION

In the propagation environment of digital mobile communication, the radio signal experiences reflection, diffraction and scattering between the transmitter and the receiver, collectively referred to as multipath fading. Therefore, design of persuasive equalization and channel estimation algorithms for such channels becomes a basic obstacle. The sequel of an equalization system is to atone for transmission channel impairments such as frequency dependent phase and amplitude distortion. Besides amending for channel frequency response deviations, the equalizer can efface the effects of multipath signal components. Several probability density functions (P.d.f.) are proposed to model the fading random variable [1]. The Rayleigh fading models are basically utilized in simulating high frequency signal propagation. But the Rayleigh fading is not enough for the larger distance with adequate precise results. Nakagami was the first to scrutinize this and he gave a parametric gamma distribution based density function [2]. Nakagami-m distribution can be used for arbitrary value of 'm' [1]. To meet the plea of high data rates and the transmission reliability, Multiple input multiple output (MIMO) is the solution which can mollify the multipath fading, resulting in the augmentation of the channel performance, increases transmission reliability and high data rates achievement [6]. In the previous work, the competent combination of space time code and the OFDM system is the SFBC-OFDM. Performance analysis of SFBC-OFDM system with frequency domain equalization for Rayleigh fading MIMO channel is evaluated [7]. A way to do space frequency coding is to take the space time codes and implement them in frequency domain rather than time domain[6]-[7].The integration of MIMO and OFDM can greatly improve the system performance over flat fading channel with the reasonable complexity [13]. Use of space-time block codes in the frequency domain is attractive method because of their low complexity decoding and is suitable for fast fading [7]. The Nakagami– m fading channel simulation method which is based on the implementation of the square-root beta process and complex Gaussian noise process[11].This method is restricted to the value of $0.5 \leq m \leq 1$. Another method which is based on semi–empirical method, partially simulation based. This simulation method requires determining the values of certain

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coefficients from measured data [12]. The efficient method for Nakagami– m fading channel simulation is given in [1] which is applicable for arbitrary values of m.

In this paper we have evaluated the two domain equalizers for same Nakagami MIMO fading channel. The BER performances of both the domain equalizers for Nakagami fading channel are taken into the consideration. This paper is organized as follows; Section 2 presents the description of Nakagami – m fading channel model section 3 gives the details of SFBC –OFDM system. Section 4 has the description of domain equalization. Numerical results and discussion are provided in Section 5. Following section 6, this provides the conclusion.

2 NAKAGAMI – m FADING MODEL

The Nakagami fading distributing can model signal fading condition that ranger from severe to moderate, to light or no fading [1].The Probability density function of Nakagami – m fading model is

$$F_R(r) = \frac{2m^m r^{2m-1}}{\gamma(m)\Omega^m} e^{(-\left(\frac{m}{\Omega}\right)r^2)} \quad (1)$$

Where Ω is the scale parameter and is given as

$$\Omega = E[R^2] = \bar{R}^2 \quad (2)$$

Where $E[\,.\,]$ is the expectation operator. And

$$m = \frac{(R^2)^2}{(R^2 - \bar{R}^2)^2} \geq \frac{1}{2} \quad (3)$$

Where m is the shape parameter that controls the severity, or depth of the amplitude fading [1]. The value $m = 1$ results in Rayleigh fading model and the value of m less than one given fading more severe than Rayleigh fading and values of *'m'* greater than one gives fading less severe than Rayleigh fading. [1] - [2].The cdf of the Rayleigh fading is given as

$$Y = 1 - e^{r^2/2\sigma^2} \quad (4)$$

Where σ_2 is the second movement of the random variable 'R' that transfer the random variable RV R into uniform RV on [01), [1] [2][4]. Nakagami fading signal can be obtained from the cdf transform that maps the Raleigh fading into Nakagami fading as illustrated in Fig.1 [1].

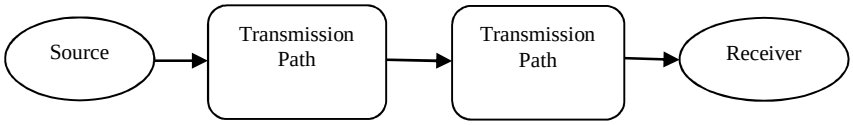


Fig. 1. The cdf corresponds to Nakagami and Rayleigh Fading.

For the integer and half integer values of m the pdf is that of the amplitude or sum of squared independent Gaussian RVs appropriately normalized as $R = \sqrt{X_1^2 + X_2^2 + \cdots X_n^2}$ where $X_i = 1 \ldots . . n$ are the i.i.d Gaussian Random variable with zero–mean and variance σ_X^2 and $n = 2m \times \sigma_X^2$ [1].

3 SFBC OFDM SYSTEM MODEL

We consider the SFBC OFDM system with N_T transmit antenna, and N_R receive antenna. Let OFDM with N_C subcarriers. N_S are the no. of sub bands chosen and $N_s = N/q$ all the subbands are modulated using BPSK modulation. Thus, a signal vector is given as $S = \{S[0], S[1] - - - - - S[R_t - 1]\}$ which is provided at the SFBC encoder.

Where

$$R_t = N_c \, x \, R_c \quad (5)$$

Where R_c is then code rate .Now, this 'S' signal is transmitted in parallel on N_c sub carriers by N_T transmit antenna to SFBC encoder. Now, SFBC encoder provides N_T blocks, i.e. $S_1, S_2 - - - - S_{NT}$ each of length 'N_c' after the IFFT the Blocks generated as follows $X_1, X_2 - - - - X_{NT}$.

The fading impulse response of ith transmit and jth receiving antenna is given as

$$H, j, I\ (t)\ =\ \sum_{i=1}^{L-1} \alpha_{m,j,i}\ (t)\tau\big(t - \tau_m(t)\big) \quad (6)$$

Where $\alpha m, j, i\ (t)$is the tap weight, $\tau_m\ (t)$ is the time delay of the m_{th} path and *'L'* is the resoluble multipath component.

After the cyclic prefix removal and FFT at the receiver we have demodulated received signals at the j_{th} receive antenna which is given as

$$r_j = \sum_{i=1}^{Nt} H_{j,i} * S_i + w_j \quad (7)$$

Where

$$R_j = \left[r_j(0) - - - - - - - - - - - r_j\ (N_c - 1)\ \right]^T$$

$$S_i = [S_i(0), S_i(1) - - - - - - - - - S_i(N_c - 1)]^T$$

is the transmitted signal at the i-th antenna. And the matrix

$$W_j = [w_j(0) - - - - - - - - - - - w_j(N_c - 1)]^T$$

Gives the AWGN. H_{ij} is an $N \times N$ diagonal matrix with elements corresponding to the DFT of the channel response between the i_{th} and j_{th} receive antennas.

A STBC is represented by a matrix. Each row and column represents time slot and one antenna's transmission over time. The STBC is given as

$$G_{stbc} = \begin{bmatrix} g_{1,1} & g_{1,2} & - - - - - g_{1,NT} \\ g_{2,1} & g_{2,2} & - - - - - g_{2,NT} \\ g_{q,1} & g_{q,2} & - - - - - g_{q,NT} \end{bmatrix} \quad (8)$$

Where G_{ij} is the modulated symbol to be transmitted in time slot i from antenna j and q is the symbol period.

4 EQUALIZATION

In MIMO system, Inter Symbol Interference (ISI) occurs due to Multipath followed by the signal, thus it is difficult to maintain the orthogonality of the transmitted signal, resulting in bit error at the receiver. Equalization is a technique used to minimize the error between actual output and throughput by continuous updating the filter's coefficients. Equalization can be implemented in both time and frequency domain. In this paper we have used the Decision Feedback equalization and the ML detection equalization for the SFBC OFDM systems.

4.1 DECISION FEEDBACK EQUALIZATION (DFE)

This is the nonlinear adaptive equalizer. The basic principle of DFE is that once the value of current transmitted symbol is determined, the value of ISI caused by that symbol can be removed for received future symbols. The nonlinear effect is due to the decision device which endeavours to determine which symbol of a set of discrete levels was basically transmitted. Once the current symbol has been decided, the filter structure can calculate the ISI effect it would tend to have on subsequent received symbols and reimburse the input to the decision device for the following samples. The DFE functional block diagram is given in Fig. 2.

The Feedback filter is driven by decision on the output of the detector, and its coefficients are adjusted such as to cancel the ISI component on the current symbol from past detected symbols. RLS (recursive least squares) algorithm is used for determining the coefficient of an adaptive filter [16]. RLS (recursive least squares) algorithm is used for determining the coefficient of an adaptive filter [16]. RLS algorithm uses information from all past input samples to estimate the autocorrelation matrix of the input vector. To minimize the influence of transmitted input samples, a tap weight for the influence of each sample is used**.** First process is the filtering in which RLS computes the output of a linear filter in response to an input signal and generates an estimation error. Secondly, the adjustment of parameters of the filter in congruity with the estimation error.

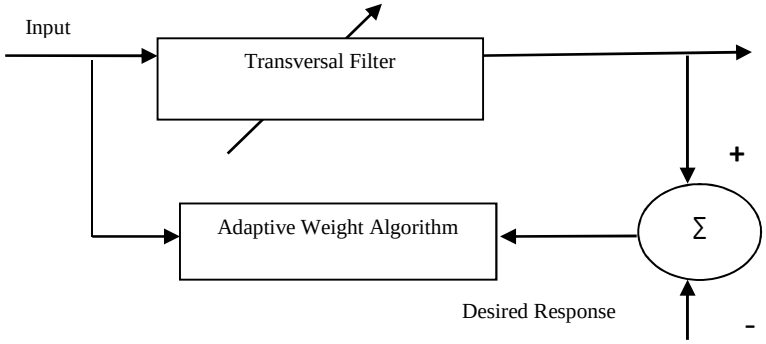


Fig. 2. Functional Block Diagram of DEF

The filter algorithm is given [3] as

$$r(n) = wH(n)C(n) \quad (9)$$

Where w is the weight vector and C(n) are the feedback tap coefficients. The error estimation is given as

$$e(n) = D(n) - r(n) \quad (10)$$

Where D(n) is the desired response and is given as

$$D(n) = w\, r(n) \quad (11)$$

The tap –weight vector update is given as

$$w(nr+1) = w(nr) + \mu C(n) e^*(n) \quad (12)$$

Where nr is the number of iteration and μ is the step size.

4.2 MAXIMUM LIKELIHOOD (ML) DETECTION

ML equalization technique is used for measuring the Euclidean distance between all the received signal vector and finding the lowest value from the entire transmitted signal vector in channel H. Maximum posteriority detection is used for maximum optimal detection. It requires knowledge of channel characteristics in order to compute the metrics for making decisions. It also requires the knowledge of statistical distribution of the noise, which determines the form of metric for optimum demodulation of the received signal. Assuming that perfect CSI is available, the receiver chooses $S = (s1, s2, \ldots\ldots, sN)$ from the transmission constellation C that minimize the following decision metric is given as [3]

$$\|r - Hs\|^2 = \sum_{m=1}^{N_r} \sum_{t=1}^{L} d^2\left(r_{t,m} \sum_{n=1}^{N_t} h_{n,m}\, S_{n,t}\right) \quad (13)$$

Finally, under the channel state information (CSI) at the receiver, Maximum likelihood detection can be used for the SEFBC decoding of the received signal given as

$$S[k] = \sum_{j=1}^{N_r}\left(h_{j,i}^*[2n] r_j[2n] + [2n] r_j^*[2n+1]\right) \quad (14)$$

$$S[k+1] = \sum_{j=1}^{N_r}\left(h_{j,i}^*[2n+1] r_j[2n] - h_{j,1}[2n+1] r_j^*[2n+1]\right) \quad (15)$$

The minimization of equation (12), (13) results in ML decoding which can be written as [3]

$$\hat{s} = \arg min \|r - Hs\|^2 \quad (16)$$

Where $\|A\|$ denotes the Euclidean norm of matrix A defined by $\|A\|^2 = tr(A^H A), tr(A)$ and A^Hdenotes the trace and Hermitian transpose of matrix A, and $d^2(a,b)$ is the squared Euclidean distance between the signals and the b is calculated as

$$d^2(a,b) = |a-b|^2 = (a-b)(a^* - b^*) \quad (17)$$

This is the best coding for minimizing error probability. The complexity involved is also large and increases exponentially with increase in the number of antennas. The job of the equalizer is to implement an inverse filter to counter its ill effect.

5 NUMERICAL RESULTS AND DISCUSSION

We have evaluated the BER performances of SFBC OFDM for frequency selective Nakagami MIMO fading channel for $m = 2, m = 4$ by varying SNR. In the performance results, for SFBC we have used 312.5 KHz the subcarrier spacing, FFT sampling frequency is 20 MHz, $N_c = 52$ subcarriers and a cyclic prefix longer than delay spread. The number of multipath followed is 10. Here we have used $N_t = 2$ and $N_r = 2$. The simulation is carried for 10^6 number of bits using 16 QAM modulation. Assuming that the channel information is perfectly known to receiver. The behaviour of diversity is studied for the value of m=2 and m=4 in Fig.3 and Fig.4.

In Fig 1, we have plotted the BER performance of the SFBC-OFDM system for two transmitters and two receiver for m=2. The BER is 0.0004 for ML detection and 0.0015 for DFE for SNR= 10dB. The ISI caused due to Nakagami frequency selective fading channel is less as the BER is 0.0134 when no diversity is applied. As the Nakagami distribution is the one that gives accurate results for high frequencies, also for less and more severe than Rayleigh fading provided in [1]-[2]. The Nakagami MIMO fading channel is complex to simulate than Rayleigh MIMO fading channel, but gives better BER results.

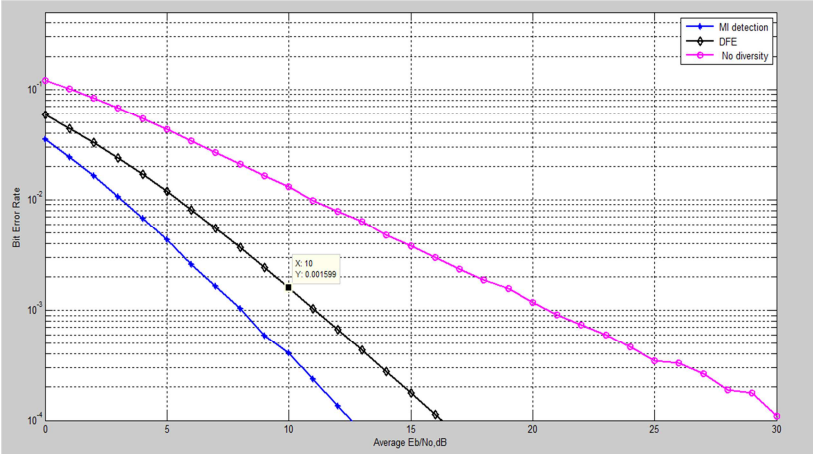


Fig. 3. BER of SFBC-OFDM system using 2Tx and 2Rx for Nakagami MIMO fading channel for m=2, 16QAM with frequency domain equalization

The plot for m=4 for two transmitter and two reciever is given in fig. 4. As it is shown from the graph that BER is 0.00023 for Ml detection and 0.00029 for DFE for SNR= 10dB.And BER when no diversity is applied is 0.009.thus we get refined results when the equalization is applied for SFBC- OFDM system. Thus ISI is greatly reduced for the Nakagami Fading channel for m=4.

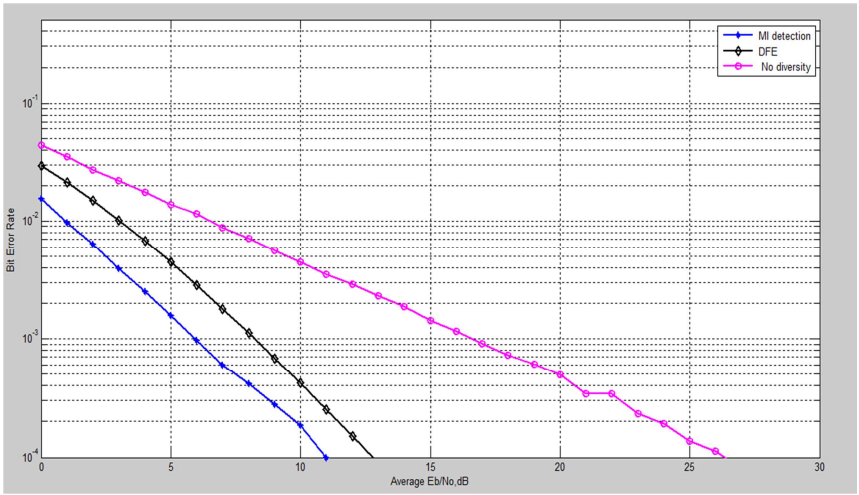


Fig. 4. BER of SFBC-OFDM system using 2Tx and 2Rx for Nakagami MIMO fading channel for m=4, 16QAM with frequency domain equalization

6 CONCLUSION

The SFBC – OFDM diversity scheme is examined for simulated Nakagami MIMO fading channel for the value m=2 and m=4. Further, the BER performance of SFBC OFDM with the DFE and ML detection equalization is considered. It is evaluated from the result that ML detection performs better but the complexity increases with increase in the numbers of antennas for transmitter and receiver. The results obtained are best for increasing value of m, as it can be seen that BER decreases with the increasing value of m. System performance can further be increased by using full diversity and extending the code in three dimensions , i.e. time, space and frequency. Results can be found for the M-ary Modulation.

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Etude de commercialisation de la filière légumes dans la ville de Niamey

[Marketing Study of the sector of vegetables in Niamey city]

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ABSTRACT: The supply of Niamey in foodstuffs is made by products cultivated in the gardens of the city, vegetables were imported by the inside of Niger or through their import from the bordering countries. The vegetable sector is a chain which contains producers, retailers, intermediaries; public and private services, wholesalers as well as exporters. In the marketing of vegetables we find two seasons which are, among other, season price increase and the price decline.

KEYWORDS: marketing, sector, vegetables, dealers, city, market, Niamey, actors, price, rise, drop, wholesalers, retailers.

RESUME: L'approvisionnement de Niamey en denrées alimentaires s'effectue par des produits cultivés dans les jardins de la ville, des légumes importés de l'intérieur du Niger ou à travers leur importation en provenance des pays limitrophes (Burkina Faso, Benin, Nigéria, Ghana etc.). La filière légumes correspond à une chaine qui contient en son sein des producteurs, détaillants, intermédiaires ; services publics et privés, grossistes ainsi que des exportateurs. Dans la commercialisation de légumes on retrouve deux saisons qui sont entre autre la saison de hausse de prix et celle de baisse de prix.

MOTS-CLEFS: commercialisation, filière, légumes, revendeurs, ville, marché, Niamey, acteurs, prix, hausse, baisse, grossistes, détaillants.

1 INTRODUCTION

La présente étude porte sur la commercialisation de la filière légumes de la ville de Niamey. Elle a pour objectif principal d'identifier les principaux groupes sociaux qui s'impliquent dans la commercialisation de légumes. Cette étude est réalisée à partir d'une enquête de terrain menée dans trois marchés de Niamey entre 2010 et 2012. Un questionnaire a été formulé et adressé aux vendeurs afin de bien décrire la commercialisation de la filière légumes.

Pour comprendre la filière légumes à Niamey, nous formulons les hypothèses suivantes:

La commercialisation de légumes est pratiquée essentiellement par des femmes résidentes de Niamey. Les femmes vendeuses et revendeuses jouent de ce fait un rôle important dans le fonctionnement la filière ;

Les principaux vendeurs se concentrent au petit marché ;

Les prix de légumes restent identiques tout au long de l'année.

Ainsi, pour mener à bien cette étude nous avons constitué un échantillon de 30 vendeurs (10 vendeurs dans chacun des trois marchés). Concernant la vérification de ces hypothèses nous verrons dans la mesure du possible la définition de la filière. Dans un second temps nous tenterons d'aborder les différents types de marché qui ont fait objet d'étude. En troisième point de cette étude nous essayerons d'identifier les principaux acteurs de commercialisation de légumes dans la ville de Niamey. Enfin, nous terminerons par la variation de prix des légumes.

2 DÉFINITION DE LA FILIÈRE

La théorie de la filière a pris naissance à la fin des années 1950 dans les travaux de Goldberg et Davis[1]. Ces deux auteurs sont les premiers à intégrer dans leurs travaux, une approche systémique, permettant d'étudier un système complexe qu'on appelle filière. Ce système inclut les acteurs impliqués dans la production de produits agroalimentaires ainsi que ceux de la commercialisation. « La notion de filière englobe tous les agents impliqués dans la production, la transformation et la commercialisation d'un produit. Mais, dans le cas d'un produit agricole, elle inclut les fournisseurs de l'agriculture, les agriculteurs, les entrepreneurs réalisant le stock, les transformateurs, les grossistes et les détaillants, c'est-à-dire l'ensemble des agents, permettant au produit brut de passer de la production à la commercialisation[2] ». Cette définition est suivie par une autre qui consiste à considérer la filière comme une succession d'opérations de produire un bien, mais il faut en considérer aussi, l'ensemble des techniques et technologies nécessaires, les relations de complémentarité, les cheminements entre les étapes, les résultats économiques, l'ensemble des acteurs ainsi que leurs stratégies et les relations existant entre eux[3]. Ces différentes définitions montrent que la théorie de la filière prend plusieurs formes qui se succèdent les unes aux autres.

Ainsi, depuis 1958, la notion de filière ne cesse de connaître des modifications. Ces premières analyses ont été par la suite complétées par Goldberg qui a considéré que le concept de filière peut être pris comme un outil qui permet de décrire les étapes successives pour passer d'une matière première à un produit fini. Aujourd'hui, elle connaît des modifications plus poussées, liées à la pluralité des disciplines qui s'y intéressent. L'école française d'économie industrielle (De Bandit 1988, Morvan 1991, De Bandit, Huron 1988[4]) a défini pour sa part, la filière par ses dimensions technologiques d'intégration, de relations intersectorielles et de stratégies de firmes et de groupes. Le concept de filière émerge aussi, dans l'ingénierie agricole, à travers notamment des travaux d'un groupe de travail de l'INRA, dirigés par Benoît Janequin sur les fruits et légumes[5], et qui s'est également intéressé à la concurrence internationale.

Concernant cette étude nous considérons la filière, la chaine partant de la production à la commercialisation et incluant essentiellement les acteurs et leurs motivations tant au niveau de la production qu'au niveau de la commercialisation de légumes. Nous faisons également ressortir les facteurs influençant les variations des prix.

3 MARCHÉS DE NIAMEY

Il existe dans la ville de Niamey une multitude de marchés qui sont réputés pour la commercialisation des légumes. Mais pour cette étude, nous nous intéressons à trois marchés qui se distinguent alors les uns des autres par l'architecture des stands, le nombre des boutiques ainsi que la situation du marché par rapport aux sites maraîchers.

Le « grand marché », communément appelé habou-béné[6], le « petit marché » ou habou-ganda, le marché Katako. La préférence des revendeurs pour ces trois marchés est liée à leur lieu d'habitation, à leur situation en plein cœur de la capitale, à la proximité des sites de production. En tout état de cause, les raisons sont multiples et varient selon le revendeur.

3.1 PETIT MARCHÉ

Il existe dans le petit marché des revendeurs à plein temps, des revendeurs à temps partiel, des revendeurs occasionnels ainsi que des marchands ambulants qui commercialisent les légumes. Concernant cette dernière catégorie de revendeurs, leur particularité est la possibilité de circuler tout au long du marché pour la conquête des clients. Au petit marché, ils se tiennent au bord des stations de taxi de la rive droite ou de Yantala.

1 Davis JH, Goldberg RA, A concept of agribusiness, Division of Research Harward Business School, Boston, 1957. 136p. Pour plus de détail voire Goldberg (1958).

2 Jamaïel Hassaïnya. Et. Al. Lait et produits laitiers en méditerranée, Editions Karthala, 2006, p.290.

3 Charlotte Fanton, CED /IFReDE-GRES- Université Montesquieu Bordeaux, 2006. P.2.

4 Philippe HUGON, Concepts et méthodes en économie de filières, Communication, Montpellier, 2007. P.1.

5 Benoît JEANNEQUIN et al. Un point sur les filières fruits et légumes : Caractéristiques et principaux enjeux, Editions, INRA. 2005.

6 Habou béné correspond à marché en langue zarma et béné, veut dire quelque chose qui est située au dessus de. Donc habou béné veut dire simplement marché d'en haut. Quant à ganda il veut dire en bas en langue zarma. Le mot habou ganda correspond alors à : marché d'en bas.

Plus de 75% de personnes enquêtées (23 sur 30 revendeurs) ont confié qu'elles préfèrent « le petit marché » pour la commercialisation des légumes. Cela est certainement lié à sa situation géographique par rapport aux différents sites maraîchers de la capitale, dont Gounti yéna et la Corniche de Gamkalley. Habou-ganda est situé aussi en face de l'hôtel de ville et environ 200 mètres de Gounti yéna. Il est construit en plein centre de Niamey. Sa situation géographique lui confère un carrefour urbain et des possibilités de connexion avec les quartiers de Yantala et de Haro banda à travers les taxis urbains. Le « petit marché » dispose sur son périmètre, des vendeurs assis, derrières leurs paniers de légumes. Ces derniers exposent les légumes en plein air. Le prix de la place, occupée par un revendeur varie de 50 à 100 FCFA par jour.

Mais c'est qu'il faut savoir de ce marché, ce qu'il est le plus ancien parmi les marchés de Niamey. Il est aussi le premier marché de légumes. La capitale nigérienne est approvisionnée dès 1967 par les villageois de Darahiré[7]. A cette époque l'approvisionnement de Niamey en denrées alimentaires de toute sorte se faisait essentiellement par les villages de proximité. Les résidents l'appelaient le marché de « huit heures », puisque les fréquentations ne se déroulaient qu'entre 6 et 8 heures. Jusqu'aux années 1960, le petit marché se trouvait au bord du fleuve où il constituait le carrefour entre les ruraux de la rive droite qui venaient dans des pirogues et les urbains de Niamey. Mais à huit heures, c'est le son d'une cloche qui se trouvait au musée national qui détermine la fin du marché.



Photo1 : petit marché, un modèle de marché urbain dans la ville de Niamey

L'architecture du « petit marché » ressemble à un mélange de celle du grand marché et Katako. Ce dernier garde un caractère de type traditionnel. Dans le « petit marché », les revendeurs de produits de luxe passent la journée dans des boutiques construites avec ciment, et, tous ceux qui commercialisent les aliments sont sous des hangars ou exposés au bord des grandes voies qui traversent le marché.

7 Arouna Hamidou SIDIKOU, Opp. Cit. p.399.

3.2 GRAND MARCHÉ



Photo2 : intérieur du grand marché.

A tout début, le grand marché était un marché mixte de denrées alimentaires et de bétails. Il se trouvait à l'actuel pont kennedy de Niamey. En 1942, le marché fut transféré à l'emplacement actuel du monument aux morts. Face aux flux de plus en plus importants de marchandises à cause notamment du développement de Niamey, une partie du marché fut implanté en 1949 au site actuel. Jusqu'en cette période, tous les matins, et après 8 heures (fin officielle de l'animation du petit marché) tous les marchants et clients du petit marché sont priés de rejoindre le grand marché qui ne ferme ses portes que le soir.

Contrairement à habou-ganda, le « grand marché » est un marché moderne avec des stands construits pour la commercialisation des légumes et 1882 boutiques pour des diverses marchandises. Le grand marché correspond au centre commercial à l'africain. C'est sous le grand hangar d'une surface de 5000 m2 situé au cœur du marché, que la SOCOGEM[8] laisse des places dont la superficie unitaire est de 4,5 m2. Lors de la construction du grand marché en 1986, ces places sans construction étaient réservées uniquement à la commercialisation des denrées alimentaires. Sous ce hangar se trouvent également des bouchers. La cohabitation des revendeurs avec les bouchers attire les demandeurs de tout genre à l'achat des légumes. Les revendeurs du grand marché, représentent seulement 8% de ceux qui commercialisent les légumes. Ils louent la place à la SOCOGEM environ 3000 FCFA par mois. Comme le petit marché, le grand marché de Niamey se situe en plein centre de Niamey. Il est situé sur la route nationale n°1 qui traverse la ville de Niamey. Avant 1982, le grand marché de Niamey avait une structure architecturale atypique. C'est suite à l'incendie qui ravagé la totalité de ses boutiques, que l'Etat avait décidé la construction d'un marché moderne. Aujourd'hui, il est le carrefour commercial où se vendent, des bijoux, vêtements, couvres lits, les chaussures récipients, fournitures scolaires, équipement stéréo, les lunettes, des moustiquaires, bref, il correspond à un centre commercial.

3.3 KATAKO

Le commerce de légumes par étalage et leur exposition sur les voies qui traverse le marché est une spécialité des revendeurs de Katako. La photo n°12, montre que les brouettes constituent pour certains détaillants, le moyen le plus

8SOCOGEM : Société de construction et de gestion des marchés.

important par sa flexibilité. Ils sont appelés les revendeurs ambulants et ils passent leur temps à longueur de journée à se déplacer dans le marché pour chercher des clients.



Photo3 photo montrant les détaillants de légumes de « Katako »

Nous trions les légumes pour attirer les clients, surtout les ménages qui préfèrent les bonnes tomates et bien mûres pour cuisiner de suite. Seuls les services et les grands restaurants ne sont pas très exigeants concernant à l'état de qualité de nos légumes. Nous faisons ici sauve qui peut aussi, car souvent la police nous disperse et prend nos produits pour la simple raison soit disant que nous engloutissons le passage» déclare monsieur Boubé, le revendeur qui se trouve courbé, sur la photo.

D'après Martine FOURN,[9] Katako signifie « planches » en hausa. C'est un marché, réputé par le nombre de forgerons, des vendeurs de planches, d'ignames, de poulets, de pneus, de menuisiers, de légumes, etc., qui l'occupent. Katako est aussi un marché qui attire la clientèle des produits de tout genre tels que les céréales, les pièces détachées, bref, quand un objet est volé, c'est souvent ce marché qui sert de le stocker.

Les vendeurs de légumes se trouvent à l'extrémité du marché et sur la route qui mène vers Yantala en passant pars le stade général Seyni Kountché. Ils sont généralement venus des villages voisins de Niamey. Katako est un marché traditionnel, et, a des caractéristiques atypiques. Les passages sont étroits avec des boutiques construites en bois ou tôle. Sa position par rapport aux anciens quartiers tels que le quartier « Liberté », Banizoumbou, Boukoki, Dayzébon, lui offre une clientèle importante, mais généralement pauvre. Ce sont dans ces quartiers qu'on trouve une forte concentration de la population de la communauté urbaine de Niamey. Les revendeurs de Katako s'installent sur les grandes voies qui traversent le marché. Ils représentent 17% de revendeurs de légumes dans la communauté urbaine. La carte nous montre que les 3 marchés sont concentrés au centre 10 de la Communauté Urbaine de Niamey. Ils sont séparés les uns des autres par des petites distances.

4 ACTEURS DE LA COMMERCIALISATION

Dans ce travail, on considère un acteur économique comme une personne physique qui intervient dans la commercialisation des légumes.

Comme le souligne Cheikh Alassane Fall[10] (2001), dans les grandes Niayes au Sénégal, la forte capacité d'absorption du marché local constitué de chaînes hôtelières, de restauration de rue et de ménages solvables dont la majorité se trouve dans

9 Martine FOURN, Un centre commercial renommé de Niamey : le marché de katako, Mémoire de Maîtrise de géographie, Université de Limoges, 1989, p.19.

10 Cheikh Alassane Fall et Abdou Salam Fall « L'horticulture, une activité agricole majeure », in L'agriculture urbaine dans les grandes Niayes au Sénégal, Sous la dir. Safiatou Touré, CRDI, 2001.

les villes est en progression constante. En ce qui concerne le commerce des produits maraîchers et vivriers dans la ville de Yaoundé, les commerçants se spécialisent dans la vente de telle ou telle variété. En général, ils vendent une, deux ou trois sortes de légumes-feuilles, ajoutés aux piments, gombos et céleri-persil. La plupart des commerçants sont des intermédiaires (ou presque) obligés entre les producteurs et les consommateurs, à moins que certains consommateurs ne viennent directement dans le jardin. En fait, il existe plusieurs catégories de commerçants : les grossistes, les semi-grossistes et les détaillants. Cependant, il n'est pas rare de voir qu'un seul commerçant peut combiner les trois systèmes de distribution ou deux d'entre eux (grossiste/semi-grossiste, grossiste/détaillant ou semi-grossiste/détaillant) (Prosper Asaa Nguegang, 2008).

Les résultats de notre enquête montrent que les producteurs maraîchers urbains sont les vendeurs de légumes. Ils pensent que la demande des légumes est forte sur les marchés locaux. Cela les encourage à produire plus. La commercialisation des légumes se réalise par des femmes et des hommes résidant dans la ville Niamey qui viennent dans les jardins pour leur achat. La particularité de ce domaine est l'implication de jeunes qui constituent la majorité de revendeurs. Ainsi, ceux qui sont âgés de 20 à 40 ans, représentent plus de 70% de revendeurs. Seulement 2%, de revendeurs ont plus de 70 ans. Si la production des légumes reste une activité masculine, la commercialisation, elle, laisse une place relative aux femmes

La raison de l'implication de la femme dans le secteur est liée à son rôle nutritionnel et alimentaire qu'elle joue dans le foyer. Toutes les vendeuses rencontrées dans ces trois marchés confient qu'au cas où une quantité de légumes n'a pas été achetée, elle leur servira de repas du soir pour nourrir la famille. Ce qu'il faut retenir des revendeuses, ce sont surtout les veuves et les divorcées qui s'adonnent à la commercialisation des légumes. Car, elles ont le plus souvent des enfants à nourrir seules.

Les revendeurs achètent les légumes en gros, le plus souvent sur place dans les jardins pour les revendre par la suite dans les marchés locaux. Parmi ceux qui font le commerce de légumes, certains revendeurs préfèrent habiter non loin des marchés, d'autres par contre, préfèrent vivre au bord des sites maraîchers afin, de pouvoir se lever tôt, aller dans les jardins et se rendre au marché avant l'heure de pointe (7 heures-9 heures). Cette tradition de se rendre au marché très tôt est ancienne. Mais, aujourd'hui, la forte demande se fait surtout le matin (avant 10heures) et l'après midi (à partir de 16 heures).

D'autres acteurs s'impliquent également dans la commercialisation des légumes. Ce sont les femmes béninoises ou togolaises qui revendent les légumes en détail dans les quartiers populaires de Niamey. Ces dernières font l'achat des légumes dans le marché, le plus proche de leurs résidences. Généralement, elles revendent de plats de légumes au bord des grands boulevards. C'est à proximité de leurs lieux de résidence qu'elles étalent les légumes dans de grands vases.

Certains opérateurs économiques de Niamey commencent à s'intéresser à la commercialisation des légumes. Dans certains cas, ce sont eux qui fournissent les services publics en légumes frais. Ils ont des activités parallèles telles que l'importation des semences, la commercialisation des produits céréaliers, la vente d'engrais chimiques, etc. Ils achètent les légumes chez les revendeurs dans les marchés locaux pour revendre à des prix très élevés. Ils sont 5% de ceux qui commercialisent leurs légumes avec les intermédiaires. Ces derniers sont généralement des personnes qui connaissent bien le milieu administratif nigérien. Ils s'intègrent dans des réseaux leur permettant l'obtention de l'ordre de payement pour les produits qu'ils ont fournis aux services publics. Ils achètent les légumes au marché à des prix bas pour les revendre à ces services plus que le double. En guise d'exemple, le prix du kilogramme de la carotte qui est vendu dans les marchés autour de 450 en période de non traite) et 600 FCFA (en période de traite) est revendu à 2000 FCFA quelque soit la période dans les services publics comme par exemple à l'hôpital national de Niamey, ou, au restaurant de l'université de Niamey par la voie du CNOU[11].

Malgré nos différentes enquêtes dans la ville de Niamey, il n'a pas été possible d'obtenir le nombre exact des services publics qui achètent des légumes dans les jardins ou les marchés locaux. Cependant, nous avons recueilli des données auprès des revendeurs concernant ceux qui leur vendent des légumes. D'après les résultats de nos enquêtes, ce sont 20% de revendeurs qui ont des services publics comme clients, comme les camps militaires et les restaurants des hôpitaux de Niamey. Une grande partie de ces services s'abonnent auprès des producteurs pour l'approvisionnement en légumes. C'est le cas de la compagnie de sapeurs pompiers qui ont une livraison régulière chaque semaine. D'autres passent par des intermédiaires pour se ravitailler. C'est le cas du restaurant de l'université Abdou Moumouni de Niamey.

11 Centre national des œuvres universitaires.

De résultats de nos enquêtes, il ressort le constat que tous les revendeurs disent avoir pour clients des restaurants et 5% des petits revendeurs. Parmi, ces restaurants on distingue trois types qui participent à la commercialisation des produits maraîchers ;

Les restaurants des hôtels: Tous les restaurants des hôtels de Niamey sont approvisionnés en légumes par les maraîchers urbains. Ce sont les restaurants tels que celui d'hôtel Gaweye, de grand hôtel de Niamey, d'hôtel Terminus mais également celui d'hôtel Sahel. Ils utilisent leurs propres moyens pour le transport de légumes. Le prix de légumes préparé est très élevé dans les restaurants de luxe. Sa clientèle est composée essentiellement de touristes, hauts fonctionnaires, mais aussi de grands commerçants de Niamey.

Les restaurants de taille moyenne sont ceux qu'on trouve dans le centre urbain de Niamey, dans les centres commerciaux mais également à côté des administrations. Ces types de restaurants sont fréquentés par une classe moyenne composée des cadres administratifs et revendeurs des marchés de Niamey. Ils sont approvisionnés en légume dans une forte proportion par les revendeurs des marchés locaux. A cause du prix de leur repas (un repas pour une personne coûte environ 2000FCFA), ils attirent plus de clientèle que les restaurants des hôtels. Le taxi urbain est le moyen de transport utilisé par ce type de restaurant;

Les restaurants de rue sont ceux qui s'installent généralement au bord des grands boulevards de la ville et autour des marchés locaux. Les propriétaires de ce type de restaurant sont des vendeuses de « Mafé » qui est une spécialité culinaire commune dans plusieurs pays de l'Afrique de l'ouest (Sénégal, Mali, Burkina, etc.).

Il existe aussi dans la ville de Niamey, des commerçants qui se sont spécialisés dans l'exportation des légumes vers l'extérieur, notamment vers les pays voisins. Le piment frais et l'oignon sont les principaux produits exportés. Parmi les pays où la demande des légumes nigériens est forte, on trouve le Burkina Faso, le Bénin et le Nigeria. Cependant, l'oignon est essentiellement exporté vers le Burkina Faso et le Maroc. Il convient aussi de rappeler que le piment nigérien est très demandé au Bénin. Parmi les exportateurs, on trouve des hommes et des femmes généralement veuves ou divorcées. Elles sont plus nombreuses dans l'exportation du piment. Certains revendeurs achètent également des légumes auprès des producteurs pour les exporter vers l'étranger. Cependant, ils ne font pas l'exportation comme activité principale.

Les résultats de nos enquêtes nous conduisent à dire que tous les revendeurs ont pour clients, les ménages ou les services urbains. D'après les revendeurs, les acheteurs de légumes sont principalement du sexe féminin, même si une fine proportion est composée d'hommes. C'est essentiellement au petit marché que les femmes font l'achat des légumes. Grâce à la situation géographique du « petit marché » par rapport aux services publics, les femmes fonctionnaires s'y rendent en fin de service pour se ravitailler en légumes. Celles qui restent femmes au foyer, s'y rendent le matin aux environs de dix heures. S'il est préféré par les femmes, c'est parce qu'il constitue le lieu de concentration de boucheries et de poissonneries et divers articles qui rentrent dans les préparations culinaires.

Quoiqu'on puisse dire ici, les produits maraîchers sont consommés par, outre les producteurs et revendeurs, une classe favorisée de la population. Car, d'une manière ou d'une autre, la consommation de légumes est surtout effectuée par les fonctionnaires, salariés et commerçants urbains[12].

5 VARIATIONS SAISONNIÈRES DES PRIX

Les premiers résultats de cette enquête montrent que les prix de légumes varient tout au long de l'année. Chaque spéculation a une période où sa production se trouve baissée ou montée. Cette variation de quantités produites se répercute sur l'offre des légumes. Ainsi, la variation de l'offre influence celle du prix. De même la variation de la demande fait varier le prix des légumes. Du fait que la tomate ou l'oignon ne résistent pas aux pluies abondantes, leur production baisse pendant la saison de pluie. C'est pourquoi cette période correspond à la période de prix élevé. Les résultats de notre enquête de 2010 montrent que les prix de légumes ne varient pas de la même façon. Les résultats du tableau n°20 montrent par exemple que les prix d'achats du kilogramme d'oignon varient relativement de 100 FCFA entre les deux périodes (période de traite et non traite). Quant aux prix de la carotte et la tomate, ils connaissent une très forte variation entre la période de traite et de non traite. Le table 20 montre aussi que les différences entre les prix d'achat pour les deux période sont comprises entre 50 et 300 FCFA pour l'oignon, 200 et 750 FCFA pour la tomate, 60 et 800 FCFA pour la carotte et entre 100

12 Martine DOKA, Sécurité alimentaire au niveau des ménages, IRSH, Université de Niamey, 1990, p.5.

et 350 FCFA pour le chou. Ce qui montre que les ne varient pas de la même façon. En guise d'exemple je cite le cas de revendeurs 15 et 17. On constate, bien que le vendeur n°15 achète moins cher que le vendeur n°17, il est aussi celui qui vend plus cher que les deux autres. Du même tableau (tableau 19), il ressort la constatation selon laquelle on peut dire que c'est surtout l'écart entre la plus petite marge et la plus grande réalisée par les revendeurs de l'oignon qui est très importante et c'est à la commercialisation du chou où les revendeurs ont fait un écart moins important. Cependant, en période de non traite, c'est chez les revendeurs du chou qu'on remarque le plus petit écart. En période de non traite l'écart entre la plus petite et la plus grande marge de la carotte reste la plus élevée. Donc la conclusion qui peut être tirée de cette étude est le constat que les revendeurs du petit marché ne réalisent pas les mêmes marges. Car, puisque le prix n'est pas conventionnellement fixé, chaque revendeur vend les légumes en fonction de la demande et de leur disponibilité dans les jardins. La rareté des légumes est aussi un facteur important dans la fluctuation de prix.

Cependant, en période de non traite, c'est chez quelques revendeurs du chou de la carotte et d'oignon qu'on remarque le plus petit écart. En période de non traite l'écart entre la plus petite et la plus grande marge d'oignon reste la plus élevée. Ce qui parait normal du fait que l'oignon est le condiment que l'on utilise quotidiennement dans les familles. Donc la conclusion qui peut être tirée de cette étude est le constat que les revendeurs du petit marché ne réalisent pas les mêmes marges. Car, puisque le prix n'est pas conventionnellement fixé, chaque revendeur vend les légumes en fonction de la demande et de leur disponibilité dans les jardins. La rareté des légumes est aussi un facteur important dans la fluctuation de prix.

Tableau 1 Variation de prix de légumes

n° vendeurs	période de traite		période de non traite		légumes	PV-PA Traite	PV-PA n Traite	PAT-PAnT
	prix d'achat	Prix de vente	prix d'achat	prix de vente				
15	700	1200	600	800	chou	500	200	100
14	750	1000	400	600	chou	250	200	350
20	500	700	200	350	chou	200	150	300
5	650	1300	500	800	carottes	650	300	150
10	1000	1700	200	400	carottes	700	200	800
17	660	1500	600	700	carottes	840	100	60
18	700	1500	400	600	carottes	800	200	300
3	830	1000	350	665	tomate	170	315	480
6	900	3000	450	800	tomate	400	350	450
10	750	1500	400	750	tomate	750	350	750
12	1000	1100	400	500	tomate	100	100	600
21	700	900	500	700	tomate	200	200	200
28	1000	2300	500	1300	tomate	300	800	500
1	1000	2000	800	1000	oignon	1000	200	200
3	600	660	300	350	oignon	60	50	300
9	450	500	220	300	oignon	50	40	230
10	600	1000	400	700	oignon	900	300	200
21	500	1400	400	650	oignon	250	250	100
22	750	1000	600	700	oignon	250	100	150
23	650	700	600	650	oignon	50	50	50

Source. Enquête 2010

D'une manière générale, la plupart des spéculations connaissent une forte baisse de production entre les mois de juillet à novembre. Cela est une réalité que nous avons constatée au cours de nos deux voyages de 2008. Le prix de chaque spéculation varie en sens inverse de sa production sauf le mois de ramadan où les prix augmentent quelle que la période.

Les prix des légumes varient aussi selon la qualité de planches qui dépend de la qualité des pieds qu'elle contient ou en fonction de la semence et de l'engrais mis pour la fertilisation de la terre. Lors de nos enquêtes, tous les producteurs de faible moyen financier (surtout les locataires) m'ont fait part de leurs doléances liées aux difficultés de se doter de l'engrais chimique. Pour eux, une planche ne peut pas bien pousser si on n'y met pas de l'engrais, alors que le prix de la planche

dépend de sa qualité. En guise d'exemple, une planche de chou pommé peut coûter jusqu'à 10 000 FCFA si elle a bien pommé. Parallèlement et à la même période son prix peut ne pas dépasser les 5 000 FCFA si elle n'a pas été cultivée dans les mêmes conditions que la première.

6 CONCLUSION

Dans la ville de Niamey, la production maraîchère est écoulée essentiellement dans les marchés locaux. C'est aussi dans ces marchés que la majorité d'acteurs viennent se ravitailler en denrées alimentaires. Ainsi, les clients qui viennent s'approvisionner dans les jardins sont ceux qui revendent les légumes à travers les marchés urbains de Niamey. La particularité du commerce des légumes est l'obligation de s'en débarrasser dans un délai court, au risque de perdre une grande quantité, du fait du manque de moyen de conservation adapté aux légumes. Divers marchés de légumes existent dans la Communauté Urbaine de Niamey.

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Electronic and Optical Properties of Reactive Orange 16 azo dye

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ABSTRACT: Azo dyes constitute the largest family of synthetic dyes. They are widely used in the textile, dye stuff and pharmaceutical industries. The uncontrolled and undesirable discharge of the azo dyes into the environment may represent a serious ecological problems and health effects. The oxidation of azo dyes (e.g., Photo-oxidation, Oxidation by ozone) leads to its degradation. To determine the reactivity and the active sites of azo dye reactive Orange 16 (RO16) , we calculated its electronic and optical properties by using DFT and TD-DFT methods at B3LYP/6-311+G(,p) level in solvent (IEF-PCM model). The results showed that RO16 is polar and high soluble compounds in water. The Fukui indices showed that the N11 is the favoured site of nucleophilic attack (e.g, ozone). A good correlation was obtained between the predicted and experimental absorption bands of RO16 (R2=97%).

KEYWORDS: Reactive Orange 16, DFT, TD-DFT, UV/vis, PCM.

1 INTRODUCTION

Azo dyes constitute the largest group of synthetic dyes. They are widely used in the textile dye and pharmaceutical industries ([1],[2],[3],[4],[5],[6],[7],[8]). The azo dyes' chemical structure contains at least an azo group (–N=N-), and substituted aromatic rings by different group, which make them recalcitrant and xenobiotic [9, 10]. The poor fixation of azo dyes to the fibre or the discharge of the coloured textile wastewater lead to its loss into the environment, which may represent a serious ecological problem and impact on health, in addition to the generation of degradation products [1, 7].Various physical, chemical and biological techniques were employed for wastewater remediation. The combination of biological treatment (bioremediation) with advanced oxidation processes (e.g, ozonation, advanced oxidation process by using OH radical) is one of the most known efficient techniques for azo dyes degradation or colour removal[11, 12].

In most cases the oxidation reaction is selective and proceeds through electrophilic attack on double bond of azo chromophoric group or on double bonds of the connecting aromatic rings [13],[14],15]. The biodegradation of dyes, or other pollutant by liquid fungal cultures and/or purified ligninolytic enzymes has been extensively studied, and it proved the capacity of white rot fungi to degrade synthetic dyes as well as other types of organic pollutants ([7],[16][17],[18],[19]]. Reactive orange 16 (RO16) dye belongs to the group of vinylsulfone dyes and it is used for dyeing cellulose fibres. Svobodovà et al. reported the degradation mechanism of RO16 by the fungus Irpex lacteus cultures and they observed that no re-colorization effect appeared during azo dye degradation [20]. Tauber et al. used Laccase enzyme and ultrasound treatments to degrade azo dyes and they reported that a simultaneous treatment with both processes showed synergistic effects for dye degradation compared with individual treatments[21].

The computational chemistry is an important tool for the investigation and the understanding of the reactivity and optical properties of natural or synthetic organic compounds. Density functional theory (DFT) is a convenient method to determine the electronic properties and reactivity of azo dyes. It has great importance to help understand the mechanism by means the azo dyes operate and with this to potentially obtain application for the protection of the environment. Hihara et al. used a

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semi empirical approach (PM5 method) to study the reactivity of azo dyes with singlet oxygen by using molecular orbital theory and they obtained a linear correlation between the second-order rate constants and the sum of electrophilic frontier density of the reactivity of azo dyes with singlet oxygen [22]. Time dependent density functional theory (TDDFT) appears the most reliable method to predict UV/vis spectra of azo dyes with an intermediate size [23-26]. Jacquemin et al. reported the methodology choice and reproduction of the UV/visible spectra of a large series of dyes by using PBE0 and B3LYP hybrid functionals in polarisable continuum model (PCM) [23, 24, 27, 28].

In this paper, focus is on determining the electronic and optical properties of RO16 azo dye by using DFT and TDDFT methods. First, the electronic properties and Fukui indices of the titled azo dyes were calculated by means of DFT, with the purpose of generating accurate information such as polarity, solubility, reactivity and nucleophilic, electrophilic and radical attack sites which enables a better understanding of its degradation. Secondly, by using TD-DFT calculations, an attempt is made to predict the UV/vis spectra of RO16, with the aim of rationalizing the differences observed in its experimental spectra.

2 MATERIALS AND METHODS

Materials

- RO16 azo dye was obtained from hight school of textiles, Casablanca, Morocco.

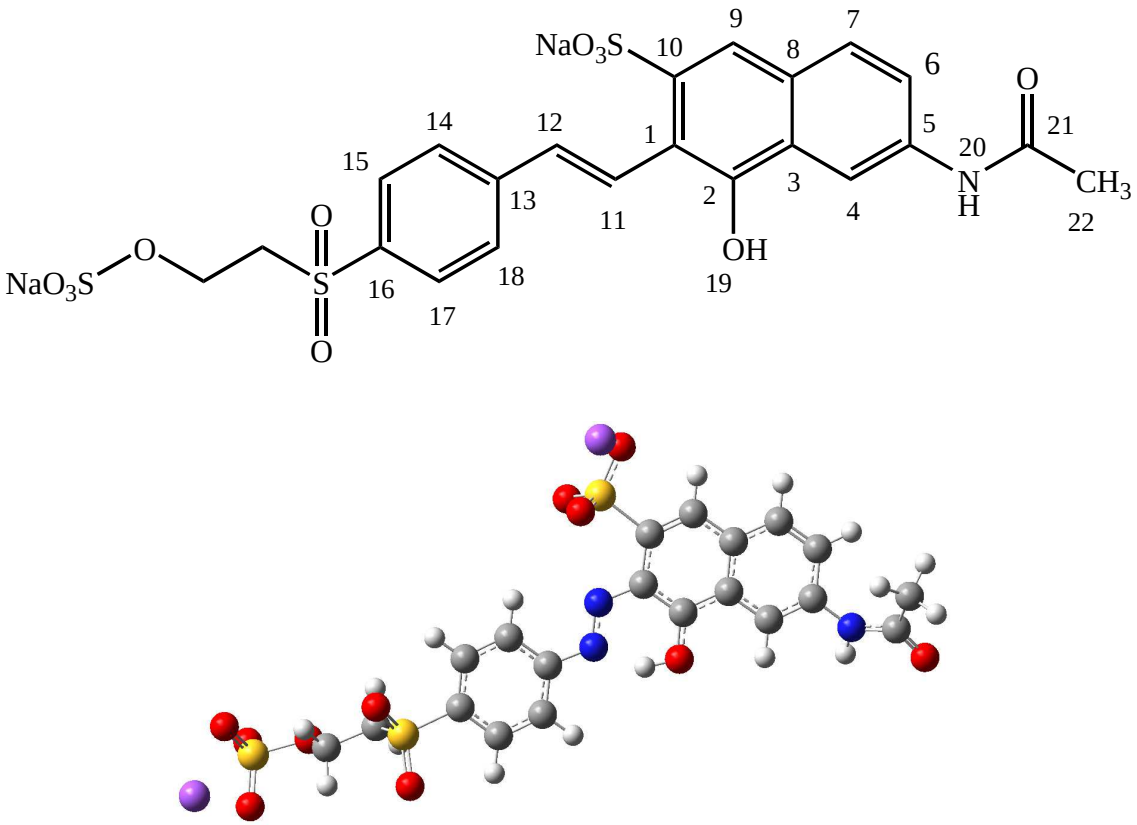


Fig.1. Chemical and optimized structures of RO16 obtained at B3LYP/6-31+G(d,p) level

Table.1 Orange 16 molecul

Name	Reactive Orange 16	
Synonyms	6-(Acetylamino)-4-hydroxy-3-[[4-[[2-(sulfooxy)ethyl]sulfonyl]phenyl]azo]-2-naphthalenesulfonic acid disodium salt	
Molecular Structure	Molecular Formula:	C20H17N3O11S3.2Na
	Molecular Weight:	617.53
	CAS Registry Number:	20262-58-2 (12225-88-6)

- Experimental UV/visible spectra for reactive RO16 azo dye was recorded on a *spectrometer in our laboratory* in water solvent.

3 THEORETICAL DETAILS

Geometry optimization and frequency calculations for colorants RO16 have been carried out at B3LYP/6-31+G(d,p) level (DFT method) as implemented in Gaussian 09[29]. The minima of ground states (GSs) were confirmed by the absence of imaginary frequencies. To determine the reactivity of the titled colorants, the electronic properties such as energy of solvation, the dipole moment (μ'), the isotropic polarizability (α), total energy, HOMO and LUMO energies, energy gap, electronic affinity (EA), ionization potential (IP), electronegativity (χ), chemical hardness (η), softness (S), electrophilicity (ω) and a Fukui functions analysis were calculated at the same level of theory (B3LYP/6-31+G(d,p)). The values of EA, IP,χ, η were calculated in two different ways. One, by using Koopman's theorem, which states that IP=-E_{HOMO} and EA=-E_{LUMO}. The other, by taking the differences of total energies when adding/removing an electron from/to the neutral molecule EA=E_0 –E_{-1} and IP=E_{+1}-E_0 where E_0, E_{-1} and E_{+1} are the electronic energies of neutral molecule, neutral molecule when adding an electron and neutral molecule when removing an electron, respectively. χ, η and ω are calculating using the following formula:

$$\chi = \frac{IP + EA}{2} = -\mu \qquad (\mu \text{ is the chemical potential})$$

$$\eta = \frac{1}{2}\left(\frac{\partial \mu}{\partial N}\right)_v = \frac{1}{2}\left(\frac{\partial^2 E}{\partial N^2}\right)_v = \left(\frac{IP - EA}{2}\right)$$

$$S = \frac{1}{\eta}$$

$$\omega = \frac{\mu^2}{2\eta}$$

$$\mu' = \sqrt{\mu'^2_x + \mu'^2_y + \mu'^2_z}$$

$$\alpha = \frac{1}{3}(\alpha_{xx} + \alpha_{yy} + \alpha_{zz})$$

In the hardness formula, N is the number of electrons, υ the external potential, and E the electronic energy. To identify the most likely reactive atoms for titled colorants to react with electrophile or nucleophiles, Fukui indices were calculated. In DFT, the Fukui functions are the key of region selectivity indicators for electron-transfer controlled reactions [Reference Fukui book]. The condensed Fukui functions were computed using Mulliken population analysis method [30].The Fukui indices are obtained by the following formula:

$$F_k^+ = q_k(N+1) - q_k(N) \text{ : For nucleophilic attack}$$

$$F_k^- = q_k(N) - q_k(N-1) \text{ : For electrophilic attack}$$

$$F_k^0 = \frac{\left[q_k(N+1) - q_k(N)\right]}{2} \text{ : For radical attack}$$

Excited singlet state (ES) energies were calculated from the optimized geometries at B3LYP/6-31+G(d,p)level (TDDFT method)[31]. The allowed vertical electronic excitation energies were thus obtained, which consequently give the absorption

energies in the UV/vis range with their configuration interaction(CI) description as well as their oscillator strength (*f*>0.1). The solvent effects are taken into account implicitly by using the polarisable continuum model with the integral equation formalism variant (IEFPCM). In PCM model, the solute is embedded into a cavity surrounded by a dielectric continuum characterized by its dielectric constant (ε_{CH3OH}=32.613)[32]. The molecular orbitals and the optimized geometries were visualized by using Molden software (http://www.cmbi.ru.nl/molden/) and Gaussian View 5, respectively.

4 RESULTS AND DISCUSSION

4.1 ELECTRONIC PROPERTIES OF OR 16

The free solvation energie for RO16 is -86 kcal/mol. This indicates that the azo dye is highly soluble in water, so it don't transfer to sludge. It has an amphipathic behaviour i.e. its chemical structure containing hydrophobic (phenyl rings) and hydrophilic (hydroxyl groups) parts. The high polarity of RO16 is corroborated by the high values of permanent dipole moments of RO16 18Debye, which confirm its high solubility in water. The dipole moment is considered an important parameter to determine the reactivity in molecular systems (*i.e.* it represents a measurement of charge distribution in a molecule as we can see in Fig.2.

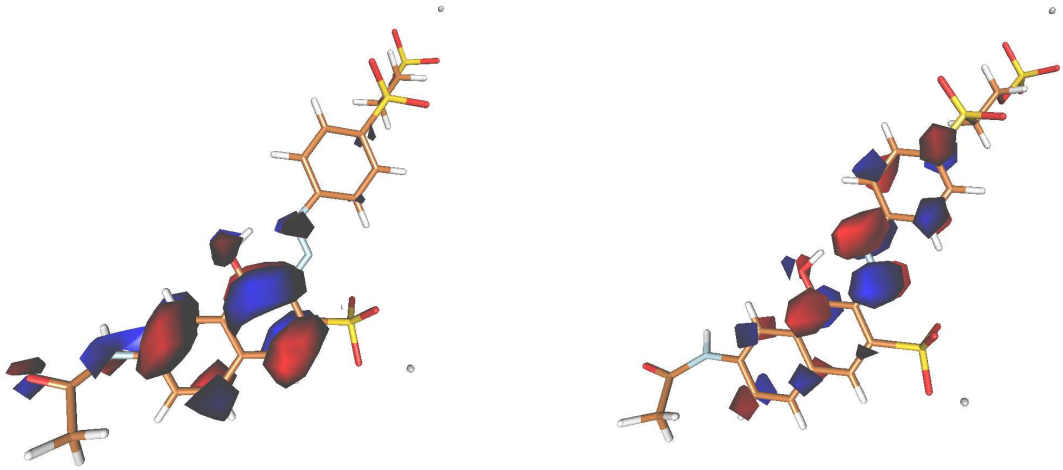


Fig.2. HOMO and LUMO charge distribution of RO16 obtained at B3LYP/6-31+G(d,p) level.

The high polarisability values of RO16 (613 Boh^3 for RO16) indicate that the azo dye has the capacity to polarize other neighbouring systems. The low energy of the LUMO orbital indicates that this azo dye can behave as soft electrophiles. The ionization potential (IP) is the energy required to remove an electron from the outer shell of a molecule system. High IP values indicate that the molecular system does not lose its electrons with facility. While, adding an electron to a molecular system is defined as electronic affinity (EA). High E.A values indicate that molecular systems tend to take electrons easily. The gap energy values (difference energy between HOMO and LUMO energies) are an indication of the reactivity and stability of molecular systems. A low gap energy value indicates the molecular system is less stable and more reactive, while high values indicates that the molecular system is more stable and less reactive. In case of RO16, azo dye has small gap energie (2.94 eV), which indicates that the azo dye is less stable and more reactive systems. Table 2 reports the electronic properties associated with the chemical potential for RO16.

To determine the active sites through Fukui indices for RO16, two types of charge distribution are calculated (i) electrostatic potential(ESP) and (ii) natural population (NPA) charges. In accordance with Fukui indices showed in Table 2, nitrogen atom N11 of the double N11=N12 for RO16. This result is confirmed by the charge distribution in the LUMO orbitals of RO16 (Fig.2), in which a high electronic density in nitrogen atoms of the double N11=N12 is present. In a recent study, Tizaoui and Grima reported that the oxidation of azo dyes by ozone proceed through electrophilic attack, and the attack occurs on sites possessing high negative charge density including multiply bonded species such –C=C- or –N=N- double bonds [4].

Table.2. Fukui indices of RO16 calculated at IEF-PCM/B3LYP/6-31+G(d,p) level.

	Orange 16		
	Nucleophilic Attack	Electrophilic Attack	Radical Attack
C1	-0.008	-0.142	-0.075
C2	-0.018	-0.002	-0.010
C3	-0.048	-0.026	-0.037
C4	-0.005	-0.099	-0.052
C5	-0.017	-0.050	-0.034
C6	-0.049	-0.017	-0.033
C7	-0.013	-0.098	-0.056
C8	-0.006	0.083	0.039
C9	-0.063	-0.203	-0.133
C10	0.010	0.024	0.017
N11	-0.142	0.054	-0.044
N12	-0.173	-0.090	-0.131
C13	0.077	0.019	0.048
C14	-0.088	-0.035	-0.061
C15	-0.022	-0.001	-0.012
C16	-0.052	-0.039	-0.046
C17	-0.018	0.005	-0.007
C18	-0.087	-0.043	-0.065
O19	-0.096	-0.095	-0.095
N20	-0.010	-0.042	-0.026
C21	0.014	0.016	0.015
C22	-0.004	0.010	0.003
O23	-	-	-

Several studies reported that the mechanism responsible for the partial oxidation of azo dyes by ozone (first stage of decolourization) occurs through the ozone reaction with the double bond of azo (-N=N-) group [14, 15, 33]. These results appear in accordance with the results obtained here regarding the favoured sites of nucleophilic attack (i.e, ozone). Electrophilic attack can be in different sites e.g. C1 and C9 sites for RO16. The charges distribution in HOMO orbitals for RO16 confirmed that the mentioned positions are sites of electrophilic attack (Fig.3). Hihara et *al,* showed that C1=C2, C4=C5, C6=C7, C13=C14, C13=C18 and N11=N12 are almost all possible double bonds that can react with the single oxygen ($^1O_2$)[22]. The authors excluded the reactivity of C3=C4 and N11=N12 with the $^1O_2$ due to the low electron density, d_{HOMO} of the HOMO orbitals (See Fig. 2).

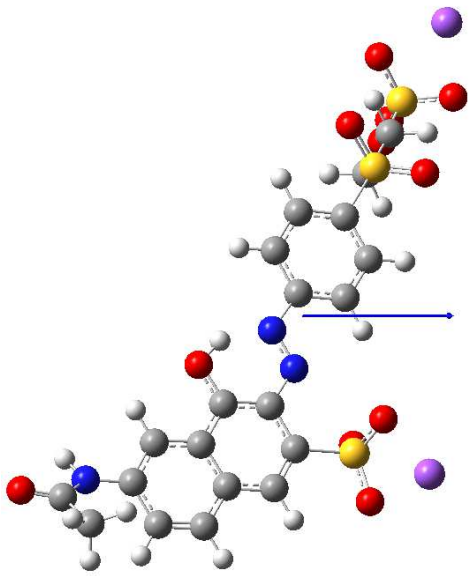


Fig.3. Dipole moment orientations of RO16 obtained at B3LYP/6-31+G(d,p) level.

The electrophilic site obtained by using NPA or ESP are in good agreement with the results obtained by Hihara et al [22]. Regarding the radical attack, different active sites can be suggested. The C9 and N12 are the favoured sites for radical attack in RO16.

4.2 UV/VIS SPECTRA OF OR 16

The experimental UV/vis spectra of RO16 were obtained in water solvent. The calculated electronic excited states are performed in gas and in PCM by using TD-DFT method at B3LYP/6-31+G(d,p) level (Table 3). The maximum absorption bands at 490 nm for RO16 (Fig.4), correspond to HOMO→LUMO electronic transition. The electronic transition induces a charge transfer from one side to another site in the azo dye (Fig. 5).

Table.3. Electronic properties of RO16 calculated at IEF-PCM/B3LYP/6-31+G(d,p) level.

	IA (eV)	EA (eV)	χ (eV)	η (eV)	S (eV)	ω (eV)	α (Bohr^3)	μ' (Debye)
Orbital consideration	6.17	3.23	4.70	2.94	0.17	3.76	613.47	18.46
Energy consideration	6.05	3.37	4.71	2.68	1.34	4.14	613.47	18.46

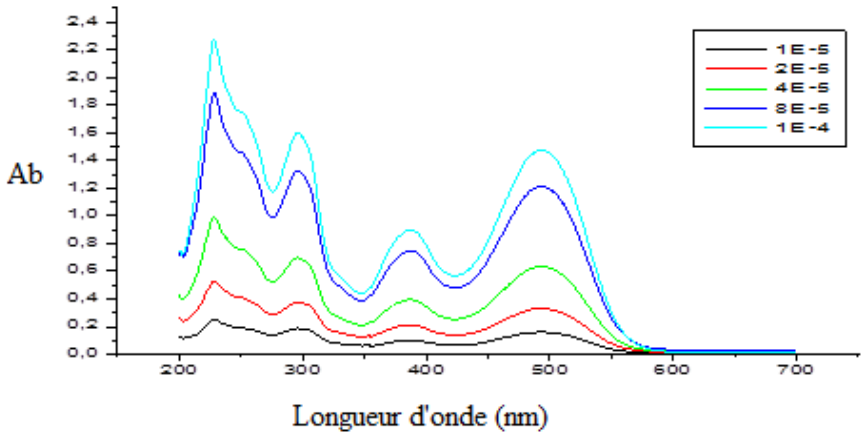


Fig.4 . OR16 absorption

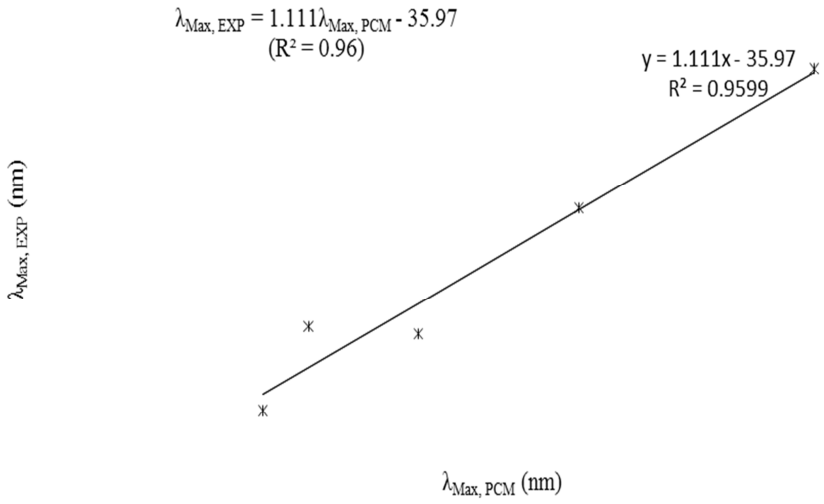


Fig.5. Linear correlation between calculated and experimental absorption bands for RO16 obtained at B3LYP/6-31+G(d,p) level.

The calculated absorption bands were underestimated in the gas phase. The PCM solvent induces a bathochromic shift of the absorption bands. A good correlation was obtained between the calculated and experimental absorption band values of RO16 (R^2= 96 %).

5 CONCLUSION

In the present study, by using DFT method we showed that RO16 is polar and high soluble azo dye in water, and N11 is the most active site involved in the degradation process (by ozone for example). The UV/vis spectra of RO16 is well reproduced using TDDFT method (R^2=97%). The perspectives of this study are the determination of the degradation products, and density functional study of the oxidation process.

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COMPARATIVE ANALYSIS OF APPROPRIATENESS OF DRUG INFORMATION GIVEN IN PEDIATRIC FORMULARIES AVAILABLE IN INDIA

Running title: ANALYSIS OFPEDIATRIC FORMULARIES AVAILABLE IN INDIA

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ABSTRACT: *Objective:* This study was done to assess the appropriateness of drug information on prescribing in Pediatric age group given in a popular formulary, CIMS and IAP.
Methods and Material: We collected detailed information of 51 drugs (Anti-infectives, NSAIDS, Drugs acting on respiratory system and Vitamins) which are commonly prescribed in pediatric age group from Current Index of Medical specialities (CIMS) (April-July2012) and Indian Academy of Pediatrics (IAP) Drug formulary (2013) 30th edition. WHO model formulary for children 2010, was used as standard reference. We compared appropriateness of drug information which is given in CIMS and IAP with WHO model formulary for children.
Results: In our study, it was found that indication was inappropriate for 52% drugs in IAP and 73% drugs in CIMS , regarding contraindication 36% drugs in IAP and 43% drugs in CIMS was inappropriate, Precautions was inappropriate for 77% drugs in IAP and 88% in CIMS, Drug dosage was not mentioned appropriately for 75% drugs in IAP and 85% drugs in CIMS, Relevant information in pediatric patients in presence of renal and hepatic impairment was not mentioned for 86% drugs in IAP and 100% drugs in CIMS, adverse effects were not mentioned properly for 77% drugs in IAP and 95% in CIMS, interactions were not mentioned properly for 75% drugs in IAP and 83% in CIMS and ancillary information was inappropriate for 39% drugs in IAP and 70% in CIMS.
Conclusions: This study highlights the inadequacy of popular Indian formularies CIMS and IAP in context of pediatric prescribing. Thus, there is imminent need of a pediatric national formulary with due focus on guidelines for pediatric prescribing.

KEYWORDS: Appropriateness, Drug formulary, Pediatrics.

KEY MESSAGES: *There is ample scope of improvement in existing pediatric formularies. Hence we suggest there is need to establish a national pediatric formulary to provide therapeutic guidelines to prescribers.*

1 INTRODUCTION

Pediatric patients comprise a large proportion of the patient population, but concern about their medication safety has been neglected for a long time. Drug prescribing for pediatric patients offers special challenge. [1] They are the most vulnerable group of population suffering from frequent but usually nonserious illness. Most of these are self-limiting and treated not only inappropriately but also report to polypharmacy.[2] In 2007, the World Health Assembly passed a Resolution titled 'Better Medicines for Children'.[1] This resolution recognized the need for research and development into medicines for children, including better dosage forms, better evidence and better information about how to ensure that medicines for treating the common childhood diseases are given at the right dose for children of all ages. Compared to adult medicines, drug use in pediatrics is not extensively researched and range of licensed drug in appropriate dose form is limited. [3] Unfortunately, nowadays, 50% of the medicines used in children may not have been studied in this age group. [4] Children

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have therapeutic needs which probably cannot be met if medicines representing major therapeutic advances in adults are not tested and labeled for pediatric use. Prelicensure studies on safety and efficacy of a drug are generally carried out in adult subjects. [5] In majority of times their safety and tolerability are extrapolated from such adult studies. Once a medicine becomes available in the market for adults, it is possible to use it in children in an off-label way. Thus, the use of unlicensed and off-label medicines for children has been a common practice for decades; this does not offer children the same quality, safety and efficacy of medicines as in adults. Approximately 75% of the prescription medications listed in the Physician's Desk Reference lack pediatric labelling.

Inappropriate prescribing (IP) is a major public health problem and screening for IP is highly desirable since detection and correction are easy and worthwhile.[6] Most developed nations have formularies to provide therapeutic guidelines to prescribers and enhance rational use of drugs. Most prescribers look upon other sources of drug information like Current Index of Medical Specialties (CIMS), Drug Formulary, Monthly Index of Medical Specialities (MIMS), Drug Index, Drugs Today etc., for guidance on drug information. These proprietary formularies may have shortcomings in terms of authenticity, accuracy of drug information in general, and a specific age group of patients, in particular. Promotion of appropriate and safe use of drugs in children is the need of the hour. Hence there is a need to quantify these errors and look for possible solutions.

Thus, this study was done with the objective to assess the appropriateness of drug information on prescribing in pediatric age group given in a popular formulary, CIMS-India (April-July2012) and IAP drug formulary (2013) 30th edition.

2 MATERIALS AND METHODS

We collected detailed information of 51 drugs which are commonly prescribed in pediatric age group. List of drugs included are anti-infective, non-steroidal anti-inflammatory drugs (NSAIDs), drugs acting on respiratory system and vitamins. WHO model formulary for children 2010 was taken as a standard reference and given information of drugs considered appropriate. Detailed information about the drug groups was taken from Current Index of Medical specialities (CIMS-India) (April-July2012) and Indian Academy of Pediatrics (IAP) Drug formulary (2013) 30th edition (which is published by Indian Pediatrics Association). Appropriateness was checked regarding indications, contraindications, precautions, dosage, renal and hepatic impairment, adverse effects, interactions and ancillary information. We compared the appropriateness of drug information which is given in CIMS and IAP with WHO model formulary for children. Comparison of drug information was also done between IAP and CIMS.

3 RESULTS

The study results showed that out of the selected 51 drugs from WHO Model formulary for children, informations were lacking for 11 drugs in CIMS which include Niclosamide, Benzathine Benzyl Penicillin, Benzyl Penicillin, Procaine Benzyl Penicillin, Trimethoprim, Epinephrine, Diloxanide furoate, Ferrous salt, Vit K, Riboflavin and Thiamine. As compared to WHO Model Formulary for children appropriate informations were not mentioned, for all of the rest 40 drugs in CIMS (fig.1)

In CIMS, 29 drugs had inappropriate information regarding indications and the remaining drugs with appropriate information were Levamisole, Praziquental, Ivermectin, Cefalexin, Erythromycin, Nitrofurantoin, Gentamicin, Ibuprofen, Paracetamol, Budesonide and Salbutamol.

Considering contraindications, informations were inappropriate for 17 drugs which included Amoxycillin, Amoxycillin + Clavunalic Acid, Ceftriaxone, Imipenem+ Cilastin, Azithromycin, Chloramphenicol, Ciprofloxacin, Doxycycline, Erythromycin, Nitrofurantoin, Gentamicin, Sulfamethoxazole+Trimethoprin, Clindamycin, Ibuprofen, Folic acid, Vit C and Colecalciferol.

Details regarding precautions were inappropriate for 35 drugs and the informations were appropriate for Folic acid, Vit C, Colecalciferol, Pyridoxine and Retinol. Dosages were inappropriate (age-wise, weight-wise, dose, duration) for 34 drugs while it was appropriate for Levamisole, Ampicillin, Chloramphenicol, Sulfamethoxazole+ Trimethoprin, Budesonide and Vit C.

Relevant information in presence of renal and hepatic impairment (Modifications, Severity and consequences), were not mentioned for all the 40 drugs. Adverse effects were not properly mentioned for 38 drugs, while for Pyrantel and Paracetamol it was mentioned properly.

WHO model formulary for children 2010 has put asterisk mark (*) for some of the potentially hazardous interactions. These interactions were not mentioned for 33 drugs while it was mentioned properly for Albendazole, Ivermectin, Paracetamol, Colecalciferol, Pyridoxine, Retinol and Hydroxycobalamine.

WHO Model Formulary has mentioned ancillary information where ever applicable such as administration instructions, patient advice and storage information; while in CIMS the same was lacking for 28 drugs and the remaining 12 drugs which had the ancillary information are Pyrantel, Amoxycillin, Ampicillin, Cefalexin, Cefazolin, Doxycycline, Acetylsalicylic acid, Ibuprofen, Paracetamol, Salbutamol, Folic acid and Hydroxycobalamine.

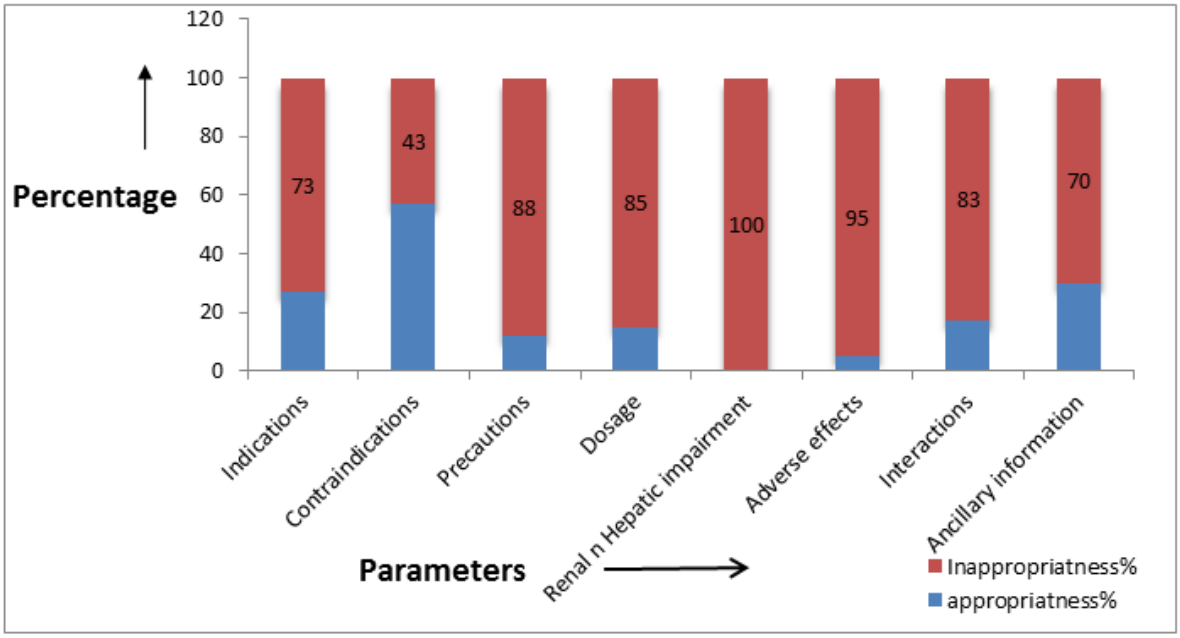


Figure 1: Qualitative comparative analysis between WHO model formulary and CIMS

When we compared IAP drug formulary with WHO Model formulary for children, study results showed that out of the selected 51 drugs, informations were lacking for 7 drugs in IAP which include Amoxcillin+Clavulanic acid, Cefazolin, Procaine Benzyl Penicillin, Doxycycline, Sulfamethoxazole+trimethoprim, Trimethoprim and Epinephrine. Considering all parameters, appropriate information was not mentioned for all of the rest 44 drugs in IAP as compared to WHO Model Formulary for children (Fig.2). Inappropriate information regarding indications were present in 23 drugs and remaining drugs had appropriate information which include Albendazole, Niclosamide, Ivermectin, DEC, Ibuprofen, Paracetamol, Cloxacillin, Imipenam + Cilastin, Chloramphenicol, Erythromycin, Gentamicin, Metronidazole, Nitrofurantoin, Clindamycin, Budesonide, Diloxanide furoate, Amphotericin B, Ferrous salt, Folic acid, Vit K and Hydroxycobalamine. Considering contraindications information of 28 drugs were appropriate and the rest had inappropriate informations which include Albendazole, Amoxycillin, Benzathine benzyl Penicillin, Ceftriaxone, Cefotaxime, Imipenem+Cilastin, Chloramphenicol, Ciprofloxacin, Erythromycin, Nitrofurantoin, Clindamycin, Vancomycin, Diloxanide furoate, Ferroys salt, Vit C and Cholecalciferol. Details regarding precautions were inappropriate for 34 drugs and the remaining 10 drugs which include Levamisole, Diloxanidefuroate, Amphotericin B, Folic acid,Vit C, Pyridoxine, Retinol, Riboflavin, Thiamine and Hydroxycobalamine had appropriate information. Dosage were inappropriate (age-wise, weight-wise, dose, duration) for 33 drugs, rest of the drugs which include Abendazole, Levamisole, Ibuprofen, Ampicillin, Cephalexin, Cloxacillin, Imipenam + Cilastin, Chloramphenicol, Budesonide, Diloxanide furoate and Folic acid had appropriate information. Relevant information in presence of renal and hepatic impairment (Modifications, Severity and consequences), were not mentioned for 38 drugs, remaining drugs with appropriate information were Levamisole, Ceftazidime, Ciprofloxacin, Metronidazole, Thiamine and Colecalciferol. Adverse effects were not mentioned properly for 34 drugs, while for the remaining 10 drugs (Pyrantel, Acetylsalicylic acid, Budesonide, Diloxanide furoate, Amphotericin B, Vit K, Colecalciferol, Retinol, Riboflavin and Thiamine) it was mentioned properly. WHO model formulary for children 2010 has put asterisk mark (*) for some of the potentially hazardous interactions. These interactions were not mentioned in 33 drugs while it was mentioned properly for Albendazole, Niclosamide, Pyrantel, DEC, Paracetamol, Diloxanidefuroate, Colecalciferol, Pyridoxine, Retinol, Riboflavin and Thiamine. WHO Model Formulary has mentioned ancillary information where ever applicable such as administration instructions, patient advice and storage information which was lacking for 17 drugs which include Levamisole, Pyrantel, Ivermectin, DEC, Cefotaxime, Ciprofloxacin, Erythromycin, Gentamicin, Metronidazole, Nitrofurantoin, Ferrous salt, Vit K, Vit C, Colecalciferol, Pyridoxine, Retinol and Thiamine.

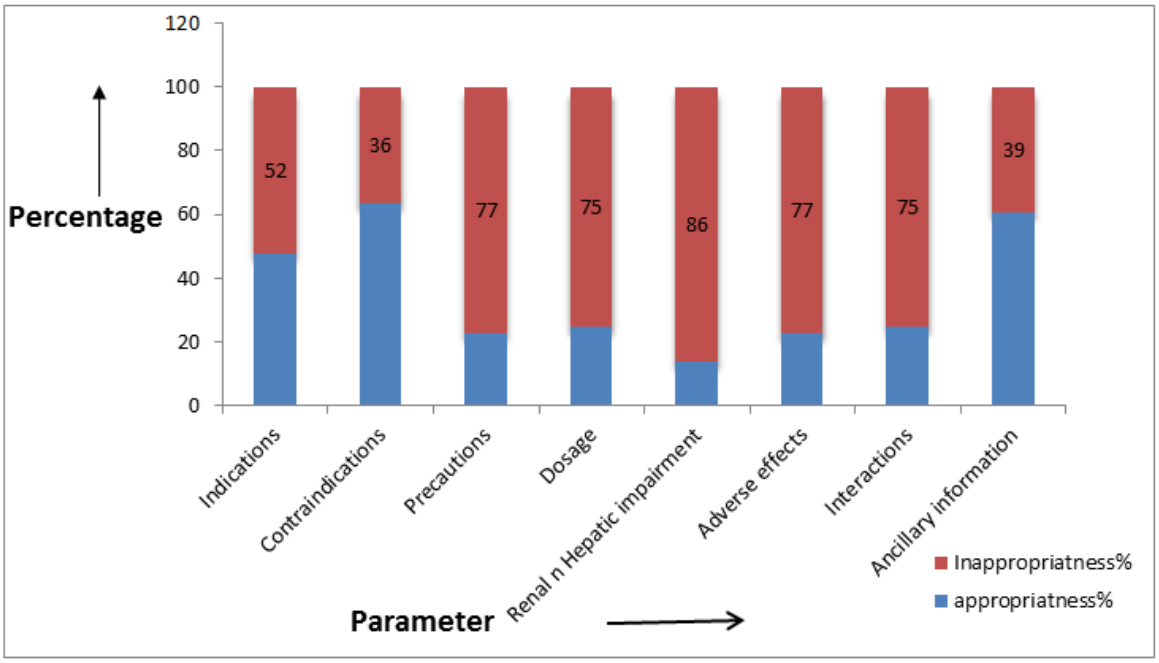


Figure2: Qualitative comparative analysis between WHO model formulary and IAP

There are additional 39 drugs as shown in Table 3, with related information mentioned in IAP under sections of antimicrobial, antiprotozoal, antihelminthic, NSAIDS, drugs acting on respiratory tract and vitamins which are absent in WHO list of essential medicines 17th ed. and Indian list of essential medicines.

Table 3: Additional drugs mentioned in IAP

SECTIONS	DRUG LIST
Antimicrobial	Aztreonam, Carbapenems, Cefaclor, Cefadroxil, Cefdinir, Cefepime, Cefoprazone, Cefpodoxime, Cefuroxime, Furazolidone, Linezolid, Meropenem, Minocycline, Netilmicin, Oxytertracyclin, Piperacillin with tazobactam Roxithromycin, Spiramycin, Teicoplanin and Tobramycin.
Antiprotozoal	Gamma Benzene Hexachloride, Nitazoxanide, Furazolidone, Nitazoxanide and Tinidazole.
NSAIDS	Indomethacin, Meloxicam, Naproxen, Nimesulide and Piroxicam.
Drug acting on respiratory system	Aminophylline, Theophylline and Pholcodine.
Vitamins	Alphacalcidol, Biotin, Ergocalciferol, MVI pediatric, Vitamin B complex and Vitamin E.

When we compared CIMS with IAP study results showed that out of the selected 51 drugs from IAP, information were lacking for 9 drugs in CIMS. Considering all parameters, appropriate information was not mentioned for all of the rest 42 drugs in CIMS as compared to IAP (Fig.3). Appropriate information regarding indications was lacking in 38 drugs and contraindications were inappropriate for 24 drugs. Details regarding precautions were not appropriate for 9 drugs. Dosage were not appropriate (age-wise, weight-wise, dose, duration) in paediatric patients for 32 drugs. Relevant information in paediatric patients in presence of renal and hepatic impairment (Modifications, Severity and consequences), were not mentioned for 14 drugs. Adverse effects were not mentioned properly for 27 drugs. Interactions were not mentioned properly in 28 drugs. Ancillary information where ever applicable such as administration instructions, patient advice and storage information were lacking for 5 drugs.

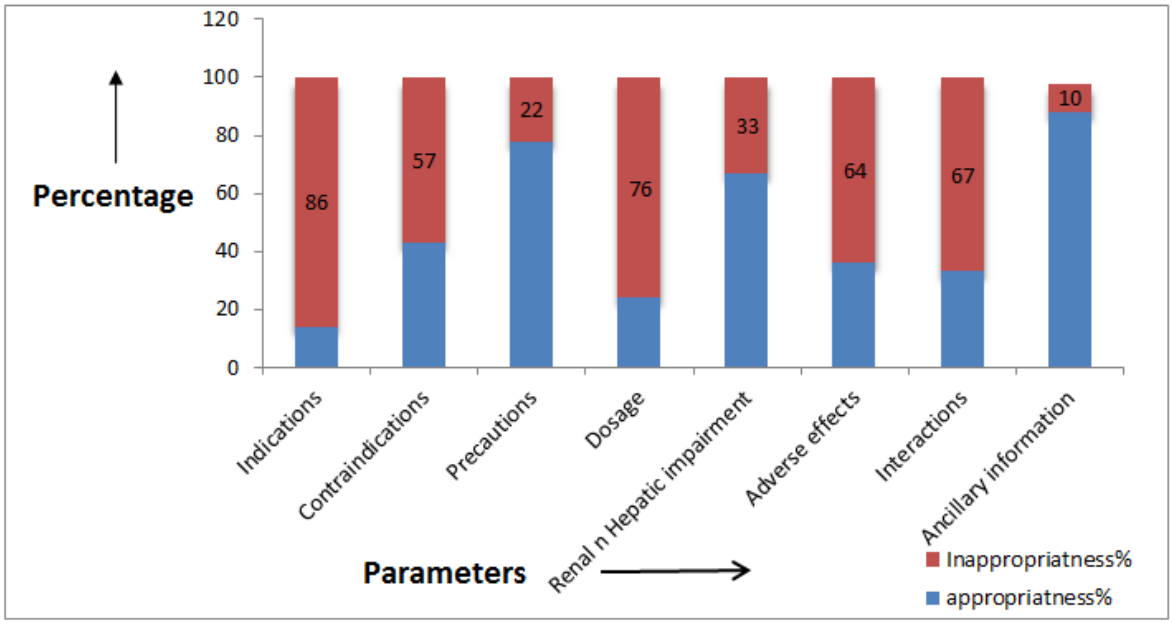


Figure 4: Qualitative comparative analysis between IAP and CIMS

4 DISCUSSION

Children form one of the largest groups of patients consulting general practitioners.[7] It is estimated that every year 18% of all general practitioners consultations concern children <16 years. Treating pediatric patients requires specialized knowledge and skills and must consider the unique physiological, emotional and social characteristics of this population subset.[8] Health care practitioners must pay close attention to a child's age, weight, medication dosing frequencies, allergies and other factors to ensure safety of medication therapy. Inappropriate prescription not only increases the cost of medical treatment but also increases the morbidity and mortality. [3]Third world population spends 30-40% of their total health budget on drugs many of which are prescribed irrationally.

Individual prescribers are always responsible for ensuring that there is adequate information to support the quality, efficacy, safety and intended use of a drug before prescribing it. [7] Doctors themselves report that they often use promotional drug literature as a source of information about new drugs. [9] Doctors in private practice or who graduated long ago report the highest use of promotional drug literature as a source of drug information. Physicians should be aware of the limitations of these sources of information for daily practice in this vulnerable group.

In the present study, selection of drugs was based on various studies: Ajapuje et.al stated that antibiotics (78%) are the most prescribing drug in paediatrics followed by NSAIDS (19%), Multivitamins (14%) and Bronchodilators(12%).[3] Similar results were found in another two studies by Mothilol M et.al[10] and Shamshy K et.al.[11]VenKateswaramurthy N et.al stated anti infective and anti-inflammatory comprises of total (75%) of prescription.[12] Of the anti infective agents, antibiotics were most commonly prescribed. So, in our study we have selected 51 drugs which include anti infective, anti-inflammatory, drugs acting on respiratory system and vitamins.

Indication parameter illustrate the official use of the drugs and while prescribing drugs to pediatric patients physicians must stick to it thus for curbing off-label usage of drugs and problems regarding dosing information. In our study, considering indication, inappropriate information was present in 78% and 58% of drugs in CIMS and IAP respectively. Spectrum of medication error can be further narrowed with adequate information regarding contraindications and precautions for drug usage. In our study considering contraindication, inappropriate information were present in 45% and 51% of drugs in CIMS and IAP, respectively. Considering precaution inappropriate information were present in 84% and 82% of drugs in CIMS and IAP. This implies that the prescribers would have to look for more information of these drugs elsewhere which is often tedious and time consuming. All drugs have a therapeutic range below which they do not work and above which they are toxic. [4] Wrong dosage causes toxicity or treatment failures. [13] Drugs (age-wise, weight-wise) need to be used in utmost rational manner in the correct dosage and for correct duration. The road to pediatric drug testing has been a rocky one. [14] Nobody wants to use children as guinea pigs, but the problem remains that drugs are being given to children in potentially unsafe doses. The FDA understands that giving medications to children for which there is only adult data available could be

harmful, considering that children have dosing concerns and side-effect risks that differ from adults. In our study, dosage was inappropriate for 88% and 76% of drugs in CIMS and IAP respectively.

Children may have unique disease states and immature organ development that may impact the elimination of a drug from their bodies or create unique needs for drug elimination. [15] Information relevant in pediatric patients in presence of renal and hepatic impairment (modifications, severity and consequences) is thus equally important. In our study, relevant information in presence of renal and hepatic impairment was not mentioned for 100% and 88% drugs in CIMS and IAP respectively. Children are more likely to experience adverse events as a result of errors because of their physiology and limited defences.[16] Reference to drug formularies for prescribing information has been reported as an important step to prevent ADRs. Prescribing doctors should monitor specifically adverse reaction of prescribing drugs to pediatric age group thus; more classified emphasis of adverse effect is required. Our results showed that adverse effects were not mentioned properly for 94% and 80% drugs in CIMS and IAP respectively. Polypharmacy and overprescribing is common in India. [3] More medicines increase the risk of drug interactions, adversely affect the patient compliance and hike cost of treatment. In our study, interactions were not mentioned properly in 78% and 68% of drugs in CIMS and IAP respectively.

Further it was found that, some of the drugs mentioned in IAP (Table 3) are lacking in WHO list of essential medicines, 17th ed. and Indian list of essential medicines. When IAP and CIMS are compared with each other (Table 4), IAP seems to be superior to CIMS. In our setup presence of formulary like IAP is of due importance.

Children cannot evaluate and articulate their response to medications. [8] Drugs on the market approved for use in children may not have been tested in clinical trials on children.[17] High-profile incidents of heparin overdoses in California, Indiana and Texas and cardiovascular medication errors have shed light on the unique safety challenges associated with the medications to the pediatric population.[18] Reducing pediatric medication errors is topmost priority nationwide. The latest examples are the ban of drugs like nimesulide and phenylpropanolamine in anticold formulation. [5]

Oshikoya Kazeem A et.al states that there is reduced level of confidence among prescribers (Interns) while prescribing drugs to pediatric age group.[19] This signifies pitfalls in traditional teaching of pharmacology, medical students are not formally taught pediatric dose calculation either in pharmacology or pediatrics; they have demonstrated difficulty in calculating pediatric doses. Deficiency in the knowledge and basic skills of prescribing are also responsible for significant number of medication errors. Thus, there is a need to improve the undergraduate teaching methods so that it encompasses more knowledge and practice directed towards rational prescribing.

When compared with WHO Model Formulary, both IAP and CIMS formularies give widely different dosing guidelines for drug prescription in pediatric age group. This study highlights the inadequacy of popular Indian formularies CIMS and IAP for pediatric prescribing. The respondents are likely to prescribe drugs that are more expensive and unavailable locally at that time; this totally negates the WHO's guidelines for rational prescribing. Thus, there is an imminent need of a pediatric national formulary with due focus on guidelines for pediatric prescribing. Buck MarciaL et.al also stated need of pediatric formulary for drug evaluation, selection and therapeutic use. [20] Similar results are found in other two studies by Elora Hilmas et.al.[18] and Yewala Vijay N et.al.[5]

5 CONCLUSION

As the pediatric population continues to rise, the need for improving the healthcare of these patients should be a priority of all nations. There is ample scope of improvement in existing pediatric formularies. Hence we suggest there is need to establish a national pediatric formulary to provide therapeutic guidelines to prescribers.

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Effet du type de matière grasse alimentaire sur quelques paramètres biochimiques, de croissance et de la semence chez le Canard de Barbarie

[Effect of the diet fat type on some biochemical, growth and semen characteristics of Muscovy ducks]

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ABSTRACT: The effects of the diet fat type on some biochemical, growth and semen characteristics were studied in 32 males Muscovy ducks distributed into 4 comparable experimental groups of 8 birds. During a period of 12 weeks, each of the group was randomly fed one of the rations including the control diet (T) or one diet containing either soya bean oil (S), pig fat (G) or palm oil (P). Life weight of group G was significantly (P<0.05) lower as compared to other groups. The carcass yield and percentage of liver relative to life weight was similar (P>0.05) among groups. Diet containing Pig fat induced the lowest (P<0.05) heart percentage while Soya bean oil induced the highest. The highest (P<0.05) testis proportion (0.59%) was registered in control group and the lowest (0.16%) with Palm oil which also induced the highest (P<0.05) gizzard proportion. Pig fat induced the significantly (P<0.05) higher intra testicular protein as compared to the others treatments. Control group recorded the significantly (P<0.05) lower intra hepatic protein rate as compared to the pig fat group. The intra testicular cholesterol rate remained comparable (P>0.05) among treatment groups. For the hepatic cholesterol rate, value obtained with palm oil was significantly (P<0.05) higher than that of the control group. Sperm volume induced by pig fat was significantly (P<0.05) smaller than that of other treatments groups. Semen characteristics (concentration, motility, viability and pH) were not statistically (P>0.05) different among groups. The type of dietary fat except pig fat may therefore improve growth and reproduction performance of Muscovy duck.

KEYWORDS: dietary fat, biochemical, growth, semen, Muscovy duck.

RESUME: L'effet du type de matière grasse alimentaire sur quelques caractéristiques biochimiques, de croissance et de la semence a été étudié sur 32 canards de Barbarie mâles repartis en 4 traitements comparables de 8 sujets. Pendant 12 semaines, chacun des traitements a reçu au hasard soit la ration témoin sans matière grasse (T), soit l'une des rations contenant l'huile de soja (S), la graisse de porc (G) ou l'huile de palme (P). Le poids vif du traitement G à la fin de l'essai a été significativement inférieur (P<0,05) à celui des trois autres traitements par ailleurs comparables (P>0,05). Le rendement carcasse et la proportion du foie par rapport au poids vif ont présenté pour chacun ces paramètres des valeurs comparables (P>0,05) entre les différents traitements. La proportion des testicules significativement (P<0,05) la plus élevée a été enregistrée avec le traitement témoin (0,59%) et la plus faible avec l'huile de palme (0,16%). Le taux de protéine intra testiculaire le plus faible (P<0,05) a été relevé avec le traitement P et le plus élevé (P<0,05) dans le traitement G. Le taux de protéine intra hépatique du traitement témoin a été plus faible (P<0,05) comparé à celui des autres traitements qui ont été par ailleurs comparables (P>0,05). Le traitement témoin a également enregistré le taux de cholestérol hépatique significativement (P<0,05) plus faible comparé au traitement à l'huile de palme. La graisse de porc (G) a induit le volume spermatique significativement (P<0,05) plus faible par rapport aux autres traitements. Cependant, les autres caractéristiques de la semence (concentration, motilité, viabilité et pH) ont été comparables (P>0,05) quel que soit le traitement. Les

matières grasses autres que la graisse de porc sont suggérées pour améliorer les performances zootechniques du canard de Barbarie.

MOTS-CLEFS: matière grasse, biochimique, croissance, semence, canard de Barbarie

1 INTRODUCTION

Les matières grasses sont des sources par excellence d'énergie en alimentation animale et leurs constituants interviennent dans les phases de croissance et de reproduction [4], [8]. Les matières grasses peuvent être d'origine animale ou végétale. La plupart des graisses animales contiennent beaucoup d'acides gras saturés ; ce qui en fait un produit peu recommandable pour la santé à cause des maladies cardiovasculaires qu'elles sont susceptibles de causer [3]. L'influence des matières grasses sur les performances de croissance et/ou de reproduction a été largement étudiée. En effet, Mc Namara *et al.* [18] ont trouvé que les suppléments gras de la panse des bovins pouvaient augmenter le taux de conception chez ces derniers. L'âge et la composition lipidique de la semence des pintades affecteraient le temps de conservation, la motilité et la viabilité des spermatozoïdes [9]. Les travaux de Mitre *et al,* [19] ont démontré que la prise orale d'huile de foie de requin modifie la composition lipidique et augmente la motilité ainsi que la vélocité des spermatozoïdes chez les taureaux. Si plusieurs travaux [1], [2], [5], [10], [15], [17], [27] ont déjà été consacré au canard en général et au canard de Barbarie en particulier, les données de l'effet du type de matière grasse sur les paramètres zootechniques sont quasiment inexistants. En effet, si divers types matières grasses sont très souvent utilisées pour ajuster le niveau d'énergie métabolisable alimentaire chez les animaux, les effets sur certains paramètres telles que la croissance ou la reproduction ne sont pas toujours connus.

Ce travail a pour objectif d'évaluer l'effet du type de matière grasse alimentaire sur quelques caractéristiques de la croissance et de la reproduction chez le canard de barbarie

2 MATÉRIEL ET MÉTHODES

2.1 MILIEU D'ÉTUDE

L'essai a été mené à la Ferme d'Application et de Recherche de la Faculté d'Agronomie et de Sciences Agricoles (FASA) de l'Université de Dschang (Ouest-Cameroun). Dschang est situé à environ 1420m d'altitude. Le climat est de type tropical soudano-guinéen avec environ 2000 mm de pluie par an répartie sur une seule saison allant de mi-Mars à mi-Novembre. La température moyenne est de 20°C et l'humidité relative généralement supérieure à 60%.

2.2 ORIGINE, LOGEMENT ET PROTECTION SANITAIRE DES ANIMAUX

Provenant de la Ferme d'Application et de Recherche de la FASA, Un total de 32 canards de barbarie mâles d'environ 33 semaines et 2800g d'âge et de poids respectivement a été utilisé dans le cadre de cet essai.

Les animaux avaient été repartis en 4 groupes de 8 sujets comparables, puis logés dans des loges crépies de 8 m² chacune. Les traitements anthelminthiques et anticoccidiens avaient été administrés avant leur mise en traitements. Les antistress étaient donnés chaque fois la veille et après la manipulation des animaux.

2.3 DISPOSITIF EXPÉRIMENTAL

Quatre rations expérimentales (T, S, P et G) formulées en fonction du type de matière grasse ont été utilisées. La première ration (T) ne contenait pas de matière grasse tandis que les trois autres contenaient 3 % d'huile de soja (S), d'huile de palme (P) ou de graisse de porc (G) respectivement. Chaque ration contenait sensiblement 19 % Protéines brutes et 3000 kcal/kg d'énergie métabolisable.

Chacune des rations expérimentales avaient été attribuée au hasard pendant les 12 semaines de l'essai à l'un des 4 lots. L'aliment était rationné à 140g/j tandis que l'eau était servie *ad libitum.* Les animaux étaient pesés à jeun tous les 7 jours à l'aide d'une balance de sensibilité 5 g.

2.4 COLLECTE DES DONNEES ET PARAMETRES ETUDIES

2.4.1 RENDEMENT CARCASSE ET PROPORTIONS DE QUELQUES ORGANES PAR RAPPORT AUX POIDS VIF

Pour la détermination de ces paramètres, 6 animaux par lot ont été sacrifiés à la fin de l'essai. Les données ont été relevé sur le poids carcasse (sans tête ni pattes), du cœur, du foie, du gésier et des testicules.

Ces données collectées ont permis de calculer les paramètres suivants :

- Rendement carcasse $= \frac{\text{Poids carcasse}}{\text{Poids vif}} \text{x}100$
- Proportions des organes $= \frac{\text{Poids (organe)}}{\text{Poids vif}} \text{x}100$

2.4.2 DETERMINATION DU TAUX DE PROTEINE ET DE CHOLESTEROL INTRA TESTICULAIRE ET HEPATIQUE

Pour la détermination du taux de protéine et de cholestérol total intra testiculaire et hépatique, après avoir sacrifié les animaux à la fin de l'essai, les testicules et le foie ont été prélevés, nettoyés puis pesés et broyés dans un mortier de porcelaine contenant de l'eau distillée de manière à obtenir un homogénat à 15%. Le broyat a ensuite été centrifugé à 3000 tr/min pendant 30 min. Le surnageant était prélevé puis conservé à -20°C jusqu'au moment de leur analyse. Le dosage des protéines intra testiculaire et hépatique était fait par la méthode de Bradford, et celui du cholestérol était déterminé par la méthode de CHOD-PAP à partir d'un kit de Boehringer Gmbh (Mannheim Germany).

2.4.3 COLLECTE ET ANALYSE DE LA SEMENCE

Pour l'évaluation du volume, du pH, de la concentration, de la motilité et de la viabilité des spermatozoïdes, tous les sujets réceptifs de chaque traitement étaient prélevés toutes les quatre semaines. La semence était collectée le matin à l'aide d'une femelle boute-en-train (26). Une goutte de sperme était diluée dans 1ml de Nacl à 0,9% et à 36°C. Les lames étaient préparées et observées au microscope au grossissement 400X. Les spermatozoïdes mobiles et immobiles étaient comptés sur 10 champs choisis au hasard. Le pourcentage des formes mobiles était déterminé de la manière suivante :

Pourcentage de spermatozoïdes mobiles $= \frac{Nombre\ de\ \ spermatozoïdes\ mobiles}{Nombre\ de\ spermatozoïdes\ comptés} \text{ x } 100$

La solution contenant les spermatozoïdes était ensuite diluée au 1/20 avec le liquide de Marcano et les spermatozoïdes comptés. Pour déterminer le nombre de spermatozoïdes (N) par ml de sperme, la formule suivante a été utilisée :

$$N = \frac{Nombre\ de\ spermatozoïdes \text{ x } 1000 \text{ x } 1}{\text{mm}^3}$$

Où 1 est le volume de la solution et 1000 le facteur de conversion des mm^3 en ml

2.5 ANALYSE STATISTIQUE DES DONNÉES

Toutes les données ont été soumises à l'analyse de la variance (ANOVA) à un facteur suivant un dispositif aléatoire complètement randomisé. En cas de différences entre les traitements, les moyennes ont été séparées à l'aide du test de Duncan au seuil de signification de 0,05. Le logiciel SPSS 12.0 a été utilisé pour les analyses.

3 RÉSULTATS

3.1 PARAMÈTRES DE CROISSANCE

❖ ***Evolution du poids vif***

L'influence du type de matière grasse (TMG) sur l'évolution hebdomadaire du poids vif tel que résumé à la figure 1 montre les poids vifs oiseaux des traitements T, S et P, ont légèrement augmenté; par contre ceux du traitement G contenant de la graisse de porc ont perdu du poids tout au long de l'essai. Le poids vif du traitement G à la fin de l'essai (2093,75±249g) a été significativement ($P<0,05$) inférieur à celui des trois autres traitements en l'occurrence 3025±65g, 3125±119g et 3087±165g pour les traitements T, S et P respectivement. Ces derniers ont présenté des poids comparables ($P>0,05$) à la fin de l'essai.

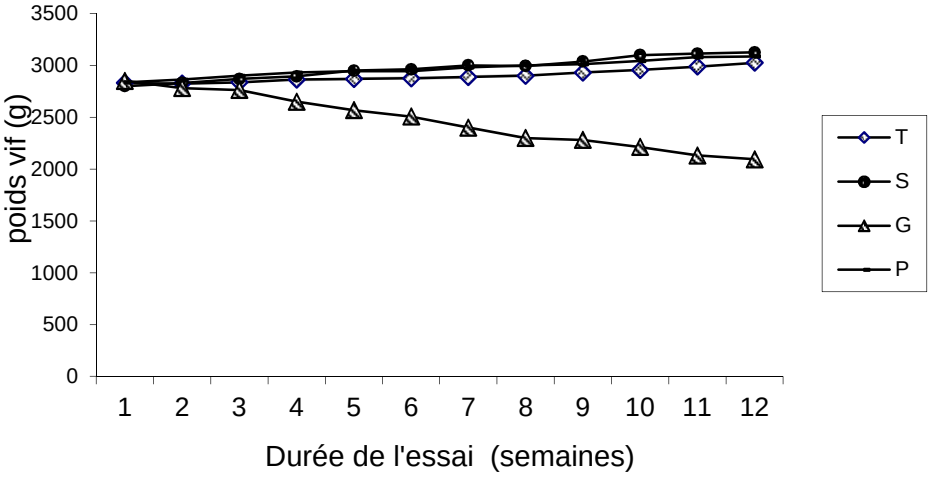


Figure 1 : Evolution hebdomadaire du poids vif en fonction du type de matière grasse chez le canard de Barbarie

❖ ***Rendement carcasse***

Il ressort de la figure 2, illustrant l'effet du type de matière grasse sur le rendement carcasse qu'il a varié entre 58,66 et 71,04% pour les traitements G et S respectivement. Le rendement carcasse des différents traitements ont cependant été tous comparables (P>0,5) quel que soit le type de matière grasse.

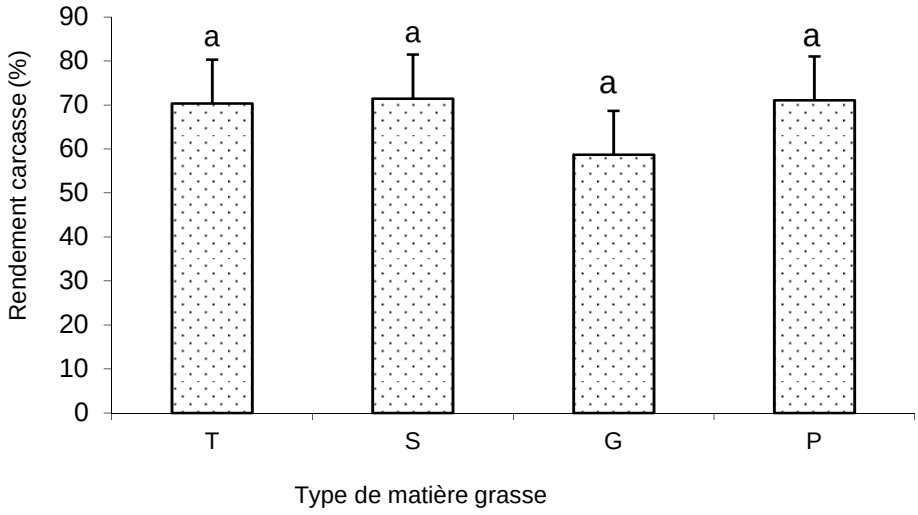


Figure 2 : Influence du type de matière grasse sur le rendement carcasse chez le canard de Barbarie. a : les colonnes affectées de la même lettre ne diffèrent pas significativement (P>0,5)

❖ ***Proportions de quelques organes par rapport aux poids vif***

Ainsi que qu'il ressort de la figure 3 résumant l'effet du type de matière grasse sur les proportions de quelques organes chez le canard de Barbarie, les proportions du foie ont varié de 1,37 à 1,56% tout en restant comparables (P>0,5) quel que soit le type de matière grasse utilisé.

La proportion du cœur a été très variable allant de 0,44 à 0,91% en fonction des types de matière grasse. Les proportions significativement (P<0,5) les plus élevées ont été enregistrées dans le lot témoin (T) et celui contenant de l'huile de soja (S) en comparaison à celle du traitement contenant de la graisse de porc dans l'aliment. Le traitement P a induit une valeur intermédiaire significativement (P<0,5) inferieur aux valeurs des traitements T et S mais supérieur à la valeur du traitement G.

La valeur de la proportion des testicules du traitement G (0,24%) a été significativement (P<0,5) supérieur à celle du traitement P (0,16%) mais inférieur (P<0,5) à celles des traitements T (0,59%) et S (0,54%) qui étaient par ailleurs comparables (P>0,5).

La proportion du gésier du traitement P (2,55%) a été significativement (P<0,5) plus élevée que celles de tous les autres traitements qui ont par ailleurs été tous comparables (P>0,5).

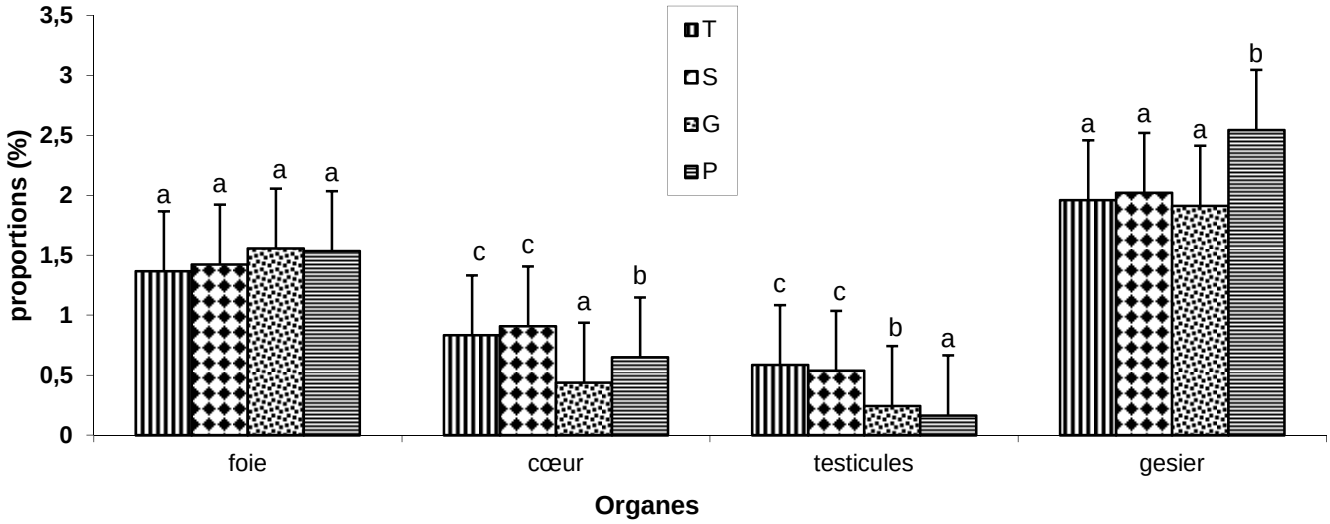


Figure 3: Effet du type de matière grasse sur les proportions de quelques organes par rapport au poids vif chez le Canard de Barbarie

a, b,c : les colonnes affectées de la même lettre ne diffèrent pas significativement (P>0,5)

3.2 TAUX DE CHOLESTEROL ET DE PROTEINE HEPATIQUE ET TESTICULAIRE

Le tableau 1 présente l'effet du type de matière grasse sur le taux de protéine et de cholestérol hépatique et testiculaire chez le canard de Barbarie. Il en ressort que le taux de protéine testiculaire a varié de 2,14 à 3.37 µg/mg. Aucune différence significative (P>0,5) n'a été enregistrée aves les lots T, S et P. Seul le traitement G a induit une valeur significativement (P<0,5) plus élevé que celles des traitements P et T mais comparable (P>0,5) celle du traitement S contenant de l'huile de soja.

Le taux de protéine hépatique des traitements T, S et P ont présenté des valeurs comparables (P>0,5) mais significativement (P<0,5) plus faibles que celui du traitement G.

Le taux de cholestérol testiculaire a varié de 12,14 à 14,38 µg/mg tout en restant comparables (P>0,5) quel que soit le type de matière grasse.

Le taux de cholestérol hépatique a été beaucoup plus variable (1,78 à 6,34µg/mg), toutefois les traitements T, S et G d'une part et S, G et P d'autre part ont présenté des valeurs comparables (P>0,5). Cependant, la valeur obtenu pour le traitement P a été significativement (P<0,5) supérieure à celle du traitement T.

Tableau 1: Effet du type de matière grasse sur le taux de protéine et de cholestérol hépatique et testiculaire chez le canard de Barbarie

Caractéristiques	Types de matière grasse			
	T	S	G	P
Protéine testiculaire (µg/mg)	2,21±0,48[a]	2,8±0,28[ab]	3,37±0,67[b]	2,14±0,76[a]
Protéine hépatique (µg/mg)	2,46±0,66[a]	3,91±0,34[b]	3,8±0,9[b]	4,13±0,78[b]
Cholestérol testiculaire (µg/mg)	12,14±3,38[a]	12,7±3,17[a]	12,79±2,71[a]	14,38±4,76[a]
Cholestérol hépatique (µg/mg)	1,78±0,54[a]	3,2±0,26[ab]	3,64±0,71[a b]	6,34±3,17[b]

a, b : sur la même ligne, les valeurs affectées de la même lettre ne diffèrent pas significativement (P>0,5)

3.3 EFFET DU TYPE DE MATIERE GRASSE SUR LES CARACTERISTIQUES DE LA SEMENCE DU CANARD DE BARBARIE

Le tableau 2 présente l'effet du type de matière grasse sur quelques caractéristiques de la semence. Les valeurs les plus basses ont été enregistrées chez les sujets du traitement G tandis que les plus élevés sont celles du traitement S à l'exception de la viabilité qui a été la plus élevée chez les sujets du traitement P. Cependant, aucune différence significative (P>0,5) n'a été notée entre les traitements pour ces trois paramètres. Le pH du sperme a varié de 6,8 à 6,93 mais il n'y a pas eu de différence significative (P>0,5) entre les traitements quel que soit le type de matière grasse.

Le volume d'éjaculat significativement (P<0,5) le plus faible a été enregistré chez les oiseaux du traitement (G) consommant un aliment à la graisse de porc tandis que ceux des autres traitements ont été tous comparables (P>0,5).

Tableau 2 : Effet du type de matière grasse alimentaire sur quelques caractéristiques de la semence chez canard de Barbarie

Période de collecte	Types de matière grasse				
	caractéristiques	T	S	G	p
4ème semaine	Concentration	109,56±4,95[a]	112,66±3,21[a]	108,83±5,2[a]	111,93±2,1[a]
	motilité	78,66±2,08[a]	79,33±1,52[a]	77,66±3,51[a]	78,66±3,05[a]
	viabilité	85,33±3,21[a]	88,33±3,05[a]	89,33±5,85[a]	87,33±3,21[a]
8ème semaine	Concentration	111,3±1,8[a]	113,3±6,48[a]	108,86±3,55[a]	111,7±2,78[a]
	motilité	80,33±4,16[a]	81,33±4,93[a]	77,33±3,51[a]	79,66±3,05[a]
	viabilité	89,33±2,08[a]	90,33±2,51[a]	89,33±1,52[a]	89,33±2,51[a]
12ème semaine	Volume	1,35±0,45[b]	1,43±0,25[b]	0,66±0,11[a]	1,23±0,25[b]
	pH	6,9±,01[a]	6,86±0,2[a]	6,8±0,26[a]	6,93±0,11[a]
	concentration	111,5±1,8[a]	113,3±6,48[a]	109,6±2,08[a]	112,24±0,5[a]
	motilité	80,33±4,1[a]	82,66±4,72[a]	79,33±1,52[a]	80,66±2,08[a]
	viabilité	90,66±4,16[a]	90±6,08[a]	85,33±3,21[a]	91,66±3,51[a]

a, b : sur la même ligne, les valeurs affectées de la même lettre ne diffèrent pas significativement (P>0,5)

4 DISCUSSION

A l'exception du traitement G recevant de la graisse de porc dans la ration, le poids vif a augmenté avec la quantité d'aliment ingéré quel que soit le type de matière grasse. Un résultat similaire a été enregistré par Sauveur et De Carville [24] chez la même espèce et par Garet et Thoby [11] chez les pintades. La croissance a été néanmoins faible en comparaison à celle des auteurs ci-dessus cités. Cela pourrait s'expliquer par le fait que les animaux du présent essai étaient à l'âge adulte caractérisé par un processus de croissance est considérablement réduit [24]. En effet, si la croissance chez la majorité des oiseaux est relativement rapide en phase de démarrage, elle diminue en finition et le poids adulte est atteint à la fin de cette phase. En phase de reproduction, la croissance pondérale quasiment nulle et évolue généralement de manière non significative [24]. La baisse du poids du traitement nourrit à la graisse de porc pourrait s'expliquer par la forte teneur en acide gras saturés de ce type de matière grasse qui entrainerait des effets délétères sur la croissance [24]. . A l'exception du traitement G, les observations corroborent avec celles de Salichon [23], Leclercq et Baeza [15] chez le canard de Barbarie, de Lehmann et al [16] chez les dindonneaux, Kidd et Kerr [14] et de Rezaei et al [22] chez les poulets de chair reformés. En effet, l'animal utilise plus de protéine apportée l'aliment pour la construction de nouvelles cellules en phase de croissance et pour l'entretien et ou le remplacement de ces dernières en phase d'entretien et de reproduction [24]. Bien que le traitement G ait eu un poids vif significativement inférieur à ceux des autres traitements à la fin de l'essai, les différents rendements carcasse

ont été comparables quel que soit le type de matière grasse. La différence obtenue entre le traitement G et les autres serait dont imputable au cinquième quartier. Les proportions du foie et du gésier à l'exception du traitement P ont été comparables [P>0,5] quel que soit le type de matière grasse alimentaire. La proportion du gésier du traitement P a été significativement plus élevée [P<0,5] par rapport à celles des autres traitements. Cela traduit une activité intense de cet organe dans ce traitement, toutefois, les raisons de cette intense activité nous sont inconnues. Les variations observées tant au niveau du cœur que des testicules serait dues au profil différentiel des acides gras de chaque type de matière grasse et qui agirait différemment dans les processus d'ingestion, de digestion et d'assimilation des nutriments dans le tractus digestif, la muqueuse intestinale et la circulation sanguine. Il en est de même pour les taux de protéines et de cholestérol hépatiques et testiculaires. Exception faite du traitement recevant de la graisse de porc dans l'aliment, le volume du sperme a été comparable dans tous les autres traitements. Des résultats similaires ont été enregistrés par Tan [26] chez la même espèce. Ces résultats sont en contradiction avec les travaux de Kasai et Izumi [13], Stunden *et al.* [25] et Noirault et Brillard [20]. Ceci serait dû à l'espèce et à la méthode de collecte. En effet, il a été démontré que l'utilisation du vagin artificiel donne des résultats beaucoup plus satisfaisants que le massage abdominal [26]. La concentration, la motilité et la viabilité des spermatozoïdes ont évolué avec le temps. Ces résultats corroborent ceux de Etuk *et al.* [10], de Kasai *et al.* [13] et Noirault et Brillard, [20]. Hors mis la concentration des spermatozoïdes, les autres caractéristiques de la semence sont influencés par le mode de collecte, la fréquence de collecte et le temps mis après la collecte [6,] [7], [12], [21], [25], [28].

5 CONCLUSION

L'étude de l'effet du type de matière grasse alimentaire sur quelques caractéristiques de croissance et de reproduction chez le canard de barbarie a montré qu'à l'exception du traitement à base de la graisse de porc (G), le poids vif a augmenté avec la quantité d'aliment ingérée quel que soit le type de matière grasse ; Cependant, le rendement carcasse n'a pas été significativement affecté par le type de matière grasse ; A l'exception du traitement à base de la graisse de porc une fois de plus, les proportions du foie et du gésier n'ont pas été significativement affectées par le type de matière grasse. Cependant, celles du cœur et des testicules ont été plus petit dans les traitements à la graisse de porc et à l'huile de palme (P) en comparaison au traitement au Soja (S) et au témoin. Le taux de protéine et de cholestérol intra hépatique ainsi que le taux de protéine intra testiculaire a été plus élevé dans les rations expérimentales par rapport au témoin. Cependant, le type de matière grasse n'a pas influencé le taux de cholestérol intra testiculaire. Bien qu'il ne soit pas statistiquement significatif, la concentration, la motilité et la viabilité augmentent avec la durée de l'essai. Les matières grasses autres que la graisse de porc sont suggérées pour améliorer les performances zootechniques du canard de Barbarie. Une étude sur des oiseaux plus jeunes serait souhaitable pour étudier l'effet des matières grasses sur les paramètres biochimiques et zootechniques du canard de Barbarie.

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Seismic Performance Assessment of Masonry Infilled Steel Frame Structures

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ABSTRACT: Infilled steel frame structures are known to perform better as compared to infilled concrete frames under seismic loading. In comparison with masonry infilled reinforced concrete (RC) frame structures, very little research has been done on masonry infilled steel frames structures. Contribution of masonry infill in the positive performance of the infilled structures is widely recognized but no codes provide the clear and detailed guidelines on the design of infilled frame structures especially infilled steel frame structures due to the complex and unpredictable behaviour of masonry during an earthquake event. This study aims to provide a detailed insight into the composite behaviour of steel frame structures with unreinforced masonry infill under seismic loading. Time history analyses have been performed on masonry infilled steel moment resisting frame structures and structural performance has been evaluated in terms of global structural performance parameters of fundamental time period, maximum roof displacement and base shear and local parameters of interstorey drift ratios, structural member forces and infill stresses. The effect of masonry infill on the performance of infilled steel moment resisting frames has been investigated by varying the number of bays, number of storeys, percentage opening in the infill wall, location of the opening, type of openings, number of openings, infill strength, outer frame strength and infill thickness. The results of this research will help to understand the complex behaviour of masonry infilled steel frames for different variations mentioned above.

KEYWORDS: Masonry infill, Infilled steel frame structures, Time history analysis, Opening in the infill, Performance parameters, Seismic Performance Assessment, SAP2000, FEM.

1 INTRODUCTION

Construction of masonry infilled frame structures is common practice in many countries. Infills contribute to the performance of structures which is generally neglected in analysis and design by considering it as non-structural element. However the infill panels have significant in-plane stiffness that contribute to the frame stiffness and as a result, presence of the infills significantly increases the lateral strength and stiffness and frequency of the frame structures.

Contribution of masonry infill in the positive performance of the infilled structures is widely recognized but no codes provide the clear guidelines on the design of infilled frame structures especially infilled steel frame structures due to the complex and unpredictable behaviour of masonry during an earthquake event. A very little research has been done on masonry infilled steel frames. In this research seismic performance assessment has been conducted for detailed evaluation of seismic behaviour of masonry infilled frames, which is concerned with the evaluation of local and global parameters of a structure when it is subjected to seismic loads.

2 PREVIOUS RESEARCH

Analytical and experimental studies on seismic response of infilled frames started from mid-1950. Various research studies have shown that infill improves lateral strength and the stiffness of bare frame significantly and also greatly improves the energy dissipation capability of the structure.

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Benjamin and Williams (1958) [1] investigated three models including a masonry wall, masonry wall encased with the reinforced concrete frame and the masonry wall with steel frames. All these models were tested under an in-plane load. The test revealed the importance of aspect ratio which influences the ultimate capacity of the infilled frames. It was also reported that masonry has significant role in contributing lateral strength to the frame, however the size of masonry element did not affected the result.

Smith (1962) [2] conducted a study on a infilled structure experimentally on a small scale specimen. The specimen had steel frame and concrete mortar as infill. The in plane load was applied at the top corner of the infilled specimen. A compression region within the infill panel was observed which made the frame stiff and thus the concept of Diagonal strut method was evolved. It was also reported that longer is the contact length between the infill panel and the frame, wider the width of strut is.

Carydis et al (1992) [3] performed shake table tests on steel frames infilled with brick walls in which the gap between the frame and infill walls was filled with a non-shrinkable grout. The experiment revealed that frames good behavior was mainly due to grout filled gap.

Moghaddam (2004) [4] investigated lateral load behavior of masonry infilled steel frames with repair and retrofit. Experimental and analytical investigations on repaired and strengthened brick infilled steel frames were done. Two main repair techniques were examined in which the corner material was replaced with concrete or a concrete cover is placed on the panel. Efficiency and adequacy of these techniques were confirmed both experimentally and analytically.

Menari and Aliaari (2005) [5] developed an isolation system called SIWIS system. This system prevents the failure of column or infill walls by introducing a sub system which is breakable after reaching the full strength and stiffness of the infill wall. However, such system is not recommended in any of the codes yet as it would be expensive solution.

Arthur de Rooij (2005) [6] conducted an experimental and numerical research on steel frames with precast reinforced concrete infill panels. It was found that the behaviour of the panel-frame connections has a very large influence on the behaviour of the total structure. It was reported that the load-displacement behaviour of the steel frame with precast reinforced concrete infill panel can be represented by four stages: a linear elastic stage, a linear plastic stage and a non-linear plastic stage. The stresses in the concrete infill panel showed a compression and a tension diagonal.

Moghaddam et al. (2006) [7] performed experimental and analytical investigation to evaluate the shear strength and cracking pattern of infill panels in masonry and concrete infilled steel frames. It was reported that unlike masonry infills, corner crushing was dominant mode of failure in concrete infills.

Amin Mohebkhah (2008) [8] studied a two-dimensional numerical model using the specialized discrete element method (DEM) software UDEC, developed for the nonlinear static analysis of masonry-infilled steel frames with openings subjected to in-plane monotonic loading. It was found that the model can be used confidently to predict collapse load, joint cracking patterns and explore the possible failure modes of masonry-infilled steel frames with a given location for openings and relative area.

Tasnimi et al. (2011) [9] described an experimental program to investigate the behavior of brick-masonry infilled steel frames with openings. Test specimens included masonry infills having a central opening, strong pier-weak spandrel, weak pier-strong spandrel and a door opening. All infills were unreinforced and all lateral deformations were imposed in the plane of the frames. It was reported that that infilled frames with openings are not always more ductile than the ones with solid infill and the ductility of such frames depends on the failure mode of infill piers. This experimental investigation showed that infilled frames with openings experienced pier diagonal tension or toe crushing failure and had smaller ductility factors than those frames with solid infill.

3 METHODOLOGY

All selected structures have been designed in SAP2000 under gravity loads only. Micro modeling has been used to model the infill. Three acceleration time histories were used and dominant earthquake was selected for further research. Seismic performance assessment involves investigation of response of structure in terms of structural performance evaluation parameters by varying selected variation parameters under seismic loading. It gives insight of structural behaviour during an earthquake. A step by step procedure of seismic performance assessment is shown in figure 1 in the form of flow chart.

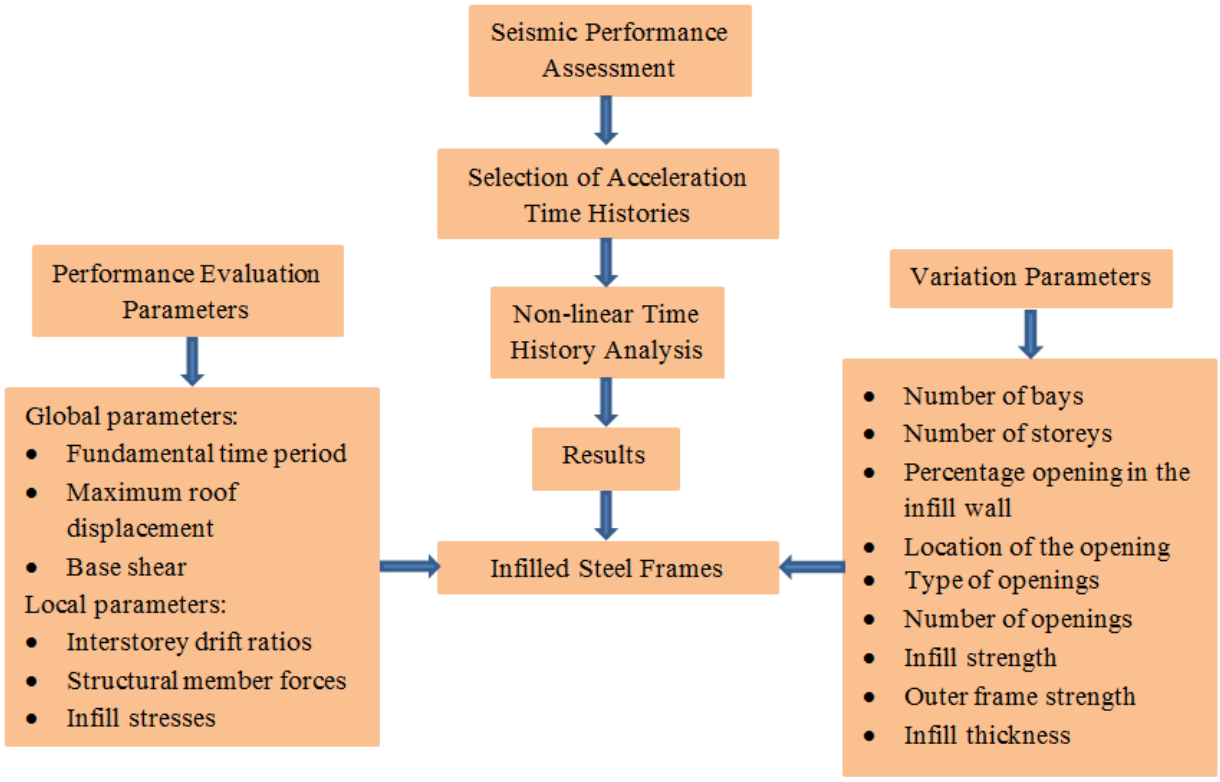


Figure 1: Seismic Performance Assessment (Flow Chart)

4 DESIGN OF PROPOSED BUILDINGS

Two groups of structures have been considered for this research. First group includes three storeys frame structures with varying number of bays from one to four and the other includes three bays structures with varying number of storeys as three, five, seven and nine. All structures are hypothetical regular and symmetrical moment resisting frame structures. Soil Structure Interaction is ignored and a raft foundation is considered representing fix supports at the base of structure in models.

Table-1: Geometric parameters of models

Bay Size	20 ft.
First Storey Height	13 ft.
Typical Storey Height	12 ft.
Roof Slab Thickness	5 inch.
Typical floor Slab Thickness	6 inch.

All the buildings are considered as office buildings and are designed in SAP2000 under gravity loading, with live loads being taken from UBC-97 [10]. Steel frames have been designed according to AISC LRFD99 [11]. ASTM A-36 steel (FY= 36 Ksi and FU=58 Ksi, AISC LRFD99 Table-2) has been used for all structural members.

5 MODELING OF MASONRY INFILL PANEL

Infill has been modeled in SAP2000 by using micro modeling i.e. Finite Element Modeling, FEM). Before modeling of all structures a detailed study on a single bay three storey models was conducted to investigate the effect of different area elements available in SAP2000, meshing and interface elements on behaviour of structure and was compared with the results of previous researches to optimize the modeling. Gap element (Figure 2.a) was used as interface element at contact surface of frame and infill to transfer the forces between infill and frame. It was found that if meshing is very fine, the increased

numbers of contact points due to very fine meshing are sufficient enough to transfer the forces between infill panel and frame elements and the results of models with fine meshing were similar to those models with Gap elements. So for all models Gap elements were neglected due to the conformance of results. The results of time history analysis using El Centro acceleration time history data on single bay three storey model in terms of base shear and roof displacement are given in Table-2.

Finite element modeling (FEM) of infill has been done using plain stress elements in SAP2000. Very fine meshing (9"x9") has been used to transfer forces from outer frame to infill by assuming semi integral infilled frame.

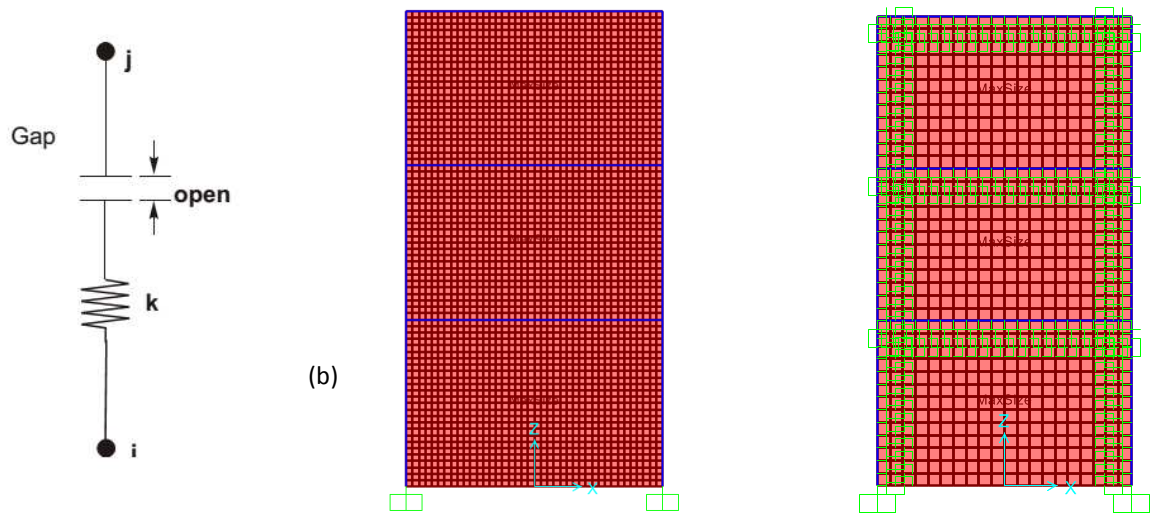


Figure 2: (a) Gap element (CSI Reference Manual SAP2000) (b) FEM Model with very fine meshing (c) FEM Model with Gap elements

Table-2: Results of time history analysis on initial investigation models

Model Type	Parameters	
	Base Shear (Kips)	Roof Displacement (ft)
Model with Gap element	85	0.004917
Model without Gap element	85	0.004917

The properties like compressive strength and unit weight of infill were taken as actual as found by experimental testing (Table-3). Modulus of Elasticity for bricks masonry was calculated by using an empirical relation $E=750f_m$ (Pauley, 1992) [12] where f_m is compressive strength of masonry. Thickness of the infill for general models was used as 9", equal to the standard length of Pakistani brick.

Table-3: Compressive strength of brick masonry prisms

Sr. No.	Crushing Load (Kips)	Compressive Strength (Ksi)
1	23.16	0.61
2	28.78	0.77
3	25.85	0.70
Average	25.93	0.69

6 ANALYSIS, RESULTS AND DISCUSSION

Three earthquake records of Kobe, Loma Preita and El Centro were selected initially and dominant earthquake was determined on the basis of structural response in terms of maximum roof displacement, base shear and interstorey drift ratio. For all structures considered, El Centro was found to be dominant earthquake due to longer ground motion duration and matching frequency. So this earthquake has been used in further research. Mass source for earthquake forces has been taken as recommended by UBC97 [10] i.e. Dead Load (DL) + 0.25 Live Load (LL). Results of analysis have been described below.

6.1 EFFECT OF VARIATION OF NUMBER OF BAYS

In this analysis four three storey structures with varying number of bays from 1 to 4 have been considered. Fundamental time period, maximum roof displacement and interstorey drift ratios decrease with the increase in number of bays due to the increased lateral stiffness and infill stresses and base shear follow the opposite trend and increase with the increase in number of bays. The results have been shown in figure 3. Figure 3 (a) shows that percentage difference of time period between one bay and two bay structures is found to be 11.7%, between two bay and three bay structures is 10.3% and between three bay and four bay structures is about 2%. So the percentage difference of the time period between structures decreases as the number of bays decreases. From figure 3(d), it can be seen that the infill stresses are less than compressive strength of the brick masonry which means material is able to resist the lateral loads without being crushed.

6.2 EFFECT OF VARIATION OF NUMBER OF STOREYS

In this analysis four three bay structures with varying number of storeys as 3, 5, 7 and 9 have been considered. All parameters including structural period, maximum roof displacement, Interstorey drift ratio, Base shear and infill stresses increase with the increase in number of storeys.

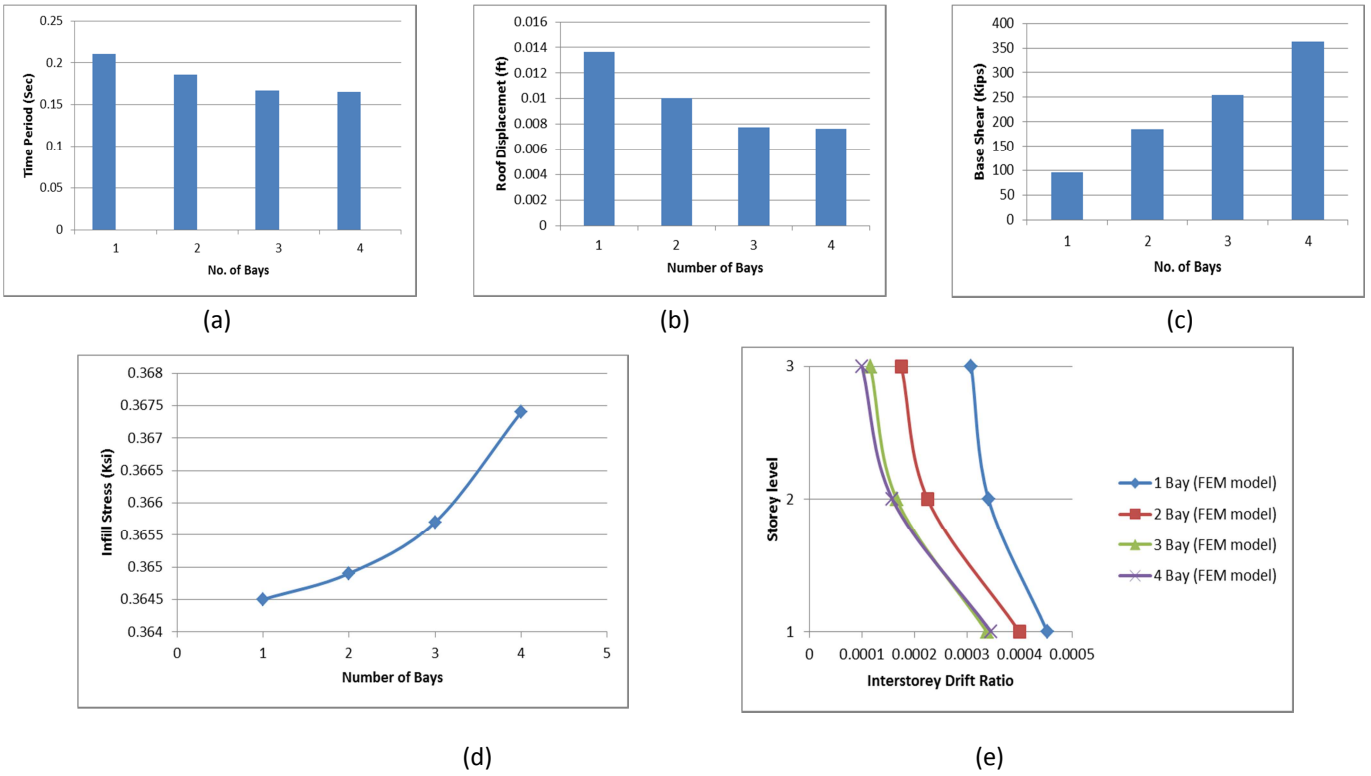


Figure 3: Effect of variation of number of bays on (a) Structural Period (b) Maximum roof displacement (c) Base shear (d) Infill stresses (e) Interstorey drift ratios

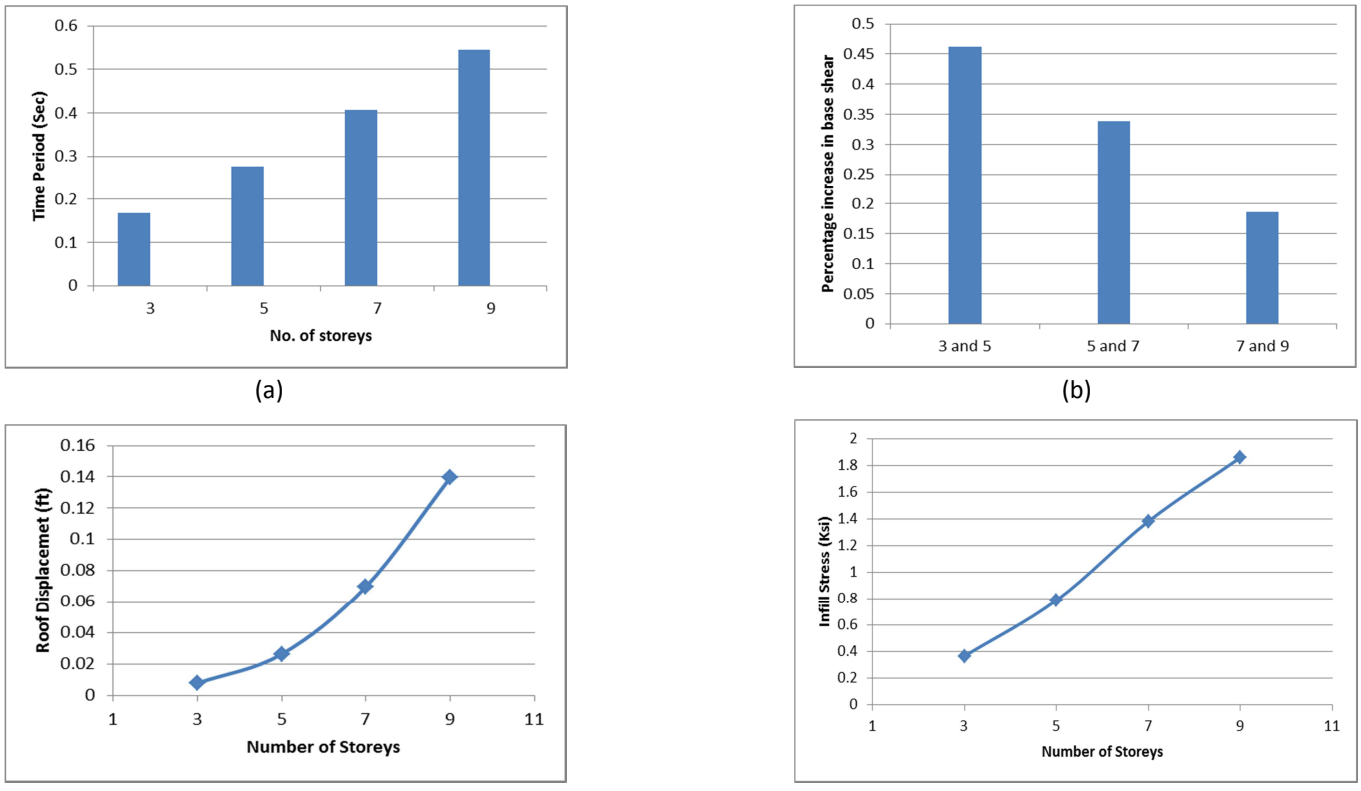


Figure 4: Effect of variation of number of storeys on (a) Structural Period (b) Base shear (c) Maximum roof displacement (d) Infill stresses

Results show that the percentage increase in maximum roof displacement decreases as we move to structures with greater number of storeys. The percentage difference between the maximum roof displacement of three storey and five storey structures is 70% and between seven storey and nine storey structures is 50%. This is due to the reason that the effect of increase in the mass of the structure becomes dominant over the increase in the lateral stiffness for structures with higher number of storey. The percentage increase in the base shear also decreases from 3 storey structures to 9 storey structures as shown in the results (figure 4-b). Results also show that the infill stresses are less than compressive strength of the brick masonry for low rise structures and it exceeds the compressive strength value for medium to high rise structures. So infills effectiveness decreases with the increase in height of structure and infill with higher compressive strength is required. Average percentage increase in the infill for every additional two storeys is 40.7% (figure 4-d).

6.3 EFFECT OF VARIATION OF PERCENTAGE OPENING IN INFILL WALL

Openings are essentials in almost every type of buildings. Openings have significant effect on the performance of infilled frame so it is necessary to assess the response of the infilled structures by considering the effects of the openings. For this research a central opening has been considered and size of the opening is expressed in terms of percentage of infill wall area. Percentage opening has been varied from 0% (fully infilled) to 100% (bare frame).

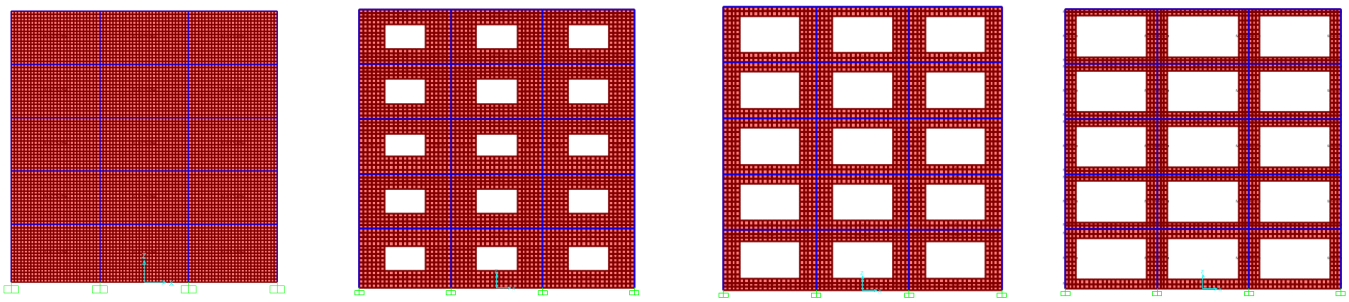


Figure 5: 5 Storey model with different percentages of openings in the infill (a) Fully infilled (0% Opening) (b) 20% Opening(c) 40% Opening (d) 60% Opening

Fundamental time period, maximum roof displacement, interstorey drifts ratio and structural member forces increase with the increase in percentage opening in infill wall. This is due to reason that with increase in opening size the lateral stiffness provided by infill decreases. On other hand base shear and infill stresses decrease with the increase in opening size which shows less resistance by the structure to lateral loads. The percentage difference in the fundamental time period of the fully infilled nine storey model and the nine storey models having percentage opening of 20%, 40%, 60%, 80% and 100% is 23.9, 41.1, 71.2, 82.4 and 83.01 respectively. Maximum value of roof displacement is 1.36’ for a nine storey structure with 100% opening (bare frame) and minimum is 0.14’ for a nine storey structure with no opening (fully infilled). The percentage difference of maximum roof displacement between the fully infilled model and the models with 20%, 40%, 60%, 80% and 100% is 26.9, 56.05, 73.5, 85.8 and 89.8 respectively for nine storey infilled steel frame structures. The percentage difference of the base shear between the fully infilled frame and frames having 20%, 40%, 60%, 80% and 100% openings in infill panel is 29.6, 48.5, 57.9, 62.5 and 65.7 respectively for nine storey structures and for five storey structures the percentage difference is 13.6, 26, 48.6, 50.2 and 55.3 respectively. There is no specific trend for interstorey drift at different storey levels for the same structures however the maximum interstorey drift occurs at one third of structure height form base as found by the researchers. As the percentage in the opening increases, the interstorey drift ratio at a particular storey level also increases and approaches to that of bare steel frame. As already described that stresses in the infill were found to be decreased with the increase in the percentage opening in the infill due to decrease in lateral load resisting capacity. As the percentage opening increases the lateral load resisting capacity of the infill decreases because infill can absorb or resist less stresses due to reduced amount of infill in the structural system. Infill stresses variation for a 9 storey steel infilled structure is shown in the figure 6-d. Average decrease in infill stresses for a nine storey model is 29.5% for every 20% increase in the infill opening. Structural member forces are also affected by opening in the infill wall. The column moments (Mc) were found to increase by 36.3% on average and beam moments (Mb) were found to increase by 45.2% on average for every 20% increase in the opening size. Similarly, the shear forces in the beam (Vb) and column (Vc) were found to increase by 43.4% and 34.3% on average respectively for every 20% increase in the opening size. The increase in the member forces by increasing percentage opening is due to decrease in the lateral stiffness of the structure.

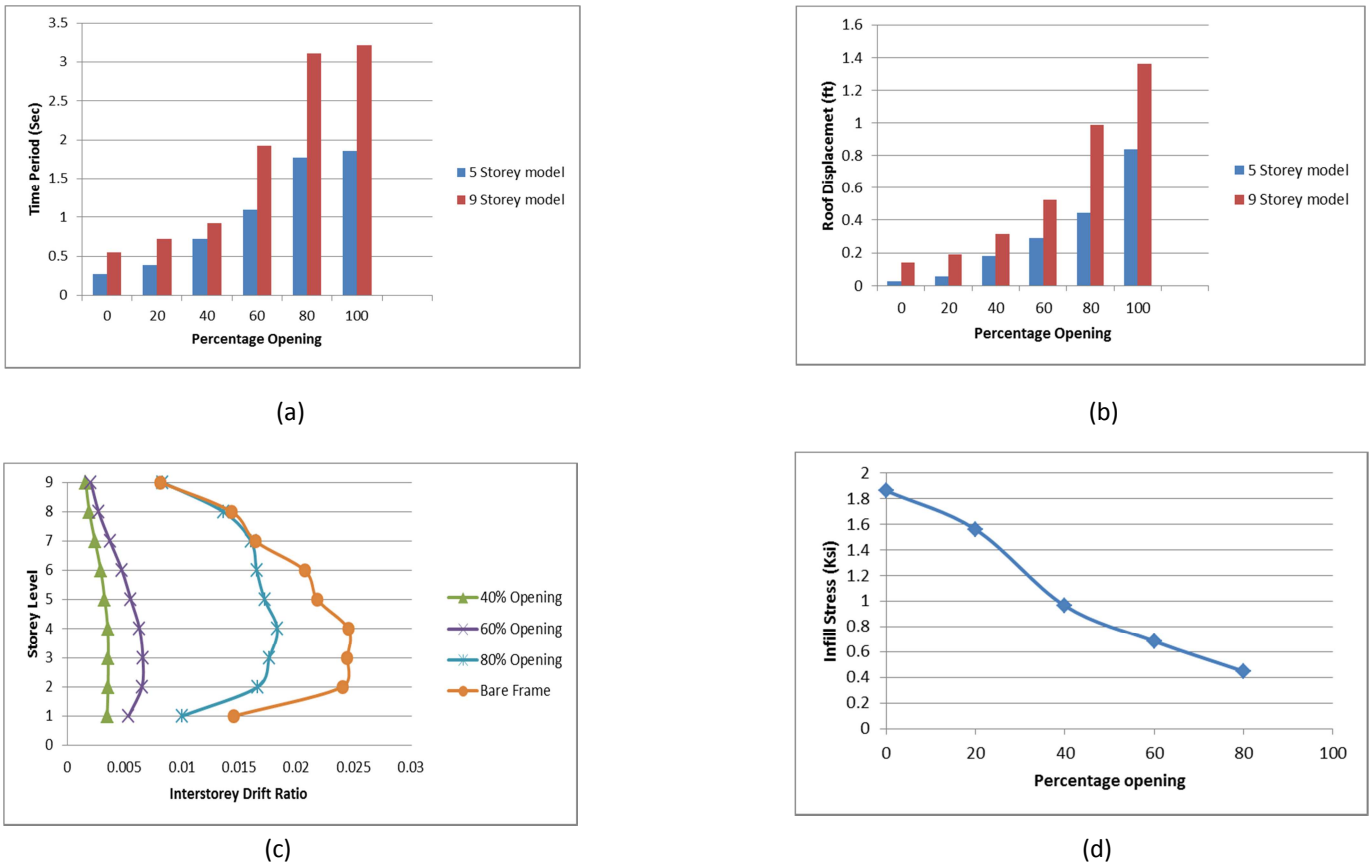


Figure 6: Effect of variation of Percentage Opening on (a) Structural Period (b) Maximum roof displacement (c) Interstorey drift ratio (d) Infill stresses

For models with openings in the infill, maximum infill stresses are found at corners unlike to fully infilled models where maximum stresses are found at the compressive corners of the masonry infill panel. Figure 7 shows compression stress path in infill with an opening which is according to FEMA 356 [13] compression strut analogy for perforated infill panels.

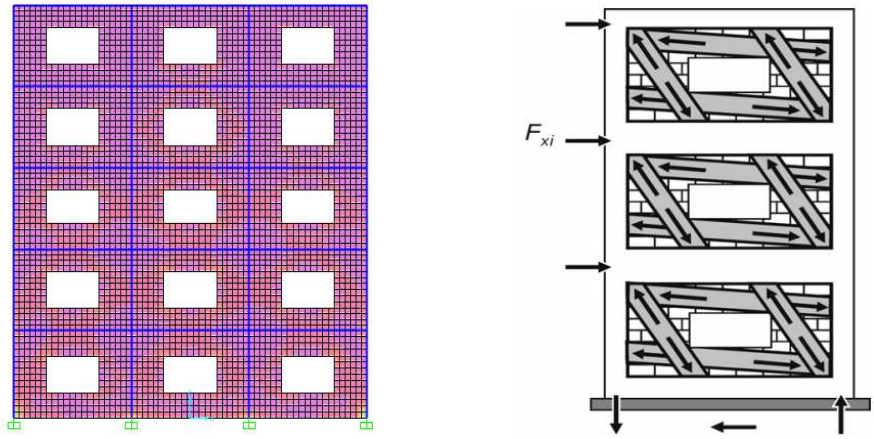
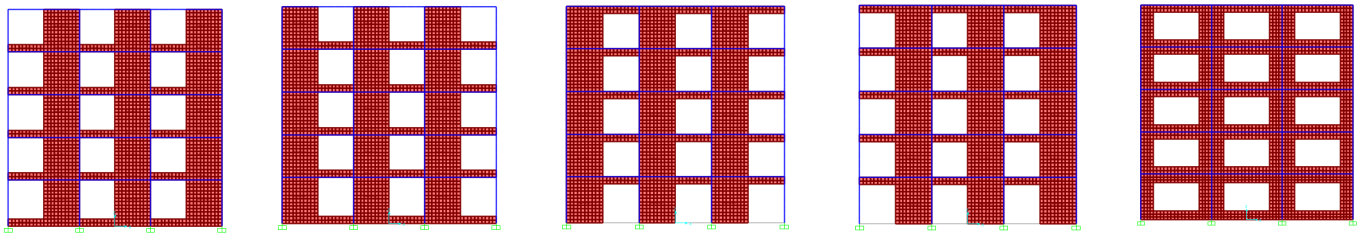


Figure 7: Compression stress path around an opening in comparison with FEMA 356

6.4 EFFECT OF DIFFERENT OPENING LOCATIONS

Opening can be present at different locations in any building like at center, at right side, at left side in the infill wall etc. For this research five types of variations in the opening location are considered as at center, bottom left corner, bottom right corner, top left corner and top right corner to represent the possible opening locations in buildings. 40% opening was selected as a representation of typical openings sizes in infill walls in Pakistan.



(a) Top Left (b) Top Right (c) Bottom Right (d) Bottom Left (e) Central

Figure 8: Different locations of 40% openings considered in the study

Time period, interstorey drift ratio and maximum roof displacement for structures having opening at bottom are maximum and minimum for the structures with central opening. All parameters of a regular and symmetrical structure doesn't depend on whether the top or bottom opening is at right or left corner. Stresses in the infill were found to be maximum for central opening and minimum for bottom left corner opening. This is due to the presence of infill at corners of the structure to resist the lateral forces. Also infill stresses for right openings were found to be larger than left openings for both top and bottom locations. Another result obtained from this study is infill stresses were found higher in 5 storey models than in 9 storey models although stresses were found to be increased with number of storeys. Reason is influence of infill in high rise structures is reduced with increase in the openings size in the infill because increase in mass predominate the increase in stiffness due to infill. A similar trend is found for base shear i.e. base shear is maximum for central opening and minimum for bottom opening.

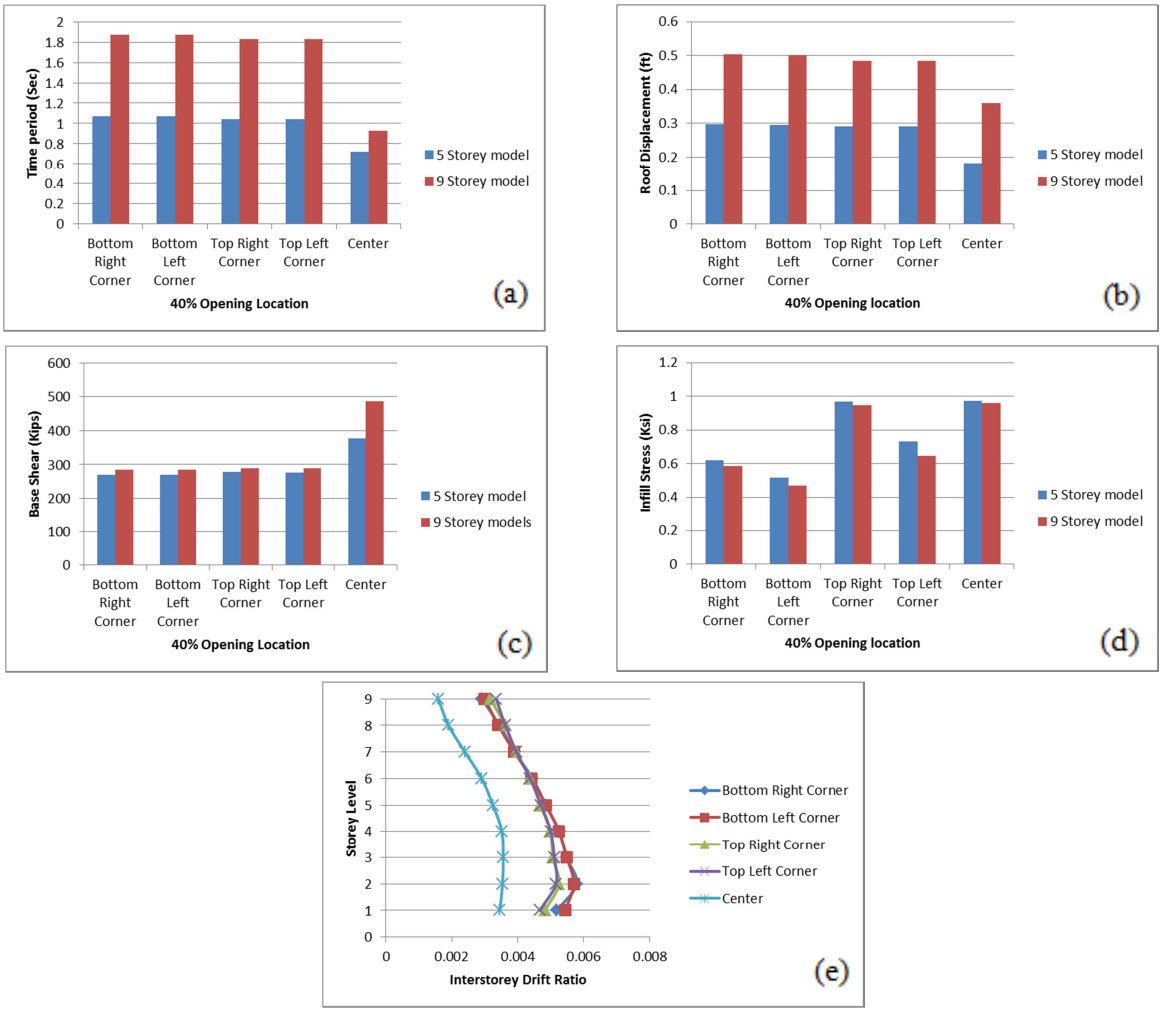


Figure 9: Effect of Different opening locations on (a) Structural Period (b) Maximum roof displacement (c) Base shear (d) Infill stresses (e) Interstorey drift ratios

6.5 EFFECT OF DIFFERENT TYPES OF OPENING

This section has been introduced to study the phenomenon like partially infilled frames, frame with no infill at bottom storey (Soft storey phenomenon) or any storey at intermediate level (Weak storey or soft storey at intermediate height level).

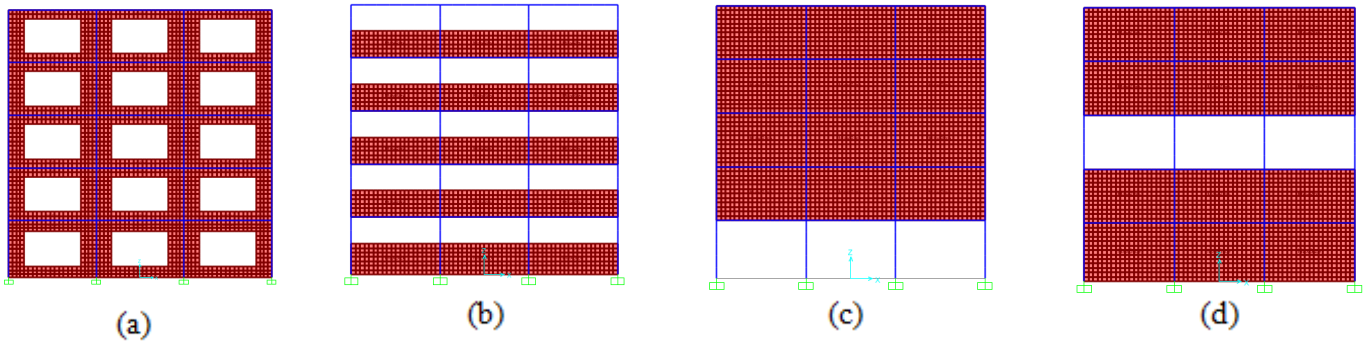


Figure 10: Different types openings considered in the study

Fundamental time period, maximum roof displacement and interstorey drift ratio were found maximum for partially infilled frame even more than the bare frames. This is because of the localized failure of the main frame structural members (columns). So instead of providing stiffness, it concentrates the forces at the level to which frame is partially infilled and infill just increases the mass only. Also the base shear and infill stresses were found least for partially infilled frames than other

options. Even the infill stresses are negligible showing no role of infill in lateral stiffness. Base shear for the partially infilled steel structures are less than the bare steel frames by 19.94% and 37.8% for 9 storey and 5 storey structures respectively. Performance of structures with soft storey at middle level is better than those having soft storey at base due to the presence of infill at the base to resist the lateral loads. Percentage difference of the structural period between the soft storey (at base) and weak storey (at mid-height) is 2.23% and 15.3% for nine and five storey infilled steel frame models. Also the roof displacement for the soft storey is greater than weak storey by 3% and 25% for nine storey and five storey steel infilled frame structures respectively. Interstorey drift ratios were found to be maximum at first storey and middle storey for soft storey and weak storey structures respectively. This is due to the uneven distribution of damage in all storeys. Partially infilled frames are the worst case and must be avoided in every case.

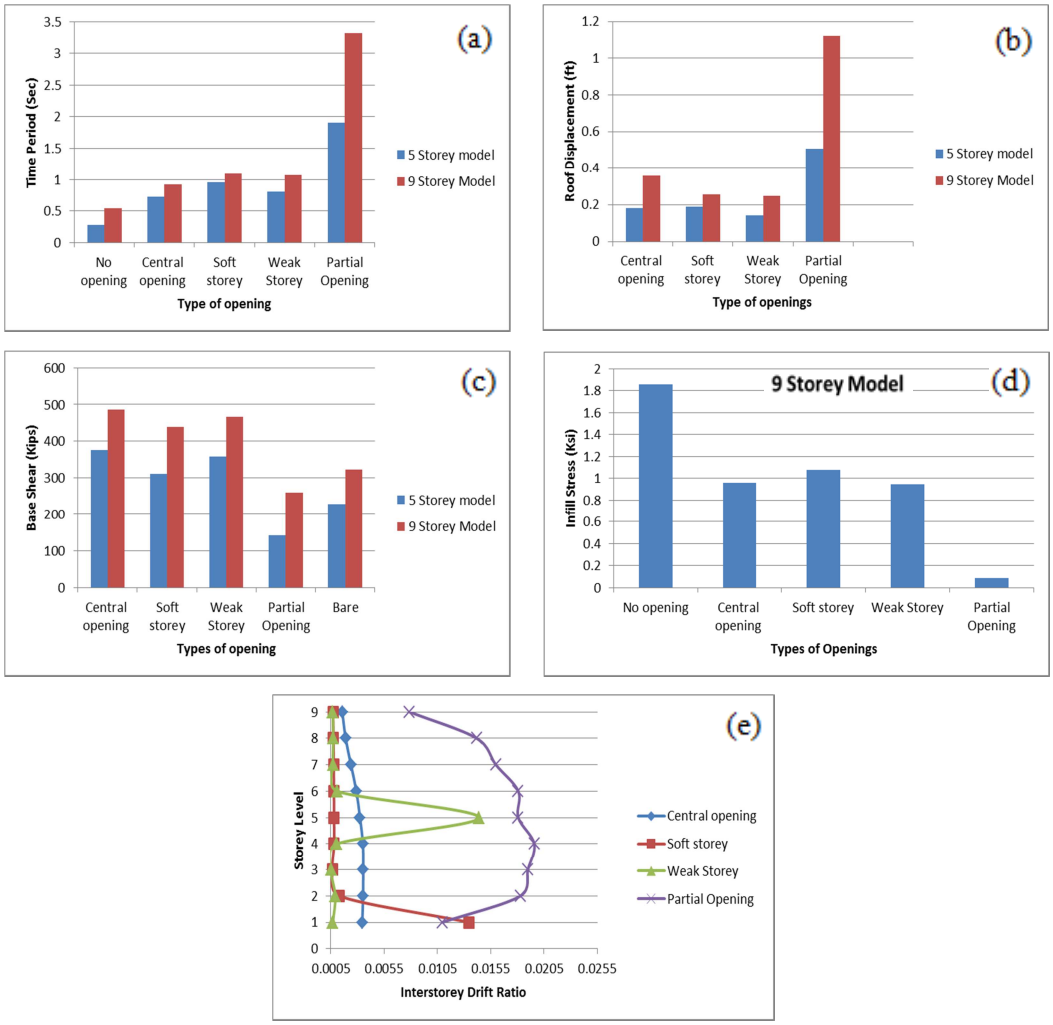


Figure 11: Effect of Different types of opening on (a) Structural Period (b) Maximum roof displacement (c) Base shear (d) Infill stresses (e) Interstorey drift ratios

6.6 EFFECT OF NUMBER OF OPENINGS

This parameter has been considered to evaluate the performance of the structure if a specific percentage of the opening is provided either as single opening or as dual opening. This will help us to understand whether an infilled structure with a single opening in the center is safer or structure having two openings. The results for 20% and 40% opening in the infill wall for 5 storey and 9 storey structures are presented below.

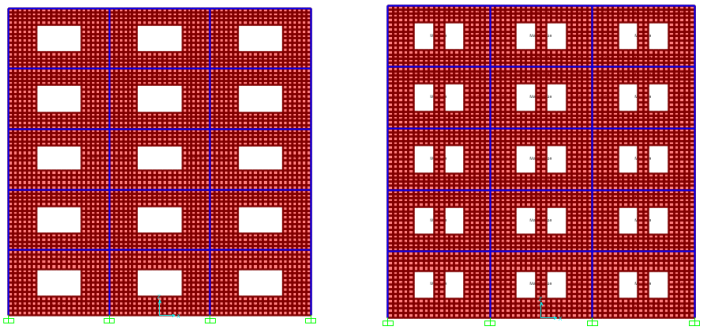


Figure 12: 20% single and dual opening for 5 storey steel infilled frame

The time period, roof displacements and interstorey drift ratio were found to be decreased with the increase in number of openings. Base shear was found to be increased with the increase of opening number. For 40% opening, the percentage increase in base shear between single and double opening is 14.3 and 21.9 for 9 storey and 5 storey infilled steel structures respectively. This is because of dividing the specific percentage of opening at two locations distributes the single major structural discontinuity in the form of opening in the infill wall and prevents the concentration of stresses and forces around a single central opening. Infill stresses were found to have a different pattern for this variation parameter. Infill stresses were found to be increased with increase in number of openings for 20% opening but as the percentage opening is increased the infill stresses were found to decrease which may be due to the reason that with the higher percentages of openings, by increasing the number of openings from one to two causes two major discontinuities as the opening is larger and causes concentration of stresses at corners.

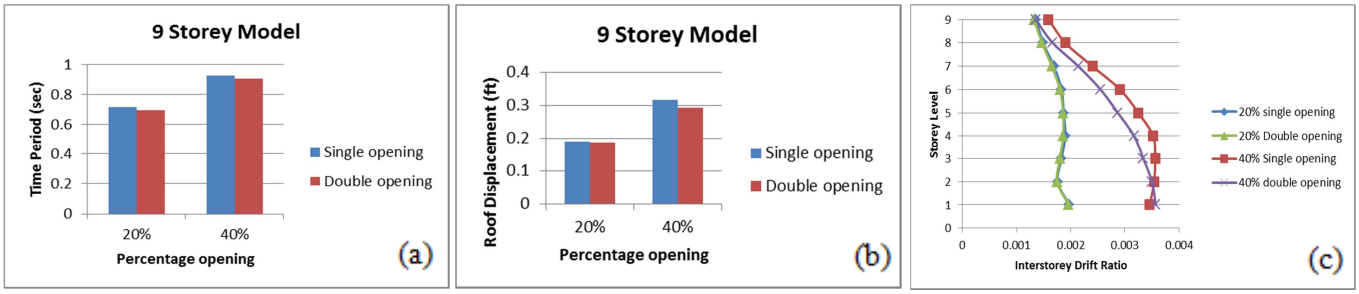


Figure 13: Effect of number of openings on (a) Structural Period (b) Maximum roof (c) Interstorey drift ratios

6.7 EFFECT OF VARIATION OF INFILL STRENGTH

This parameter has been selected to evaluate the variation in the strength of the infill. Strength of infill may vary due to availability of different types of infills in the market like bricks, concrete hollow and solid blocks, stone infills and glass infills etc. Even strength may vary for one type of materials like concrete blocks of different strengths are available. For this analysis infill materials with strengths of 600 Psi, 800 Psi, 1000 Psi, 1200 Psi, 1400 Psi, 1600 Psi and 1800 Psi were used. Time period, roof displacements, interstorey drift ratio and member forces were found to be decreased with the increase in the infill strength. Base shear and infill stresses were found to be increased with the increase in the infill material strength for infilled steel structures. The percentage decrease in the time period and roof displacement decreases with increase in the infill strength. The difference of time period between the infill of 600psi and 800psi is 8.11% and between 1600 and 1800 psi is 3.62% for nine storey steel structure and for five storey structure the difference of time period between 600psi and 800psi infill is 9.96% and between 1600psi and 1800psi is 4.25%. Similarly, the percentage difference of maximum roof displacement between 600psi and 800psi is 15.6 and 22.3 for nine storey and five storey structures respectively and the percentage difference between 1600psi and 1800psi is 8.3 and 9.69 for nine storey and five storey structures respectively. Percentage increase in the base shear is less significant. For a nine storey structure the increase in base shear is about 4% between 600 psi and 800 psi and percentage increase is about 1% between 1600 psi and 1800 psi. Average percentage increase in infill stresses is 2.82 and 6.5 for 5 and 9 storey structures respectively for every 200 psi increase in the infill strength. The percentage decrease in the member forces is decreased with the increase in infill strength. On average the column shear (Vc) decreases by 15.65% and beam shear (Vb) decreases by 16.65% on average for every 200 psi increase in the infill strength. Similarly the percentage decrease in beam and column moments was found to be 16.54 and 15.1 respectively for every 200 psi increase in the infill strength.

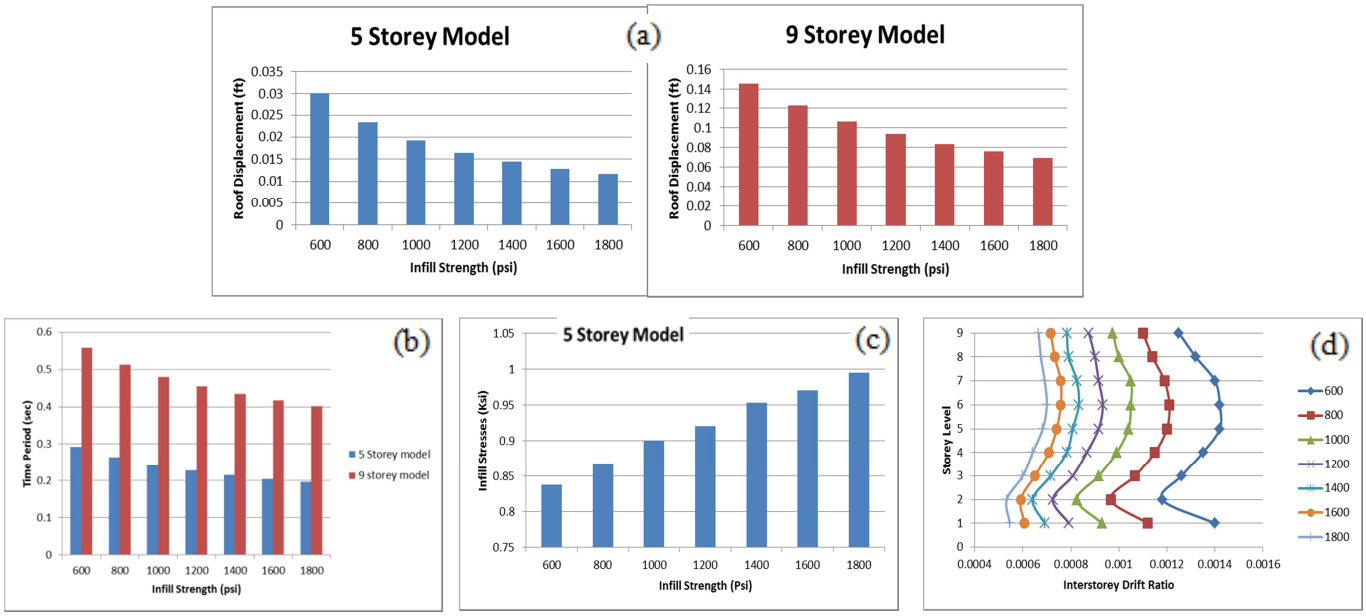


Figure 14: Effect of Variation of Infill Strength on (a) Maximum roof displacement (b) Structural Period (c) Infill stresses (d) Interstorey drift ratios

6.8 Effect of Variation of Outer Frame Strength

Frame strength variation may happen due to the availability of different grades of steels for frames. In this study AISC grade A992 (represented by A50 for this study) and grade 36 steels have been used to assess this parameter. Effect of the outer frame strength is negligible for infilled steel frame structures due to same modulus of elasticity for both grades of steel. This is because the stiffness is function of modulus of elasticity (E) and moment of inertia (I). Maximum roof displacement, time period and interstorey drift ratio are found to be decreased with the increase in the outer frame strength and base shear and infill stresses are found to be increased with the increase in infill strength however variation is negligibly small. The increase in the base shear for 9 storeys and 5 storeys structure is only 0.1% and 1% respectively. Similarly percentage decrease in roof displacement is 0.5% for nine and 0.87% for five storey structures and increase in infill stress is 0.11% for 9 story model and 0.51% for 5 storey model.

6.9 Effect of Variation of Infill Thickness

In Pakistan, burnt clay bricks are most commonly used infill material. Thickness of brick infills is generally 9” for external walls and 4.5” for the internal or partition walls. Also the trend for concrete solid and hollow blocks is also increasing to be used as infill materials, which have thickness varying as 6” and 8”. So these four values were used as infill thickness variation. Time period, roof displacement, interstorey drift ratio and member forces were found to be decreased with the increase in the infill thickness. The percentage decrease in the fundamental time period gradually decreases with the increase in the infill thickness as the difference of time period between 4.5in and 6in thick infill is 7.5% and 8in and 9in thick infill is 2.7% for nine storeys structure. On average the beam (Vb) and column (Vc) shear (kips) decreased by 13.6% and 12.4% by varying thickness from 4.5” to 9” at above stated intervals. Also the percentage decrease in beam (Mb) and column (Mc) moments (kip-ft) was found to be 13.6 and 11.97 respectively by varying thickness from 4.5” to 9” at above stated intervals.

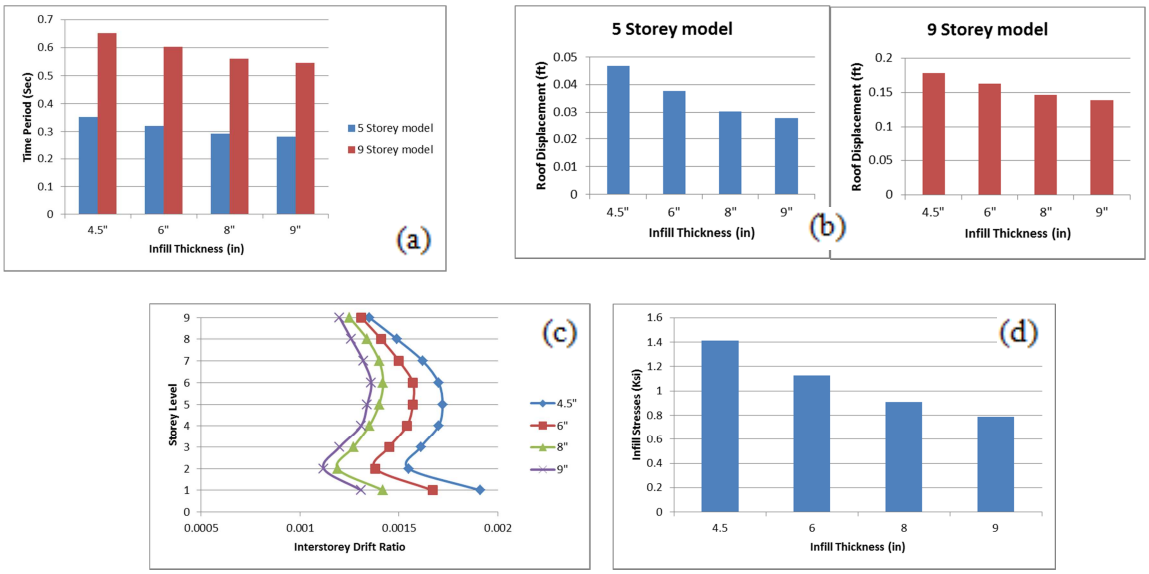


Figure 15: Effect of Variation of Infill thickness on (a) Structural Period (b) Maximum roof displacement (c) Interstorey drift ratios (d) Infill stresses

Base shear was found to be increased with the increase of infill thickness. However percentage increase in base shear does not follow any specific trend. Stresses in the infill were found to be decreased with the increase in the infill thickness. Average percentage decrease in infill stresses by varying the thickness of the infill between the values of 4.5”, 6”, 8” and 9” is 7.98 and 17.6 for 9 storey and 5 storey infilled steel structures respectively.

7 CONCLUSIONS

Following conclusions can be drawn from this research:

- Performance of the infilled frames is dependent on the material and geometric properties of the infill and frame and on how well they perform in integrity with each other.
- For infilled steel frame structures the fundamental time period, roof displacement and interstorey drift ratios decrease with the increase in number of bays due to increase in the lateral stiffness. However percentage decrease in these parameters decreases as the number of bays increases. Base shear and infill stresses increase with the increase in number of bays representing higher resistance to the lateral loading at the base and attracting more forces respectively.
- The fundamental time period, roof displacement, infill stresses, base shear and interstorey drift ratios increase with the increase in number of storeys due to increase in the mass of the structure and larger height to base width ratio (aspect ratio of the structure).
- With the increase in the opening sizes the time period, roof displacement, member forces and interstorey drift ratio increases due to decrease in the lateral stiffness of the structure and infill stresses and base shear decrease showing less resistance to the lateral forces.
- Influence of the infill in positive performance of the structures decreases from low rise to high rise buildings because the increase in the stiffness provided by the infill is dominated by the increase in mass due to the presence of the infill.
- For infilled structures having openings, maximum infill stresses were found at the corners of the openings unlike to the fully infilled structures where the maximum infill stresses were found at the compression corners of the panel.
- Time period, roof displacement and interstorey drift ratios are maximum for the partially infilled frames even greater than the bare frames due to the localized failure of the structural members (columns) at the level to which infill is provided. The infill provided is just addition to the mass of the structure.
- Interstorey drifts were significantly higher at soft storey level and weak storey level as compared to the other levels for structures with soft storey and weak storey respectively.

- Roof displacement, time period, interstorey drift ratio and member forces were decreased with the increase in the strength of the infill due to increase in the lateral stiffness. Base shear and infill stresses increase with the increase in the infill strength.
- Time period, interstorey drift ratio and roof displacement decrease and base shear increases if a specific percentage of the opening in the infill is provided at more than one location due to the distribution of irregularity at different locations. And the percentage variation increases with the increase in the opening percentage.
- Infill stresses decreases with the increase of infill thickness probably due to the more load bearing area as the contact surface between frame and infill wall increases with the increase in the infill thickness.

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Effect of Variation of Number of Bays on the Seismic Vulnerability of Masonry Infilled Steel and Reinforced Concrete (RC) frame Structures

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ABSTRACT: In general practice, buildings can range from small residential houses to large commercial plazas. Size of the structure may change at base with the type of building and availability of area. Bay analysis has been performed to analyze the effect of variation in number of bays on infilled frames. Four three storey models (Bare and Masonry infilled) with number of bays varying from one to four have been considered in this study. Non-linear static analysis or pushover analysis has been performed in Perform-3D and capacity spectrum method of ATC-40 followed by seismic vulnerability assessment framework proposed by Kyriakides (2007) have been used to derive the vulnerability curves for all models considered in this study. Results of seismic vulnerability assessment have been used to determine the effect of variation of number of bays on the seismic vulnerability of masonry infilled steel and RC frames. Vulnerability curves of bare frames have also been compared with the vulnerability curves of infilled frames for both steel and RC frame structures to determine the percentage decrease in the seismic vulnerability of masonry infilled frames as compared to bare frames.

KEYWORDS: Bay analysis, Masonry infill, Perform-3D, Seismic vulnerability assessment, Seismic vulnerability curves, Infilled steel frames, Infilled RC frames, Capacity Spectrum method.

1 INTRODUCTION

In many countries most of the frame buildings are infilled with masonry. Infills contribute to the performance of structures which is generally neglected in analysis and design by considering it as non-structural element. However the infill panels have significant in-plane stiffness that contribute to the frame stiffness and as a result presence of the infills significantly increases the strength, stiffness and frequency of the frame structures. Studies have shown that influence of infill on the positive performance of the frame structures decreases with the increases in number of storeys. However no significant research has been done to find the effect of variation of number of bays on the seismic performance of masonry infilled frames.

Seismic Vulnerability assessment has been conducted to evaluate the seismic hazards corresponding to various levels of damage in the three storeys bare and infilled frames by varying the number of bays from one to four for both steel and concrete models. Perform-3D has been used as an analytical tool for this purpose. Cyclic pushover analysis followed by the capacity spectrum method and seismic vulnerability assessment framework proposed by Kyriakides (2007) [1] have been used to derive the vulnerability curves for bare and masonry infilled steel and RC frames.

2 PREVIOUS RESEARCH

Analytical and experimental studies on seismic response of infilled frames started from mid-1950. Various research studies have shown that infill improves lateral strength and the stiffness of bare frame significantly and also greatly improves the energy dissipation capability of the structure.

One of the pioneer researchers in this field Polyakov (1958) [2] suggested that infill panel can be considered equivalent to diagonal bracing. This suggestion was practically undertaken by Holmes (1961) [3] who replaced the infill panel by an

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equivalent pin-jointed diagonal strut having same properties and thickness as infill panel and a width equal to one-third of diagonal length of infill. Polyakov was the first to describe the action of infill as an equivalent diagonal strut.

Mainstone (1971) [4] developed eight equations for equivalent strut, four equations for strut width and four for strength equations. These equations were based on three full scale tests on brick infill and twenty one small scale model brick and micro concrete tests. Mainstone approach estimates the infill contribution both to the stiffness of frame and its ultimate strength.

Kodur et al (1994) [5] indicated that addition of infills significantly changes dynamic characteristics of buildings and influence their behavior during earthquakes. Fardis et al (1999) [6] performed shake table test on single bay two storey RC frames with eccentric masonry infill walls subjected to bidirectional ground accelerations. The main focus of their study was to analyze the effects of eccentricity on the displacement demands of corner columns. Hassan et al. (1997) [7] presented a simplified method of ranking reinforced concrete, low-rise, monolithic buildings according to their vulnerability to seismic damage.

Shunsuke Otani (2000) [8] reviewed development of seismic vulnerability evaluation standards for reinforced concrete buildings in Japan. A general procedure consistent with the present design provisions in Japan was introduced.

Kyriakides (2007) [1] In order to extend vulnerability curves went for the analytical procedures to investigate building behavior when exposed to earthquakes. He concluded that although empirical assessment curves are easy to derive but its drawbacks are that it cannot describe unusual buildings, Expert Judgment method gets limited due to the opinion of the experts, and the inherent uncertainties in the building performance. Analytical procedures are most suitable when past records of building damage are not available, working in detail, and near to exact information is required, but models obtained from analytical methods are to be verified by empirical models.

Haldar et al. (2012) [9] presented an analytical study on the seismic performance and fragility analysis of Indian code-designed RC frame buildings with and without URM infills. HAZUS 1999 [19] methodology along with nonlinear static analysis was used to compare the seismic vulnerability of bare and infilled frames. The comparative study suggested that URM infills significantly increase the seismic vulnerability of RC frames and their effect is needed to be properly incorporated in design codes.

Alok Madan (2013) [10] did an analytical study on the seismic performance and vulnerability of typical planar masonry infilled reinforced concrete (RC) frames considering the effect of distribution of masonry infill panels over the elevation of the RC frame using rational displacement based analysis methods such as non-linear dynamic time-history analysis based on realistic and efficient hysteretic models of the structural elements. The results of the displacement based analyses were used to develop fragility curves for these infilled RC frames.

3 METHODOLOGY

Non-linear Static cyclic pushover analysis has been performed in Perform-3D on all proposed structures. Perform-3D has been used as analytical tool due to availability of inbuilt diagonal strut module for infill panel modeling and also its ability to conduct non-linear analysis. Capacity Spectrum Method of ATC-40 [11] is used for the seismic vulnerability assessment of structures. The step by step methodology is described in flow chart below:

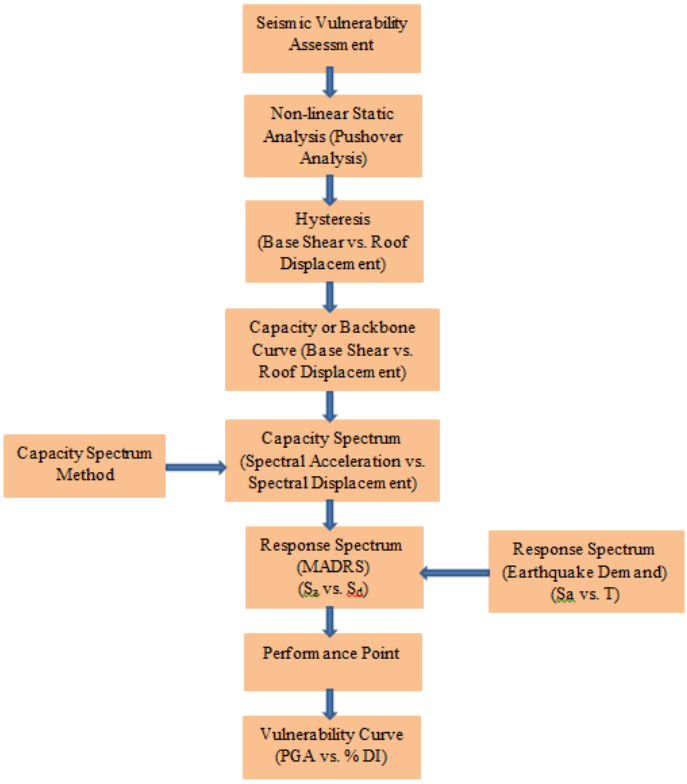


Figure 1: Seismic Vulnerability Assessment (Flow Chart)

4 EXPERIMENTAL TESTING

For infill panel's construction, burnt clay bricks masonry is most widely used in different areas of Pakistan. Experimental testing has been done to find the compressive strength of locally available brick masonry. Results of compressive strength test for brick masonry are shown below:

Table-1: Compressive strength of brick masonry prisms

Sr. No.	Crushing Load (Kips)	Compressive Strength (Ksi)
1	23.16	0.61
2	28.78	0.77
3	25.85	0.70
Average	25.93	0.69



(a) (b)

Figure 2: (a) Compression testing assembly for brick masonry (b) Craked Sample after testing

5 Design of Proposed Buildings

Two groups of structures have been considered for this research. First group includes three storeys frame structures with varying number of bays from one to four and the other includes three bays structures with varying number of storeys as three, five, seven and nine. All structures are hypothetical regular and symmetrical moment resisting frame structures. Soil Structure Interaction is ignored and a raft foundation is considered representing fix supports at the base of structure in models.

Table-2: Geometric parameters of models

Bay Size	20 ft.
First Storey Height	13 ft.
Typical Storey Height	12 ft.
Roof Slab Thickness	5 inch.
Typical floor Slab Thickness	6 inch.

Table 1. Table-3: Materials used for buildings design

Steel (Frames)	ASTM A-36 (Fy=36 Ksi and FU=58 Ksi , AISC LRFD99 Table-2)
Concrete	f'c=3000 psi
Steel (Reinforcement)	ASTM A615 Grade 60 (Fy =60 Ksi)

All the buildings are considered as office buildings and are designed in SAP2000 under gravity loading, with live loads being taken from UBC-97 [12]. Concrete frames have been designed according to ACI-318-08 [13] and steel according to AISC LRFD99 [14].

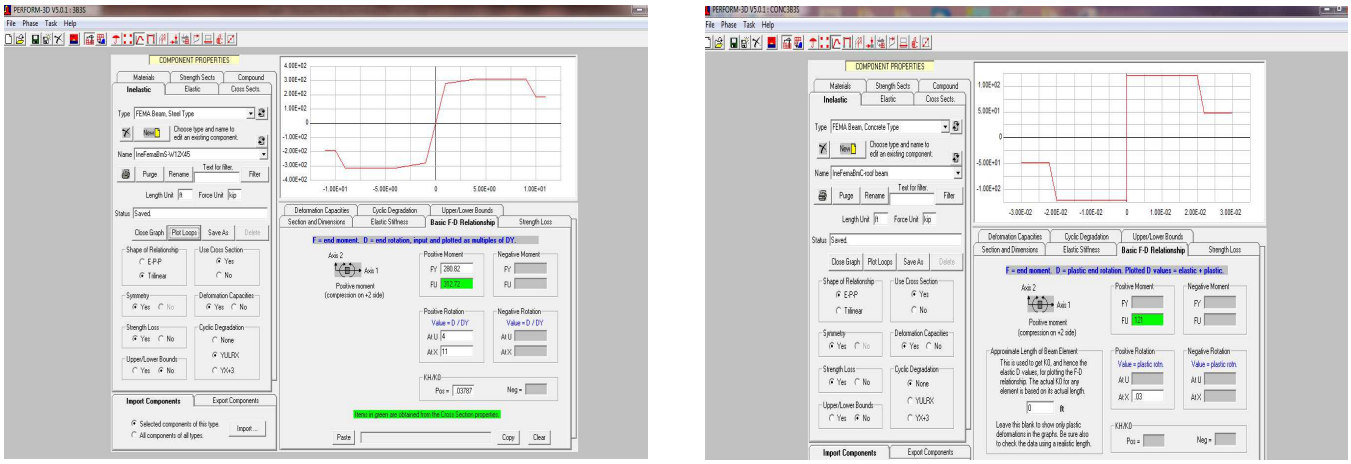
6 Modeling in Perform-3D

For non-linear analysis and seismic vulnerability assessment of infilled steel and RC frame structures 2D models of both frames have been exported from SAP2000 to Perform-3D. To make the frames behave as 2D, restraints are applied at all nodes. All nodes except the foundation nodes are free to translate in H1 and V direction and free to rotate in H2 direction. The foundation nodes have fixed supports.

For modeling of beams and columns of steel frames, FEMA beam steel type and FEMA column steel type have been used. F-D relationships, Deformation Capacities and strength loss parameters are inputted using the guidelines of FEMA 356 [15] chapter 5 Steel (Table 5-6). Inelastic strength properties of steel beams and columns have been determined by using plastic

section modulus from AISC steel code. Tri-linear behavior has been used for modeling F-D relationships of FEMA beams and columns steel type.

Similarly, for modeling of beams and columns of RC frames, FEMA beam concrete type and FEMA column concrete type have been used. F-D relationships, Deformation Capacities and strength loss parameters of these members have been inputted using the guidelines of FEMA356 [15] chapter 6 Concrete. However in order to determine inelastic strength properties of RC beam and columns an analytical tool XTRACT has been used. Elastic perfectly plastic (EPP) behavior for F-D relationships of FEMA concrete beams and FEMA concrete column is used.



(a) (b)

Figure 3: Basic F-D relation for FEMA beam (a) Steel type (b) concrete type

For modeling of masonry infill, infill panel element of Perform-3D has been used. Each infill panel element consists of one infill panel component. The diagonal strut model consists of two struts, each of which resists compression force only. The actions and deformations are the compression forces and compression deformations of the struts, as shown in figure (Perform-3D User guide) [16].

In this study Compression failure mode has been considered for determination of strength of infilled frames. For compression failure of the equivalent diagonal strut, a modified version of the method suggested by Stafford-Smith and Carter (1967) [17] can be adopted (FEMA 306) [18]. The shear force (horizontal component of the diagonal strut capacity) is calculated as:

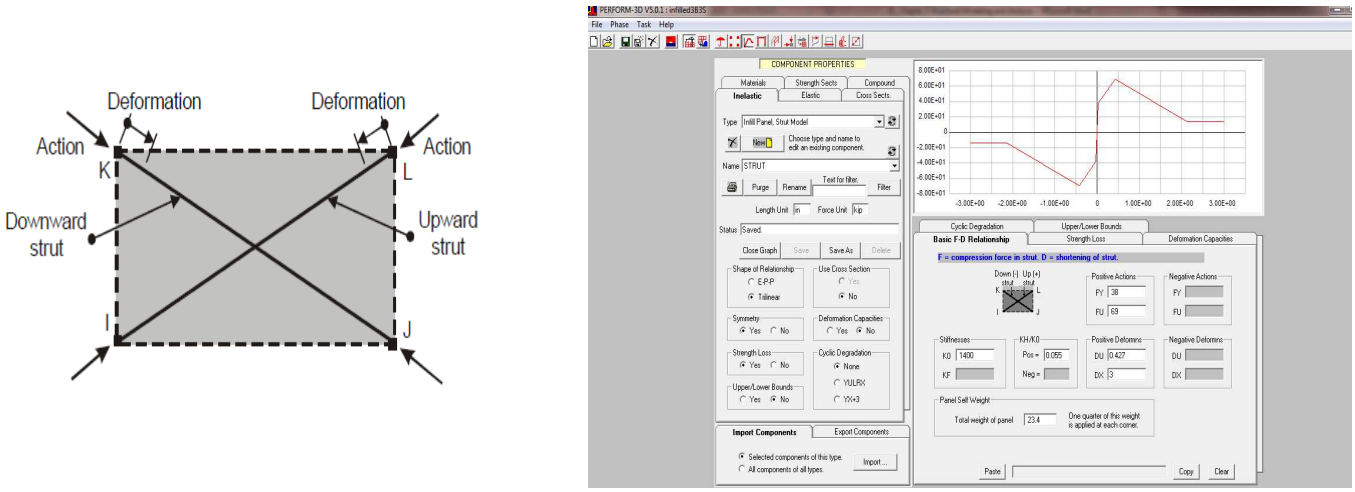
$$V_C = a t_{inf} f'_{m90} \cos\theta$$

Where:

a= Equivalent strut width

$\mathbf{t_{inf}}$ = Infill thickness

$\mathbf{f_{m90}}$ = Expected strength of masonry in the horizontal direction, which may be set at 50% of the expected stacked prism strength f_m.



(a) (b)

Figure 4: (a) Infill panel diagonal strut model (b) F-D relationship for Infill panel strut model

7 ANALYSIS AND RESULTS

For this study a displacement controlled cyclic pushover analysis was performed in Perform3D. In perform-3D, it is easy to visualize the cyclic and hysteric behavior of the structure and investigate the post peak behavior with the effects of strength and stiffness degradation. So after the modeling was completed cyclic pushover analysis was performed on bare and infilled steel and RC frame structures.

For this purpose gravity and fifty pushover load cases were defined in analysis phase in Perform3D. For pushover analysis triangular distribution as given in UBC97 [12] was used. In each step the maximum drift was increased by 0.002 than the preceding step starting from 0.002 in first step in H1 direction (In plane loading). Each next step pushes the structure in opposite direction than the previous step and uses the stiffness at the end of previous pushover load case. In analysis drifts keep on increasing until either the structure fails or maximum allowable push in Perform3D is reached i.e. 10%. After the completion of analysis we can see the hysteresis loop between base shear and roof displacement. Using this hysteresis we can get the capacity or backbone curve which is used to develop the vulnerability curves. Results for infilled steel and infilled RC frames structures are presented separately.

Hysteresis loop for 1 bay 3 storey and 3 bay 3 storeys bare and infilled steel and RC frame structures are shown in figure 5 and 6 respectively. It can be clearly seen from hysteresis plot that with the inclusion of infill panel base shear has increased and roof drift is reduced indicating an increase in strength and lateral stiffness of structure with inclusion of masonry infill. Also base shear for 1 bay structures are less and for 3 bay structures are more.

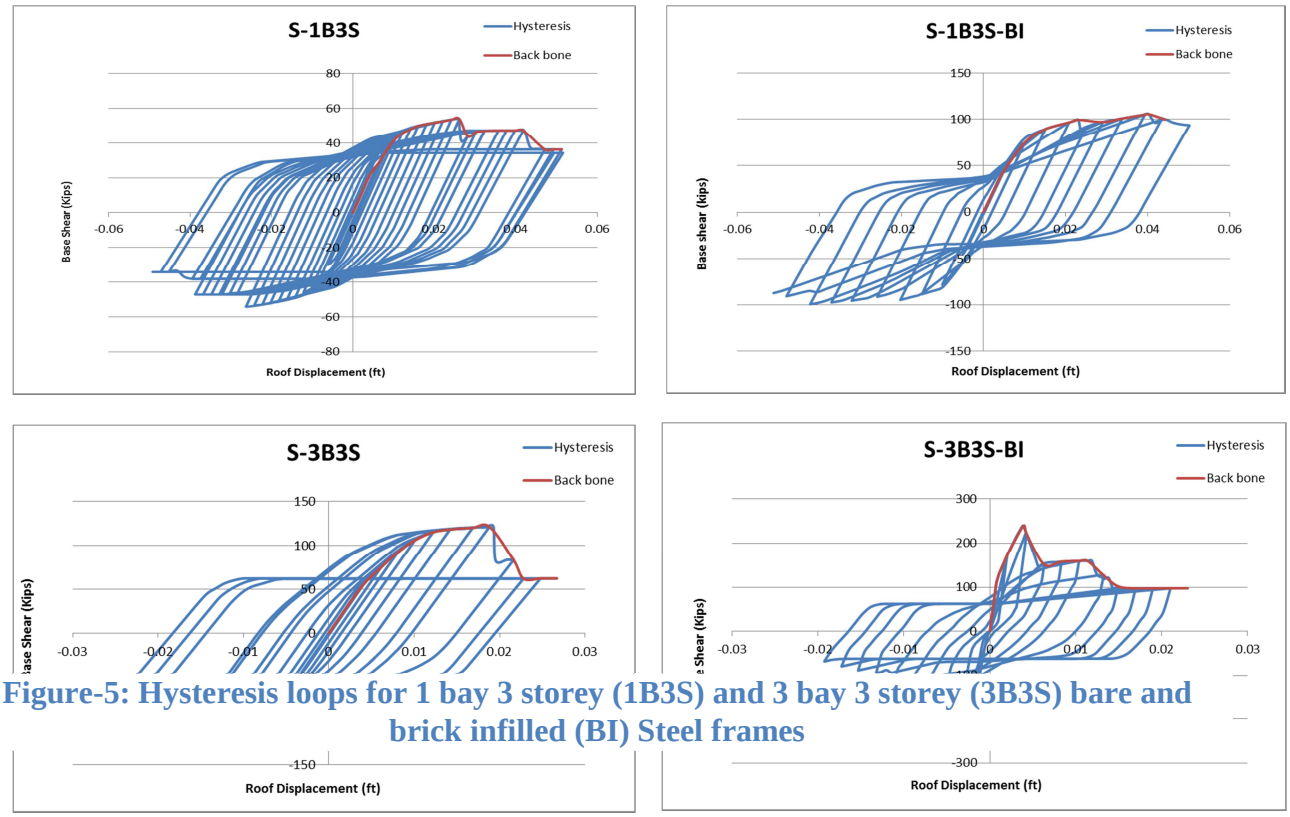


Figure-5: Hysteresis loops for 1 bay 3 storey (1B3S) and 3 bay 3 storey (3B3S) bare and brick infilled (BI) Steel frames

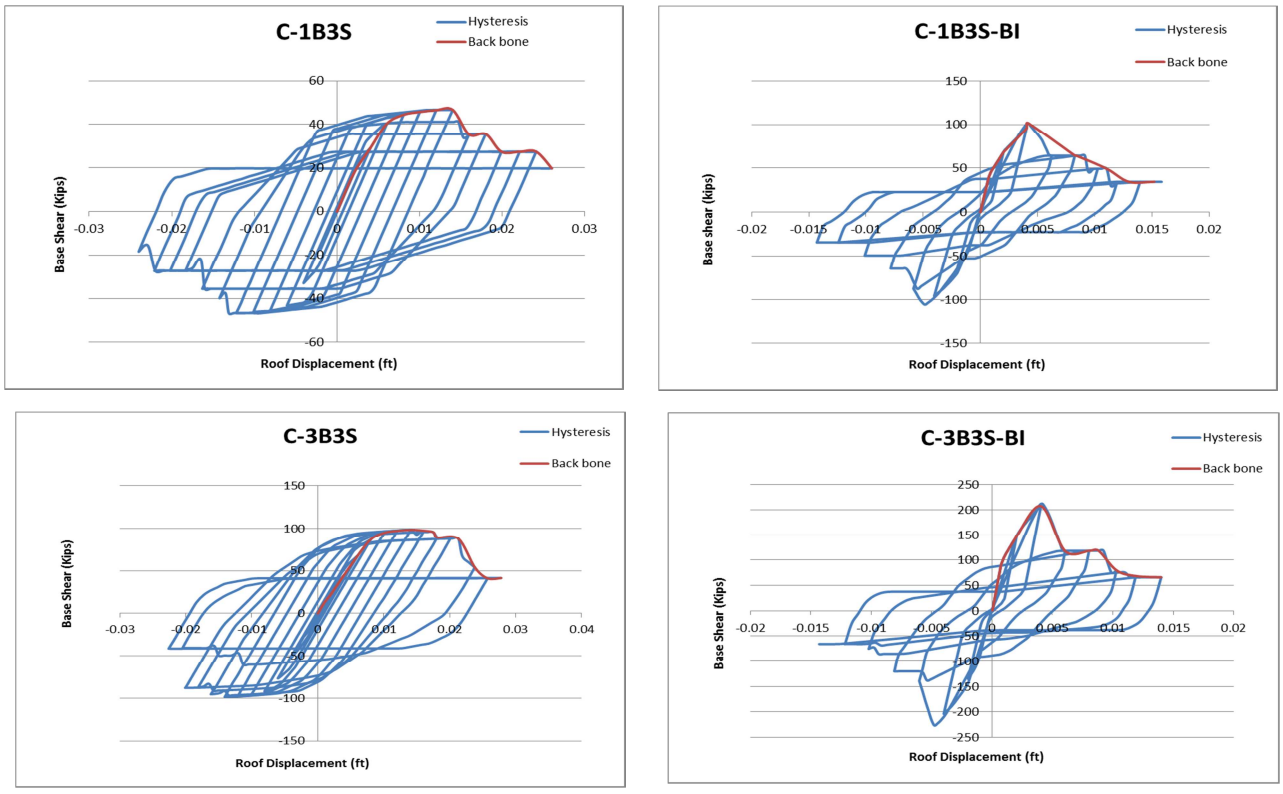


Figure-6: Hysteresis loops for 1 bay 3 storey (1B3S) and 3 bay 3 storey (3B3S) bare and brick infilled (BI) RC frames

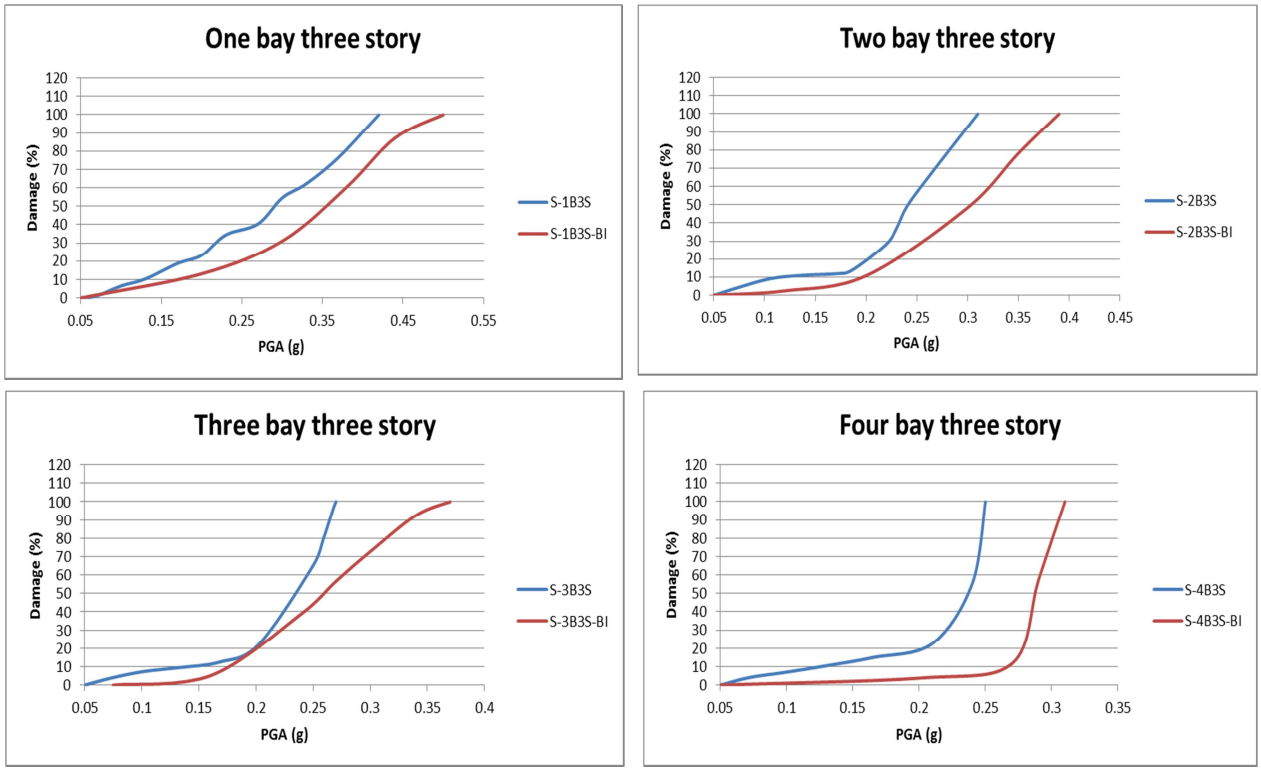


Figure-7: Vulnerability curves for bare and brick infilled (BI) Steel frames

8 SEISMIC VULNERABILITY CURVES

After the formation of hysteresis loops for all the structures considered in the study, capacity spectrum method mentioned in ATC-40[11] was used to get the performance point of the structures which is actually the intersection point of capacity spectrum and response spectrum. These performance points are then used to determine the hazard level of the structure by determining the PGA at each performance point (Kyriakides, 2007) [1]. Finally a plot between peak ground acceleration (PGA) and damage index (DI) is made which is the vulnerability curve. Vulnerability curves for three storeys bare and infilled steel and RC frame structures by varying number of bays from 1 to 4 are shown in figure 7 and 8 respectively.

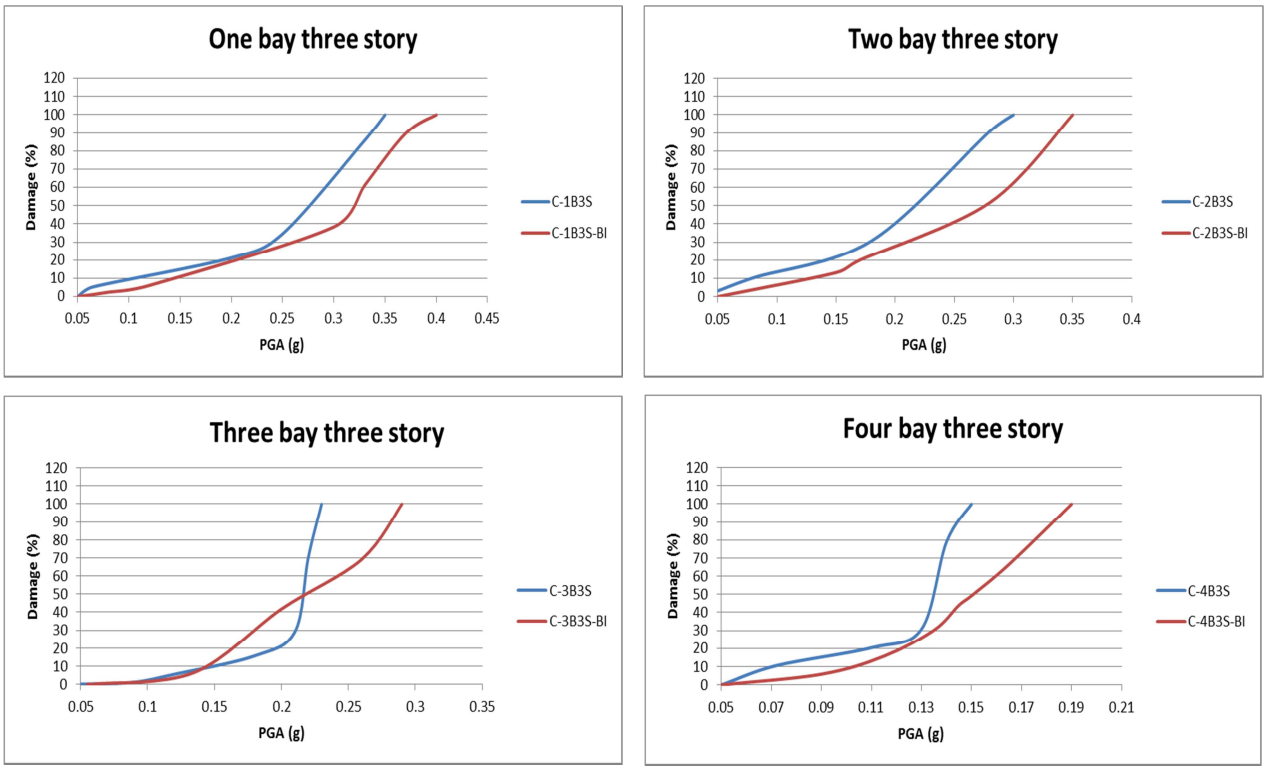


Figure-8: Vulnerability curves for bare and brick infilled (BI) RC frames

9 DISCUSSION

It can be clearly seen from the results of seismic vulnerability assessment i.e. seismic vulnerability curves that brick infilled frames offer greater resistance to earthquakes than bare frames. A comparison of seismic resistance of bare and infilled frames is presented below in the form of bar charts for both steel and RC frames. Here the PGA at 100% damage of bare frame is compared with the PGA at 100% damage of burnt clay brick infilled frames by varying number of bays from 1 to 4.

A close look at this comparison suggests that as the number of bays are increasing the effect of infill is increases as the PGA increase for one bay three storey brick infilled steel frame is 19% as compared to 1 bay three story bare frame while PGA increase for four bay three storey brick infilled frame is 42% as compared to four bay three story bare frame indicating that influence of infill in positive performance of structure increases as the number of bays increases. Similarly, the PGA increase for one bay three storey brick infilled RC frame is 14.29% as compared to 1 bay three story bare frame while PGA increase for four bay three storey brick infilled frame is 27% as compared to four bay three story bare frame. However the PGA at 100% damage is decreased with increase in number of bays for both infilled steel and RC frame structures. Also brick infilled steel frames are less vulnerable to earthquake damages as compared to infilled RC frames.

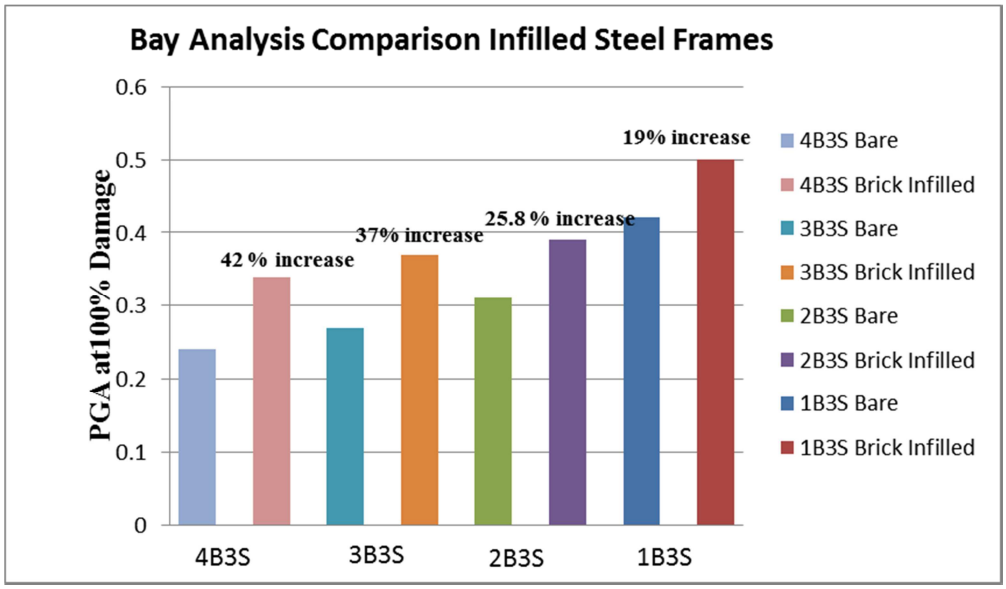


Figure 9: Comparison of PGA at 100% damage of Brick Infilled Steel frames with variation of number of bays.

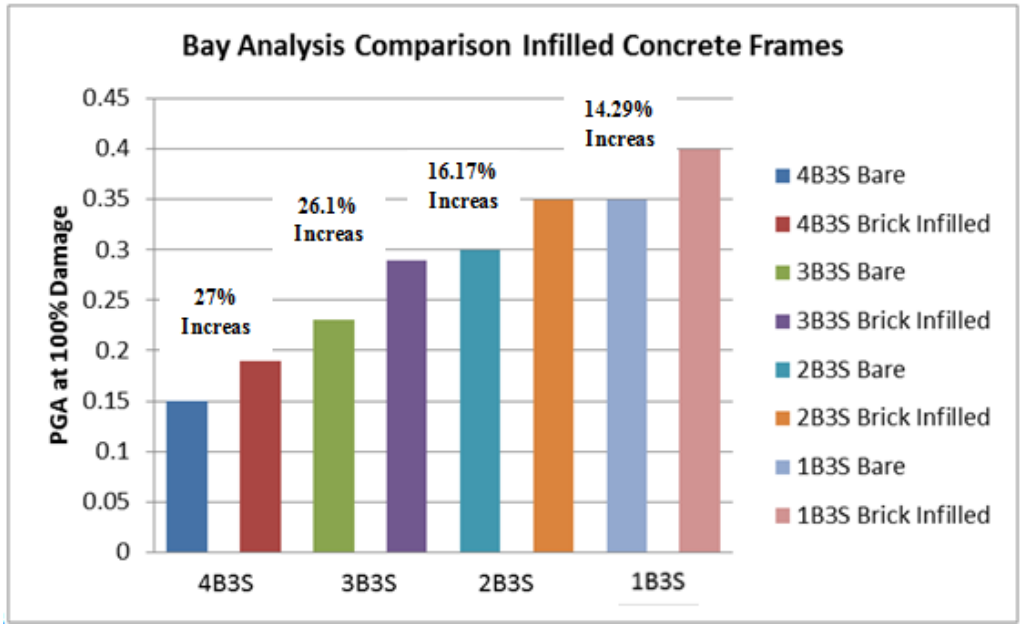


Figure 10: Comparison of PGA at 100% damage of Brick Infilled RC frames with variation of number of bays.

10 CONCLUSIONS

Following conclusions can be drawn from the results of Seismic Vulnerability Assessment:

- Infilled frames can resist more PGA at 100 % damage thus are less vulnerable to earthquake damages as compared to bare frames.
- With the inclusion of infill panel the collapse of frames become more gradual (Brittle collapse to gradual Collapse).
- As the number of bays increase the effect of infill wall increases. Increase in PGA at 100% damage of infilled frames as compared to bare frames increases with the increase in number of bays.
- Infilled steel frames are less vulnerable to earthquake damages as compared to infilled RC frames.
- The PGA at 100% damage is decreased with increase in number of bays for both infilled steel and RC frame structures due to increased stiffness.

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Identification des Tiques (*Acarina-Ixodidae*) Parasites des Bovins au Sud-Kivu, République Démocratique Du Congo

[Identifying Ticks (*Acarina-Ixodidae*) Parasites of Cattle in South Kivu, Democratic Republic of Congo]

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ABSTRACT: An enquiry was made about different modes of breeding of cattle, the species parasitizing the bovines, and the organs preferred by ticks from June 2012 to November 2012.In total 1439 ticks were collected from 159 cows, on the abdomen and leg, the dewlap and encolure, ano-genital, tail, ear and face. Five species of ticks were collected succemvely with the following frequency: *Rhipicephalus appendiculatus (*46, 8%), *Rhipicephalus appendiculatus (21, 3), Boophilus decoloratus (*17%), *Amblyomma variegatum (*14, 8), *Haemaphysalis Leachi Leachi* (0, 13) as well as the knowledge of their preferable organs on the bovines. The use of rearing in absolute stalling was displayed here and there, which exposes them to ticks and others deseases.Finally the knowledge of acaricid products and their use proved to be of much avail in the farm.

KEYWORDS: Identification, Ticks, Parasites, Bovines et South Kivu.

RESUME: Cette étude a été conduite de juin à Novembre 2012 sur les bovins au Sud-Kivu cela pour récolter et identifier les différentes espèces des tiques qui les parasitent. Elle avait pour objectif de connaitre ces espèces qui sont dans certaines zones agro écologiques de cette province et éventuellement les dangers que courent ces bovins. Ainsi 1439 tiques ont été récoltées sur des organes anatomiques de 159 bovins avec comme fréquence : *Rhipicephalus appendiculatus (*46, 8%), *Rhipicephalus compositus (21, 3), Boophilus decoloratus (*17%), *Amblyomma variegatum (*14, 8), *Haemaphysalis Leachi Leachi* (0, 13). Cette étude à prouve que les tiques se fixent sur les bovins selon des organes anatomiques préférés (Oreilles, face…queue et que chaque espèce de tiques transmet ses microorganismes sources des maladies chez le bovins.

MOTS-CLEFS: Identification, Tiques, Parasites, Bovins et Sud- Kivu.

1 INTRODUCTION

Les tiques sont des arthropodes hématophages obligatoires et représentent l'une des contraintes majeurs au développement de l'élevage en Afrique comme partout ailleurs dans le monde (OGDEN 2004 ; MUBAMBA, 2006).Il existe plus de 800 espèces des tiques (AESCHLMAN 1982) parmi celles-ci certaines sont spécifiques aux bovins et leur transmettent des maladies parasitaires, virales, bactériennes et peuvent provoquer la paralysie chez ces animaux (SCOTT et al. 2001).En effet, en dehors de l'action pathogène directe liée à la fixation de ces acariens sur les bovins pendant 5 à 25 jours

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à la conquête du repas sanguin, des nombreuses espèces de tiques causent de dommages et de stress aux animaux hôtes (FARAGOUS et al. 2006).

Dans les régions intertropicales existent des espèces des tiques qui parasitent les bovins et qui de ce fait pèsent sur leur croissance.

Des études menées en Algérie ont mis en évidence l'âge des bovins sur l'infestation par les tiques ou plus de la moitié ont été collectées sur des bovins adultes. Les résultat sont été justifiés par le mode de vie de ces veaux, qui sont généralement nourris et gardés en stabulation durant les premiers mois de leur vie diminuant ainsi les risques de leur exposition aux tiques dans les pâturages (BENCHIKH-ELFEGOUN 2007).

Une étude réalisée en Tunisie rapporte que la fréquence de l'infestation des bovins adultes est plus élevée que celles des jeunes animaux (BOUATTOUR 2001).

Une étude a été conduite au laboratoire d'entomologie vétérinaire du CRSN-LWIRO 1996 sur la performance reproductive des tiques (BALAGIZI 1996).

La présente étude a pour objectif, après la récolte, dresser une liste des tiques en tenant compte de l'abondance et la fréquence des espèces par site; ainsi que détecter les zones préférées de fixation des tiques sur les bovins.

2 MATÉRIEL ET MÉTHODES

2.1 RÉGION D'ÉTUDE

Les groupements de Bugorhe, Bushumba et Rwabika sont situés entre 2° et 2°8' de latitude Sud et entre 28° 20' et 20° de longitude Est sur le flanc Est du massif de la Kahuzi-Biega. Cette zone est une savane herbeuse de montagne dominée par les graminées et quelques arbustes. L'altitude varie entre 1600 et 2000m, son climat est tropical tempéré par l'altitude. On distingue principalement deux saisons : une saison de pluie de 9 mois (Septembre à Mai) entrecoupée par une courte saison relativement sèche (de Janvier à Février) et une saison sèche de 4 mois (Juillet à Octobre) à température moyenne annuelle de l'air est voisine de 19^0C et l'humidité varie entre 68 et 75% (MASUNGA et al. 2006,).

2.2 GESTION DE L'ÉLEVAGE

L'étude a été menée dès Juillet jusqu'à Novembre 2012 sur des bovins qui sont gardés en semi- stabulation, stabulation strictes, sur piquet et/ou en divagation dont certains sur pâturages semés et clôturés, d'autres sur pâturages semés non clôturés ou sur fourrages spontanés. Les bovins rencontrés sont à 90% de race locale, mais pour le petit nombre de race améliorée exogène(*FRISON*) et un peu moins encore les hybrides. Les bovins adultes sont sur les pâturages pendant que les jeunes bovins sont nourris au lait à domicile où à l'étable. Le cheptel bovin, assez développé dans la région de notre étude est généralement de type extensif, qui durant la saison sèche les bovins sont entrainés dans les bas-fonds où persiste l'humidité, nourris durant le trois mois au Cypéracée et autres fourrages maraichères.

2.3 RECOLTE, CONSERVATION ET IDENTIFICATION DES TIQUES

Les tiques ont été étaient prélevées sur chaque animal par simple extraction après contention de l'animal. Elles ont été récoltées sur 7 à 20 bovins par troupeaux et cela en une récolte unique dans la zone agro écologique et d'un système d'élevage. Les tiques sont récoltées sur les bovins selon les organes anatomiques à savoir : ano-génitaux, fanon et encolure, queue, abdomen et pattes, face, puis placées dans les tubes portant le nom du bovin sur lequel on a prélevé ses tiques. Ces tubes sevraient de matériel de transport depuis le terrain jusqu'au laboratoire d'entomologie vétérinaire du CRSN-Lwiro. Au laboratoire, le jour suivant 4ml de formol ont été versées dans le tube contenant les tiques afin de les tuer, cela afin de faciliter l'observation.

Deux loupes dont une monoculaire et l'autre binoculaire et une clé d'identification ont été utilisées dans la détermination des espèces des tiques .Un GPS a servi dans la récolte des coordonnées sur terrains.

2.4 CHOIX DES PÂTURAGES D'ÉTUDE

Les pâturages d'étude ont été choisis par leur mode d'élevage, par leur disposition.

Sachant d'avance que l'âge du bovin dispose de l'influence sur son parasitisme par les tiques. Nous avons fait la récolte des tiques sur les bovins en âge d'être conduit sur le pâturage, mâles et femelles. Le GPS a permis de prélever les coordonnées de nos sites dans lesquels nous avons rencontré les bovins.

La méthodologie utilisée est une enquête, réalisée auprès des éleveurs dans leurs fermes à l'aide d'un questionnaire préétablit que nous remplissons sur place lors de l'entretien avec les fermiers. Cette fiche contenait les rubriques suivantes : le mode d'élevage, le nombre de bovins, les espèces des tiques récoltées, la charge à tique, le mode de lutte utilisé contre les tiques, les maladies rencontrées sur la ferme et le nombre de bovins atteints, ceux soignés et guéris et ceux morts, le traitement utilisé et enfin la récolte des tiques sur les organes anatomiques (fanon et encolure, anneau génital, abdomen et pattes, oreilles, face, queue)

Les principales pathologies transmises par les tiques montrent qu'après les moustiques viennent les tiques comme les principaux vecteurs de maladies humaines et vétérinaires au monde. Elles sont vectrices de nombreux agents pathogènes et susceptibles de transmettre aux hommes comme aux animaux un grand nombre de maladies différentes selon l'espèce et la zone agroécologique.Il est possible d'ailleurs que la même morsure de tique transmette plusieurs maladies différentes.

2.5 ANALYSES STATISTIQUES

Les comparaisons portant sur le nombre moyen de tiques retrouvées sur les bovins ont été effectuées au moyen du test de $\frac{\delta y}{\delta x}$x 100 cela pour trouver l'écart types.

3 RESULTATS

3.1 CARACTERISTIQUES DES FERMES D'ELEVAGE DES BOVINS

Le tableau 1 présente les différentes caractéristiques des fermes d'élevage des bovins. Nyakadaka, Izambyo, Kamakombe, Cegera affichent un grand nombre de tiques que bovins quand Nyamakana, Karhongo, Kavea, UCB et Buloli qui sont des fermes modernes ,avec fourrages semés et clôturés, disposant d'un systèmes de soins de leurs bovins.

3.2 PEUPLEMENT DES TIQUES DANS DIFFERENTS SITES

Le tableau 2 présente les différentes espèces de tiques récoltées dans nos sites.les sites ont été peuplée dans cet ordre : Ferme de Nyakadaka avec 454 tiques, Kamakombe 356 tiques, Izambyo 262 tiques Mulamba et Kanyawagwa 251 tiques Karhongo 6 tiques pour les restent de fermes à savoir : Buloli, Kavea, Nyamakana, UCB/Nyacibamba le nombre de tiques est de 0 pour chaque ferme. L'espèce *Rhipicephalus appendiculatus* est la plus abondante avec 643 individus, puis *Rhipicephalus* compositus 244, Boophilus decoloratus 341 tiques *Amblyomma variegatum* 209 tiques et enfin *Haemaphysalis Leachi Leachi*2 individus.

3.3 REPARTITION DES TIQUES SUIVANT LES ORGANES ANATOMIQUES

La figure 1 présente les différentes espèces de tiques et leur distribution sur les bovins selon l'organe de préférence. Pour F&E nous avons un total de 666 tiques, avec une prédominance de *Rhipicephalus appendiculatu*s 269 tiques et l'absence de *l'Amblyomma variegatum* ; sur A&P nous rencontrons 516 tiques avec un pic de *Rhipicephalus appendiculatus* 227 et absence de *l'Amblyomma variegatum* ; sur A &G un total de 341 tiques avec toujours *Rhipicephalus appendiculatus* pour pic 154 tiques. Sur cet organe anatomique nous trouvons les cinq espèces des tiques. Sur la queue nous avons récolté seulement *Rhipicephalus appendiculatus* et *Boophilus decoloratus* et absence de ces trois autres espèces. Enfin sur F nous avons trouvé dans presque les mêmes proportions *le Rhipicephalus appendiculatus* et *le Boophilus decoloratus* 13 – 12 et pour les trois autres espèces restantes 0.

3.4 REPARTITION DES ESPECES DE TIQUES PAR ZONES AGRO-ECOLOGIQUE.

La figure 2 présente la répartition des espèces des tiques par zones agro écologiques constituées suivant les différentes altitudes. La distribution selon les zones agro écologiques reste inégale, certaines espèces cas de *Rhipicephalus appendiculatus* prédomine et s'étant dans toutes les zones agro écologiques pendant que *Amblyomma variegatum* se raréfié de la deuxième à la troisième.

4 DISCUSSION ET CONCLUSION

Dans les groupements de Bugorhe, Bushumba et Rwabika les bovins sont les principaux hôtes préférentiels de certaines espèces de tiques. Au total 1439 tiques ont été récoltées sur 159 bovins soit une charge de 9 tiques par bovin. Cinq espèces tiques sont trouvées sur les bovins, *Rhipicephalus appendiculatus*, *Rhipicephalus compositus*, *Boophilus decoloratus* et *l'Amblyomma variegatum* et *Haemaphysalis Leachi Leachi.*

L'infestation par les tiques dispose des effets pathogènes direct, tels : la réaction locales aux points de piqures (inflammation infection), l'animal est affaiblit par suite de la consommation du sang, lors de l'infestation massive une tique femelle adulte absorbe 2 à 4 ml de sang, puis l'endroit où les tiques s'agrippent, l'enzyme contenue dans la salive y provoquent la paralysie.

Pour les quatre premières espèces (*Rhipicephalus appendiculatus*, *Rhipicephalus compositus*, *Boophilus decoloratus* et *Haemaphysalis Leachi Leach)* elles ont été trouvées dans les fermes se trouvant dans les deux premières zones agro écologiques altitude variant entre 1500m et 1750m. Mais pour *A*mblyomma *v*ariegatum, elle a disparu sur les fermes d'IZAMBYO, KAMAKOMBA, ces deux fermes qui sont en altitude et profitant du froid venant du parc national de Kahuzi-Biega. Or dans ces deux fermes, le record de la récolte a été de 599 tiques avec une charge de 23 tiques par bovins.

La récolte maximale de tique a été faite sur deux organes à savoir l'anneau génital 313 tiques et sur l'abdomen et pattes 202 tiques. Ces deux organes représentent 66,9%, cela veut dire que ces deux organes sont stratégiques (FAROUGOU, 2006).

Ce résultat se justifie aussi par le mode de vie des animaux, gardés en stabulation, réduction au minimum de contamination des animaux par les tiques. Quoique l'influence de l'âge qui est aussi un fait qui favorise l'infestation des bovins par les tiques cela suite à leur présence sur le pâturage (BENCHKH-ELFEGOUN.2007).

Pour les fermes se trouvant dans la première zone agro-écologiques, elles renferment cinq espèces de tiques ; deux fermes voisines hébergent des bovins dont les propriétaires ne disposent pas de lieu de pâture. Alors plusieurs bovins viennent ici pour la saillie, cela sans prédispositions de lutte contre les infestations aucune. Cette situation a fait que l'on trouve dans les deux fermes 7 bovins dont 3 taureaux pour avoir les bouvier qui viennent d'ailleurs pour faire saillir leur bovin, payant une caution d'une tôle par saillie et par bovin. Ces éleveurs se laissent aussi accompagner dans leur garde par des chiens. Cela à fait dans notre récolte l'on a attrapé une espèce de tique parasitant uniquement les chiens : *Haemaphysalis Leachi Leachi*. La charge à tique a été la plus haute dans notre étude, 38,8 et ces fermes restent les centres de dissémination des tiques dans le groupement de Bugorhe. La distribution des espèces des tiques dans les trois zones agro-écologiques prouve que toutes les cinq espèces de sont réparties inégalement. Dans les trois zones agro-écologiques, la distribution va en régressant de la première (538 tiques au total) à la troisième (420 tiques) en passant par la seconde zone agro-écologique(421).

Pour les espèces des tiques certaines disparaissent dans la troisième zone agro-écologique, cas de l'*Amblyomma* variegatum et de l' *Haemaphysalis Leachi* Leachi .Pour *Rhipicephalus appendiculatus* se maintient statique dans les deux premières zones agro-écologiques (30,7% e 29%t, mais s'accroit dans la troisième (40,3%).Par contre pour *Boophilus décolora tus* la distribution est élargie et reste plus répartie dans toutes les trois zones agro-écologiques. Son pourcentage des distributions (12,7%,34%, 53,3% prouvent que cette tique peut atteindre dans notre milieu d'étude les monts les plus hauts, vers Kahuzi.

En somme dans toutes les fermes visitées, la lutte contre les tiques reste préoccupante même si l'achat des produits acaricides fait de fois de faux par suite soit de méconnaissance ou de moyen financier. La chaine trophique ayant été détruite par l'homme, surtout pour ce qui est de bovins en causant une rupture de la symbiose entre le garde-bœuf et les gobe-mouches ; ces deux oiseaux qui intervenaient dans la lutte biologique du detiquetage des bovins.

Un autre facteur est celui lié aux conditions environnementales identiques dans ces trois groupements (ensoleillement, la pluviosité, la température…) Au fur et à mesure que l'on monte en altitude, le nombre de tiques se raréfie (BISUSA et al. 2014). La distribution des espèces de tiques respecte le principe tellement que même certaines espèces disparaissent (figure 2)

Le taux d'infestation de 8 à 120 tiques par bovins reste largement suffisant pour entretenir l'endémicité des maladies à la suite des agents transporteurs/disséminateurs cas des rats, le passage des chiens et autres mammifères y compris l'homme doit être vu car ces derniers infestent aussi les animaux dans les fermes (SAMEDI. 2005).La rencontre des fermiers avec les vétérinaires pour des formations continues des éleveurs sont des sources d'information qui doivent être exploitée pour améliorer la santé des animaux et principalement sur la lutte contre les acariens (ASHFORT et al. 2001).

Les tiques disposent des points de préférences d'occupation sur les organes chez les bovins. Généralement ses organes sont les lieux de choix par espèces des tiques. Sur les 1439 tiques, 538 tiques ont été récoltes sur fanon et encolure soit 37,4% des tiques dont *Rhipicephalus appendiculatus* à elle seule représente 269 individus soit 50%.Pour abdomen et pattes ,496 tiques dont *Rhipicephalus appendiculatus* 227 tiques soit 45,8%, suivi de *Rhipicephalus compositus* 130 tiques soit 26,2% ;en ce qui concerne anneau génital, *Rhipicephalus appendiculatus* a 154 individus soit 45,2%, suivi de *Amblyomma variegatum* 78 tiques soit 22,9% ;pour la queue et la face, moins des tiques y ont été récoltées.

La figure 1 montre la réalité du choix de site préféré sur les bovins. Ainsi, le fanon et encolure restent très prisé par les tiques car (17,7%) du total des tiques récoltés ont été trouvées sur cet organe suivi de l'abdomen et patte ; puis de l'anneau génital cela pour le *Rhipicephalus appendiculatus* .Pour *Amblyomma variegatum*, anneau génital est suivi de fanon et encolure puis de abdomen et pattes. *Boophilus decoloratus* elle se fixe plus sur abdomen et pattes, anneau génital suivit enfin de fanon et encolure. *; Rhipicephalus compositus* préfère fanon et encolure, suivi d'abdomen et pattes.

L'infestation des organes anatomiques selon les pourcentages obtenus sur certains organes Rhipicephalus appendiculatus. Sur les F&E :18,7%, et pour *Rhipicephalus compositus* sur le même organe 8,6% ;A&P :15,8% pour *Rhipicephalus appendiculatus* résultats de cette étude suggèrent trois éléments importants pour la et pour *Rhipicephalus compositus* 9% ;A&E 10,7% pour *Rhipicephalus appendiculatus* ; pour Q :8,3% pour *Rhipicephalus appendiculatus* et 0,9% pour *Rhipicephalus compositus*, et pour F :8,3% pour *Rhipicephalus appendiculatus.*

Le *Rhipicephalus appendiculatus* reste la plus dominante, comme cela a aussi été prouvé comme « Brown ear ticks »par certains auteurs dont (ASHORT et al. 2001 et WALKER 2003). Ainsi nos résultats coïncident avec ceux de FAROUGOUS et al. 2005) ces derniers ont trouvé que :Pour la sauvegarde de notre élevage : Le facteur lié au type d'élevage à Bugorhe, les tiques les organes anatomiques les plus préférés sont tête et encolure, abdomen et pattes et ano-génital suivies des autres organes sur lesquels Bushumba et Rwabika, caractérisé par des mouvements des autres organes Cette infestation reste accrue dans notre milieu d'étude sur les .animaux incontrôlés de bétail ; cela suite à l'exode rurale, et toute autres formes de ce genre dû à l'insécurité. A cela s'ajoute aussi la recherche passionnée du fourrage, types de rotation des bovins dans le pâturage (BYAVU et al. 2000).En ce qui concerne la distribution des tiques, nous constatons que la charge à tiques varie d'une ferme à l'autre .Probablement, les facteurs environnementaux (conditions du milieu, la composition qualitative et quantitative de la faune et de la flore, les différences saisonnières et climatiques) MATHYS et al. 1966).

Des déplacements des animaux venant des pays ou/et régions voisins(Nord-Kivu, Ouganda via le Ruanda) pour des raisons d'abattages, sans que ses derniers ne soient placés en quarantaine ;ils sont directement introduits dans des fermes ou transférés au marché(Katana, Kavumu, Mudaka).Mais aussi entre les éleveurs localement, lors des saillies dont le propriétaire du taureau reçoit deux tôles ou son équivalent par bovins sailli, des recherche du fourrages très tôt le matin(entre 2 heures et 4 heures du matin) et tard le soir(ente 20 heures et 23 heures du soir) dans un champ qui ne pas le sien (TAYLOR et al. 2008).Toutefois les mouvements de bovins par suite de recherche de fourrage aussi bien que des endroits pâturables sont à considérés dans la mesure où ils facilitent la dissémination des tiques au bovins porteurs sains (OOCH et al. 2003).

La présence des tique *Rhipicephalus appendiculatus* au taux de 46,8 % prédispose de la présence de la thélèriose, et pour *Amblyomma variegatum* (14,8) de la présence du Cowdriose dans les trois groupements et environ.

Tableau 1 : Mode d'élevage de bovins dans nos différentes fermes

Caractéristiques	Buloli	Karhongo	Kavea	Mulamba et Kanyawagwa	Nyamakana	Nyakadaka	UCB/ Nyacibamba	Izambyo et Kamakombe	Cegera
Latitude, altitude, …	S 0° 1' 35,5'' ; E :028° 48'58,9'' ; Alt.1655m	S:02° 15' 15,8'';E:028° 50' 26,2'';Alt. 1628m	S :02° 17' 29,9'' ;E :028° 49' 54,0'' ; Alt :1680 m	S :02° 15' 57,0'' ;E :028° 49' 30,9'' ; Alt :1652 m S :02° 15' 51,1'' ;E :028° 49' 26,4'' ; Alt :1663 m	: S :02° 14' 19,8'' ;E :028° 49' 13,9'' ; Alt :1665 m .	:S: 02° 14' 29, 7'; E: 028° 48' 46, 0'';Alt: 1668 m	S :02° 14' 19,8'' ;E :028° 49' 13,9'' ; Alt :1665 m	S:O2° 17' 34,9'';E: 028° 46' 19,0''; Alt.1945m IZAMBYO:S :2° 17 57,9'' ; E :028° 47' 15,7'' ; Alt.1799 m	S: 02° 14' 24, 7''; E: 028° 49' 57, 4'';Alt: 1657 m
Type d'élevage	Tabulation stricte	Pâturage semé et clôture	Tabulation stricte et moderne	Pâturages exposé à tous bovins, parcours libre	Ferme clôturé, pâturage modèle	Ferme des bovins sur parcours libre	Ferme clôturé, pâturage modèle	Pâturages exposé à tous bovins, parcours libre	Ferme en semi-stabulation et semi-divagation.
Nombre de bovins	17	9	31	43	30	54	11	87	34
Bovins présents	15	6	29	7	30	30	11	14 et 12	5
Bovins morts	2	3	2	36	0	24	0	42	29

Tableau 2 : Espèces des tiques par site en tenant compte de l'abondance et la fréquence

Espèces de tiques	**Buloli**	**Karhongo**	**Kavea**	**Mulamba et Kanyawagwa**	**Nyamakana**	**Nyakadaka**	**UCB/ Nyacibamba**	**Izambyo**	**Kamakombe**	**Cegera**	**A.**	**Fréq. (%)**
Rhipicephalus appendiculatus	0	0	0	92	0	170	0	150	135	96	643	50
Amblyomma variegatum	0	6	0	55	0	144	0	4	0	0	209	40
Boophilus décoloratus	0	0	0	98	0	80	0	27	113	23	341	50
Rhipicephalus compositus	0	0	0	4	0	60	0	72	108	0	244	40
Haemaphysalis Leachi Leachi	0	0	0	2	0	0	0	0	0	0	2	10
Total	**0**	**6**	**0**	**251**	**0**	**454**	**0**	**262**	**356**	**119**	**1439**	

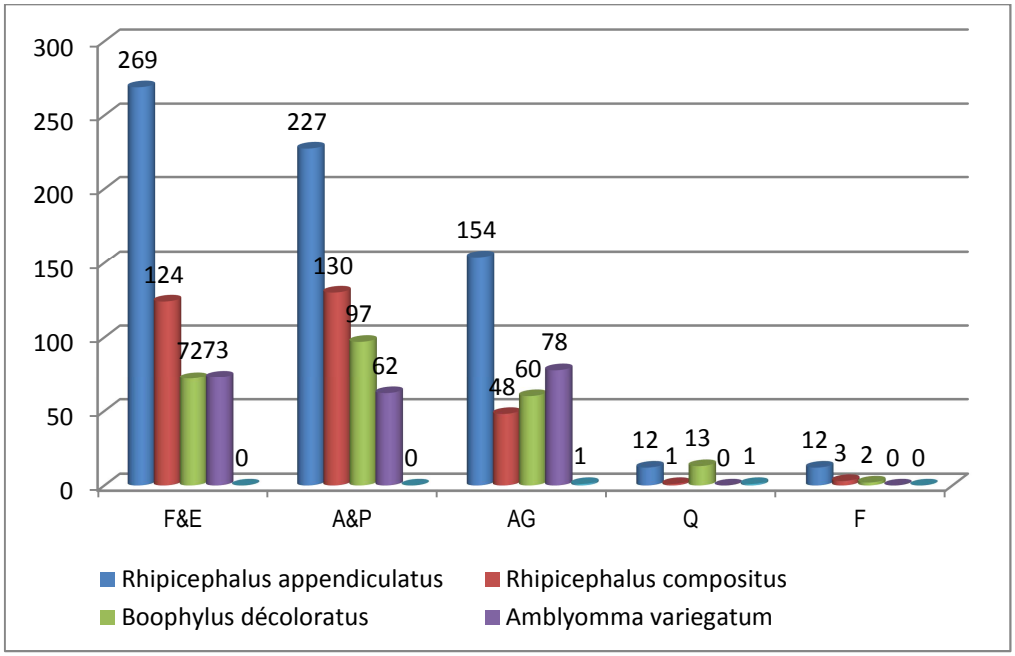


Figure 1. Espèces des tiques suivant les organes anatomiques

***Légende** : **F&E** : Fanon et encolure ; **A&P** : Abdomen et pattes ; **AG** : anneau génital ; **Q** : queue ; **F** : face.*

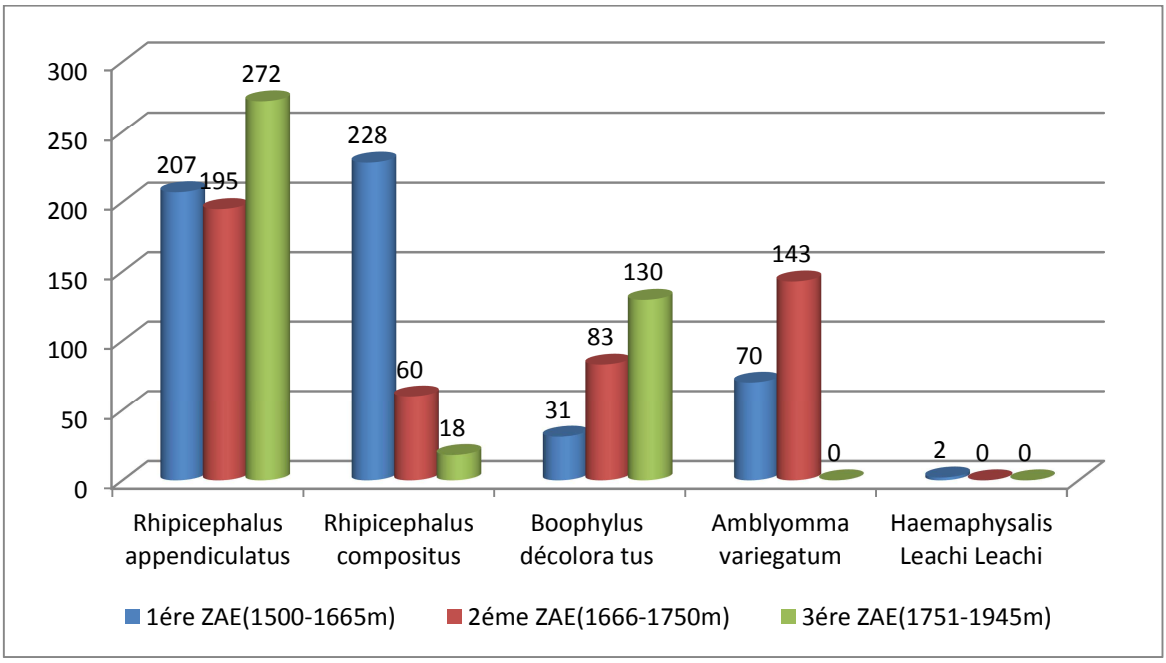


Figure 2. Distribution des tiques par zones agro écologiques

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Virtual Machine Consolidation Challenges: A Review

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ABSTRACT: Virtualization is a powerful technology that facilitates better use of the available data center resources using a technique called Virtual Machine (VM) consolidation which involves gathering of several virtual machines into a single physical server. To address the problem of high energy usage, it is necessary to eliminate inefficiencies and waste in the way electricity is delivered to computing resources, and in the way these resources are utilized to serve application workloads. This can be done by improving the physical infrastructure of data centers as well as resource allocation and management algorithms. VM consolidation involves live migration, which is the capability of transferring a VM between physical servers with a close to zero down time is an effective way to improve the utilization of resources and energy efficiency in cloud data centers. VM placement and VM migration act as a backbone to the VM consolidation process. Issues such as heterogeneity and scalability of physical resources, volatile workloads and migration cost make the VM consolidation process difficult. This paper presents a comprehensive survey of different VM consolidation challenges such as host underload detection, host overload detection, VM selection, VM live migration and VM placement algorithms. The paper discusses these VM consolidation challenges and presents a comparison between different state-of-the-art VM consolidations algorithms.

KEYWORDS: Cloud computing, Hypervisor, Virtualization, VM selection, VM live migration, VM placement.

1 INTRODUCTION

Cloud computing is defined by NIST [1] as a model for enabling convenient, on demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimum management effort or service provider interaction. Several other definitions have been proposed for cloud computing [2], but they all imply the existence of a shared pool of computing resources. Virtualization plays a vital role in managing and coordinating access to the resource pool via a software layer called Virtual Machine Monitor (VMM) or hypervisor. It hides the details of the physical resources and provides virtualized resources for high level applications. Moreover, it virtualizes all of the resources of a given physical machine (PM) allowing several virtual machines (VM) to share its resources [3]. It should be noted that an essential characteristic of a virtual machine is that the software running on it is limited to the resources and abstractions provided by the virtual machine. Virtualization also allows gathering several virtual machines into a single physical server using a technique called VM consolidation.

VM consolidation can provide significant benefits to cloud computing by facilitating better use of the available data center resources. It can be performed either statically or dynamically. In static VM consolidation, the VMM allocates the physical resources to the VMs based on peak load demand (overprovision). This leads to resource wastage because the workloads are not always at peak. On the other hand, in case of dynamic VM consolidation, the VMM changes the VM capacities according to the current workload demands (resizing). This helps in utilizing the data centers resources efficiently.

In dynamic VM consolidation, the VMs can be dynamically reallocated using live migration according to the current PM resource demand to minimize the number of active physical servers, referred to as hosts, required to handle the workload. The idle hosts are switched to low power modes with fast transition times to eliminate the static power (power consumed while there is no circuit activity so it is considered as wasted energy) and reduce the overall energy consumption. The hosts are reactivated with the increase of the resource demand to avoid violating QoS requirements. This approach has basically two objectives, namely minimization of energy consumption and maximization of the quality of service (QoS) delivered by the system, which forms an energy-performance tradeoff [4]. VM consolidation is faced by a large number of challenges that are discussed in this paper.

The paper is organized as follows: Section 2 explains virtual machine consolidation steps and challenges. Section 3 explains host overload detection algorithms. VM selection algorithms, VM live migration algorithms, and VM placement algorithms are discussed in sections 4, 5, and 6 respectively. Finally, the conclusions are provided in section 7.

2 VIRTUAL MACHINE CONSOLIDATION STEPS AND CHALLENGES

As mentioned in Section1, dynamic consolidation of virtual machines can improve the utilization of resources and reduce energy consumption by live migration, the capability of transferring a VM between physical servers (referred to as hosts, or nodes) with a close to zero downtime. VM consolidation involves the following steps [3] as shown in Fig. 1:

- Gathering the requirements of each VM, sizing the VM and placing the VM on a suitable PM (initial placement).
- Resizing each VM according to workload demands.
- Monitoring and profiling the resource utilization for hotspot detection (overloaded and underloaded PMs).
- Remapping the VM to another PM and thus migration according to a placement plan.

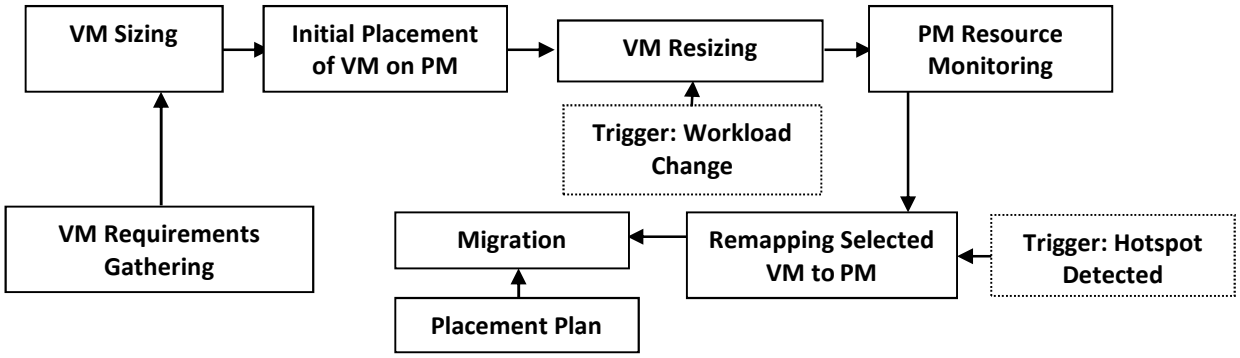


Fig. 1. Virtual Machine Consolidation Steps

VM placement and VM migration both act as a backbone to the VM consolidation process. The issues such as heterogeneity and scalability of physical resources, volatile workloads and migration cost make the VM consolidation process difficult. The basic challenges for efficient VM consolidation can be summarized as follows:

- **Host underload detection:** Deciding if a host is considered to be underloaded so that all VMs should be migrated from it and the host should be switched to a low-power mode (to minimize the number of active physical servers).
- **Host overload detection:** Deciding if a host is considered to be overloaded so that some VMs should be migrated from it to other active or reactivated hosts (to avoid violating the QoS requirements).
- **VM selection:** Selecting VMs to migrate from overloaded host.
- **VM live migration**: Performing VM migration process with minimal service downtime and resource consumption during migration process.
- **VM placement:** Virtual machine placement by placing VMs selected for migration on other active or reactivated hosts.

For host underload detection the VMs can be migrated from the least utilized host or set a static threshold to decide if a host is underloaded as presented in [4].The other challenges and the corresponding algorithms proposed in the literature are discussed in more details in the following sections.

3 HOST OVERLOAD DETECTION ALGORITHMS

Detecting when a host becomes overloaded directly influences the QoS, because if the resource capacity is completely utilized, it is highly likely that the applications are experiencing resource shortage and performance degradation calling for the migration of some VMs from it. What makes the problem of host overload detection complex is the necessity to optimize the time-averaged behavior of the system, while handling a variety of heterogeneous workloads placed on a single host. To address this problem, most of the current approaches to dynamic VM consolidation apply either heuristic-based techniques, such as static utilization thresholds, adaptive utilization threshold based on statistical analysis of historical data; or regression based algorithms as shown in Table 1. The limitations of these approaches are that they lead to suboptimal results and do not allow the administrator to explicitly set a QoS goal [5].

Table 1. Types of Host Overload Detection Algorithms

Type	Static utilization threshold based algorithms	Adaptive utilization threshold based algorithms	Regression based algorithms
Explanation	Based on fixed CPU utilization threshold	Based on statistical analysis of historical data of VM	Based on estimation of future CPU utilization
Pros	Simple	Robust in case of dynamic environments	Better predictions of host overloading
Cons	Unsuitable for dynamic environment	Poor prediction of host overloading	Not simple
Examples	THR (averaging threshold-based algorithm)	MAD (Median Absolute Deviation), IQR (Inter Quartile Range)	LR (Local Regression), LRR (Local Robust Regression)

3.1 STATIC CPU UTILIZATION THRESHOLD ALGORITHMS

One of the simplest overload detection algorithms is based on an idea of setting a CPU utilization threshold distinguishing the non-overload and overload states of the host. When the algorithm is invoked, it compares the current CPU utilization of the host with the defined threshold. If the threshold is exceeded, the algorithm detects a host overload [6]. An example of static CPU utilization threshold based algorithms is the averaging threshold-based algorithm (THR) [4]. The algorithm calculates the mean of the n latest CPU utilization measurements and compares it to the specified threshold. It detects overload situations if the mean of the n last CPU utilization measurements is higher than the specified threshold. Unfortunately, fixed values of utilization thresholds are unsuitable for an environment with dynamic and unpredictable workloads, in which different types of applications can share a physical PM. The system should be able to automatically adjust the utilization threshold depending on the workload patterns exhibited by the applications.

3.2 ADAPTIVE UTILIZATION THRESHOLD BASED ALGORITHMS

These algorithms provide auto-adjustment of the utilization thresholds based on a statistical analysis of historical data collected during the lifetime of the VMs. Its main idea is to adjust the value of the upper utilization threshold depending on the strength of deviation of the CPU utilization. The higher the deviation, the lower the value of the upper utilization threshold, as the higher the deviation, the more likely that the CPU utilization will reach 100% and cause an SLA violation. Example algorithms are Median Absolute Deviation (MAD) and Interquartile Range (IQR) [7]:

- Median Absolute Deviation (MAD): It is a measure of statistical dispersion that behaves better with distributions without a mean or variance and is a more robust estimator of scale in comparison to sample variance or standard deviation, as it. In case of the standard deviation, the distances from the mean are squared, so on average, large deviations are weighted more heavily, and thus outliers can heavily influence it. On the other hand, in case of MAD, the magnitude of the distances of a small number of outliers is irrelevant.
- Interquartile Range (IQR): It is another measure of statistical dispersion. It is also called the midspread or middle fifty as it equals the difference between the third and first quartiles in descriptive statistics. The interquartile range is a robust in comparison to the (total) range, having a breakdown point of 25%, and is thus preferred to the total range.

Adaptive utilization threshold algorithms are more robust than static CPU utilization threshold algorithms in case of dynamic environments. But, unfortunately, they provide poor prediction of host overloading.

3.3 REGRESSION BASED ALGORITHMS

They are based on the estimation of the future CPU utilization. They provide better predictions of host overloading, but are more complex. Example algorithms include Local Regression algorithms (LR) [8] such as Loess method and Local Regression Robust (LRR) [9], which is a modification of LR robust to outliers.

Table 2. Host Overload Detection State-of-Art Algorithm Comparison

Technique	Type	Parameters considered				Performance metrics accounted					
		Utilization threshold	Median absolute deviation (MAD)	Interquartile range (IQR)	Future expectations of CPU utilization	CPU utilization	Energy (E)	SLA violation (SLAV)	E.SLAV (ESV)	SLA violation Time per Active Host (SLATAH)	Performance degradation due Migrations (PDM)
THR [4]	Static CPU utilization threshold	✓				✓	✓	✓	✓	✓	✓
MAD [7]	Adaptive utilization threshold		✓				✓	✓	✓	✓	✓
IQR [7]	Adaptive utilization threshold			✓			✓	✓	✓	✓	✓
LR [8]	Regression based				✓		✓	✓	✓	✓	✓
LRR [9]	Regression based				✓		✓	✓	✓	✓	✓

Meeting QOS requirements is extremely important for cloud computing environments. Qos requirements are commonly formalized in the form of SLAs which can be determined in terms of such characteristics as minimum throughput or maximum response time delivered by the deployed system. As these characteristics can vary for different applications, it is necessary to use a workload independent metric that can be used to evaluate SLA delivered to any VM deployed in an IaaS.

The main metrics used are energy consumption by physical nodes and SLAV (SLA violation), however these metrics are typically negatively correlated as energy can usually be decreased by the cost of the increased level of SLA violations. Since the objective of resource management system is to minimize both energy and SLA violations a combined metric is denoted by Energy and SLA violation (ESV) is used. Also two other metrics are used which are the percentage of time during which active hosts have experienced the CPU utilization of 100%, SLA violation Time per Active Host (SLATAH) and the overall performance degradation by VMs due to migrations, Performance Degradation due to Migrations (PDM). Both SLATAH and PDM metrics independently and with equal importance characterize the level of SLA violations. Since SLAV = SLATAH.PDM.

A comparison of the state of art of host overload detection algorithms is summarized in Table 2. The following conclusions have been assessed [7]:

- Heuristic-based dynamic VM consolidation algorithms substantially outperform the static CPU utilization threshold algorithm (THR) due to a vastly reduced level of SLA violations.
- Dynamic VM consolidation algorithms based on local regression outperform the threshold-based and adaptive-threshold based algorithms due to better predictions of host overloading, and therefore decreased SLA violations due to host overloading (SLATAH) and the number of VM migrations.
- The algorithm based on local regression produces better results than its robust modification, which can be explained by the fact that for the simulated workload it is more important to react to load spikes instead of smoothing out such outlying observations.

4 VM SELECTION ALGORITHMS

Once a host overload has been detected, it is necessary to determine what VMs are the best to be migrated from the host. This problem is solved by VM selection algorithms. VM selection algorithms can be classified into:

- Techniques that use fixed criteria for selecting VMs.
- Techniques that apply multiple criteria for selecting VMs.

4.1 TECHNIQUES THAT USE FIXED CRITERIA

They employ a fixed criterion for decision-making so they are not suitable in dynamic environments. Some examples of those techniques are presented

- Dynamic management algorithm (DMA): It defines a VM selection criterion based on CPU utilization of VMs. In fact, the VMs with the lowest CPU utilization are selected. It was proved that selecting VMs based on this criterion can result in minimized migration cost [10].
- The Minimum Migration Time Policy (MMT): This policy selects a VM that requires the minimum time to complete a migration relative to the other VMs allocated to the host. The migration time is estimated as the amount of RAM utilized by the VM divided by the spare network bandwidth available for the host [7], [11], [12].
- The Random Choice Policy (RC): This policy selects a VM to be migrated according to a uniformly distributed discrete random variable whose values index a set of VMs allocated to a host [7], [11].
- The Maximum Correlation Policy (MC): This policy is based on the idea that the higher the correlation between the resource usage by applications running on an oversubscribed server, the higher the probability of the server overloading. According to this idea, the VMs to be migrated are those that have the highest correlation of the CPU utilization [13]. To estimate the correlation between CPU utilization with VMs, the multiple correlation coefficient is applied. The multiple correlation coefficient is used in multiple regression analysis to assess the quality of the prediction of the dependant variable. It corresponds to the squared correlation between the predicted and the actual values of the dependant variable. It can also be interpreted as the proportion of the variance of dependant variable explained by the independent variables [6] [7].

4.2 TECHNIQUES THAT APPLY MULTIPLE CRITERIA FOR SELECTING VMS

The VM selection task is considered as a dynamic decision making task. An example of these techniques is VM selection using Fuzzy Q-Learning (FQL).

- VM Selection using Fuzzy Q-Learning (FQL): VM selection, on the other hand, has been somehow neglected in the past, often using fixed criteria instead of dynamic ones. The VM selection task is considered as a Dynamic Decision-Making (DDM) task and thus can be modeled using Fuzzy Q-Learning (FQL). It is shown that FQL can be used to dynamically choose VM selection strategies from a set of possible strategies in order to achieve better results than each of the individual strategies achieves when used alone [14].

A comparison between state-of-art existing VM selection algorithms is presented in Table 3.

Table 3. VM Selection State-of-Art Algorithm Comparison

Technique	Parameters considered					Performance metrics accounted					
	Upper Utilization threshold	Lower Utilization threshold	Memory Size	Network bandwidth	No. VMs	CPU utilization	Energy (E)	SLA violation (SLAV)	ESV	No. VM migration	Migration cost
DMA [10]			✓	✓	✓	✓					✓
MMT [15]	✓	✓	✓	✓			✓	✓	✓	✓	
RC [15]	✓	✓	✓	✓			✓	✓	✓	✓	
MC [7]			✓	✓			✓	✓	✓	✓	
FQL [14]					✓	✓	✓	✓	✓	✓	

It has been concluded that:

- The MMT policy [15] produces better results compared to the MC policy [7], meaning that the minimization of the VM migration time is more important than the minimization of the correlation between VMs allocated to a host and the resources.
- DMA [9], MMT [15], and MC [7] employ a fixed criterion for decision-making so they are not suitable for decision-making in dynamic environments.
- A Fuzzy Q-Learning (FQL) approach as an online decision making strategy enhances the VM selection task in a dynamic VM consolidation procedure. It is able to integrate multiple VM selection criteria to benefit from all advantages and possible synergetic contributions of them in long-term learning. In fact, this approach learns how to find an optimal

strategy to applying multiple criteria for selecting VMs during a dynamic VM consolidation procedure towards improving the energy performance trade-off.

5 VM LIVE MIGRATION ALGORITHMS

Live migration makes possible for VMs to be migrated without considerable downtime. The transfer of a VM actually refers to the transfer of its state. This includes its memory, internal state of the devices and that of the virtual CPU. Among these, the most time-consuming one is the memory transfer. Two parameters to be considered while performing the live VM-migration are downtime and migration time. Migration time refers to the amount of time required to transfer a virtual machine at source node to destination node without affecting its availability. Down time refers to the time during which the service of the VM is not available. Total migration time and downtime are two key performances metric that the clients of a VM service care about the most; because they are concerned about service degradation and the duration that the service is completely unavailable [16].

Virtual machine migration techniques are classified according to their goals into [17]:

- Fault Tolerant Migration Techniques: Fault tolerance allows the virtual machines to continue its job even any part of system fails. This technique migrates the virtual machine from one physical server to another physical server based upon the prediction of the failure occurred ,fault tolerant migration technique is to improve the availability of physical server and avoids performance degradation of applications.
- Load Balancing Migration Techniques: The Load balancing migration technique aims to distribute load across the physical servers to improve the scalability of physical servers in cloud environment. The Load balancing aids in minimizing the resource consumption, implementation of fail-over, enhancing scalability, avoiding bottlenecks and over provisioning of resources etc.
- Energy Efficient Migration Techniques: The power consumption of Data center is mainly based on the utilization of the servers and their cooling systems. The servers typically need up to 70 percentage of their maximum power consumption even at their low utilization level. Therefore, there is a need for migration techniques that conserves the energy of servers by optimum resource utilization.

Also, the migration mechanisms have been divided into three main branches [18]:

- Process migration: Process migration which was born along with distributed systems is the beginning of VM's migration. The mechanisms based on process migration have some characteristics such as complexity, performance, transparency, fault resilience, scalability and heterogeneity that have a major impact on the effectiveness and deployment of process migration.
- Memory migration: The memory state migration has been widely studied and basically there are two methods post copy and pre-copy. Post copy migration transfers a VM's memory contents after its processor state has been sent to the target host. It differs from the pre-copy approach which first copies the memory state to the destination through a repetitive process after which its processor state is transferred to the target.
- Suspend /Resume Migration: It refers to the motion of a VM from one host to another where the VM is locally inactive during the translation. Usually this is a migration across a WAN. The network connections are typically dropped and need to be re-established. For a WAN migration, it is crucial to not just transfer the VM images but also transfer the local persistent state, its ongoing network connections, and the support for the disconnected operation.

Some of live VM migration techniques are discussed below.

- Pure stop-and-copy approach: This involves halting the original VM, copying all pages to the destination, and then starting the new VM. This has advantages in terms of simplicity but the service downtime is proportional to the amount of physical memory allocated to the VM. This can lead to an unacceptable outage if the VM is running a live service [19].
- Post-copy approach: A short stop-and-copy phase transfers essential kernel data structures to the destination. The destination VM is then started, and other pages are transferred across the network on demand. This results in a much shorter downtime, but produces a much longer total migration time [20], [21].
- Pre-copy migration: It iteratively copies the memory pages from the source machine to the destination host, without ever stopping the execution of the VM being migrated. The iterative nature of the algorithm is due to the dirty pages, i.e. memory pages that have been modified in the source host since last page transfer must be sent again to the destination host. If the rate of updating of pages is very high, migration time will rise to a very high value. But the advantage of this approach is that all updating are available at the destination host. It can be activated any time. Every VM will have some

(hopefully small) set of pages that it updates very frequently and which are therefore poor candidates for pre-copy migration [22].

- Modification of pre-copy approach: It is a modification of pre-copy approach; a framework is constructed that includes pre-processing phase in traditional pre-copy based live migration so that the amount of transferred data is reduced [23].
- Hybrid pre and post copy: It is a technique that performs single round of pre-copying which precedes the virtual CPU state transfer. This is followed by post-copying of the remaining dirty pages from the source PM. Therefore, it gets the benefits of both approaches and improves live migration process [24].
- Memory compression: Virtual machine migration performance is greatly improved by cutting down the amount of transferred data. In the source node, data being transferred in each round are first compressed by the algorithm. When arriving on the target, compressed data are then decompressed. Compression time is a performance bottleneck of additional overhead introduce by compression operations. If the compression overhead outweighs the advantage of memory compression, live migration would not get any benefit from it [25], [16], [3].
- Delta page transfer: It is a technique that reduces the network bandwidth consumption by maintaining a cache of previously transferred memory pages. This optimizes the transmission of dirtied pages by sending the difference between cached page content and page content that is going to be transferred. This improves the live migration process with reduced risk of service interruption [26], [27].
- Dynamic self Ballooning (DSB): Ballooning is an existing technique that allows a guest OS to reduce its memory footprint by releasing its free memory pages back to the hypervisor. DSB automates the ballooning mechanism so it can trigger frequently (every 5 seconds) without degrading application performance. Our DSB implementation responds directly to OS memory allocation requests without the need for kernel patching. It neither requires external introspection by a co-located VM nor extra communication through the hypervisor. DSB thus significantly reduces total migration time by eliminating the transfer of free memory pages [28].
- Data deduplication: It is a technique that uses hash based finger print technology that finds the similar and identical data inside the memory and disk of a single VM and optimizes the live migration process. This technique requires transferring memory data from source to target PM only once [3], [29].
- Adaptive prepaging: Adaptive prepaging is another technique where we intelligently identify the pages which may be accessed by the VM in near future and transfer them beforehand. This helps in quick transfer of the VMs working set [28].
- Content bashed hashing: To be able to fetch memory pages from the memory of other VMs in the site, the destination node needs to discover which VMs in the network have a copy of a specific page. Since these other VMs are running and their memory content change over time, this information has to be discovered dynamically. To solve this problem hash table allowing to locate nodes having a copy of a given page using its hash value is used [29], [30], [31].
- Multiple VM Migrations: Whenever there is a need to shift entire virtual clusters to different locations, it requires large amount of data to be transferred over the network which results in network and CPU overhead. This leads to performance degradation of applications running in the PM. So identical contents of co-located VMs in the physical machine can be pro-actively tracked and transferred only once to the target PM. This improves the performance of multiple VM migration. This is known as “Gang Scheduling” of virtual machines. It optimizes both memory and network overhead of migration [28], [32].

Table 4. Comparison of State-of-art Existing Live Migration Approaches as Presented in [3]

Technique	Parameters considered				Performance metrics accounted			Single VM/ Multiple VM	WAN		
	VM size	Page dirty rate	N/W traffic	CPU cycles	Total migration down time	N/W BW	CPU util.		Y/N	N/W	Storage
Pre-copy [18]		✓	✓		✓			Single VM	No		
Pre-copy + memory compression [23]		✓			✓			Single VM	No		
Pre-copy + delta page transfer [24]		✓	✓		✓	✓		Multiple VM	Yes		✓
Post copy + adaptive pre-paging + dynamic self ballooning [28]		✓			✓			Single VM	No		
Pre-copy + Post-copy [22]		✓			✓			Single VM	No		
Pre-copy + multiple migrations [28]		✓	✓		✓	✓		Multiple VM	No		
Pre-copy + Content based hashing [29]		✓			✓			Multiple VM	yes		✓
Delta page transfer + data deduplication + VPN configuration [25]		✓	✓		✓	✓		Multiple VM	yes	✓	✓
Pre-copy + data deduplication [27]		✓			✓			Single VM	No		

The live migration approach consumes resources such as CPU, memory and network which can seriously impact the performance of both the VM being migrated as well as other VMs in the PM. The performance of the migration approach depends on the parameters such as VM size, memory, page dirty rate, network traffic and amount of available CPU resource.

It has been is concluded that:

- The performance of a migration approach depends on the parameters such as: VM size, memory page dirty rate, network traffic and amount of available CPU resource.
- Also, it is observed that the two important parameters VM size and available CPU cycles have not been taken into consideration during migration. For efficient migration, all the mentioned parameters should be taken into account and also the performance of the migration algorithm needs to be measured in terms of performance metrics.
- Current research efforts on live virtual machine migration take considerable amount of migration time and down time. A new model for live migration of VMs should be designed with reduced overheads of downtime and migration time

6 VM PLACEMENT ALGORITHMS

The virtual machine placement involves two main steps which are provisioning of resources for the virtual machines according to the capacity requirements of corresponding applications (VM sizing) and actual placement of VMs onto PMs. The placement approach should consider multiple resources such as CPU, memory, disk storages and network bandwidth to reduce the energy consumption at data centers and also maintain the energy performance tradeoff. The goal of virtual machine placement is to do VM consolidation either for power savings or load balancing to deliver best possible QoS to the applications running in VMs. Automating the process of VM placement has become important with the increase in size of the data centers [33]. Some of the factors that are typically used to quantify the cost functions are:

- Processor usage
- Storage usage
- Memory usage
- Network usage
- Power usage

The choice of which performance factors and how many performance factors are to be taken into consideration varies from cloud provider to cloud provider.

6.1 CLASSIFICATION OF VM PLACEMENT ALGORITHMS

The VM placement algorithms can be broadly classified into two categories on the basis of their placement goal [34]:

- **Power Based approach:** The main aim of these approaches is to map virtual machines to physical machines in such a way, so that the servers can be utilized to their maximum efficiency, and the other servers can be either hibernated or shut down depending on load conditions.
- **Application QoS based approach:** These algorithms manage the mapping of virtual machines onto physical hosts with the aim of maximizing the quality of service (QoS) delivered. By continuously monitoring virtual machine activity and employing advanced policies for dynamic workload placement, such algorithms can lead to better utilization of resources and less frequent overload situations eventually leading to savings in cost.

VM Placement algorithms can be further classified as shown in Fig. 2.

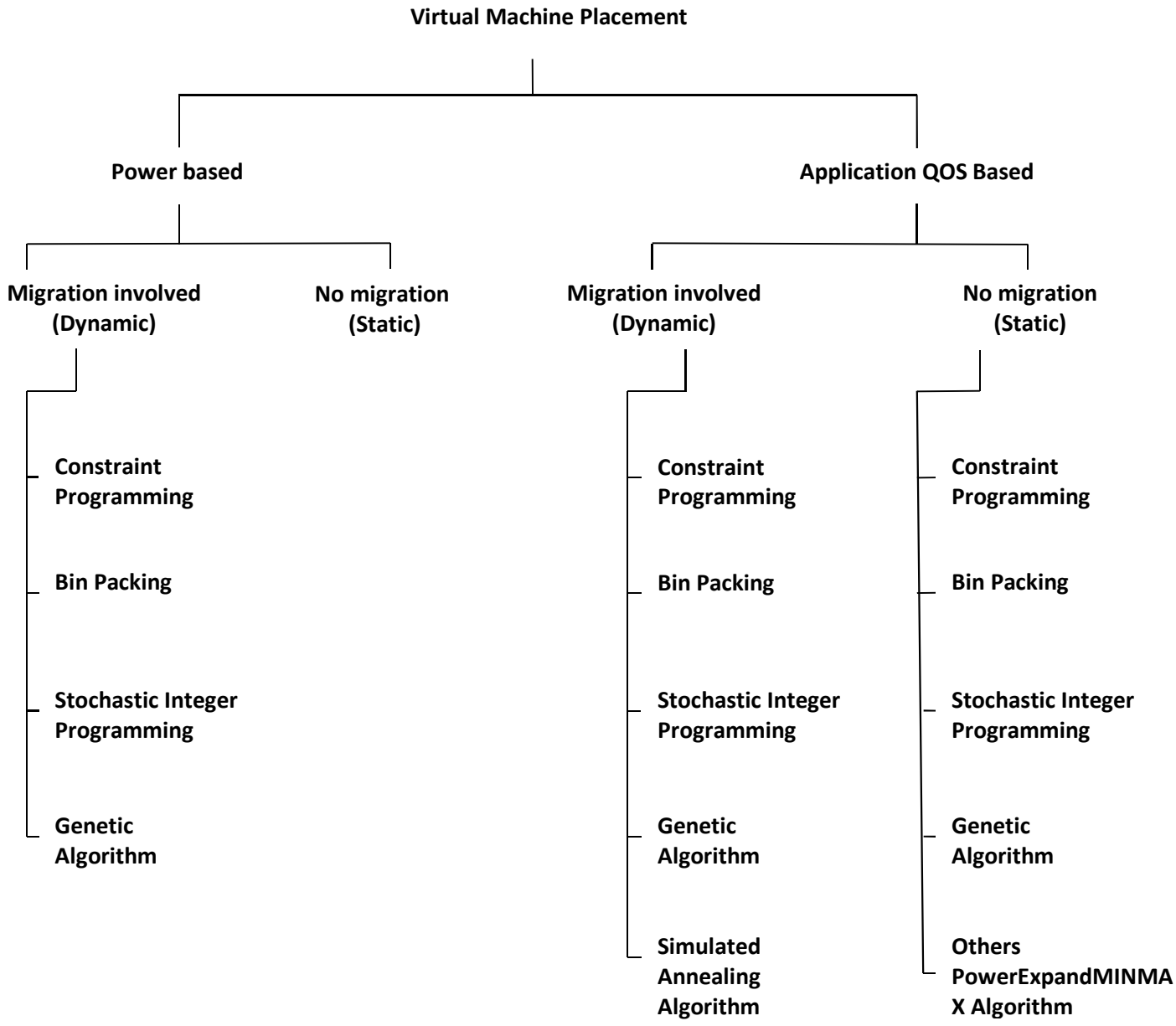


Fig. 2. Classification of VM Placement Algorithms

6.2 DISCUSSION AND COMPARISON OF DIFFERENT TECHNIQUES

This sub-section provides a discussion and comparison among different VM placement algorithms [34]:

- **Constraint programming:** It is useful in cases where we have the input data with us, that is, before we compute the cost functions, we know the demands of the Virtual Machines. The techniques using constraint programming are easily extendable so as to take additional constraints into account. The time taken to generate an optimal solution is high as the number of constraints increases [35].
- **A Bin packing approach:** It can be considered as a subset of Constraint Programming approach. It is useful for dynamic VM Placement, especially where the demand is highly variable. It is a heuristic based approach. Thus it may not give us an optimal solution. However, it will always generate a good solution in considerable amount of time. A Bin-packing approach is really useful when all physical machines have the same amount of memory and processing capabilities. However, we can even model Bin packing algorithms with constraints. There is always a tradeoff between packing maximum number of virtual machines on a single physical machine versus distributing the load across all the physical machines. Multi-dimensional bin-packing algorithm can also be applied to VM placement problem. In this the dimensions correspond to amount of memory and number of processing units [34], [4].
- **Stochastic integer programming:** It is useful where the future demands and prices of resources are not known, but their probability distributions are either known or can be computed. This is the best technique to be used in the case where we have two or more uncertain parameters on which the cost depends [36].
- **Genetic algorithm:** It is a way to solve the bin packing problem with certain constraints. The Grouping Genetic Algorithm requires more computing time and higher computing resources as compared to bin packing. It is particularly useful for static placements, that is, in scenarios where the demands do not vary over a considerable period of time. GA is also useful for specifying VM-VM and VM-PM interference constraints [37].

Each of the virtual machine placement algorithm works well under certain specific conditions. Thus, it is important to choose a technique that suits the needs of the cloud user and cloud provider. Also, the parameters to these algorithms should be properly specified. The performance metrics are measured at both system level and application level. The system level metrics are measured in terms of CPU load and the application level metrics are measured in terms of response time of applications.

Physical and virtual machines are characterized by their CPU (MIPS), RAM (MB) and bandwidth (Mbits/s). The goal of virtual machine placement problem is to determine the minimum number of physical machines required by the set of virtual machines.

In [36] vm sizes are generated as random variables following some distribution and actual Violation Probability is the failure probability of ensuring the target overflow probability for all the hosts.

It is concluding from table 5 that:

- Constraint programming algorithm can compute approximately global optimization solution within timeout. It can efficiently reduce the number of physical servers but it suffers from relatively long search times.
- Bin packing approach is a heuristic based approach .Thus it may not give us an optimal solution. However,it always generate a good solution in considerable amount of time.
- Stochastic integer programming is the best technique to be use in the case where we have two or more uncertain parameters on which the cost depends
- The computation time of the GA increased with the number of VMs and the number of PMs.

Table 5. Comparison of State-of-Art Existing Bin Packing VM Placement Approaches

Technique	Type	Input parameters							Output		
		Host CPU (MIPS)	Host RAM (MB)	Host BW (Mbits/s)	VM CPU (MIPS)	VM RAM (MB)	VM BW (Mbits/s)	VM size	Actual violation probability	Allocations of VMs	Average running time
CP-Based VM Placement Algorithm [35]	Constraint Programming	✓	✓	✓	✓	✓	✓			✓	✓
Modification of Best Fit Decreasing[4]	Bin Packing	✓	✓		✓	✓				✓	
Stochastic VM Multiplexing [36]	Stochastic Integer Programming	✓	✓					✓	✓	✓	
GA energy efficient VM placement Algorithm [37]	Genetic Algorithm	✓	✓		✓	✓				✓	✓

7 CONCLUSIONS

This paper presented a survey of different virtual machine consolidation challenges in addition to a comparison among corresponding algorithms. From the survey, it can be concluded that:

- Dynamic VM consolidation algorithms based on local regression outperform the threshold-based and adaptive-threshold based algorithms due to better predictions of host overloading, and therefore decreased SLA violations due to host overloading (SLATAH) and the number of VM migrations.
- A Fuzzy Q-Learning (FQL) approach as an online decision making strategy enhance the VM selection task in a dynamic VM consolidation procedure.
- New models for live migration of VMs should be designed with reduced overheads of downtime and migration time.
- Automating the process of virtual machine placement has become important with the increase in size of the data centers. The choice of which performance factors and how many performance factors are to be taken into consideration varies from cloud provider to cloud provider.

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Performance externe des industries de transformation au Maroc et normes qualité

[External performance of processing industries in Morocco and quality standards]

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ABSTRACT: This article aims firstly to show how the quality standards, understood as a convention, plays a key role in reducing uncertainty and promotes the definition of coordination procedures. Secondly, it explains how standards can be playing a role of "barrier to entry", also how an updated normative level allows an economy to improve its external competitiveness. This impact of quality standards is empirically verified for the Moroccan case using an econometric model testing the impact of quality standards on export growth of processing industries. The estimated model shows a significant positive effect.

KEYWORDS: barrier to entry, convention, econometric model.

RESUME: Cet article vise d'une part à montrer en quoi la norme, appréhendée comme une convention, joue un rôle déterminant pour réduire l'incertitude et favorise la définition de procédures de coordination. Et d'autre part à expliquer comment les normes peuvent être un instrument à caractère protectionniste et jouer un rôle de « barrière à l'entrée », par ailleurs une mise à niveau normatif permet à une économie d'améliorer sa compétitivité externe. Une telle amélioration est vérifiée empiriquement pour le cas marocain à l'aide d'un modèle économétrique testant l'impact des normes qualité sur la croissance des exportations des industries de transformation. Le modèle estimé montre un effet positif significatif.

MOTS-CLEFS: barrière à l'entrée, convention, modèle économétrique.

1 INTRODUCTION

Le Maroc s'est engagé dans un processus d'ouverture et de libéralisation de son économie en concluant environ 55 accords de libre échange, qui prévoient la suppression des obstacles tarifaires. A cet égard, les entreprises marocaines sont appelées plus que jamais à se doter de moyens nécessaires pour relever les défis qu'imposent une tendance à l'ouverture et à la compétitivité croissante. Cependant, au delà de la disparition des mesures tarifaires dans le processus de démantèlement douaniers, nul ne peut nier que les normes volontaires restent l'un des piliers de la compétitivité, de la productivité et de l'efficience économique. Néanmoins, elles peuvent être un instrument de contrainte à caractère protectionniste et jouer le rôle de « barrière à l'entrée ».

Les entreprises marocaines ne peuvent continuer à approvisionner le marché intérieur ni tirer profit de la mondialisation des marchés sans amélioration de leur compétitivité sur le plan qualité et innovation et sur le plan des prix. Cette compétitivité passe par l'adoption par nos entreprises d'une modernisation des techniques de production et par un management moderne basé sur le respect des normes.

Dans cette perspective, le Maroc déploie des efforts pour moderniser son économie notamment par les normes qui jouent un rôle déterminant dans le renforcement de la compétitivité des entreprises et leur accès aux marchés mondiaux. Dans ce sens, le Maroc a œuvré pour garantir un environnement favorable à l'amélioration de la qualité à travers la consolidation du fonds normatif marocain qui s'élève aujourd'hui à environ 11 000 normes en compatibilité avec les normes internationales et le développement d'un système de certification et d'accréditation des organismes d'évaluation de la conformité conforme aux pratiques internationales.

Cet article s'intéressera à l'évaluation de l'impact des normes qualité existantes au Maroc sur les exportations des industries de transformation. Il est organisé en 4 sections. La première section présente quelques éléments théoriques concernant la question qualité. La deuxième section est consacrée à la présentation de quelques statistiques sur les normes qualité au niveau international. Les deux dernières sections présentent le modèle économétrique adopté pour évaluer l'impact des normes qualité sur les exportations des industries de transformation d'une part, et d'autre part l'estimation d'un tel modèle pour le cas marocain.

2 ESSAI D'ÉCLAIRAGE THÉORIQUE DE LA NORMALISATION ET DÉFINITIONS

2.1 DÉFINITION DE LA NORMALISATION

La normalisation vise à fournir les documents de référence comportant des solutions à des problèmes techniques et commerciaux concernant les produits et services qui se posent de manière récurrente dans les relations entre acteurs économiques, scientifiques et techniques.

Dans le dictionnaire le Petit Robert, la norme renvoie « aux règles d'usages, prescriptions techniques relatives aux caractéristiques d'un produit ou d'une méthode, édictées dans le but de standardiser et de garantir les modes de fonctionnement, la sécurité, et les nuisances ».

D'après [3], une norme « est un document écrit, accessible au public, établissant une règle du jeu évolutive concernant des signes directeurs ou des spécifications techniques, dont le respect n'est pas obligatoire mais volontaire, qui est établi avec la coopération et le consensus ou l'approbation générale de toutes les parties intéressées fondé sur les acquis conjugués de la science, de la technologie et de l'expérience, destiné à une application répétitive et continue, approuvé par un organisme qualifié sur le plan national, régional ou international, et visant, en réponse à des problèmes réels ou potentiels, l'avantage optimal de la communauté dans son ensemble ».

2.2 LES TYPES DE NORMES

Les normes se présentent sous différents types selon leur contenu et les aspects qu'elles traitent. Il est à noter que ces différents types ne s'excluent pas mutuellement et qu'une même norme peut appartenir à plusieurs types.

Normes de base : il s'agit des normes de portée générale ou encore qui comportent des dispositions d'ensemble dans un domaine particulier notamment les symboles à utiliser, les dessins techniques, le marquage et l'étiquetage…etc.

Normes de terminologie : Ce sont des normes qui fixent les termes, généralement accompagnés de leurs définitions et parfois de notes explicatives, d'illustrations, d'exemples,… etc.

Normes de spécifications : Elles spécifient tout ou partie des exigences telles que : caractéristiques, performances, exigences de sécurité, protection de l'environnement, auxquelles doit satisfaire un produit ou un groupe de produits pour répondre à l'usage auquel il est destiné.

Normes d'essai ou d'analyse : Elles concernent les méthodes d'essai ou d'analyse, parfois accompagnées d'autres dispositions, tels que l'échantillonnage et les méthodes statistiques, l'ordre des essais Ces normes visent essentiellement la reproductibilité des résultats d'essais et d'analyses par la prédétermination des modes opératoires, des conditions d'essai, des canevas des rapports…etc.

Normes de service : Elles spécifient la totalité ou une partie des exigences auxquelles doit répondre un service d'une manière générale pour remplir son objet.

Normes de sécurité : Elles concernent des prescriptions destinées à assurer la sécurité des personnes, des animaux et des biens (transport des matières dangereuses, manipulations des machines industrielles, sécurité des appareils domestiques…).

Normes de système : Ce sont des normes génériques qui arrêtent les lignes directrices à respecter pour pouvoir répondre à un objectif déterminé telles que les séries de normes ISO 9000 relatives à la gestion de la qualité, ISO 14000 relatives à la gestion environnementale ou des normes portant sur le management de la sécurité.

2.3 CONVENTION, QUALITÉ, NORME, INVESTISSEMENT DE FORME ET CERTIFICATION

Une convention est un processus de résolution stable d'un problème récurrent. Elle est considérée comme un référentiel commun aux individus, sur lequel ils fondent leur décision, en situation d'incertitude. Les normes sont considérées dans ce sens comme une convention. C'est-à-dire « des structures de coordinations des comportements offrant une procédure de résolution récurrente de problèmes ». Dans un contexte d'incertitude, elles permettent aux acteurs économiques de se doter d'une rationalité procédurale. L'adhésion à une convention est volontaire et libre. L'individu qui décide de s'y conformer, le fait parce qu'il y a intérêt. La convention étant le résultat d'un accord sur un objet collectif, il s'agit d'une indication de conduite normative et elle a un statut de bien public.

Par ailleurs, la qualité au sens industriel est la satisfaction des besoins exprimés ou implicites du client. Par contre, l'ISO 9001 ne concerne pas un niveau de performance des produits, mais sert à démontrer aux clients que leur fournisseur a défini et a appliqué une organisation qui lui permet de comprendre et de satisfaire leurs exigences, le tout dans une optique de progrès permanent. La normalisation peut-être considérée comme un levier de la qualité, définie comme « l'ensemble des propriétés et caractéristiques d'un produit ou service qui lui confèrent l'aptitude à satisfaire des besoins exprimés ou implicites ». Nous empruntons à L. Thévenot [5], le concept « investissement de forme » : ce dernier a élargi la notion d'investissement à l'ensemble des ressources mises en œuvre dans l'entreprise, y compris celles qui ne procèdent pas d'un investissement d'ordre financier c'est-à-dire qu'il inclut des ressources ne rentrant pas dans la panoplie habituelle des facteurs de production. Ces ressources pour être assemblées dans l'opération de production nécessitent une mise en forme qui repose sur un investissement particulier leur attribuant une « capacité d'équivalence » [5]. Ces ressources sont d'une grande diversité : marques, labels et appellations, normes, …etc.

Dans ce cadre, la certification du produit ou de l'entreprise s'inscrit dans la problématique conventionnaliste. En effet, la production de normes dont le corollaire donne lieu à certification relève de la convention puisqu'il s'agit d'objectiver la qualité incertaine du produit, par une mesure générale et communément admise de sa qualité. La certification est un signal qui est connaissance commune et qui, de ce fait, sert de référentiel aux individus et économise une recherche d'information. Elle s'apparente à une « convention de qualité », c'est-à-dire qu'elle témoigne de la qualité de ce à quoi elle se rapporte. Dans tous les cas, la médiatisation de la qualité par la certification permet de pallier le manque d'information et qui aurait pu entraver l'échange et la coopération. La certification, qui peut être qualifiée d'""investissement de forme", est de nature "industrielle" ou technique.

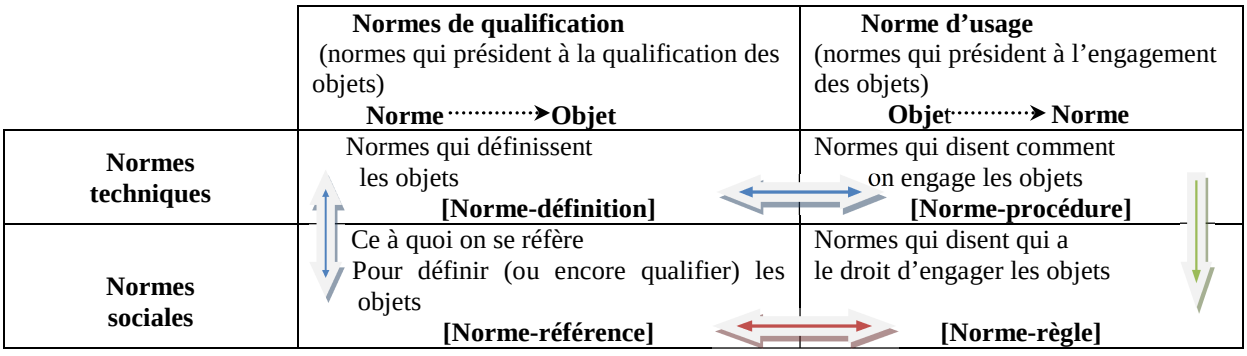


Fig. 1. Quatre formes de norme (elles font système pour un objet particulier) (B. Billaudot, 2010)

La figure 1 illustre la relation entre les quatre forme, à noter qu'il s'agit des formes parce que la matière peut changer : cette matière est relative à l'objet considéré. Ainsi, ces diverses normes se spécifient en fonction du type d'objet pris en compte. Elles font système pour un objet particulier. Les normes définitions se situent en l'amont des normes procédures (ISO 9001, ISO 14001, etc.) visant la certification.

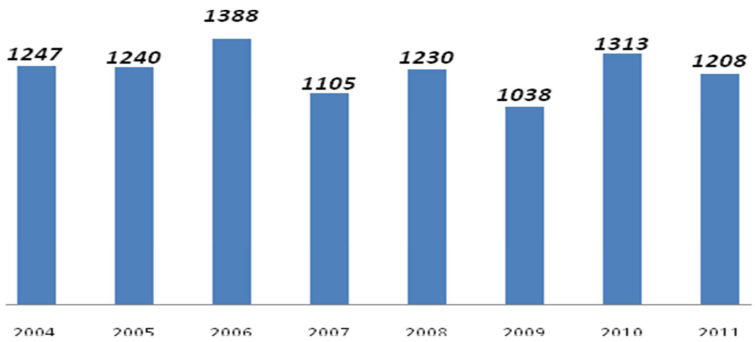
Selon B. Billaudot [1], à partir de cette matrice ces quatre formes de norme associées à un objet particulier font système. 1/ Les normes procédures font appel à la norme-définition (si cette dernière n'est pas assez précise, l'expression de ces normes est insuffisante). 2/ Les normes-règles sont nécessairement reliées aux normes-procédures. 3/ La norme-définition est nécessairement relative à une norme-valeur. Le bouclage du système implique qu'il existe un lien entre « norme-valeur » et « normes-règles ». Pour la norme ISO 9000, la norme-définition explique qu'un produit de bonne qualité est un produit dont la production a conduit à respecter les caractéristiques fixées à la sortie du processus de conception de ce produit. Cette norme-définition strictement industrielle est établie en se référant, comme norme-valeur, à l'efficacité technique instrumentale. Quant à la norme-règle, elle porte sur celui qui a le droit de certifier l'entreprise.

Or, la valeur « efficacité technique instrumentale » commence à être sujet à controverse dès lors que l'on considère qu'un bon produit doit être un produit dont la production a été réalisée dans des conditions sociales acceptables (pas de travail des enfants, conditions minimales d'hygiène et de sécurité, respect des droits sociaux, etc..

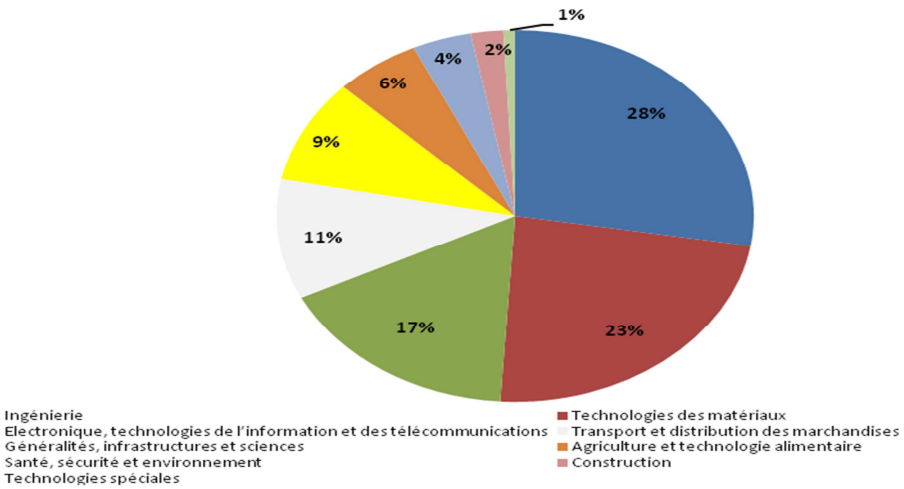
3 LES NORMES À L'ÉCHELLE INTERNATIONALE

L'ISO est l'Organisation internationale de normalisation. Elle est composée de quelque 163 membres qui sont les instituts nationaux de normalisation de pays industrialisés, en développement et en transition, de toutes tailles et de toutes les régions du monde. Le stock normatif élaboré par l'ISO compte actuellement plus de 19 milles norme, qui fournissent au monde économique, aux gouvernements et à la société dans son ensemble des outils concrets pour les trois volets – économique, environnemental et sociétal – du développement durable. Il y a lieu de noter qu'une norme internationale ISO représente un consensus mondial sur les connaissances sur un sujet ou processus donné.

La collection de l'ISO [4], compte en 2011 plus de 19 023 normes, le graphique ci-après montre l'évolution de la production annuelle des normes par l'ISO. En 2011, l'organisation internationale de normalisation a élaboré environ 1208 normes.



Graphique 1. Production annuelle des normes par l'ISO



Graphique 2. Répartition des normes internationales par secteur (année 2011)

Le graphique 2 fait apparaitre une prédominance des normes relatives à l'ingénierie avec 28%. On constate également que le secteur des technologies des matériaux occupe la deuxième place avec 23%. Il est suivi par le secteur électronique et de la technologie de l'information avec 17% et en 4ème position se trouve le secteur du transport et de distribution des marchandises avec 11%.

4 MODÈLE ÉCONOMÉTRIQUE ADOPTÉ

Pour tester l'impact des normes qualité sur l'évolution des exportations en volumes d'une économie donnée, on adopte le modèle économétrique simple suivant :

$$\Delta ln(X_{it}) = \alpha_i + \beta_i 1_{\{t \geq t_0\}} + e_{it}$$

Un tel modèle est estimé pour chaque grand secteur de l'économie.

LES NOTATIONS DU MODÈLE

$\Delta ln(X_{it})$ Est la différence $ln(X_{it}) - ln(X_{it-1})$, i réfère aux grands secteurs de l'industrie de transformation de l'économie. Le terme t_0 est l'année à partir de laquelle un effet des normes sur les exportations peut être attendu, un tel seuil peut être déterminé soit subjectivement soit à l'aide de méthodes statistiques de détection de ruptures. Le paramètre α_i peut s'interpréter comme la croissance moyenne des exportations du grand secteur i, quant à β_i il mesure l'éventuel impact de la normalisation sur les grands secteurs économiques i. Enfin, le terme e_{it} est le terme d'erreur du modèle.

Il est à noter que les grands secteurs de transformation regroupent : Industries agroalimentaires, Industries textiles et cuirs, Industries chimiques et para chimiques, Industries mécaniques et métallurgiques et les Industries électriques et électroniques.

5 ANALYSE EMPIRIQUE

5.1 APERÇU SUR L'EVOLUTION DE LA NORMALISATION AU MAROC

Il convient de souligner que le cadre juridique du système de normalisation au Maroc remonte à l'année 1970. En revanche, la politique de normalisation n'a pas connu d'essor qu'à partir de 2005. Une des explications à ce constat est la logique protectionniste du marché ayant caractérisé cette période qui n'a pas favorisé l'éclosion de l'arsenal normatif étant donné que le volume de production de normes dépend des besoins du marché et des opérateurs industriels.

Par ailleurs, il est à noter qu'une nouvelle loi 12-06 relative à la normalisation, à la certification et à l'accréditation a été publiée en 2010 qui restructure le système de la normalisation, notamment en créant 3 structures. Il s'agit du Conseil Supérieur de la Normalisation, de la Certification et de l'Accréditation, chargé de proposer au Gouvernement les orientations et dispositions nécessaires pour développer ces activités support au développement dans tous les domaines, ainsi de l'Institut Marocain de Normalisation (IMANOR), chargé de la Normalisation et des activités y afférentes, et le Comité Marocain d'Accréditation (COMAC) chargé de superviser les activités d'accréditation des organismes d'évaluation de la conformité.

5.2 EVOLUTION DES NORMES AU MAROC

D'après les données de [3], Le bilan normatif marocain a connu ces deux dernières décennies un saut remarquable en passant d'une production moyenne annuelle de 90 normes au début des années 90 à une moyenne de production qui atteint aujourd'hui plus de 700 normes.

Le bilan global qui était de moins de 500 normes en 1995, se chiffre en 2012 à 10071 normes. Soit un taux de croissance moyen de 15%.

Quant à la répartition des normes par secteurs le graphique ci-après fait apparaître que le secteur des industries mécaniques et métallurgiques vient en tête avec près de 20% du total des normes. Il est suivi par le secteur de Bâtiment et travaux publics avec 17%, l'Industrie agroalimentaire (14%) et l'industrie chimique et para chimique avec 11%.

5.3 ESTIMATION DU MODÈLE

L'analyse de la série des données montre comme précédemment que l'année 2009 s'écarte de l'ensemble des observations. Pour remédier à ce problème on introduit une variable indicatrice corrigeant le comportement spécifique de cette observation.

Ainsi le modèle à estimer à partir des données devient :

$$\Delta ln(X_{it}) = \alpha_i + \beta_i 1_{\{t \geq t_0\}} + \gamma D_{it} + e_{it}$$

La variable D_{it} est une variable dume définit comme ci-dessous :

$$D_{it} = \begin{cases} 0, & t \neq 2009 \\ 1, & t = 2009 \end{cases}$$

Le modèle a été estimé par les moindres carrées ordinaires sur la période 1990-2012, la validation du modèle a été basé sur le test de la stationnarité et de l'absence de l'auto-corrélation des erreurs. Le test de signification des paramètres utilisé est le test classique de Student.

Les résultats obtenus, récapitulé dans le tableau 1, montrent un effet positif significatif sur les exportations globales des industries de transformation. La valeur 0.09 de l'effet des normes montre que les normes ont amélioré en moyenne l'accroissement des exportations de 9 points.

Pour les industries : agroalimentaire, textile et cuir, mécanique et métallurgique et électrique et électronique, le modèle estimé montre un effet non significatif.

Par contre, le modèle montre un effet très significatif des normes sur les exportations des industries chimie et parachimie. En effet, le modèle montre que les normes ont amélioré en moyenne l'accroissement des exportations de 27%.

Tableau 1. Résultats de l'estimation

		valeur	Statique de Student	prob
L'ensemble des industries de transformation	**Constante**	0.07***	3.67	0.004
	Effet normes	0.09**	2.61	0.02
	R^2	0.80		
	Statistique de DW	1.50		
L'agroalimentaire	**Constante**	0.07**	2.07	0.06
	Effet normes	0.016	0.28	0.79
	R^2	0.11		
	Statistique de DW	2.32		
Textile et cuir	**Constante**	0.027	1.53	0.15
	Effet normes	-0.02	-0.59	0.57
	R^2	0.14		
	Statistique de DW	1.99		
Mécanique et métallurgique	**Constante**	0.15**	2.55	0.03
	Effet normes	0.07	0.67	0.52
	R^2	0.15		
	Statistique de DW	2.57		
Chimie et parachimie	**Constante**	0.09*	1.64	0.12
	Effet normes	0.27**	2.67	0.02
	R^2	0.76		
	Statistique de DW	1.60		
Electrique et électronique	**Constante**	0.14***	2.99	0.01
	Effet normes	-0.034	-0.42	0.68
	R^2	0.31		
	Statistique de DW	2.03		

**** significatif à p<0.05, ** significatif à p<0.10, * significatif à p<0.15*

6 CONCLUSION

Dans cet article, on a expliqué en quoi la norme, appréhendée comme une convention, joue un rôle déterminant pour réduire l'incertitude et favorise la définition de procédures de coordination d'une part. Et d'autre part, on a essayé de montrer comment les normes peuvent améliorer la compétitivité externe d'une économie. L'impact des normes est analysé à l'aide d'un modèle économétrique. Le modèle estimé montre un effet positif significatif des normes qualité sur les exportations globales des industries de transformation.

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Screening of Taxillus Tomentosus Ethanolic Extract for Nootropic and Antistress Activity in Rats

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ABSTRACT: In recent years, attempts have been made to develop drugs for treatment of dementia and attention deficit disorders to improve memory and learning. Some nootropic agents (eg: Piracetam) are widely used but the resulting chemo phobia associated with them and other similar agents has made their use limited. So it is worthwhile to explore medicines from the traditional system in the treatment of these cognitive disorders.
Stress is a broad, ambiguous, and often poorly understood concept. In its most simplified Sense, stress is what one feels when life's demands exceed one's ability to meet those demands. The objective of the study is to study the effect of ethanolic extract of *Taxillus tomentosus* for nootropic and antistress activity in experimental animals. It has been documented in traditional system that *Taxillus tomentosus* plant belonging to family loranthaceae effective in nervine disorders, acts as a nervine tonic. In a survey of ethnobotanical literature, numerous plant preparations have been used in the treatment of age related cognitive disorders in human beings in European countries; so in present study is to evaluate the same on *Taxillus tomentosus* alone by using various screening models in rats.
However, this plant has not been scientifically investigated for the same. Therefore, the present study is designed to evaluate effect of whole plant extract on learning and memory.

KEYWORDS: Cognition, Memory, Stress, Ethanolic extract, Alzheimer, Nootropic.

1 INTRODUCTION

Learning is the most characteristic attributes of the man and also of higher animals. Learning is defined as the ability to alter behaviour on the basis of experience[1]. Memory is special facility of brain which retains the events developed during the process of learning and both are mediated by nervous system[2]. Once memories have been stored in the brain, it becomes the part of brain –process mechanism when it will recall in future[3]. Learning and memory are closely related, all learning involves memory but all memory not involves to learning[4].

Probably learning and memory are most evolutionary advantageous developments for human. These are interesting but ill-understood subjects. By utilizing past experience due to learning and it's storage in memory one can get success and avoid failure[5].

Alzheimer's disease is progressive loss of memory and cognitive function in middle age individuals. (Cognition: that means by which one is aware of the process of thinking and perceiving. It involves an awareness of sensation and usually its cause. Mental component consist of cognitive changes.) Symptoms of Alzheimer's disease are–memory is failed for recent events, lack of spontaneous activity and initiative with loss of intellectual functions, loss of spatial orientations.

After 2 or 3 years dementia will take place. Following symptoms are found-aphasia (speech disorder), ataxia (unable in voluntary movements) and agnosia (unable in recognizing objects). Dementia is not a disease, but rather a group of

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symptoms caused by the impact of diseased brain. 10-15% of the populations over 65 years of age and 50% of population over 85 years have some degree of dementia. Severity increases with increase in age.

The indications of cognition enhancer's are- senile dementia of Alzheimer type and multi infarct dementia - common symptoms of elderly, dizziness and memory disturbances – mental retardation in children, learning defects, attention deficit disorder[6].

Stress can be described as the sum of all the reactions of the body, which disturb the normal physiological equilibrium and results in a state of threatened homeostasis. Stress is an internationally recognized phenomenon fortified by advancement of industrialization and a demanding civilization. Modern life is full of hassles, deadlines, frustrations, and demands. For many people, stress is so common place that it has become a way of life. Thus, every person today faces stressful situations in day to day life. Stress represents reaction of body to stimuli that tend to disturb its normal physiological equilibrium or homeostasis and has been defined as non-specific response of the body to any demand imposed on it[7].

For optimal survival of the individual it is important that bodily functions are subject to homeostatic control. Hence there is a continuous effort to maintain these functions within a certain range variable to demand by a process referred to as allostasis [8]. Just about everybody men, women, children and even foetuses suffer from stress. Relationship demands, chronic health problems, pressure at workplaces, traffic snarls, meeting deadlines, growing-up tensions or a sudden bearish trend in the bourse can trigger stress conditions. Stress isn't always bad. In small doses, it can help you to perform under pressure and motivate you to do your best. But when you're constantly running in emergency mode, your mind and body pay the price. As per the observations of American Institute of stress it has been reported that forty-three percent of all adults suffers from adverse health effects due to stress and if remain untreated more than 50% suffers from lifetime emotional disorders. Stress costs American industry more than $300 billion annually.

A great research is required in early diagnosis of the condition and development of newer effective drugs to prevent or halt the progression of such diseases.

2 MATERIALS AND METHODS

2.1 MATERIALS

COLLECTION AND AUTHENTIFICATION

Taxillus tomentosus plant was collected in March 2013 from S.V. University, Tirupathi, India. Verified by prof. Dr.M. Madhava Shetty Department of Botany.

DRUGS AND CHEMICALS

DRUGS

Mentat: A poly herbal preparation containing around 25 different herbs, and is a proven memory enhancing drug available in the market. It was procured from Himalaya Herbal Healthcare, Bangalore.

Scopolamine: An antimuscarinic agent for induction of loss of memory. It was purchased from Sigma Chemicals, USA.

Diazepam: Benzodiazepine (Inj. Calmpose) manufactured by Ranbaxy Laboratory Ltd.

CHEMICALS

- Ethanol (Fisher scientific)
- Diethyl ether (Fisher scientific),
- Tween 80 (Himedia)

EXPERIMENTAL ANIMALS

Wistar albino rat's 160-200 gm body weight were obtained from the Department of Pharmacology. They were housed in well ventilated cages and kept in a room where a twelve-hour light/dark cycle was maintained. They were allowed free access to water and fed commercial growers' mash (Vital feeds, Jos) *ad libitum* throughout the period of the experiment. The rats were allowed to acclimatize for two weeks. The experimental rats were all handled in strict compliance with

international guidelines as prescribed by the Canadian Council on the Care and use of Laboratory Animals in Biomedical Research. The experiments will be conducted in accordance with protocol approved by the institutional animal ethical committee (IAEC) of Sigma institute of clinical research and administration pvt ltd Hyderabad.

2.2 METHODS

PREPARATION OF PLANT EXTRACT

The collected fresh plant materials were dried in shade (2 days) and then dried in a hot air oven at 25ºC for three days and they were made in to coarse powder with the use of mixer grinder. The powder of *Taxillus tomentosus* obtained were weighed separately and transferred to a round bottomed flask and then went to continuous heat extraction with soxhlet apparatus using 90% ethanol for 24 hours. Then the extract of ethanol was concentrated. Extract obtained was dried by placing it on a big petriplate on electric water bath (70ºC) and then kept in an oven at 30ºC for 2 hour. The extract obtained was kept for drying and stored in vacuum desiccators. The percentage yield of the extract was 9.61%.

ACUTE TOXICITY STUDY

Procedure: Acute toxicity studies were performed according to OECD-423 guidelines category IV substance (acute toxic class method). Swiss albino mice (n=3) of either sex selected by random sampling technique were employed in this study. The animals were fasted for 4 hrs with free access to water only. The plant extracts of *Taxillus tomentosus* were administered orally with maximum dose of 2000 mg/kg body weight. The mortality was observed for three days. If mortality was observed in 2/3 or 3/3 of animals, then the dose administered was considered as a toxic dose. However, if the mortality was observed only one mouse out of three animals then the same dose was repeated again to confirm the toxic effect. If mortality was not observed, the procedure was then repeated with higher dose (Organization for economic Co-operation and development, 2001).

OBSERVATIONS

Animals were observed individually at least once during the first 30 minutes after dosing, periodically during the first 24 hours (with special attention given during the first 4 hours) and daily thereafter, for a total of 14 days. All observations were systematically recorded with individual records being maintained for each animal. Observations included changes in skin, mortality and general behavioural pattern. Attention was given for observations of tremors, convulsions, salivation, diarrhoea, lethargy, sleep and coma. No death was observed till the end of study

QUALITATIVE CHEMICAL TEST

Preliminary phytochemical studies: Ethanolic extract of the plant of *Taxillus tomentosus* were subjected to chemical tests for the identification of their active constituents.

PREPARATION OF DRUGS AND CHEMICALS

Mentat: The tablets were crushed and used for preparing the drug suspension. Specified Quantity of Mentat powder was weighed and mixed with Tween 80, triturated well and suspended in distilled water quantity sufficient to produce a suspension of 10mg/ml and Was administered at a dose of 100mg/kg b.w.64.

Extract: ETT was weighed and triturated separately with Tween 80 (0.5%) and then was suspended separately in distilled water quantity sufficient to produce a suspension depending upon dose (200 and 400 mg/kg b.w). 120

Scopolamine: The scopolamine was administered through subcutaneous route. 20 mg of Scopolamine was weighed and mixed with distilled water in a volumetric flask to get the final volume of 100 ml with a final concentration of 0.2mg/ml and was administered at a dose of 0.4 mg/kg b.w.

SCREENING MODELS FOR NOOTROPIC ACTIVITY

The following methods will be employed to study the cognitive action of the test drugs, with the animals divided into five groups of six animals in each group. The test drug will be administered orally at concentration lower and higher doses mg/kg.

GROUPING OF ANIMALS

Group. 1 - Normal control treated with vehicle
Group. 2 - Negative control MES induced
Group. 3 - Positive control treated with std. drug+ MES
Group. 4 - Positive control treated with extracts Lower dose+ MES
Group . 5 - Positive control treated with extracts Higher dose+ MES

i. ELECTROSHOCK INDUCED AMNESIA

Amnesia can be induced in experimental animals by electroshock stimulation. According to standard procedure, presentation of electroshock by silver corneal electrodes induced clonic-tonic seizures and impaired memory. The electroshock was applied immediately after the training trials in the task being tested. A sham electroshock was given to the control animals. Alternatively, electroconvulsive shock (ECS)-induced convulsions in animals may produce a more severe form of amnesia. In this technique, an electroshock (150mA for 0.2sec) were applied through commercially available electro stimulators. Electric shock gives very unpleasant feeling to the animal. The model offers evaluations of various nootropic agents.

ii. DRUG INDUCED (SCOPOLAMINE) AMNESIA

Scopolamine is a powerful muscarinic antagonist capable of crossing blood brain barrier, acts both peripherally by blocking the receptors for acetylcholine at the synapse. It impairs memory storage of new information (short term memory) and learning acquisition. The dose of 0.4mg/Kg is approved to produce cognitive and memory changes without causing debilitating peripheral anticholinergic effect. Though the several models for amnesia are available, but the scopolamine induced memory deficits has been proposed to have symptomatological similarities with Alzheimer's Disease and related disorders.

Group. 1 = Normal control treated with vehicle
Group. 2 = Negative control Scopolamine induced
Group. 3 = Positive control treated with std. drug+ Scopolamine
Group. 4 = Positive control treated with extracts 200mg/kg+ Scopolamine
Group. 5 = Positive control treated with extracts 400mg/kg+ Scopolamine

iii. DIAZEPAM INDUCED AMNESIA

Diazepam 1mg/kg, ip was administered to young rats and TL was noted after 45 min of injection on 8th day and after 24hrs. Extract lower and higher doses and standard mentat were administered for successive 8 days. After 60 min of administration of the last dose on 8th day, Diazepam 1mg/kg ip, was administered. TL was noted after 45 min administration of diazepam and after 24 hrs.

Group. 1 = Normal control treated with vehicle
Group. 2 = Negative control Diazepam induced
Group. 3 = Positive control treated with std. drug+ Diazepam
Group. 4 = Positive control treated with extracts 200mg/kg+ Diazepam
Group. 5 = Positive control treated with extracts 400mg/kg+ Diazepam

The following screening methods will be employed for assessment of memory:

ELEVATED PLUS MAZE

Originally it was designed to evaluate the anti-anxiety agents but now extended to measure the spatial long-term memory in animals. The transfer latency (the time in which the animal moves from open to closed arm) is shown to be related to memory processes.

SCREENING TESTS FOR MEMORY

TRANSFER LATENCY

The maze was elevated to a height of 50cm, the animals were individually placed at the end of either of the open arms and the time taken for the animal to move from open to closed arm (Transfer latency, TL) was taken as the criterion of task. The animals were allowed to explore the apparatus for 30 seconds. After 24 hours of the first exposure, TL was again noted on the day 1 of the study for determining the acquisition. Five minutes later the animals of Group 2, 3, 4 and 5 received electroshock of 150mA for 0.2 seconds through a pair of ear electrode from an Electro-convulsometer and then the animals were dosed with respective drug and kept in their home cage. Similarly, animals of Group 2, 3, 4 and 5 received scopolamine (0.4mg/kg body weight) and then were dosed with respective drug and returned to their home cage. The electroshock/scopolamine and dosing with drug continued for up to 7 days and on 7^{th} day the animals were subjected to the retention test 25min. after the last dose, for evaluating the transfer latency keeping the time period of 60 seconds as cut off criterion.

SCREENING MODELS FOR ANTISTRESS ACTIVITY

ELEVATED PLUS-MAZE

The elevated plus-maze comprised two open (30 cm×5 cm×0.25 cm) and two enclosed (30 cm×5 cm×15 cm) arms that radiated from a central platform (5 cm×5 cm) to form a plus sign. The maze is constructed of black painted wood. A slight raised edge on the open arms (0.25 cm) provided additional grip for the animals. The plus-maze is elevated to a height of 40 cm above floor level by a single central support. The experiment is conducted during the dark phase of the light cycle (9:00–14:00 h). The trial is started by placing an animal on the central platform of the maze facing an open arm. The number of entries into, and the time spent in, each of the two types of arm, are counted during a 5 min test period. The percentage open arm entries and percentage open arm time are used as indices of anxiety. A mouse is considered to have entered an arm when all four paws are on the arm. The apparatus is cleaned thoroughly between trials with damp and dry towels. All behavioral recordings will be carried out with the observer unaware of the treatment received by mice.

EXPERIMENTAL DESIGN

Group –I	Control treated with vehicle
Group-II	Negative Control
Group –III	Standard drug (Imipramine-10mg/kg)
Group –IV	*Taxillus tomentosus* ethanolic extract 200mg/kg
Group – V	*Taxillus tomentosus* ethanolic extract 400mg/kg

STATISTICAL ANALYSIS

All the data expressed as mean SEM will evaluated by one-way analysis of variance (ANOVA), followed by Dunnett's multiple comparisons test using Prism Graphpad version 5 .0 and values of $P<0.05$ will considered as statistically significant.

3 RESULTS

ACUTE TOXICITY STUDY

The overall study showed the LD50 of oral toxicity of extracts ETT to be above 2000 mg/kg b.w. in mice. So, the extracts are safe for long term administration.

PHYTOCHEMICAL EVALUATION

Preliminary phytochemistry of the plant extract: The yield of ethanolic extract ETT was found to be 9.61 % W/W. Preliminary phytochemical analysis revealed that the plant possessed phyto constituent's alkaloids, tannins, Phytosterols, flavonoids.

Phytoconstituents	Presence or Absence
Carbohydrates	+
Glycosides	+
Fixed oils and fats	+
Gums & mucilage	-
Protein & amino acids	-
Saponins	+
Tannins	+
Phytosterols	+
Flavonoids	+++
Alkaloids	++

NOOTROPIC ACTIVITY

MES INDUCED AMNESIA MODEL

EFFECT ON TRANSFER LATENCY (USING ELEVATED PLUS MAZE)

The animals were subjected to transfer latency (TL) to evaluate the retrieval of memory in behavioural paradigm after a period of 7 days of acquisition trial, to know the effect of extracts on the long term memory. TL of day 1 reflects learning behaviour of the animals whereas; TL of day 7 reflects the retention of the information or memory.

The normal group animals (Table 1) have showed non-significant retrieval of memory in this behavioural paradigm. In the negative control group, the animals exposed to MES, produced significant (P<0.001) loss of memory in behavioural paradigm, which resulted in increase in TL on day 7 as compared to day 1.

The data presented in Figure 1, the animals treated with standard (Mentat) showed highly significant (P<0.001) decrease in the TL. ETT (200 and 400 mg/kg) treated animals produced significant (p<0.01 and P<0.001) decrease in TL.

Table 1. Effect of Ethanolic extract of Taxillus tomentosus on transfer latency by using Elevated Plus maze.

Groups	Subgroup	Transfer latency (In seconds) in Elevated Plus maze	
		Before	After
		1 day	7 day
I	Normal	19.79±0.8241	17.45±0.7482
II	Control (MES)	25.56±1.343	54.14±1.400a
III	Stanadard (Mentate)	26.81±0.6380	33.97±1.242***
IV	ETT 200mg/kg	21.29±0.6028	46.51±2.178**
V	ETT 400mg/kg	21.87±1.108	40.48±2.065***

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, **p<0.01, ***p< 0.001, as control group and [a] p<0.001, as compared to normal.*

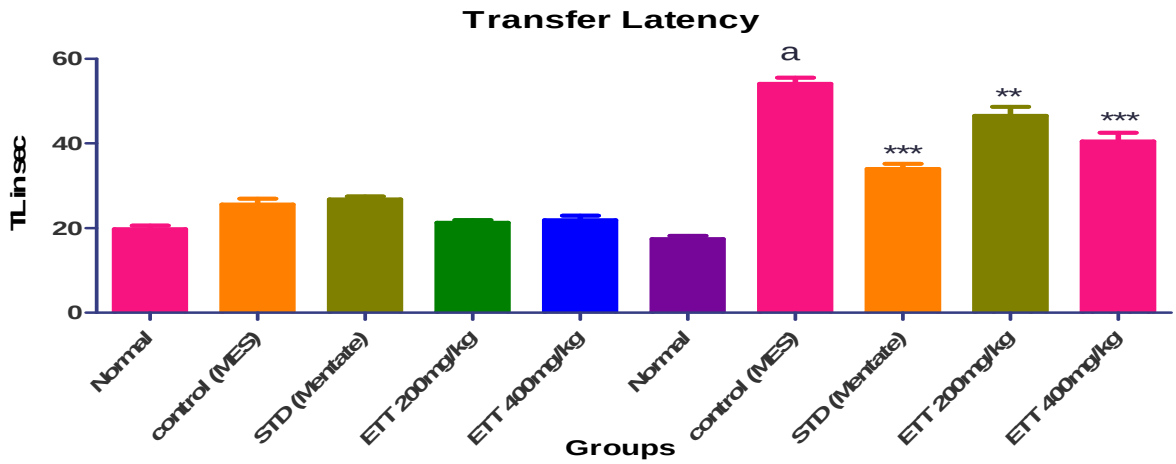


Fig. 1. Effect of Ethanolic extract of Taxillus tomentosus on transfer latency (MES Model) by using Elevated Plus maze.

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, **p<0.01, ***p< 0.001, as control group and [a] p<0.001, as compared to normal.*

SCOPOLAMINE INDUCED AMNESIA MODEL

The animals were subjected to transfer latency (TL) to evaluate the retrieval of memory in behavioural paradigm after a period of 7 days of acquisition trial, to know the effect of extracts on the long term memory. TL of day 1 reflects learning behaviour of the animals whereas; TL of day 7 reflects the retention of the information or memory (Table2).

The normal group animals have showed non-significant retrieval of memory in this behavioural paradigm. In the negative control group, the animals exposed to scopolamine, produced significant (P<0.001) loss of memory in behavioural paradigm, which resulted in increase in TL on day 7 as compared to day 1.

Table 2. Effect of Ethanolic extract of Taxillus tomentosus on transfer latency (Scopolamine model) by using Elevated Plus maze.

Groups	Subgroup	Transfer latency (In seconds) in Elevated Plus maze	
		Before	After
		1 day	7 day
I	Normal	24.57±1.08	16.49±1.04
II	Control (Scopolamine 0.3mg/kg)	22.99±1.55	55.51±1.48a
III	Stanadard (Mentate)	26.97±1.45	11.51±0.87***
IV	ETT 200mg/kg	29.19±1.58	34.96±1.46***
V	ETT 400mg/kg	28.64±1.82	22.71±0.61***

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, ***p< 0.001, as control group and [a] p<0.001, as compared to normal.*

In the treatment group, the animals exposed to Scopolamine and treated with Standard (Mentat), reduced the time taken to perform the task in elevated plus maze resulting in significant (P<0.001) retrieval of memory in behavioural paradigm. The animals exposed to Scopolamine and treated with ETT (200 and 400 mg/kg) showed significant (P<0.001) decrease in TL as compared to the negative control Figure 2.

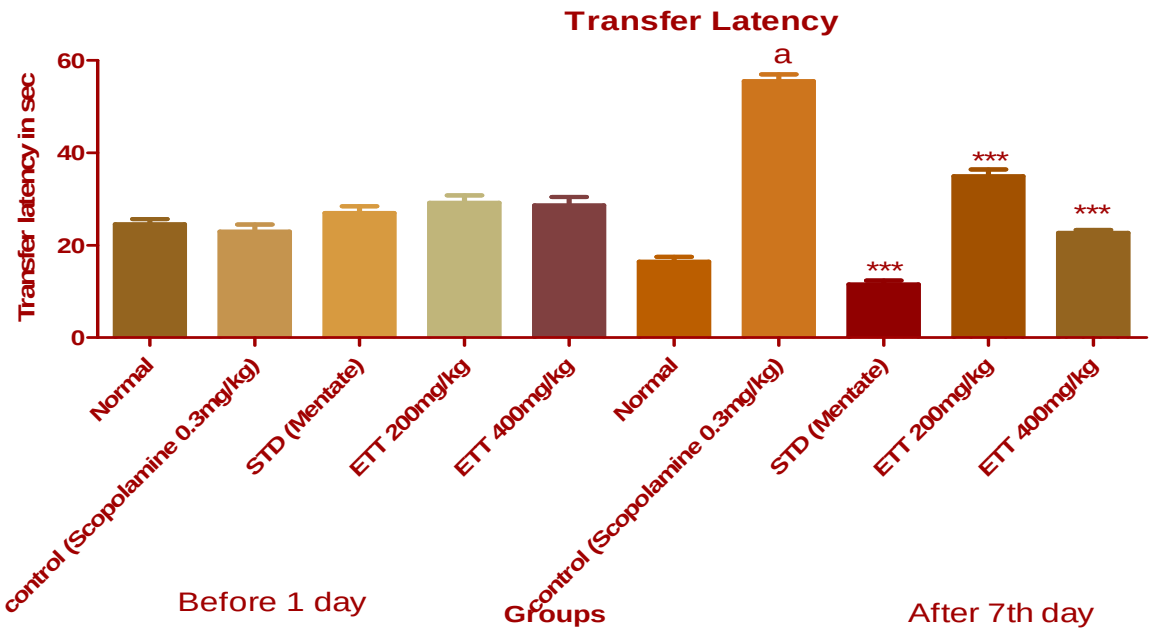


Fig. 2. Effect of Ethanolic extract of Taxillus tomentosus on transfer latency (Scopolamine model) by using Elevated Plus maze.

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, ***p< 0.001, as control group and [a] p<0.001, as compared to normal.*

DIAZEPAM INDUCED AMNESIA MODEL

The animals were subjected to transfer latency (TL) to evaluate the retrieval of memory in behavioural paradigm after a period of 8 days of acquisition trial, to know the effect of extracts on the long term memory. TL of day 9 reflects learning behaviour of the animals whereas; TL of day 8 reflects the retention of the information or memory.

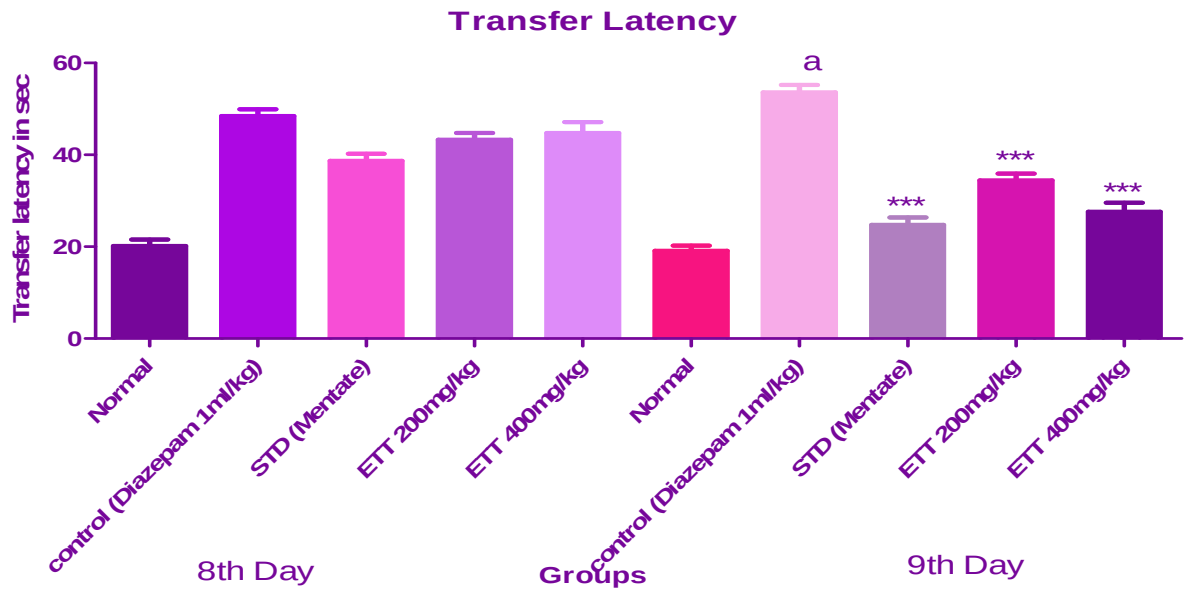
The normal group animals have showed non-significant retrieval of memory in this behavioural paradigm. In the negative control group, the animals exposed to diazepam, produced significant (P<0.001) loss of memory in behavioural paradigm, which resulted in increase in TL on day 8 as compared to day 9 (Table 3).

Table 3. Effect of Ethanolic extract of Taxillus tomentosus on transfer latency Diazepam model) by using Elevated Plus maze.

Groups	Subgroups	Transfer latency (In seconds) in Elevated Plus maze	
		8^{th} day	9^{th} day
I	Normal	20.18±1.35	19.14±1.09
II	Control (Diazepam 1mg/kg)	48.42±1.49	53.59±1.64
III	Stanadard (Mentat)	38.67±1.53	24.74±1.65***
IV	ETT 200mg/kg	43.26±1.49	34.44±1.42***
V	ETT 400mg/kg	44.80±2.33	27.59±1.92***

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, ***p< 0.001, as control group and [a] p<0.001, as compared to normal.*

The data represented in Figure 3, the animals treated with standard (Mentat) showed highly significant (P<0.001) decrease in the TL. ETT (200 and 400 mg/kg) treated animals produced significant (P<0.001) decrease in TL.



Effect of Ethanolic extract of *Taxillus tomentosus* on transfer latency (Diazepam model) by using Elevated Plus maze.

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, ***p< 0.001, as control group and [a] p<0.001, as compared to normal.*

ANTISTRESS ACTIVITY MODEL

ELEVATED PLUS MAZE MODEL

The results showed that the number of open arm entries and time spent in the open arms were increased (Table 4) and number of closed arm entries and time spent in the closed arms were decreased significantly in the extract treated groups which was comparable with the standard Diazepam and the data is represented in Figure 4

Table 4. Effect of ethanolic extract of Taxillus tomentosus on EPM model.

Treatment Groups		Elevated Plus Maze			
		Open Arm		Closed Arm	
		Time Spent	No of Entries	Time Spent	No of Entries
I	Normal	50.50±9.87	1.500±0.22	239.5±6.49	4.00±0.51
II	Control (Diazepam 2mg/kg)	161.8±1.85***	4.500±0.67***	66.50±2.50***	2.00±0.25**
III	ETT 200mg/kg	114.2±4.15***	2.333±0.42**	112.5±4.42***	3.26±0.21*
IV	ETT 400mg/kg	96.50±1.76***	1.667±0.33***	97.83±6.11***	3.66±0.42*

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, *p<0.05, **p<0.01, ***p< 0.001 as control group.*

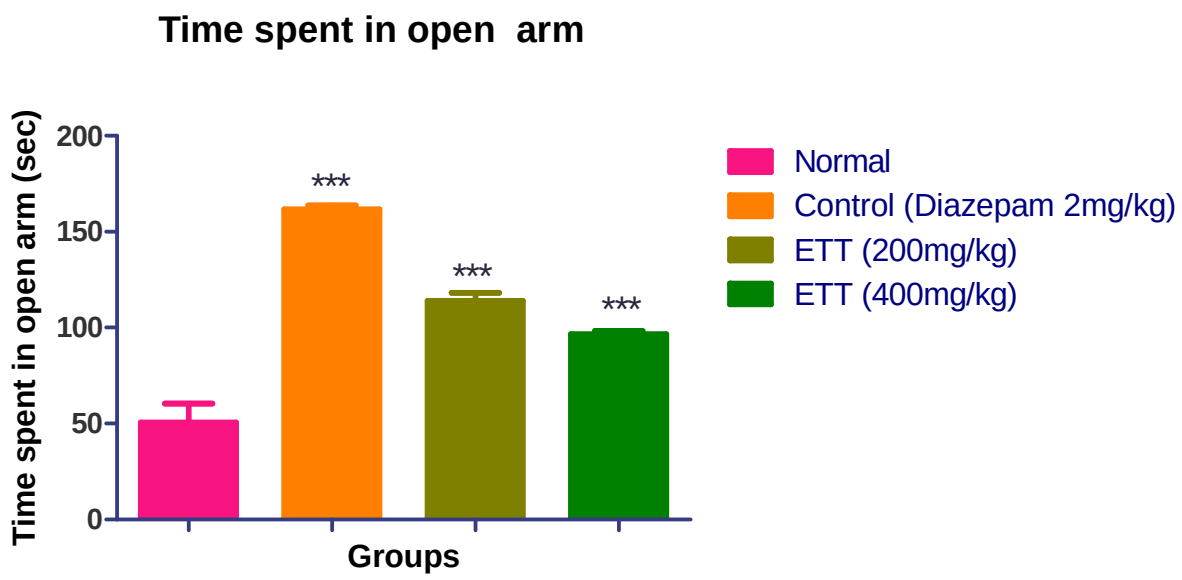


Fig. 3. Effect of ethanolic extract of Taxillus tomentosus on time spent in open arm in EPM model

*All the values are mean ± SEM, n=6, One way Analysis of Variance (ANOVA) followed by Dunnett's multiple comparison test, ***p< 0.001 as control group.*

4 DISCUSSION AND CONCLUSION

Dementia is generally defined as "a state of serious emotional and mental deterioration, of organic or functional origin". Neurodegenerative disorders such as Alzheimer's disease, Lewy-Body dementia, Parkinson's disease and cerebrovascular dementia result in an insidious cognitive and behavioral decline culminating in the development of severe dementia.

Stress can be described as the sum of the all the reactions of the body, which disturb the normal physiological equilibrium and result in a state of threatened homeostasis. Stress is an internationally recognized phenomenon fortified by advancement of industrialization and a demanding civilization.

Herbal medicines are in great demand in the developed as well as developing countries for primary healthcare because of their wide biological and medicinal activities, higher safety margins and lesser costs.[27]

The plant taxillus tomentosus used in traditional system of medicine for nervine tonic. Preliminary phytochemistry of the plant extract revealed that the plant possessed phytoconstituents alkaloids, tannins, Phytosterols, flavonoids.

On the basis of this traditional claimed and phytochemical analysis, the present study was designed for screening of Nootropic and antistress activity of ETT.

For inducing amnesia, Scopolamine, a muscarinic antagonist was used which resulted in cognitive impairment. [28]

In the present study, Mentat was used as the standard drug. Mentat improves mental functions by modulation of the cholinergic and GABAergic neurotransmissions. By restoring the frontal cortical muscarinic and cholinergic receptor activities it improves the mental quotient, memory span, concentration ability and stress threshold. It helps in reducing the level of tribulin (endogenous monoamine oxidase inhibitor). It also ameliorates attention fluctuation and behavioral disorders. Mentat exhibits significant anti-parkinsonian activity by enhancing dopamine post synaptic receptor activity. Its sedative and tranquilizing effects offer protection against convulsions which are beneficial in insomnia. It improves articulation and corrects speech defects. [30]

Stress induced effects mainly depend on duration and type of stressors. Diazepam has been the ideal choice for the induction of stress responses in animals and more specifically, for the investigation of drug effects, on typical stress-related neuroendocrine, and immunological pathology. The distinct advantage of using diazepam as a stressor lies in the fact that it produces both physical as well as inescapable psychological stress.[31]

Exposure to stress results in adrenal hypertrophy and gastric ulceration, indicating the active involvement of the hypothalamic-pituitary-adrenal (HPA) axis. The hyper-activation of the paraventricular nucleus (PVN) of the hypothalamus during stress causes a decrease in mucosal blood flow and hyper-contractility through descending projections that induce pathogenesis of gastric ulcers.

Diazepam is reported to possess non-specific anti-stress activity involving the mesocortical dopamine system and the nor-epinephrine and 5-HT levels of whole brain and hypothalamus. The mesocortical dopamine system is thought to play an important role in the etiology of the stress response. Diazepam, an anxiolytic benzodiazepine, can reverse the effects of stress on cortical DA. Though Diazepam does not affect the brain and hypothalamic 5-HT and plasma corticosterone, it attenuates stress induced elevation of brain and hypothalamic 5-HT and also simultaneously diminishes the stress induced enhancement of plasma corticosterone levels.

Data obtained from the study shows significant dose dependent neuro-protection, memory enhancement activity of ETT which might also be useful as supportive adjuvant in treatment of stress and stress related disorders, but to establish its therapeutic value in treatment of amnesia, stress and stress related disorders, further investigations are required to characterize the active constituent(s) responsible for observed activities of the *Taxillus tomentosus* ethanolic extract.

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Refusal on Qiyas and Implications for Development Contemporary Islamic Law (Study on the Ibn Hazm Critics to Qiyas)

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ABSTRACT: *Qiyas* as a method of discovery and excavation of Islamic law has been formulated with very well by Imam Shafi'i still be an intellectual debate among scholars. Ibn Hazm was one of the scholars who refuse the use of *Qiyas* to find and dig in the legal texts. The refusal of Ibn Hazm on *Qiyas* due to the results obtained with the formulation of the laws *Qiyas* method still can't give legal certainty. This refusal is influenced by al-Shafi'i's refusal on Istihsan. The refusal of Ibn Hazm on *Qiyas* is part paved the way for the development of Islamic law in the contemporary world today. There are at least two models of the development of Islamic law to do, namely the development of Islamic law that is still based on and grounded in the discovery and excavation methods of the old law that has been generated by previous scholars of Islamic law and the development of an entirely separated from the product of thought scholars' earlier. Two models are equally important in producing the formulation of Islamic law that is able to adapt to changing social, cultural, political, and economic as well as advances in science and technology today.

KEYWORDS: Ibn Hazm, refusal, qiyas.

1 INTRODUCTION

Imam al-Shafi'i as a figure who was considered to have success fully bridged the two streams of law experts and scholars of hadith and *ra'yi* proposed four sources of Islamic legal reasoning, namely the Qur'an, Sunnah, ijma', and the latter is Qiyas(Nouruzzaman, 1996 :36). In view of al-Shafi'i, Qiyas is the only method that can be trusted to perform *ijtihad*. It is, as his phrase that *Qiyas* is *Ijtihad*. (Al-Shafi'i, tt: 477).

Qiyas method which has been attempted by al-Shafi'i to be formulated, in the next development, it was still being debated among scholars intellectual. The debate was based on the accepting and refusing on *Qiyas*. Zahiris David groups and his followers werw very extreme groups in refusing Qiyas (Abdul-Wahhab, tt: 28-30). One of the followers of al-Zhahiri Davidis very well known on the stage of history of Islamic legal thought was Ibn Hazm al-Andalusi in Andalus, and the school ever grown there. In fact, according to Scaht, the school of al-Zhahir is substantially can be known through the writings of Ibn Hazm (Schat, 1964: 64). The refusal of Ibn Hazm on *Qiyas* argued at length in his work entitled"*al-Ihkam fi Usul al-Ahkam*".

Research on the Ibn Hazm refusal on Qiyas is very important to do. There are several reasons why a study of Ibn Hazm's refusal is important. First, in recent years, especially since the era of *ijtihad* spirit re-voiced, there is a tendency among Islamic thinkers to actualize back legal methods developed by classical scholars as *Qiyas, Istihsan*, and *istidlal*. The tendency in this direction starts from the premise that the law *istimbath* methods ever developed in the classical times still has relevance for dealing with and resolving any new legal issues that always arise in the midst of contemporary society. That's because the legal issue is a necessity and always appear in the historical development of human civilization, even though the legal issues that arise before and now is very much different, but methodological is the same so the old method still fit for use. The methods mentioned above after in-depth analysis and then linked to contemporary legal issues, it still retained its relevance. In a dissertation conclusion stated that *Qiyas* method is most clearly and accurately method in response to contemporary legal issues (Sulaiman, 1997: 235). But no matter how clear and accurate the method of *Qiyas,* it still has a weakness. The

weaknesses that have been shown and demonstrated by Ibn Hazm need to be revisited. Because there is possiblity over Ibn Hazm's refusal on Qiyas for some explanations to develop a method of *Qiyas* itself, as one of *istimbath* method that has been born by the scholars' earlier (the method of excavation and discovery of law) that existed in the treasury of Islamic intellectual thought while some of scolars want to abolish it.

Second, this study wants to prove scientifically the truth of an assumption that it is too tied to the textual approach may result less in accommodating towards social change. Ibn Hazm as noted above was a figure that was more tied to the textual approach and refused on *Qiyas*. Thirdly, Ibn Hazm, as pointed out by Abu Zahra, refused on *Qiyas* after he had read the works of al-Shafi'i, entitled "*Ibthal al-Istihsan*" and eventually Ibn Hazm agrees with David al-Zhahiri to say that the arguments of al Syafi'i's refusal on *Istihsan* deemed worthy as the arguments to refuse on *Qiyas*. (Abu Zahra, tt: 357). This explanation at least has given the assumptions of the author that the refusal of Ibn Hazm on *Qiyas* sourced or at least inspired by the thought of al-Shafi'i when he refused on istihsan so the refusal of Ibn Hazm on *Qiyas* was the same or at least close to the refusal of al-Shafi'i on *istihsan*. It is based on the thesis advanced by Ahmad Hasan and Subhi Mahmasani confirming that the thought of a fiqh scholar is not only determined by the socio-historical conditions surrounding him but also determined by the ideas of scholars who preceded him (Mahmasani, 1980:221, Hasan, 1994).

Based on the above considerations, there are some important questions to be discussed in terms of refusal of Ibn Hazm on *Qiyas*. Some of these questions are: what factors encouraged Ibn Hazm refused on Qiyas? Is Ibn Hazm's refusal on *Qiyas* the same with the refusal of al-Shafi'i on istihsan? How is meaningful of Ibn Hazm'refusal on *Qiyas* for the development of contemporary Islamic law?

2 RESEARCH METHODS

The main purpose of this paper is to provide scientific information and the whole of the reasons and causes of refusal of Ibn Hazm on *Qiyas*, see the possibility of continuity between the Ibn Hazm and al-Shafi'i and the meaning of Ibn Hazm's refusal on *Qiyas* for islamic law reform today. Thus the method that will be used in the search data is literature research methode (library research), that is by reading the works of Ibn Hazm literature itself as the primary data and the works that examine issues pertaining *Qiyas* and Ibn Hazm as secondary data. The data have been obtained through subsequent readings will analyze through content analysis. This analysis is intended to analyze the meanings contained within the overall ideas of Ibn Hazm which is closely related to his refusal on *Qiyas.*

3 RESEARCH FINDINGS

3.1 REFUSAL FACTORS OF IBN HAZM ON QIYAS

After Ibn Hazm believes that a law can only be obtained in the four sources namely the Qur'an, al-hadith, *ijma'* and through *al-dalil* that all of that in the view of Ibn Hazm are based on the texts themselves, then Ibn Hazm believes that the other sources, out of the four, are contrary to the texts and the historical fact and finally Ibn Hazm concluded that any use of ra'yu including *Qiyas* was incompatible with the demands of syari'ah, and hence also Ibn Hazm refused on Qiyas. This is an important factor that drives Ibn Hazm refused on *Qiyas*. It is therefore not surprising that Ibn Hazm in refusing on *Qiyas* underlying his thought by stating the number of the verses of the Qur'an, the hadiths, Companions fatwas, tabi'in fatwas and the *ijma'*.The following explanations will show the underlying thought of Ibn Hazm refused on *Qiyas*.

a. Al-Quran

In the view of Ibn Hazm, he saw quite alot of the verses of the Qur'an that expressly did not justify the use of *Qiyas*, these verses can be found in various places in of the Qur'an, among others, in Surah al-Nisa'59. According to Ibn Hazm, it clearly shows that when there is a conflict(disagreement in religious matters, especially legal issues), it is an obligation only to return to the main source of the teachings of Islam, namely of the Qur'an and *sunnah* or hadith. Because he thinks that the provision of God that must be followed so that for those who return to the referral source other than the two it means violate or conflict with God's commands. That is according to Ibn Hazm Qiyas is not one of the efforts to transform and restore of the Qur'an or al-*Sunnah* as it has been commanded by AllahSWT. This view of course will bring sin to do it.

Ibn Hazm view above indicates that Ibn Hazm still questioned , "who is actor"in applaying Qiyas, which of course is human.The question is whether the legal conclusions were deduced by humans (*mujtahid*) it can be regarded as the law of God as well, is not that formulate it is human. The formulation of the law who was born through the process of *Qiyas* is not God's law, but is a human law.

In addition because *Qiyas* is considered contrary to the command of God, Qiyas also is something in addition to the provisions of the religion (*bid'ah*/innovation). In the view of Ibn Hazm, the provisions of religion is complete and none which is not explained by of the Qur'an and *Sunnah Rasullullah*. Therefore, according to Ibn Hazm, Qiyas is not needed anymore(Ibn Hazm, al-IhkamI, I, tt: 11). In that statement, Ibn Hazm wanted to show antagonism views among Qiyas expert toward their principal assuming that not all of the events described by the Qur'an and the *Sunnah* of the Prophet. In addition, according to Ibn Hazm, in religion there was never known branch of legal , but that was only legal fundamental of which was contained in the texts and at the same time the human differences would occur at the fundamental of it, such as prayer, pilgrimage, the contract of sale and others (Ibn Hazm, al-Ihkam VIII, tt:516). Then, according to Ibn Hazm, the religious law should be based on certainty, and not allowed to conjecture. If one allowe or forbid something that is contrary to law that is establishesing in the Qur'an and Sunnah, it means doing lies and falsehood, and this means over cross the commond of the God and his messanger. These things violate the provisions outlined by Allah SWT.

When considered basic arguments put forward by Ibn Hazm as well as his understanding of the priority number of the verses, it is no exaggeration to say that Ibn Hazm in refusing on *Qiyas* because of his understanding in very strict and rigid to some verses of the Qu"ran. It shows also that for Ibn Hazm al-Qur'an itself does not justify the use of *Qiyas* in the over all of the religious law.

In addition , according to Ibn Hazm, Qiyas identifies something that isnot known for certain provisions of the law as well precede Allah and His messenger in establishing the law. This fact, according to Ibn Hazm, can be found in several verses of the Qur'an (IbnHazm, al-Ihkam VIII, tt: 522), i.e.*al-Hujurat* 1 and *al-Isra*'36. This view is in line with the very sensitive group to the form of rationalism in religion. For those that religious truth must emerge from the al-Quran and al-*Sunnah* and various forms of rationalism is heresy (Majid, 1984: 16).

b. Al-Hadith

In addition to the Qur'an, in refusing on *Qiyas*, Ibn Hazm also used the hadith. Ibn Hazm also criticized the Hadith of Mu'az Ibn Jabal that allows the use of *ra'yu*. From the its *isnaad* according to Ibn Hazm, the hadith was narrated by al-Haris Ibn Umar and he was *majhul*(the identity is unknown). In terms of honor also is contrary to the Qur'an (Ibn Hazm, al-Nabzat, 1985: 59). The Ibn Hazm's opinion is in line with the opinion of Abu Dawud, one of hadith experts, who said that Muaz ibn Jabal hadith isnot conection to Rasulullah (Abu Daud, tt:18-19), and the research conclusion of Syuhudi Ismail, one of hadith experts in Indonesia(Ismail, 1992: 110-120).

c. Companions Fatwas

In addition to the Qur'an and the hadith, in refusing on *Qiyas*, Ibn Hazm also used a number of Companions Fatwas that in his observation, the companions also did not justify *Qiyas*. According to Ibn Hazm, The refusal of Companions on Qiyas is based on texts. As the words of Abu Hurairah when he told to Ibn Abbas, when hadith comes to you , you shouldnot make it the parables. This fact, according to Ibn Hazm, Abu Hurairah clearly do not justify the use of *Qiyas*.

Then the words of Samurah Ibn Jandab quoted by Ibn Hazm who said that Qiyas was embroider the Sunnah (Ibn Hazm, al-Ihkam VIII, tt: 537). Umar bin Khattab ever does not allow the use of *Qiyas* in dealing with forgiveness with Sadaqah (Ibn Hazm, al-Ihkam, tt: 540). The same event also occurs in Ibn Mas'ud who thinks that something that is no explanation in the texts is something that is contrary to God. This is according to Ibn Hazm means cancellation of *Qiyas*. In overall view, Ibn Hazml was almost agreed to cancel *Qiyas* and something that did not exist in the Qur'an nor in the Sunnah of the prophet (Ibn Hazm, al-Ihkam VIII, tt: 541).

c. Tabi'in Fatwas

Not satisfied and fairly with the Qur'an, Hadith, Companions Fatwa, Ibn Hazm in refuseing on *Qiyas* also cites a number of tabi'in opinions.The Tabi'in Opinions shown by Ibn Hazm that it can be seen in the following explanation:

1. Muhammad ibn Sirin said, *Qiyas* is misfortunend and bad luck. And the first person who practiced *Qiyas* is the devil.
2. The words of al-Sya'bi to David al-Audi. Keep 3 things, that if you declared on something of a problem, then you answer it, then do not you follow your passions. And if you are asked about something problem, then you do not use *Qiyas* to something with something else. Because some times you forbid the lawful or justify the unlawful. And if you are asked about something, and you do not know, then say, I do notknow, and I was your friend (Ibn Hazm, al-Ihkam VIII, tt: 542-543).

Tabi'in Fatwa above according to Ibn Hazm enough to be evidence of not using of *Qiyas* in religion. It is recognized that among the companions there were who forbidden *Qiyas*, ie if Qiyas is clearly contrary to the definitive texts and based on the propositions that there is no relation between the major premise and the minor one that will axis draft of the law that are likely to produce imperfect Qiyas(Majid, 1984: 106).

d. *Ijma'*

It seems that the basics are presented as mentioned above, Ibn Hazm was also not satisfied so that he still needed to add them to the basis of *ijma'*. According to him, *Ijma*' really has explained the necessity to leave *Qiyas*, ie, ijma'of the muslim people as a whole making compulsory only to take the legal provisions of the Qur'an and *Sunnah* that are valid from rasullulah SAW and with something that has been agreed upon by the community (people *ijma'*) as a whole about the compulsory or illicit something of shari'ah. Also Ijma 'community that does not justify talking about shariah without foundation of texts or *ijma'*. All the people have agreed on the truth of the word of God as in Surah al-Annisa': 59. This fact, according to Ibn Hazm, is people Ijma to leave Qiyas. Ibn Hazm further says, in fact there is no proof (reason) for someone to use *Qiyas* except the flaws and mistakes done by someone other than the Prophet (Ibn Hazm, al-Ihkam VIII: 548).

What was done by Ibn Hazm in his refusing on *Qiyas* as shown above can at least show that Ibn Hazm attempted to prove that his refusal on or objections against *Qiyas* actually based on solid evidence and reliable and not based on weak evidence. Ibn Hazm holds that the source of Islamic teachings and traditions of the Salaf itself there are several instructions directly on the prohibition of the use of *Qiyas* and all *ra'yu*. It also is intended to head off *Qiyas* opinion of most experts generally agree that they all use *ra'yu* and *Qiyas,* it is also under the terms of religion, they even assume existing practice of the Prophet and the companions to apply *Qiyas*. The fact like this that encouraged Ibn Hazm in refusing on *Qiyas* need to put forward a number of verses, hadiths, Companions fatwas and all of which in the view of Ibn Hazm enough to show that *Qiyas* was something that was never justified by religion. It is more obvious that the previous description is visible in the efforts of Ibn Hazm in refusing on *Qiyas* more emphasis to the theological view point, and this will be more apparent again when he criticized about law illat.

3.2 IBN HAZM CRITICISM AGAINST *QIYAS* PRACTICE

in an effort to refuse on *Qiyas,* Ibn Hazm argued not only a with normative-*dogamtis* as shown in the previous explanation,but also he expressed some *Qiyas* practices that often developed among Qiyas experts and Ibn Hazm criticized the mistakes and weaknesses. There are several legal cases that became the target of criticism of Ibn Hazm.

a. Persecution Cases of Parents

Opinions are often found among Qiyas experts about this is that the persecution to the parents that are prohibited under the *Qiyas*, which departed from the word of Allah in Surah al-Isra': 23, where this verse explains even just to say do not say *hus*(uf) to parents, but here also include the prohibition to other than just saying *hus*(uf) which can take the form of beatings and even murder. Qiyas in this form often called *Qiyas awlawi*.

In the view of Ibn Hazm's opinion, it is very wrong. Because according to Ibn Hazm ban that could only be captured from the words ban *hus*(uf) limited only to ban the word *hus*(uf) without having meant otherwise like hitting or killing. However, according to Ibn Hazm, ban to hit and kill can be captured from a whole series of these verses. In this verse Allah firmly and clearly explained to do good, say the gentle, love, be kind, to both parents and at the same time there is a ban on snapping to both.Therefore, according to Ibn Hazm, based on this explanation there is obligation to treat parents well. According to Ibn Hazm, banning to hit and kill is not based on the words *uf*(*hus*) earlier, but it is based on the direct instructions that can be understood from the verse as well as the existence of some direct explanation of some traditions. If banning to hit or kill just enough with the ban say *uf(hus)*alone, Allah does not need to explain the need to do good, to love both parents and snapped to ban both. But in reality, Allah in the verse is still explaining the necessity to do good, to love them (Ibn Hazm, al-Ihkam,VIII, tt: 387-388).

When viewed in this case, Ibn Hazm's opinion seems to be more readily accepted. Because he uses a very concise path. Ibn Hazm here actually wants to show that the Qiyas experts too quickly to conclusions based on *Qiyas* , whereas the problem bright and clearly conveyed in texts. Ibn Hazm wants to show that the Qiyas expert inconsistent in their own statements. Are not they, Ibn Hazm said, have agreed that *Qiyas* wasnot allowed as long as there are explained. Even before he noted examples above, Ibn Hazm first cited the opinion of Abu Hanifah and al-Shafi'i. In the opinion of Abu Hanifah, he said that *khabar mursal* and weak hadith from Rasullullah are better than *Qiyas*, and not justified *Qiyas* while nash still explained. *Qiyas* are not allowed in *kafarat* problem, the issue of *hudud* and measures set out in the texts. While al-Shafi'i said that in his opinion,it is not allowed Qiyas while the texts are still be, and when there is none, it is obligatory using it in any law(Ibn Hazm, al-Ihkam, VIII,tt: 385).

b. Child Murder by Economic Reason

In the Qur'an, Allah describes the prohibition of killing children with poor excuses. Through the way of *Qiyas*, murder by other reasons, such as abortion, is also prohibited. According to Ibn Hazm murder because of economic reasons also is

forbidden. The prohibition, according to Ibn Hazm, not by way of *Qiyas*. The prohibition is based directly on the texts. Some texts that explain it can be seen in the Qur'an Surah al-Isra': 31, 33 and Surah al-An'am 140 (IbnHazm, al-Ihkam,VIII, tt:387-393).

Of several examples of cases above that Ibn Hazm wants to show that the Qiyas experts more prefer to Qiyas than *nash,* but clearly the problem has been stated and explicitly in the texts.The Factors neglegting *nash* too soon while it is still possible to draw conclusions of law based on texts directly encourages Ibn Hazm refuse on *Qiyas*. This fact as admitted by Ibn Hazm that *Qiyas* experts, according to Ibn Hazm, some times often ignore the Qur'an and outward prefer to *khabar ahad*. Then they, too, Ibn Hazm said, often more concerned with *Qiyas* even considered more powerful than the Qur'an (Ibn Hazm, al-Ihkam,VIII, tt: 554).

3.3 METHODOLOGICAL CRITIQUE

Ibn Hazm also criticized Qiyas methodological when he questioned whether *Qiyas* was entirely true, or only partly true. If it is said that the whole *Qiyas* is true, this is an impossibile because in fact the result of the *Qiyas* often conflicting, some time it justifies and some time forbid one. And is it possible that two contra dictory things can be gathered simultaneously. If it is said that there are also some Qiyas right and partly wrong there, the question that arises then how to identify the right *Qiyas* from the wrong one (Ibn Hazm, al-MuhallaI, tt: 79). summarily the critique of Ibn Hazm is how to distinguish between true Qiyas and wrong one or in other words what methods can be used to sort between right and wrong *Qiyas*. Ibn Hazm, wanted a single truth in the over all practice of *Qiyas.* This , of course, contrary to al-Syafi'i's oponion. According to al-Syafi'i that the right of Qiyas is possibility one. So the right of Qiyas is the external one (Al-Syafi'i, tt: 483)

Then also The prophet methodologically never taught what, how and when Qiyas can be used. If qiyas is more needed, the prophet certainly would not forget to explain its operational. Therefore Qiyas is illegal (Ibn Hazm, al-Ihkam,VII, tt: 445).

In addition, Ibn Hazm still questioned whether Qiyas is applied in the things that have been mentioned in texts or things that arenot described in the texts. If it is said to things that have been mentioned in the texts, it means it has been violated to *ijma'* and there is no such person said that. Because, according to Ibn Hazm for applicability of *Qiyas* it must be based on texts or *ijma'* and no *furu'*are back to *ashal*. If it is said that *Qiyas* is applied on those things are not explained by the texts, then this is contrary to the texts. Because, according to Ibn Hazm none of the religion and their laws unless there are texts that explain them (Ibn Hazm, al-Ihkam,VII, tt: 445).The view of Ibn Hazm was close to the views of al-Shafi'i. According to al-Shafi'i *Qiyas* should not be applied while *al-khabar* explains(Al-Shafi'i, tt: 477, 599).

Ibn Hazm gives a method for assessing errors of Qiyas, ie if there is aproblem (I) resembles the other problem(II), then the second issue of compulsory judged as problem I.Then, Ibn Hazm said, look for problems III that resembles to problems II. And the third issues hould be judged the same as the problems I (Ibn Hazm, al-Ihkam VIII, tt: 551). The final conclusion that the problem III doesnot resembles to the problem I.

3.4 REFUSAL ON LAW ILLAT(RATIO LEGIS)

Ibn Hazm does not accept *illat* because it appeared in his mind, whether *illat* including action of God and his law or not from his action and his law or not from his action and not from one besides Him. In the view of Ibn Hazm there are only three alternatives just this possibility. If *illat* considered apart from the other than Allah and His law, then the consequence is that means there is a creator besides Allah, legislator besides Him so that others can require God to do an act and the law established. Comments like this clearly, according to Ibn Hazm is *shirk* and *kufr*. Ibn Hazm recognizes that Qiyas experts wouldnot argue like this. If *illat* was considered not of his actions nor of his deeds in addition, it means that in this universe there is something that no creator, or there are people who give law to God and it is they who justify and proscribe and decided to Allah SWT.Comments like even this *kufr* pure. But if *illat is* an act of God and His law, then the question that arises is whether or not God do something for certain *illat* or not because of certain *illat*. If not because of certain *illat*, then it means the Qiyas experts*,* according to Ibn Hazm have left their basic principles and admitted that Allah didnot act because certain illat. Therefore, according to Ibn Hazm ,Allah S WT acted that he wanted and not because of *illat* at all (Ibn Hazm, al-Ihkam VIII, tt: 601-602).

The explanation shows that Ibn Hazm took *illat* as legal issues in the theological frame work. In addition to the refusal of Ibn Hazm on law *illat* because all the companions of the prophet from firts generation until last generation, the *tabi'in* and their followers never said that Allah Almighty has set a law for certain *illat* (Ibn Hazm, al-Ihkam, VIII, tt: 92).

3.5 LINKAGES BETWEEN IBNHAZM'S ARGUMENT AND AL-SHAFI'I

According to al-Shafi'i, someone saying *istihsan* is not from the command of God and not the command of His messenger and what he say can't be accepted as something that comes from God and His messenger. However, according to al-Shafi'i, some one who gives a legal decision or gives fatwa with common *khabar* or by *Qiyas* means he implements what has been ordered. If a judge or a mufti in solving aproblem does not refer to texts or *khabar* or use *Qiyas* but using *Istihsan*, he must admit the possibility of a different opinion of him. Even any judge or mufti would argue with what he thinks is right which in turn in the emerging diversity issues in Fatwas and law in accordance with the wishes of each. If this is allowed, it means that the law bases on desire of judge or mufti (Al-Shafi'i, al-Umm VII, tt: 315-316).

In his refusing on *Istihsan*, al-Shafi'i pointed out an example. If there are two people litigants come to the judge about the defects in the goods, the judge should have to know in advance or call expert witnesses, then he can only decide whether the goods is the defective one or not. If in reality the goods is defective, the judge must determine what the price of the goods in market. Therefore the judge in deciding the case must base on the explanation of the expert witnesses who know the true market price. However, if the expert witness said "if the defective goods is determined by Qiyas with other merchandise, it takes the value of the price in certain price, the result of *qiyas* show the price so , but I use *istihsan so* that the merchandise was priced in other price". According to al-Shafi'i, the results of *istihsan from* the expert witness cannot be used by the judge to decide the case and the judge must decide in accordance with the prevailing market price at that time which is a general provision (Al-Shafi'i, al-Umm VII, tt: 315-316).

Of some of the arguments put forward by al-Shafi'i above, it can be said that al-Shafi refused on *Istihsan* because He thinks that it is:

1. Assigning the law that is not based on what God and His Messenger have commanded.
2. The Prophet himself never explained the law based on what he thinks is right, but he always awaits the revelation in every issue he faced.
3. Prophet did not approve of the companions to establish legal/make decisions based on what they deemed good
4. *Istihsan* not have clear boundaries and accurate measure that it would result in adifference with no limit to the back to him.
5. Establishing the law based on *istihsan* is set the law bases on desire and wild *ra'yu.*

The purpose of al-Shafi refused on *Istihsan* is in its attempt to create legal uniformity and minimum suppress dissent (Coulson, 1987: 68), despite the efforts failed because his efforts have given rise to two mahzab more recently come later, i.e. Ahmad ibn Hanbal and of al-Zhahiri Dawud. Two figures of this school, according to Wael B.Hallaq, after al-Shafi'i go a step further in an effort to refuse on the legal reasoning although the two figures are not exactly the same. Ahmad Ibn Hanbal not use *Qiyas* except in urgent situations, and David al-Zhahiri is categorically refuse Qiyas (Hallaq, 1997: 32).

From the above description shows that the arguments of al-Shafi'i refusing on *Istihsan* are similar to that used by Ibn Hazm refusing on *Qiyas*. They are both looking at the legal determination based on the *istihsan* according to al-Shafi'i and the establishment of law based on *Qiyas* according to Ibn Hazm is contrary to the texts. Al-Shafi'i considers that I*stihsan* a legal determination based on desire. For in *Istihsan* no clear benchmarks and measure. Ibn Hazm actually see that in the *Qiyas* even then still be possible to establish the law of the mind and the passions encouragement especially when searching and analyzing *illat*.

3.6 SIGNIFICANCE OF IBN HAZM'S REFUSAL ON QIYAS FOR DEVELOPMENT OF CONTEMPORARY ISLAMIC LAW.

The renewal of Islamic law began in earnest along with the emergence of the reform movement in Islam in the ninth century was essentially a movement to revive the spirit of *ijtihad*. Islamic reformers almost agreed to *ijtihad* and *taqlid* should be encouraged back should be deductible. In fact, as stated by Iqbal that *ijtihad* is the dynamic principle of the structure of Islam (Iqbal, 1981: 148). Islamic law that the principal source is al-Quran and al-Hadith through out the course of its history has been able to demonstrate the flexibility and elasticity of the face of any changes that occur in the community. *Ijtihad* is justified even highly recommended by the Prophet has given encouragement to the *mujtahid* since companions time until the next era to bring the results of a series of *ijtihad.*

The movement to revive the spirit of *ijtihad* and eradicate culture *taqlid* has also been carried out by Ibn Hazm in his time when Andalus was hit by a very strong culture of imitation to the Maliki school. *Ijtihad* is echoed by Ibn Hazm is looking for an issue in the legal texts of the Qur'an or hadit and *ijtihad* is not the use of *Qiyas, Istihsan* and *ra'yu* in finding the law (Ibn Hazm, al-Ihkam, VII, tt: 440).

Ijtihad must revive in response to find and establish laws that can addres the new issues and developments brought about as a result of changes in culture, politics, and economics as well as the progress of science and technology (Amin, 2013: 14). In response to new problems and developments occur, there are three approaches that are often carried out by experts of Islamic law today, the approach pattern of the traditional groups that still refer to classical and medieval texts followed in accordance with their mazhab, and if the books of *mahzab* of *fiqh* followed it they do not find the answer, then they turn to the books of other *mahzab* that are applied in a way of *talfiq*. Such as approach , according to Ibrahim Hosen, make Jurisprudence (fiqh) be dynamic and be able to answer the challenges of the times and thus *fiqh* will thrive, grow and always live(Hosen, 1988: 24-25). But in the analys of Islamic experts of Western that states that the principle of *talfiq* doesnot show actual reform even more it indicates to the tendency of *taqlid* (Coulson, Conflicts and Tensions, 1966: 101).

The second pattern of approaches is to look for a solution that is faced directly with looking for the answer in the al-Quran and al-Hadith by still using methods have been developed by scholars of the past. *Istihsan, Qiyas* and some other *istimbath legal* methods are used to address the new law. The third pattern of the approaches is to look for solutions faced with finding the answer in the al-Quran and al-Hadith by using an entirely new method. This third pattern as that of Muhammad Shahrur and Fazlurrahman use. Of the three approaches above, the pattern of the first and second approaches are still dominant in the Islamic society.

Although *Qiyas* can be used to address the new law, but behind it, legal experts that often use it, according to Yusuf Qaradawi, often slipping into the use of *Qiyas* that damaged. One example of the use of such defective *Qiyas* is about MUI Fatwa dealing with livestock and eating meal of frog. In the MUI fatwa stated that the frog is haram but breeding it is allowed. Rational arguments of the fatwas are that because of the use of animal skins that are cooked is permissible in Islam, then the problem of breeding to ads equivalent(using *Qiyas*) to the tannery. The theorem states because of all the animals, except the pigs and dogs, otherwise clean(no unclean), the frog also includes a clean animal. Therefore, if eating a frog is declared unlawful, raising frogs is not forbidden, since frog isnot considered unclean animals. *Qiyas* (Analogy) between breeding frogs and tanneries are only accepted up to the stage on safeguarding alone and cannot be applied to useful of the frog. (Mudzhar, 1993: 116-117).

The above case shows that Islamic jurists are still confused to determine the legal *illat*(ratio legis) while it is a very important component in the application of *Qiyas*. Reality like this is very feared by Ibn Hazm in his refusal on the *Qiyas*. One legal cases solved by the same method but produces the opposite conclusion. Therefore behind the refusal of Ibn Hazm on *Qiyas* , there is meaningful for the contemporary development of Islamic law, namely;

1. Development of old legal theory that still needs further refinement. In this case, *Qiyas* need to be developed. *Illat* improvements itself becomes very urgent. If the previous analysis of the legal, the analysis of *illat* is not include analysis of modern science, now the current participation of modern science becomes absolute. One example which should be mentioned here is the issue of the prohibition of alcohol. In the past, Islamic jurists stated that alcohol *is* illicit because it is intoxicating. Today this is no longer enough to say intoxicating is reason for the prohibiton of alcohol alone. But it should include also the reason the number of levels of alcohol contained in it that makes those who drink get drunk. So research on the chemical elements in the strong drink becomes important.
2. Development of new methodology formulation . The critique of Ibn Hazm againts *Qiyas* shows that the science of *usul fiqh*, or better known as the Islamic Legal Theories are open and anti-establishment. The development of a new formulation of methodology in order to overcome the current crisis faced by the science of *usul fiqh* itself is more significant. The formulation of the source of law, for example, is not related to the existence of the nation state that is becoming a reality of the modern world today. Therefore, the formulation of Islamic law sources can be developed in accordance with the reality today. The source of Islamic law now is the Qur'an, al-*Sunnah*, and state legislation. Important implication of this formulation is when the source of Islamic law is the Qur'an, *Sunnah*, and State Legislation, the all products produced by state law are the part of Islamic law that must be obeyed by all Muslims. Therefore, there is no reason for Muslims not to obey the rules issued by the state on the grounds it is state law and not religious law (fiqh). Conflict between religious law and state law, as such, can be availed.

4 CONCLUSION

Based on previous explanations, the following conclusions can be drawn some;

1. The main factor why Ibn Hazm refuseed on *Qiyas* is due to the results obtained with the legal provisions of the *Qiyas* still doubt the truth and has a great opportunity for the creation of legal uncertainty.
2. There is a similarity between the refusal of al-Shafi'i on istihsan and the refusal of Ibn Hazm on *Qiyas*. Therefore, the hypothesis that the refusal of Ibn Hazm on *Qiyas* inspired by al-Shafi'i's refusal on *Istihsan* is justified.

3. The refusal of Ibn Hazm on *Qiyas* gives meaningful to the development of Islamic law in the contemporary world. The development will lead to the reconstruction of the classical Islamic legal theory and the reformulation of contemporary Islamic legal theory.

RECOMMENDATIONS

The results of this study recommends the following;

1. *Usul fiqh* as a portion of Islamic knowledge must be developed in order to respond to the demands of social change taking place in contemporary Islamic societies. Development of usul fiqh through a process of assessment and in-depth study. In this context, the works of past scholars deserve to be re-examined in order to find the pearl of thought which is very valuable as a material for the development of *usul fiqh* in today's contemporary world. The refusal of Ibn Hazm on Qiyas gives the spirit of the contemporary scholars of *usul fiqh* today to venture out of the trap methods of discovery and excavation of the old laws that are already established and working hard to find a method of discovery and excavation of new laws that are better able to address contemporary legal issues at this time. Therefore, research on *usul fiqh* should continue to be developed.
2. The refusal of Ibn Hazm on *Qiyas* should be able to inspire the contemporary scholars of *usul fiqh* to be critical to the establishment of a science building. The critical of the establishment is the basis for progress.

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Factors Affecting Competitiveness of Kenyan Cut Flower in the International Market: A Case Study of Cut-Flower Firms in Nakuru County

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ABSTRACT: The main aim of this study was to analyze factors affecting competitiveness of Kenyan cut flower in the international market. The study used descriptive case study design with a purposive sample size of 126 senior managers in the flower farms in Nakuru County. The study used structured questionnaire as the main data collection tool. Data was analyzed using descriptive statistics and information presented in frequency tables and charts. The study used factor analysis to establish the most important elements of the Porter's five force factors that are adopted in the flower industry in Kenya. The study found out that competition of Kenyan Cut in international market was affected by the following factors; activities along supply chain which were extremely many and also challenging; actors along the supply chain which were; difficult to manage, situated diversely in terms of physical distance, different laws, diverse requirements, expensive to manage and were also unpredictable; lastly international standards which were not consistent. Some of the recommendations put forward to make Kenya Cut-Flower Sector to be more competitive in the international market were; the players in the cut flower industry should develop systems that can help them identify actors in the cut flower supply chain their locations and their roles in the transmission of both the supplies and goods. This will help in making the actors more responsible and make these transmissions faster. The players should review the laws in cut flower sector in all the countries involved in the business and harmonize them as a way of making the Kenya cut flower more competitive in the international market. Third the cost associated with the diverse and unpredictable actors should be normalized through the flower councils and other associations.

KEYWORDS: International Marketing, Competitive Strategies, Supply Chain, Compliance to International Standards, International Players

1 INTRODUCTION

The business landscape is today characterized by increasing rates of globalization and technological advancements posing significant challenges for organizations management (Hussey, 1990). The environment is increasingly turbulent and complex consisting broadly of the economy at large, population demographics, societal values and lifestyles, governmental legislation and regulation, technological factors, and the company's immediate industry and competitive environments (Thompson et al, 2003).

Kenya is a major global supplier of cut flowers; the sector is estimated to employ approximately 50,000 to 60,000 people directly and over 500,000 people indirectly (Kenya Flower Council, 2009). Cut flowers, along with fruits and vegetables, make up Kenya's horticulture industry – one of the country's major foreign exchange earners (along with tea and tourism). Horticulture is one of the fastest growing sectors in the Kenyan economy, largely attributable to cut flower exports

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(Barrientos, et al., 2003). Agriculture, more broadly, accounts for approximately one quarter of GDP and 60% of export earnings and is the source of livelihood for the majority of Kenyans (International Monetary Fund, 2010).

There are over 150 flower producers in Kenya, many of which are medium to large scale commercial operations. In 2008, Ksoll et al. (2009) conducted a firm-level survey of over 100 exporter producers. According to their data, there are about 120 established grower-exporters who export throughout most of the year, with substantial heterogeneity across firms with respect to key characteristics, such as acreage, ownership structure, and level of vertical integration. 4 Major investment over the past two decades and duty-free access to the European Union (EU) has contributed to strong growth in the sector. Cut flower importers and retailers in the EU have established (largely unwritten) contractual relationships with Kenyan producers to ensure adequate supplies and timely delivery; this vertical relationship requires a readily accessible labor force (Hale et al, 2005).

The major flower-growing areas are Naivasha, Thika, Limuru, Nairobi, and the Athi river plains in the west, and the Nakuru, Nanyuki, Mount Kenya region, and Eldoret in the north. Naivasha _ located about 100 kilometers Northwest of Nairobi _ accounts for about 50% of the total land under cut flower cultivation, and about one-quarter of all flower exporters are located in the region. Additionally, the area is in close proximity to the Jomo Kenyatta International Airport and is linked by the Nairobi-Nakuru highway. Well-developed transportation networks are particularly important since fresh cut flowers are highly perishable.

2 LITERATURE

2.1 EFFECT OF ACTIVITIES ALONG THE SUPPLY AND VALUE CHAIN ON COMPETITIVENESS OF KENYA CUT-FLOWER

A cost advantage can be created either by reducing the cost of individual value chain activities, by reconfiguring the value chain (structural changes such as a new production process, new distribution channels, or a different sales approach), or by controlling the cost drivers better than the competitors do. Successful cost leaders are often low-cost product developers, low-cost marketers, and low-cost service providers (Porter, 1990). A differentiation advantage can be achieved either by changing individual value chain activities to increase uniqueness in the final product or by reconfiguring the value chain such as forward or backward integration.

i. The Traditional Supply Chain

Cut flowers are delivered from the farm to a forwarder/handling agent at the airport. The products are flown to Europe and received by a handling agent at the airport. The flowers are processed by an importer who prepares them for auctioning. At the auction, the flowers are bought by a wholesaler who sells them to retailers, where consumers constitute the end buyers concluding the supply chain.

ii. The Auction Import Supply Chain

Identical to Supply Chain no. 1, but the importer is cut out. The import division of the auction itself receives the products and unpacks and prepares the products for auctioning. A shipment is often spread over several auction days and auction locations to ensure a continuous supply to the auction clock.

iii. The Auction-Retailer Supply Chain

Identical to Supply Chain no. 2, but the wholesaler is cut out as well. Retailers themselves buy the flowers they need directly at the Dutch flower auctions.

iv. The Traditional Direct Supply Chain

The importer and flower auction links present in the supply chains described above are cut out.

Flowers are received by a handling agent who directly forwards the boxed products to a European wholesaler, who takes care of import handling and possible processing (e.g. bouquet making), before selling the products to domestic and foreign customers.

v. The Mass-Market Direct Supply Chain

This is the shortest currently used supply chain, cutting out two or three of the links mentioned in Supply Chain no. 1 and reducing the total length of this traditional supply chain by one third. Products are imported by an importer, who is selected by a retailer (in most cases a large supermarket chain). In fact, there is one case in which a retailer goes even one step further by skipping the importer and importing flowers itself.

In terms of vertical strategic alliances, most of the leading Kenyan exporters have a series of well-established relationships with EU-based importers. These range from vertical integration to trading partnerships that, although loosely based, are still very well established and can go back 20 years or more. These integrations involve joint ventures and co-investments (an example is Homegrown, Kenya's largest vegetable exporter – recently taken over by Finlay).

The cut flower value chain is undergoing structural shifts in its EU distribution channels as supermarkets increasingly source directly from suppliers in developing countries, thereby cutting out wholesalers and the Dutch auction system (Thoen et al. 2000; CBI 2007). The Dutch flower auctions (owned by the Dutch flower-growers) have historically been the most important channels through which flowers are distributed to European wholesalers and retailers. But lately the proportion of flowers imported into the EU that goes through the Dutch flower auctions has declined, and direct sourcing by large retailers is increasing, although the auctions still remain the most significant way for cut flowers to reach European wholesalers and retailers (in 2006, the auctions had an estimated 40% market share of flowers).

2.2 EFFECT OF ACTORS ALONG THE VALUE CHAIN ON COMPETITIVENESS OF KENYA CUT FLOW

Kaplinsky (2000) views on value chain analysis and the determinants of income distribution was adopted in this study. Kaplinsky indicated that value chain analysis can help to explain the growing disjuncture between the global spread of activities and incomes. This can be done first, by mapping the range of activities in the chain that will provides the capacity to decompose total value chain earnings into the rewards which are achieved by different parties in the chain. Secondly, a value chain perspective, analyses the way in which particular firms, regions and countries are linked to the global economy. This will determine to a large extent the distributional outcomes of global production systems and the capacity which individual producers have to upgrade their operations and thus to launch themselves onto a path of sustainable income growth.

Melle et.al (2007) indicated that a value chain encompass a full range of activities required to bring a product or service from conception, thorough production, transformations, and delivery to final consumers and final disposal after use. It includes a series of actors from inputs suppliers to producers and processors to exporters and buyers –engaged in the activities required to bring a product from its conception to its end use. An effective value chain analysis approach would help in the identification of good policies and programmes to accelerate development and this requires a good understanding of how local enterprises fit into the global economy. Secondly, the approach would helps to identify and select relevant stakeholders for programme planning, including distant buyers where they exert strong influence over the chain. Thirdly it helps to identify all the enterprises that contribute to the production of a good or service and shows what institutions are needed to support the enterprises. Lastly, the value chain analysis approach helps policymakers and entrepreneurs find out which parts of the chain are holding up progress –which bottlenecks deserve priority attention and provides a framework for sector-specific action.

World Bank (2011) observes that internal factors are determined in the first place by entrepreneurs themselves, but also governments and sector organizations have played an important role. Other relevant actors are research and training institutes, credit and finance institutions, quality and regulatory agencies, and trade and investment promotion agencies. In some countries, the government plays an important role in coordinating efforts of varies actors.

The global value chain (GVC) approach developed by Gereffi et al. (1994) offers an analytical framework to examine interrelations between actors in value chains, but it has traditionally downplayed the role of labour as other than a productive asset. Likewise, the existing literature shows a very limited interest in the potential active role of labour. Rather, labour is seen as a passive object that needs to be taken into consideration, managed or at best consulted. The actors in the different segments are linked together within the chain in relationships that are coordinated in different ways. A value chain may include different parallel sequences of segments, called 'strands'. These strands may differ in terms of suppliers, buyers, product types, their coordination, and/or end markets. Simply put, the flower value chain for import into the EU involves two distinctive strands: the direct strand and the auction strand.

2.3 EFFECT OF COMPLIANCE WITH INTERNATIONAL STANDARDS ON COMPETITIVENESS OF KENYA CUT FLOWER

Exporting cut flower products from ACP countries to Europe is becoming increasingly restricted due to European regulations and to private or industry-level environmental and social requirements. Driven by the various concerns of consumers, retailers, auctions, European regulators and civil society organizations, flower growers have to comply with a number of standards and codes developed by the major market-brokers, international organizations, national industry associations and multi-stakeholder partnerships (Dolan, et al., 2002)**.** The export of cut flowers from East Africa is an example of a highly codified industry (cut flower producers in Kenya for example in average comply with at least three different social

and environmental codesThis project therefore intends to investigate the effects of social standards in the cut flower value chains connecting the EU with East Africa.

The horticulture sub-sector of the agriculture sector has in the last decade grown to become a major foreign exchange earner, employer and contributor to food needs in the country. Currently the horticulture industry is the fastest growing agricultural sub-sector in the country and is ranked second to tea in terms of foreign exchange earnings. Fruits, vegetable and cut flower production are the main aspects of Kenya's horticultural production. The sub-sector has undoubtedly contributed to increased rural incomes and reduced rural poverty, through both direct production effects and linkage effects, as horticultural incomes are re-spent in rural areas (Mutuku et al., 2004). The success of the sub-sector has seen the export of horticultural produce rising from 1,480 tonnes in 1968 to 163,233 tonnes in 2006 fetching over US $600 million during this period. Exported vegetables constitute only 4% of the total production, while 96% is consumed locally. It is estimated that 70% of exported vegetables are grown by smallholders, with up to 50,000 smallholders growing French beans (Minot and Ngigi, 2004). The major export market is the European Union countries taking 80% of the exports; with the UK, Netherlands and France being the main markets. Other markets include Middle East, South Africa, Norway, USA, Canada and Japan (HCDA 2007; Minot and Ngigi, 2004).

The European Retailer Produce Working Group Good Agricultural Practices (EurepGap) is the most widely known example of a common EU retailers' standard. Though it is a private standard, it is regarded as a condition of entry to EU markets does not provide price premiums. Compliance to these standards for smallholders entails costly investments in variable inputs (for example approved pesticides) and long term structures (e.g. grading shed, disposal pit and pesticide store). These investments are "lumpy" and mostly specific to the fresh export vegetable business. It is questionable whether small-scale farmers have the resources and skills to comply with the standards. The costs of implementing the standards may drive them out of lucrative export market for horticultural produce. Researchers, development practitioners, and government are concerned that these changes in requirements by the international supply chains for horticultural and other high-value agricultural products will make it increasingly difficult for smallholders to maintain their position in the export market trade (Dolan and Humphrey, 2000; Dolan et al., 2002).

The EurepGap was originally initiated in 1997 by retailers belonging to the Euro-Retailer Produce Working Group (EUREP) and developed into an equal partnership of agricultural producers and their retail customers. The aim was to develop widely accepted standards and procedures for the global certification of Good Agricultural Practices (GAP). The development of EurepGap was driven by the desire by retailers and producers to reassure their consumers of food safety following scares such as mad cow diseases (BSE) and foot-and-mouth epidemic in U.K (Friedberg, 2004). Other concerns include pesticide levels in food products and the rapid introduction of genetically modified (GM) foods (EurepGap, 2004). The EurepGap protocol has 250 rules or control points. The goal of this protocol is to provide the tools that objectively verify best good agricultural practices to reduce the risk in agricultural production in a systematic and consistent way throughout the world.

Farm and household specific characteristics have been cited as major barriers to compliance with food safety standards. Charlotte and Fairman (2003) in their study assessing the factors affecting food safety compliance within small and medium-sized enterprises (SMEs) in UK, identified the major barriers as; lack of knowledge throughout the compliance decision process, lack of support services, lack of money to cater for the costs of compliance, and lack of information. Antle (1995) also agrees that size of the farm could explain the importance of the cost of implementation as an incentive to adopt food safety and quality practices.

Cost of certification, which is a major element of the EurepGap standards, has been cited as a major barrier to compliance. Graffham (2006), in his study on Zambian farmer's experience with the EurepGap standards, notes that some African certifiers charge up to four times more than the European-based certification bodies. These high costs as well as other recurring costs such as audit expenses, training and expensive pesticides, overburden smallholder growers if no external support is provided to them (Graffham, 2006).

Costs of complying with EurepGap requirements can be classified broadly into two categories; transaction costs and production costs. To be able to characterize these costs, it is necessary to distinguish transaction cost from production costs, which can be a difficult task in French beans business. Production of French beans for international market requires certain institutional arrangements that enhance compliance with EurepGap standards. Costs associated with these institutional arrangements are mainly transaction costs. Thus costs arising from implementing such standards such as set-up costs are regarded as transaction costs. Compliance with EurepGap standards requires taking various technical measures such as use of specific chemicals. The costs arising from these technical measures may be regarded as production costs but in reality they are transaction costs. One way of categorizing such costs would be to consider the reason why the farmer is using the chemical and whether he had been using it before complying with EurepGap requirement. Farmers using any specific chemical for the purpose of complying would be regarded to incur transaction costs. Thus all costs that are not associated

with compliance of the EurepGap requirements will be treated as production costs. In the characterization of the costs, therefore, the study notes the difficulty of separating production and transaction costs. However any additional production costs incurred as a way of complying with the EurepGap standards will be regarded as transaction costs. This is also noted by other authors in related studies such Aloui et al. (2005).

All farmers, retailers or trade operators who join the EurepGap protocol are committed to five main principles (EurepGap, 2001): To maintain consumer's confidence in the quality and safety of the EUREP certified Food; to practice good agricultural practices; to minimise the use of pesticides and other chemical inputs as much as possible; to use non renewable resources (as soil, water, etc.) efficiently; to be responsible for the occupational health and safety of their workers.

Kenya is unique among developing countries in that the most significant player in the agricultural export sector is the smallholder. In the recent past, only a few Kenyan farmers were operating to international quality and safety standards. Export-bound produce was being sold through informal networks of brokers, traders and resellers who had limited understanding of international standards. From the first of January 2005, farmers who export horticultural produce to the European Union were required to comply with the EurepGap regulations including a sophisticated set of good agricultural practices (GAP). These requirements cover among others agro-chemical use, record-keeping, farm infrastructure, hygiene facilities and grading and packing processes (New, 2005).

Kenya's tropical climate demands the use of frequent applications of pesticides that have over the years proved to be effective. EU regulation force Kenyan producers to change these applications regimes and pesticide types. However, unless Kenyan horticultural producers and exporters adapt rapidly to the new measures they will lose the share of the market built up over the years (Mussa et al., 2004). Musaa et al., (2004) in their study argue that the impact of stringent consumer health requirements on large corporations and small-scale farmers will be quite different. Large corporations have much better conditions than small-scale farmers to quickly adapt to new measures, such as EurepGap. In fact, European markets have favoured larger producers and exporters since they have the capacity to respond to new requirements leaving out smallholder farmers who dominate most of the African agricultural sector.

2.4 EFFECT OF COMPETITION AMONG OTHER INTERNATIONAL PLAYERS ON COMPETITIVENESS OF KENYA CUT FLOWER

The present day flower industry is a dynamic and highly international industry. Significant growth rates have been achieved during the past few decades. Trade is dominated by south-north flows with Europe and North-America housing the world's largest consumer markets, while the producing countries are situated close to the equator. For the past ten years, the leading flower exporting countries have been the Netherlands, Colombia, Kenya, Ecuador and Israel. Since a few years, Ethiopia has joined this list, while Israel's position has weakened (World Bank, 2011).

A comparison of last 2003 figures with 2004 confirms that production growth took place in countries around the equator. Since 2004, production area in Kenya has grown by 1,400 hectares, newcomer Ethiopia by 1,568 ha, Ecuador by 421 hectares and Colombia by 300 hectares. In Israel and the Netherlands, production area shrank. Given the rise in export value, the Netherlands nevertheless continue to play a key role in the international flower trade, being both the largest importer of flowers from outside the EU and the main supplier of flowers to other EU countries (World Bank, 2011). The astonishing growth of flower production in the countries around the equator, however, was not gradually, and certainly not automatic. Producers were hit hard by the economic crisis. Production in Colombia and Ecuador has even dropped in recent years.

Acknowledging the fact that floriculture business is very diverse and highly competitive the strategic management and competitiveness framework is required to be able to make the judgments on general success factors of the industry actors. Particularly, to address the success of Netherlands as a main floriculture industry value chain hub and the perspectives for the Ukrainian companies in this business as a final consumption hub. This section of the theory won't be elaborated deeply as this is not the main focus of the research. However, the strategic planning, implementation and control of the industry actors shape the business processes in any value chain and has to be accounted. Moreover, it will be a useful tool for the SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis for the Ukrainian floriculture business in the fifth chapter of the research.

Although Kenya is the most successful producer and exporter of fresh produce and flowers in sub-Saharan Africa, other countries both in Africa and elsewhere, offer strong competition that could erode export market share in future. Ecuador has become a strong competitor in cut flowers, mainly roses. Egypt challenges Kenya's market share in fine beans and dominates the fast-growing EU market for sweet potato. Its sweet potato exports have increased by a staggering 588% from 2005 to 2010 while fine bean exports had a strong growth in 2006 and 2008 and then started to decline in 2009. Egypt's proximity to the European market is a major cost advantage over Kenya. Ethiopia's horticultural export volumes have increased annually

over the past decade with the main contributor for this growth being cut roses. This is attributed to government subsidies introduced in 2006 facilitating private sector and FDI opportunities. Other countries neighboring Kenya have achieved insignificant growth of cut flowers, fine beans and other fresh produce in the 2005-2010 period. However, this trend could change in 2011 due to new investments in export crops in Tanzania including Kenyan companies starting farms and procurement operations for flowers and vegetables, mainly fine beans (USAID, 2012).

As expressed in the above literature review, very little has been researched on the challenges affecting the cut flower sector in Kenya and therefore necessitating this study as the fast way to narrow the literature gaps.

CONCEPTUALIZATION

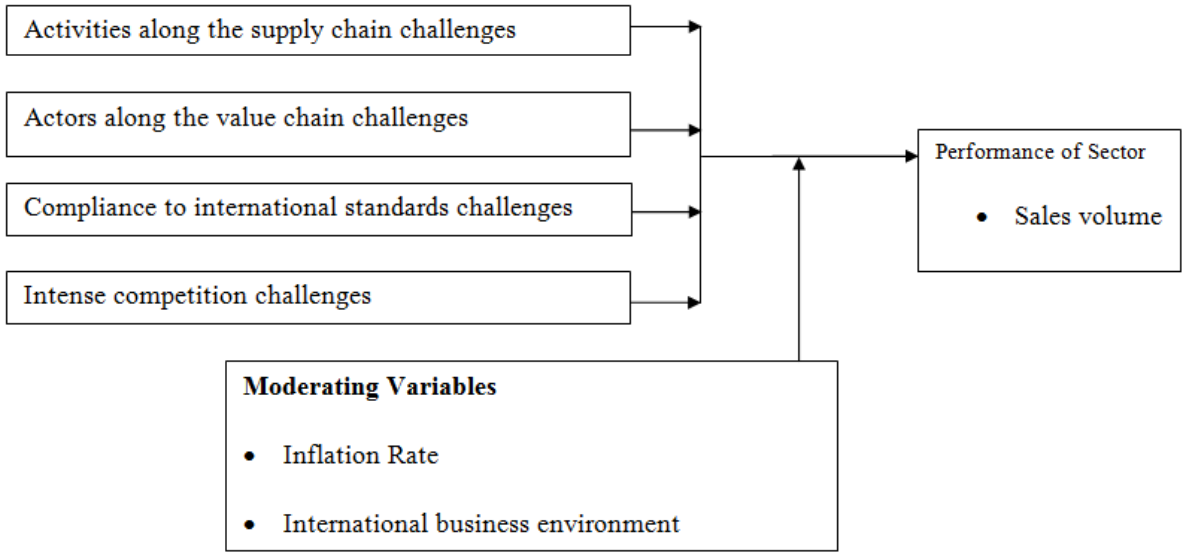


Figure 1: Factors Affecting Competitiveness of Kenya Cut Flower in International Market

The independent variables of the study are; Challenges associated with the activities along the supply chain, the actors along the value chain of the Cut Flower Sector in Kenya, the compliant with international standards of the Cut Flower Sector in Kenya and intense competition among other international players in the cut-flower sector. The dependent variable is performance of the sector measured in terms of sales volume. The moderating variables are; inflation, international business environment and exchange rates. When the cut flower sector manage Challenges associated with the activities along the supply chain, the actors along the value chain of the Cut Flower Sector in Kenya, the compliant with international standards of the Cut Flower Sector in Kenya and intense competition among other international players in the cut-flower sector then there the sales volume will increase assuming that the above listed moderating variables are kept constant.

3 METHODS

The study adopted a descriptive case study research design. The target population for this study comprised of the top management in the flower firms in Nakuru County; General Manager, Production Manager, Human Resource Manager, Financial Manager, Marketing Manager, Logistics and Transportation Manager. This category is purposively selected since they are involved in crafting, implementing and evaluating strategies used in the flower firm. There were a total of 21 flower firms in Nakuru County according to Kenya Flower Council records of 2013; De Ruiter East Africa, Lake Naivasha Growers Group, Bilashaka Flowers Ltd, Florensis (K) Ltd, Groove Ltd, Hamwel Ltd, Kudenga Ltd, Live Wire ltd, Morop Flowere Ltd, Olnjorowa Ltd, Nini Ltd, Oserian Dev. Co. Ltd, Roseto Ltd, Wild Fire, Buds and Blooms Ltd, Homegrown Ltd, Kenya Highlands, Longonot Horticulture, Maridadi Flower Ltd, Sian Roses. The target population therefore was the 21 flower firms multiplied by the 6 top management drawn from each flower firm, making 126. The study purposively took the 21 flower firms and collect information relevant to the study from the 6 managers mentioned above totaling to a population of 126 which also formed the sample size. Questionnaire was used to collect primary data to ensure a high response rate. The questionnaires were distributed to respondents to complete and were collected by the researcher. Factor analysis was used in the analysis because of the concern of decomposing the information content in a set of variables into information about an inherent set

of latent components/factors. This assisted in reducing a number of variables into fewer factors which were the most adopted factors affecting competitiveness of Kenyan cut flower in the international market.

4 RESULTS

4.1 HOW ACTIVITIES ALONG THE SUPPLY CHAIN AFFECT COMPETITIVENESS OF KENYAN CUT-FLOWER IN THE INTERNATIONAL MARKET

Table 1: Factors Related to Activities along the supply chain

Factor	N	Min.	Max.	Mean	Std. Dev.
Activities are extremely many	120.0	1.0	4.0	2	0.7
Activities are challenging to monitor	120.0	1.0	4.0	2	0.7
Activities are time bound	120.0	1.0	5.0	2	0.6
Activities involve chain reaction	120.0	1.0	4.0	2	0.6
Activities are delicate	120.0	1.0	4.0	2	0.7
Activities are affected by climate change	120.0	1.0	5.0	2	0.6

The study used Likert Scale to analyze the factors where 1 – SA – represented Strongly Agree, 2 A– represented Agree, 3 N – represented not sure, 4 D – represented Disagree and 5 SD – represented Strongly Disagree. The factors were analyzed using descriptive statistics (see table 4.1 above). N was the sample of the study which was 120 respondents, Min was Minimum value in Likert Scale which was represented by Strongly Agree, Max was maximum value in the scale which represented by Strongly Disagree, Std. Dev – was the standard deviation from the assumed mean. The study established that majority of the respondents agreed that the activities along the supply chain in the flower sector were extremely many, challenging, time bound, involved chain reaction and were affected by climatic changes. This was represented by the mean of each of these factors which was 2 representing agree in the Likert Scaling used.

4.2 HOW ACTORS ALONG THE SUPPLY CHAIN AFFECT COMPETITIVENESS OF KENYAN CUT-FLOWER IN THE INTERNATIONAL MARKET.

Table 2: Factors Related to the Actors along the Supply Chain

Factor	**N**	**Min**	**Max**	**Mean**	**Std. Dev**
Actors are difficult to manage	120	1.0	5	2	0.9
Actors are diverse in distance	120	1.0	4	2	0.8
Actors are affected by different laws	120	1.0	5	2	0.7
Actors have diverse requirements	120	1.0	5	2	0.8
Actors are expensive to manage	120	1.0	5	2	0.7
Actors are unpredictable	120	1.0	4	2	0.7

Source: Field Data (2014)

The study used Likert Scale to analyze the factors where 1 – SA – represented Strongly Agree, 2 A– represented Agree, 3 N – represented not sure, 4 D – represented Disagree and 5 SD – represented Strongly Disagree. The factors were analyzed using descriptive statistics (see table 4.1 above). N was the sample of the study which was 120 respondents, Min was Minimum value in Likert Scale which was represented by Strongly Agree, Max was maximum value in the scale which represented by Strongly Disagree, Std. Dev – was the standard deviation from the assumed mean. The study established that majority of the respondents agreed that the actors along the supply chain were difficult to manage, they were located in diverse distance, they were affected by many laws involving the flower food chain, they had diverse requirements which were difficult to attain, they were also very expensive to manage and quite unpredictable. This was confirmed by the mean of each of the factors related to actors along the supply chain which was 2 representing Agree in the Likert Scaling used.

4.3 How Compliance with International Standards Affect Competitiveness of Kenyan Cut-Flower in the International Market

Table 3: Factors Related to Compliance with International Standards

Factor	N	Min	Max	Mean	Std. Dev
Standards are inconsistent	120	1	4	2	0.7
Standards are expensive to implement	120	1	5	2	0.6
Standards are not adoptive to Kenya sector	120	1	4	2	0.6
Standards require highly qualified personnel	120	1	4	2	0.7
Standards are too high to achieve	120	1	5	2	0.6
Standard documentation difficult to obtain	120	1	4	2	0.6

Source: Field Data (2014)

The study used Likert Scale to analyze the factors where 1 – SA – represented Strongly Agree, 2 A– represented Agree, 3 N – represented not sure, 4 D – represented Disagree and 5 SD – represented Strongly Disagree. The factors were analyzed using descriptive statistics (see table 4.1 above). N was the sample of the study which was 120 respondents, Min was Minimum value in Likert Scale which was represented by Strongly Agree, Max was maximum value in the scale which represented by Strongly Disagree, Std. Dev – was the standard deviation from the assumed mean. The established that majority of the respondents agreed that the international standards were inconsistent with local agricultural production standards, expensive to implement, not adoptive to Kenya Agriculture Sector, required highly qualified personnel some of which could not be locally found, too high to achieve in Kenyan Agricultural environment and that their documentations were hard to obtain. This situation therefore affected competitiveness of Kenyan Cut-Flower in the international market. This was confirmed by the mean of each of the factors related to actors along the supply chain which was 2 representing Agree in the Likert Scaling used.

4.4 How Competition among Other International Players Affect Competitiveness of Kenyan Cut-Flower in the International Market

Table 4: Competition among Other International Players

Factor	N	Min	Max	Mean	Std. Dev
There are many substitute in market	120	1	4	1	0.6
There are strong competitors	120	1	5	2	0.6
Substitute for better price performance ratio	120	1	5	2	0.7
Buyers easily switch to substitutes	120	1	5	2	0.7
Substitute are major challenge to profitability	120	1	5	2	0.8
It is difficult to switch from our product to others	120	1	5	2	0.7

Source: Field Data (2014)

The study used Likert Scale to analyze the factors where 1 – SA – represented Strongly Agree, 2 A– represented Agree, 3 N – represented not sure, 4 D – represented Disagree and 5 SD – represented Strongly Disagree. The factors were analyzed using descriptive statistics (see table 4.1 above). N was the sample of the study which was 120 respondents, Min was Minimum value in Likert Scale which was represented by Strongly Agree, Max was maximum value in the scale which represented by Strongly Disagree, Std. Dev – was the standard deviation from the assumed mean. The established that majority of the respondents agreed that competition among other international players affect competitiveness of Kenyan Cut-Flower in the international market because there were; many substitute products in the market, there existed very strong competitors, there were substitute for better price performance ratio, buyers easily switched to substitutes, substitutes were major challenges to profitability, it was difficult switching from cut-flower to the provision of other products. This was confirmed by the response mean between 1 and 2 which according to Likert Scaling were within the range of Strongly Agree and Agree.

4.5 FACTOR ANALYSIS OF THE FACTORS AFFECTING COMPETITIVENESS OF FLOWER FIRMS

Table 5: Factors Loading

Factor	Initial	Extraction
Activities along Supply Chain		
Activities are extremely many	1	0.848
Activities are challenging to monitor	1	0.921
Activities are time bound	1	0.959
Activities involve chain reaction	1	0.921
Activities are delicate	1	0.834
Activities are affected by climate change	1	0.837
Actors along Supply Chain		
Actors are difficult to manage	1	0.720
Actors are diverse in distance	1	0.526
Actors are affected by different laws	1	0.820
Actors have diverse requirements	1	0.780
Actors are expensive to manage	1	0.738
Actors are unpredictable	1	0.848
International Standards		
Standards are inconsistent	1	0.921
Standards are expensive to implement	1	0.959
Standards are not adoptive to Kenya sector	1	0.921
Standards require highly qualified personnel	1	0.834
Standards are too high to achieve	1	0.837
Standard documentation difficult to obtain	1	0.683
Competition		
there many substitute in market	1	0.589
there are strong competitors	1	0.542
there are substitute for better price performance ratio	1	0.778
Buyers easily switch to substitutes	1	0.801
substitute are major challenge to profitability	1	0.733
it is difficult to switch from our product to others	1	0.747

Source: Field Data (2014)

Table 4.5 above was used to load the factors. The factors were categorized as per the objectives of the study; factors related to activities along supply chain, factors related to the actors along the supply chain, factors related to international standards in the flower sector and competition.

Table 6: Principle Component Extracted Factors

Factor	Component 1	2
Activities along Supply Chain		
Activities are extremely many	**0.654**	**0.572**
Activities are challenging to monitor	**0.750**	**0.312**
Activities are time bound	**0.658**	(0.149)
Activities involve chain reaction	**0.694**	(0.279)
Activities are delicate	**0.815**	(0.235)
Activities are affected by climate change	**0.706**	(0.177)
Actors along Supply Chain		
Actors are difficult to manage	**0.536**	**0.422**
Actors are diverse in distance	**0.473**	**0.533**
Actors are affected by different laws	**0.547**	**0.562**
Actors have diverse requirements	**0.596**	**0.484**
Actors are expensive to manage	**0.638**	**0.418**
Actors are unpredictable	**0.654**	**0.572**
International Standards		
Standards are inconsistent	**0.750**	**0.312**
Standards are expensive to implement	**0.658**	(0.149)
Standards are not adoptive to Kenya sector	**0.694**	(0.279)
Standards require highly qualified personnel	**0.815**	(0.235)
Standards are too high to achieve	**0.706**	(0.177)
Standard documentation difficult to obtain	**0.575**	(0.362)
Competition		
there many substitute in market	**0.674**	(0.139)
there are strong competitors	**0.659**	(0.116)
there are substitute for better price performance ratio	**0.550**	(0.343)
Buyers easily switch to substitutes	**0.786**	(0.284)
substitute are major challenge to profitability	**0.603**	(0.455)
it is difficult to switch from our product to others	**0.668**	(0.346)

Source: Field Data (2014)

The study established positive significant correlations in the following groups of factors in the second rotation as the most surviving factors;

Activities along Supply Chain

Activities were extremely many had a positive high correlation of 0.572, activities were challenging had positive correlation of 0.312

Actors along Supply Chain

Actors were difficult to manage had positive correlation of 0.422, actors were situated diversely in terms of physical distance had positive correlation of 0.533, actors were affected by different laws had positive correlation of 0.562, actors had diverse requirements had positive correlation of 0.484, actors were expensive to manage had positive correlation of 0.418, actors were unpredictable had positive correlation of 0.572.

International Standards

Standards were not consistent had positive correlation of 0.312

4.6 SALES VOLUME OF CUT FLOWER SECTOR IN KENYA

Table 7: Sales Volume of Cut Flowers in Kenya

Sustainability of growth	No	Min	Max	Mean	Std Dev
Floriculture industry in Kenya is sustainable	120	1	5	4	0.3
There is a high volume of sale of cut-flower	120	1	5	4	0.4
Innovation in the sector has lead to the current growth	120	1	5	4	0.3

The study used Likert Scale to analyze the factors where 1 – SA – represented Strongly Agree, 2 A– represented Agree, 3 N – represented not sure, 4 D – represented Disagree and 5 SD – represented Strongly Disagree. The study established that majority of the respondents disagreed that the floriculture industry in Kenya was sustainable, they also disagreed that the sales volume were high and that innovation in the sector did not lead to any growth. This was confirmed by the mean on each of the items which was 4 represented by disagree in the Likert Scaling used in the study.

5 CONCLUSIONS AND RECOMMENDATIONS

The study found out that that competition of Kenyan Cut in international market was affected by the following factors; activities along supply chain which were extremely many and also challenging; actors along the supply chain which were; difficult to manage, situated diversely in terms of physical distance, different laws, diverse requirements, expensive to manage and were also unpredictable; lastly international standards which were not consistent.

Competition is a complex concept in business and contains many theories that a single study cannot fully address the issue of competition. The initial aim of this study was to analyze the factors affecting competitiveness of Kenyan cut flower in the international market. The study managed to analyze the four main factors; activities along supply chain, actors along supply chain, compliance with international standards and competition. Further study should be done on effect of these factors on expansion of cut-flower sector in Kenya and its contribution to the Gross National Product. Findings from such a study will be important in establishing which factors investors look into when they plan tom expand their cut flower investment in Kenya towards competition in the world market. The findings will also inform policy formulators on which factors are key towards addressing flower expansion and their individual contribution towards Kenya's Gross National Product.

6 RECOMMENDATION

i. The Kenya Cut-Flower Sector should take advantage of Information and Communication Technologies (ICT) to develop effective systems that monitor the movement of the supplies and the products based on real time data transmission

ii. The players in the sector should review the laws in cut flower sector in all the countries involved in the business and harmonize them as a way of making the Kenya cut flower more competitive in the international market. The cost associated with the diverse and unpredictable actors should be normalized through the flower councils and other associations.

iii. Kenyan Flower Council should lobby so that the costs associated with international standards compliance should reduce and be made more adoptive to Kenyan situation. Kenya Government should train more personnel on disciplines like international business, international relations and international laws so that such personnel can be asset to cut flower sector as far as compliance with international standards are concerned.

iv. The Government of Kenya should engage the Dutch Government where there is cut flower auction market so that there are more bilateral trades that can position Kenyan Cut Flower to be more competitive in the World. This in turn will increase the sales volume and more expansion in the sector and hence more foreign exchange.

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Étude in silico des effets inhibitrices des Oleuropein, Kaempferol, et Quercetin sur le Protéine VP30 de Ebola Virus

[In silico study of the inhibitory effects of Oleuropein, Kaempferol, and Quercetin on the VP30 protein from Ebola Virus]

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ABSTRACT: Ebola is a severe viral disease that spreads in West Africa countries, whose a search of an effective Drug is a necessity. The VP30 protein is known as an essential activator of transcription for Ebola virus. In another, Oleuropein, Kaempferol, and Quercetin are a bio-active components, originally from several plants, and which are known by their ability of inhibiting viral transcription activators such HIV. In this context we tested in silico by molecular modeling the ability of these substrates to inhibit VP30 by Building in the active sites, and the application of new pharmaceutical compounds, although direct manipulation in vitro or in vivo is limited by the terms of Biosafety - it is reserved for laboratory level BSL-4 - which slow the search process. The Oleuropein, Kaempferol, and Quercetin components are linked with the active sites of VP30 with a free energy score estimated near -8Kacl / mol and an average distance of 1.8 angstrom. We conclude that Oleuropein, Kaempferol, and Quercetin components may be effective treatment for Ebola Virus and essentially Kaempferol which has very ambitious Pharmacodynamics and kinetic owners, the things that make the component to be a candidate to be an effective Drug. Other experimental studies in vitro and in vivo are required to confirm.

KEYWORDS: Ebola Virus, docking, Oleuropein, Kaempferol, et Quercetin, ligand, inhibitor.

RESUME: Ebola virus c'est une sévère maladie virale qui se propage dans les pays West d'Afrique, dont la recherche des Drug efficaces est une nécessité. La protéine VP30 est connue comme un activateur indispensable pour Ebola Virus. En outre Oleuropein, Kaempferol, et Quercetin sont des composants Bioactives de plusieurs végétaux, et qui sont connus par leur capacité inhibitrice des Activateurs de transcription viraux telle de VIH. Dans ce contexte nous testions par modélisation moléculaire in silico la capacité de ces substrats à inhiber la VP30 par Building dans les sites actifs, malgré que la manipulation directe in vitro ou in vivo est limité par les conditions de Biosécurité – dont elle est réservée pour laboratoire de niveau BSL-4 - ce qui retarde le processus de recherche. Les composants Oleuropein, Kaempferol, et Quercetin sont liés avec les sites actifs de VP30 avec un score d'énergie libre estimé près -8Kacl/mol, et une distance moyenne de 1.8 angström. Nous concluons que Oleuropein, Kaempferol, et Quercetin peuvent être des composants thérapeutiques efficaces pour Ebola Virus et essentiellement Kaempferol qui a des propriétaires pharmacodynamiques et cinétiques très ambitieux, les choses qui font le composant de se porter candidat pour être un Drug efficace, et que des confirmations in vitro et in vivo sont nécessaires.

MOTS-CLEFS: Ebola Virus, docking, Oleuropein, Kaempferol, et Quercetin, ligand, inhibiteur.

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1 INTRODUCTION

Depuis le début de l'année 2014, des cas de maladie à virus Ebola ont été rapportés dans quatre pays d'Afrique : Guinée, Libéria, Sierra Léone et Nigeria.[4.5.8] Le vendredi 8 août 2014, l'Organisation mondiale de la santé (WHO) a annoncé que le virus Ebola représentait une *« urgence de santé publique de portée mondiale »*. Dont il faut une *« réponse internationale coordonnée »* pour *« arrêter et faire reculer la propagation internationale d'Ebola »*, selon l'WHO. Mais le Travaille avec des virus infectieux Ebola est limitée à niveau de biosécurité (BSL) 4 laboratoires, la chose qui présente un obstacle important pour l'étude de ces virus.

La maladie Ebola virus, c'est une sèvre maladie et souvent mortelle chez l'homme, causé par un virus est dite ***Zaire ebolavirus***, or **EBOV,** dont environ 90% des cas infectés décès. [(1)]

Le virus est transmis à l'homme à partir d'animaux sauvages et se propage dans la population humaine par transmission d'humain à humain[(1)(2)] ; Chauves-souris frugivores de la famille Pteropodidae sont considérés comme l'hôte naturel du virus Ebola.[(1)] Le genre d'Ebola virus appartient a la Famille des *Filoviridaes*,[(1)] ordre des *Mononegavirales selon* la Comité international de taxonomie des virus [(6)]. Dans ce genre on cite 5 espèces : ebolavirus Zaïre, ebolavirus Soudan, ebolavirus Reston, ebolavirus Forêt de Taï, et ebolavirus Bundibugyo.[(8)] ebola virus est caractérisé par un génome a simple brin ARN avec sens négatif ,[(5)] avec un génome de longueur d'environ de 19 kb, puisque il appartient au *Filoviridaes*, son diamètre situe à 80 nm avec une forme filamenteuse torsadés (d'où le nom) d'une manière générale jusqu'à 1,1 µm de longueur, [(5)] mais à condition que les particules 14 µm ont été détectés dans des tissus de la culture[(10)].

Les patients gravement malades ont besoin de soins de soutien intensif. Aucun traitement spécifique ni vaccin licence est disponible pour une utilisation chez les personnes ou les animaux. [(1)] La première reconnaissance de cet agent se fait par Prof. S. R. Pattyn, en 1977.[(2)]

La structure d'Ebola virus caractérisée par la protéine VP24 traduit par la région 10.345- 11.100, qui a des rôles essentiels pour le virus citant : qu'elle est un immunosuppresseur[(11)], d'où ils permettent au virus de contrôler le système immunitaire inné[(12)], il se lie avec STAT1 directement en provoquant des effets antagonistes aux interférons[13].

VP40 a des rôles d'assemblage de la matrice et d'autres rôles, polypeptide non modifié peut assembler dans des structures différentes pour différentes fonctions.[14]

« Les NP, VP30, VP35, et L sont protéines associent avec l'ARN génomique dans un complexe ribonucléoprotéique (Elliott et al., 1985). Utilisant d'un système de réplication artificiel, (Mühlberger et al. (1999) ont démontré que les protéines NP, VP35 et L sont essentielles pour la réplication et l'encapsidation du génome de EBOV. Bien que VP30 ne soit pas essentielle pour la réplication, il est apparu nécessaire pour la transcription efficace dans ce système. Le NP, VP35, VP30, et les protéines L ont également été montré récemment d'être essentiel pour la récupération des infectieuse EBOV-Z à partir d'ADNc clonés (Volchkov et al., 2001). En plus d'être un composant essentiel du complexe de réplication, VP35 a été également récemment impliquée comme un antagoniste d'interféron (Basler et al., 2000). VP35 peut donc faciliter la réplication virale dans les cellules infectées par le blocage de l'induction de réponses immunitaires antivirales normalement induits par la production de l'interféron »[15]

Cette étude a pour but de tester la possibilité de liaison entre les protéines de réplication et de transcription « VP30 », « VP35 » et les substrats chimiques suivantes : Oleuropein, Kaempferol, et Quercetin, qui sont connus par leur capacité d'inhiber les Activateurs de la réplication et de la transcription viraux.[20, 21, 22, 23, 24]

La bioinformatique a arrivé un outil principal dans le domaine de recherche pharmaceutique et surtout la recherche des nouvelles Drug, la chose qui permet de minimiser le coût de rechercher et de découvrir des nouvelles médicaments.

2 MATÉRIEL ET MÉTHODES

A. Data Bank

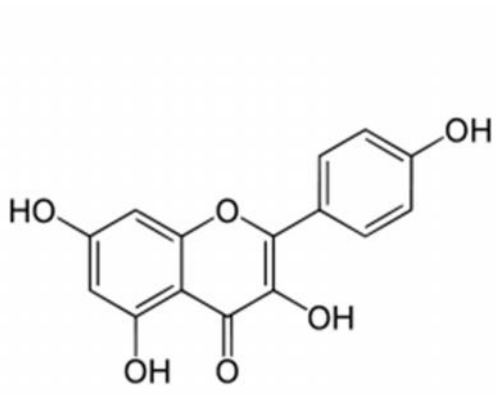
La définition et la configuration des structures des protéines est une étape essentiel dans cette recherche, nous sommes basés sur les banques des données « NCBI » et « RCSB Protein Data Bank », pour réaliser cette étape, ainsi que la définition de leurs ID utilisé pendant les études par les logiciels.

Au même temps les bases des données « ZincDocking » et « RCSB Protein Data Bank » sont les bases des données appliquées pour atteindre la structure 3D des molécules dans le fichier SD MDL, Protein Data Bank (PDB), formats Tripos MOL2.

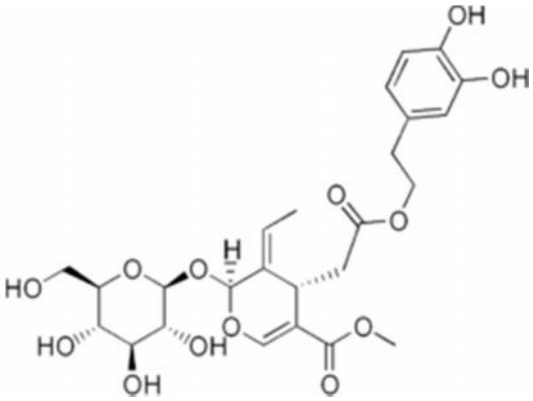
B. Logiciel et Serveur

SwissDock est un serveur qui permet de réaliser des calculs d'énergie libre, énergie des liaisons, énergie et ainsi que permet de Prédiction cible des ligands.

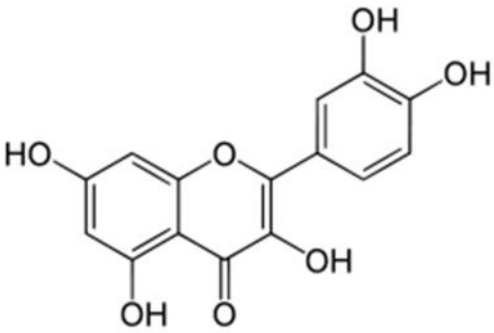
« ArgusLab.4.0 est le programme de la structure électronique qui est basé sur la mécanique quantique, il prédit les énergies potentielles, les structures moléculaires; l'optimisation de la géométrie de la structure, les fréquences de vibration des coordonnées des atomes, longueur de la liaison, l'angle de liaison et les réactions voie (Peng et al., 1995). »[25]



Kaempferol



Oleuropein



Quercetin

C. Méthodes

Pour étudier le score d'inhibition de VP30, on est basé essentiellement sur la comparaison des valeurs l'énergie libre obtenu par les calculs des logiciels ainsi que leur VdW qui permet de savoir la distance entre les molécules.

Les sites actifs de Ebola virus sont obtenus d'après le recherche réalisais via Bettina Hartlieb, et all sous titre : "Oligomerization of Ebola Virus VP30 Is Essential for Viral Transcription and Can Be Inhibited by a Synthetic Peptide," publié le 24 October2003, à The Journal of Biological Chemistry AFFINITY SITES, (référence 27)

3 RESULTATS ET DISCUSSION

Les acides aminés 94-112 de VP30 est une région indispensable pour oligomérisation à ce protéine, dont une grappe de quatre résidus leucine est d'une importance critique ; une mutation d'un seul de ces résidus leucine a donné lieu à des molécules d'oligomérisation VP30 déficiente qui ne sont plus en mesure de soutenir la transcription spécifique à EBOV. [27]

L'analyse de la séquence d'acides aminés VP30 a révélé un motif de QXXR aux acides aminés 228 à 231 qui est spécifique de la DEA (D / H) de la boîte hélicases d'ARN. [27] (Fig2)

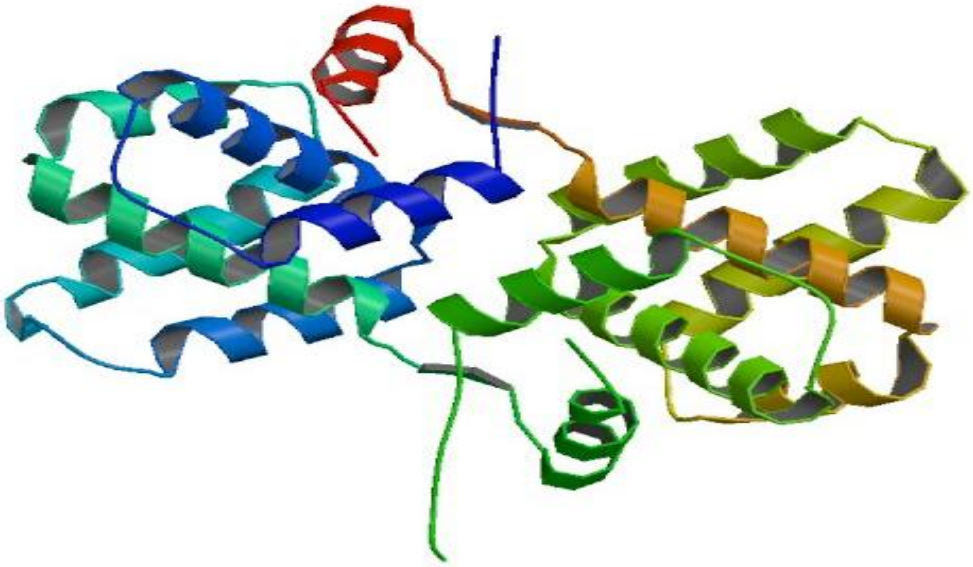


Figure1 : La structure cristalline du domaine C-terminal du virus Ebola VP30, les chaînes de protéines sont colorées à partir de l'extrémité N-terminale à l'extrémité C-terminale en utilisant un arc (spectral) dégradé de couleur « RCSB »

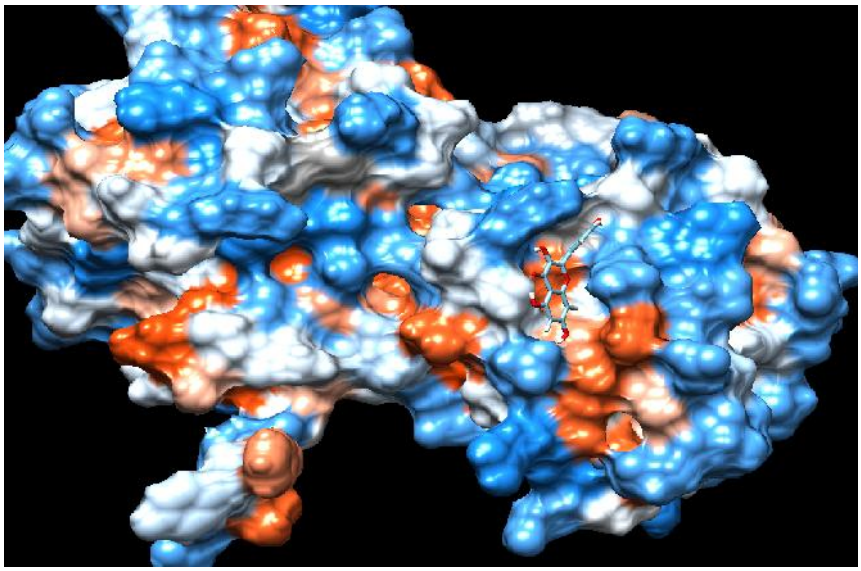


Fig 2 : Oleuropein lie à un site Actif obtenu par SwissDock

Les résultats obtenus par le Docking entre VP30 et « Oleuropein, Kaempferol, et Quercetin », sont comme suivantes par Kcal/mol :

Tableau 1 : Résultats obtenu par SwissDock pour le Building entre la VP30 et les ligands aux sites actifs.

Composant	ΔG	FullFitness	SolvFull	Xlog P
Oleuropein	-8.54	-1271.05	-1508.18	-0.36
Kaempferol	-7.91	-1249.14	-1491.21	2.43
Quercetin	-8.64	-1304.83	-1503.72	1.94

Tableau 2 : Résultats obtenu par ArgusLab.4.0 pour le Building entre la VP30 et les ligands aux sites actifs avec Site Box Size: 60 x 60 x 59.75 angströms

Composant	Energie	FullFitness	Xlog P
Oleuropein	-7.95	-7.02	-0.36
Kaempferol	-8.06	-7.43	2.43
Quercetin	-7.98	-7.25	1.94

L'Oleuropein se lie dans 34 sites avec la protéine VP30 parmi celle-ci les sites actifs des acides aminés 94-112 et 228 à 231,(fig4) dont O numéro 2 se lie avec TRH230 par une distance 2.24 angströms ainsi que avec O7 avec une distance de 2.3 angströms, H numéro17 se lie avec SER234 avec une distance de 2 angströms, ce dernier lie aussi au H numéro18 avec une distance de 2.08 angströms, une autre liaison entre H5 et GLN203 à une distance de 2.57 angströms. Avec une énergie libre estimée est -8.54 Kcal/mol via SwissDock et une énergie de -7.95 Kcal/mol en ArgusLab.4.0, Malgré tout cela leur XlogP ou **partition coefficient** est très bas. Ce composant est prédit via Swiss Target Prediction qu'il cible les Facteurs de transcription chez l'homme.

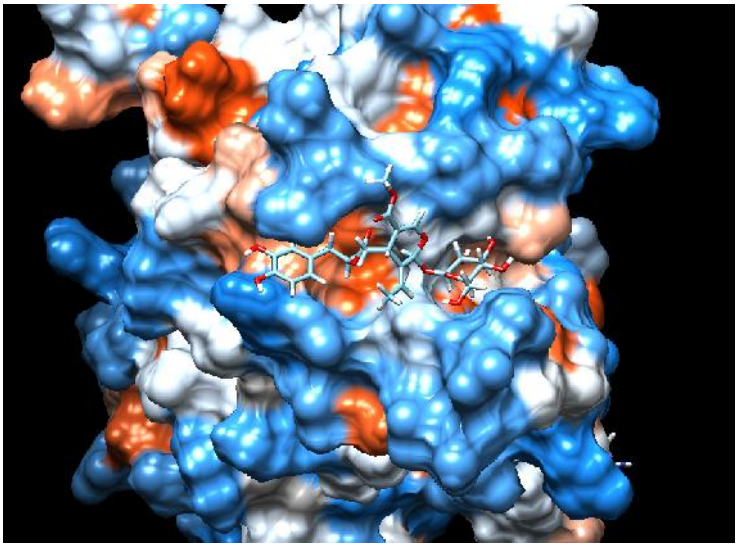


Fig 4 : Oleuropein au site actif 228 à 231.

Kaempferol se lie dans 40 sites avec la protéine VP30 parmi celle-ci les sites actifs des acides aminés 94-112 et 228 à 231, Fig5, dont H16 se lie avec Glu223 par une distance 1.8 angströms, O2 se lie avec GLY219 avec une distance de 2.03 angströms. Avec une énergie libre estimée est -7.79 Kcal/mol via SwissDock et une énergie de -8.05 Kcal/mol en ArgusLab.4.0, en outre leur XlogP ou **partition coefficient** égale 2.45 ce que donnent des propriétaires pharmacologiques et pharmacodynamiques et cinétiques encourageants. Ce composant est prédit via Swiss Target Prediction qu'il cible les Facteurs de transcription chez l'homme avec une Probabilité près de 100%.

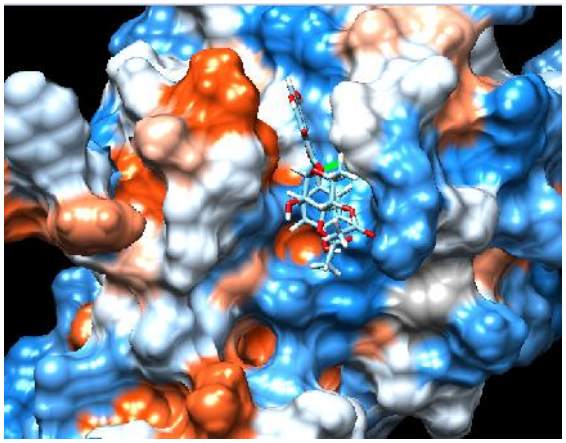


Fig5 : Kaempferol au site actif

Quercetin se lie dans 43 sites avec la protéine VP30 parmi celle-ci les sites actifs des acides aminés 94-112 et 228 à 231, Fig6, au site actif le Quercetin se dipose sans se lie à aucun acide amine, en plus, il se fixe au site en autre lieu en mettant une liaison entre H10 etSER7. Avec une énergie libre estimée est -7.79 Kcal/mol via SwissDock et une énergie de -8.05 Kcal/mol en ArgusLab.4.0, en outre leur XlogP ou **partition coefficient** égale 1.94 ce que donnent des propriétaires pharmacologiques encourageants. Ce composant est prédit via Swiss Target Prediction qu'il cible Ser_Thr Kinase, Metallo Protease et des enzymes chez l'homme avec une Probabilité près de 90%.[28]

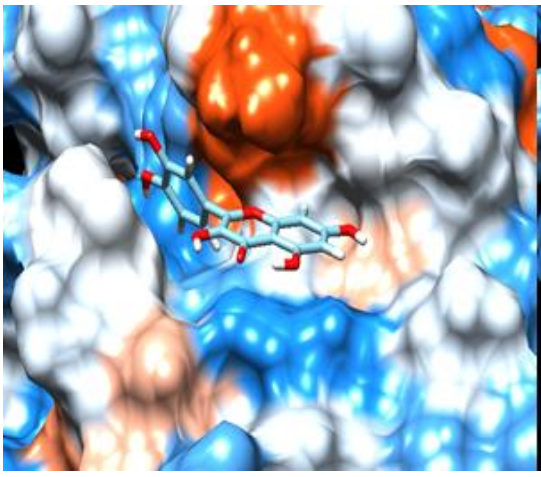


Fig6 : Quercetin en site actif

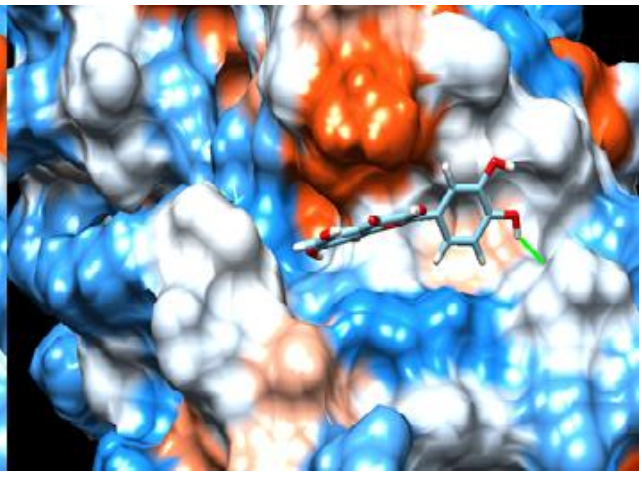


Fig7 : Quercetin en site actif SER163

4 CONCLUSION

On conclut qu'Oleuropein, Kaempferol, et Quercetin produisent des liaisons par les sites actifs inhibiteurs de la VP30 d' Ebola Virus, essentiellement le site actif des acides aminés 228 à 231. Et que tous ces substrats peuvent être le sujet des nouveaux projets de recherches in Vitro et in vivo afin de trouver des nouveaux Drug.

Kaempferol est le meilleur ligand inhibiteur pour Ebola Virus.

5 REMERCIEMENTS

Nous remercions Mr Adil AHIR pour son aide pendant le traitement de cette recherche.

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Study on Cytotoxic Activity of *Clerodendrum inerme* and *Caesalpinia crista* by Brine Shrimp Lethality Bioassay

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ABSTRACT: The science and practice of medicine and its primary source plays an important role in identifying the new molecule of drug through both synthetically and from that of natural origin. Most of the developing countries have adopted traditional medical practice as an integral part of their culture. Historically, all medicinal preparations were derived from plants, whether in the simple form of raw plant materials or in the refined form of crude extracts, mixtures, etc. The aim of this study was to evaluate the Cytotoxic Activity of Clerodendrum inerme (Family: Verbenaceae) and Caesalpinia crista (Family: Leguminosaceae), two widely distributed shrubs of the Sundarbans mangrove forest. A general cytotoxicity of all the extracts of C. inerme and C. crista were determined by Brine Shrimp Lethality Bioassay where the chloroformic extract of bark of C. inerme has the lowest LC_{50} value of 5µg/ml. The ethanolic and chloroformic extracts of leaf of C. inerme and methanolic extracts of bark of C. crista also exhibited a significant cytotoxic activity with LC_{50} values of 10µg/ml, 9.10µg/ml and 10µg/ml, respectively. In this investigation 0.5% chloramphenicol was used as the reference which LC_{50} value was 10µg/ml.

KEYWORDS: Cytotoxic Activity, Brine Shrimp, Traditional, Sundarbans, Shrubs and Lethality.

1 INTRODUCTION

Brine Shrimp Lethality Bioassay is a recent development in the assay procedure for the bioactive compounds and natural product extracts, which indicates cytotoxicity as well as a wide range of pharmacological activities e.g. anticancer, antiviral, pesticidal etc. (Anderson *et al.*, 1988). Bioactive compounds are almost always toxic in high doses. Pharmacology is simply toxicology at a lower dose or toxicology is simply pharmacology at a higher dose. Thus, *in vivo* lethality of a simple zoological organism (Brine shrimp napulii) can be used as a convenient monitor for screening and fractionation in the discovery of new bioactive natural products (Hui *et al*.,1990). Natural product extracts, fractions or pure compounds can be tested for their bioactivity by this method. This bioassay is indicative of cytotoxicity and a wide range of pharmacological activity of natural products. The brine shrimp lethality bioassay was proposed by Michael et al. in 1956 and modified by others. Since its introduction, this *in vivo* lethality test has been successively employed for providing a frontline screen that can be backed up by more specific and more sophisticated bioassays once the active compounds have been isolated. The brine shrimp lethality bioassay is rapid (24 h), simple (e.g., no aseptic techniques are required), easily mastered, inexpensive, and requires small amounts of test material (Ghisalberti, *et al.,* 1993). Thus, this research work was designed to evaluate the cytotoxic activity of *C. inerme* and *C. crista* by Brine Shrimp Lethality Bioassay for further exploration of their bioactive constituents.

2 MATERIALS AND METHOD

TEST MATERIALS

The Selected plant *Clerodendrum inerme* and *Caesalpinia crista* were collected from Ghagramaree, Chadpai range, Eastern Forest Department of the Sundarbans on 25th March, 2011 and collected plants samples were identified by the

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experts of Bangladesh National Herbarium, Mirpur, Dhaka. This research work was carried out from 26th March to 15th September, 2011 in Molecular Biology and Animal Cell Culture Laboratory of Khulna University, Khulna, Bangladesh.

EXPERIMENTAL MATERIALS

Artemia salina Leach (brine shrimp eggs form store), Table salt, Pure NaCl, Small tank (glass jar) to grow shrimp, cover and lamp to attract shrimp, Pipettes (5 ml,1 ml), Micro-pipette (10µl, 200µl adjustable), Test tube (15 ml), Volumetric flask (10ml), Tween-80, Spoon, Electric water blower to produce current, Electric bulb to produce heat, Stand to hold the bulb, Petri dish, Test tube stand, Beaker (1 liter), pH meter, Chloramphenicol, Aluminum foil, Detergent, Digital balance, Vortex machine.

PREPARATION OF MATERIALS

Collected plant samples were washed by distilled water (DW) to remove undesirable materials and excess of water was drained off. The leaves and stems were separated from each other and they were sliced into small pieces. The sliced materials were weighed by balance. The sliced leaves and stems were dried for few days under sunlight with shadow. After that the dried samples were powdered separately by grinding machine and then 5.4 gm powdered leaf of *C. inerme* was taken into clean flat-bottomed glass container and soaked in 200 ml of 95% ethanol, 5.4 gm powdered leaf of *C. inerme* and 12.8 gm powdered bark of *C. crista* was taken into clean flat-bottomed glass container and soaked in 200 ml of absolute methanol and 5.4 gm powdered leaf and 10.72 gm powdered bark of *C. inerme* and 12.8 gm powdered bark of *C. crista* was taken into clean flat-bottomed glass container and soaked in 200 ml of absolute chloroform. The containers with its contents were sealed and kept for a period of 7 days accompanying occasional shaking and stirring. The whole mixture then underwent a coarse filtration by a piece of clean, white cotton material. Then it was filtered through Whatman filter paper. The filtrates obtained were evaporated under ceiling fan and in a water- bath until dried. It rendered concentrates of greenish, brownish, reddish and sometimes blackish in color. The concentrates were designated as crude extract of 95% ethanol, methanol and chloroform of *C. inerme* and *C. crista*.

HATCHING OF BRINE SHRIMP

60gm Sea salt (pure NaCl 20gm and table salt 40gm) was weighed accurately, dissolved in distilled water to make one liter and then filtered off to get a clear solution. Sea water was taken in the small tank and shrimp eggs were added to the one side of the tank and the side was covered. The eggs were allowed for two days (24-36 hrs) to hatch and mature as nauplii (larvae). The hatched shrimps were attracted to the lamp through the perforations in the dam and they were taken for bioassay.

PREPARATION OF STOCK SOLUTION

7mg of dried ethanolic, methanolic and chloroformic extracts of leaves and chloroformic extract of barks of *C. inerme,* methanolic and chloroformic extracts of barks of *C. crista* were taken into 10ml individual volumetric flask. The extracts were dissolved in 1.4 ml sea water and one drop Tween-80 and adjusted to final concentration of 5µg/µl. As standard 0.5% sterile Chloramphenicol eye drop was used which concentration was 5µg/µl.

PROCEDURE

One hundred clean test tubes were taken, 14 of which were for the samples in seven different concentrations (two test tubes for each concentration), 14 for positive control (two test tubes for each concentration) and 2 for negative control. Then 4ml of seawater was given to each of the test tubes. With the help of the micropipette specific volumes (5, 10, 20, 40, 80,160 and 320µl) of samples were transferred from the stock solutions to the test tubes. Different concentration of choloramphenicol (5, 10, 20, 40, 80, 160 and 320µl) were taken in the rest of the 14 test tubes which are used as positive control and finally the volume is maintained at 10ml in each test tube (sample, positive control and negative control) using sea water. So, the concentration of samples and chloramphenicol became 2.5, 5, 10, 20, 40, 80 and 160µg/ml respectively. Finally with the help of a Pasteur pipette, 10 live shrimps nauplii were taken into each of the test tubes (Meyer *et al.,* 1982). After 24 hrs, the test tubes were observed and the numbers of survived nauplii in each test tube were counted and the results were noted. From this, the percentage of lethality of brine shrimp nauplii was calculated at each concentration for each sample.

STATISTICAL ANALYSIS

By using these following equations Arithmetic Mean, Standard Deviation and Standard Error were calculated:

Eq. (1) Arithmetic Mean ($\overline{X}$) = $\frac{\sum X}{n}$

Where, ΣX = Summation of Observed Value

n = No. of Observation

Eq. (2) Standard Deviation (SD) = $\sqrt{\frac{\sum(X-\overline{X})^2}{n}}$

Where, X =Individual Value

$\overline{X}$ = Mean Value

n = No. of Observation

Eq. (3) Standard Error (SE) = $\frac{SD}{\sqrt{(n-1)}}$

Where, SD = Std. Deviation

n = No. of Observation

3 RESULTS AND DISCUSSIONS

In the cytotoxicity assay based on the lethality of brine shrimp, the crude extract of *C.inerme* and *C.crista* showed lethality indicating the biological activity of the compound present in the extract. Results found in this bioassay are tabulated to the next pages.

Table 1. Results for cytotoxic effect of chloramphenicol

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	9	9	9	10	0	0	10	10
5	7	8	7.5		0.707107	0.5	25	
10	5	5	5		0	0	50	
20	4	4	4		0	0	60	
40	3	3	3		0	0	70	
80	0	0	0		0	0	100	
160	0	0	0		0	0	100	

Table 2. Results for cytotoxic effect of the methanolic extract of leaf of C. inerme

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	8	7	7.5	10	0.707107	0.5	25	36.5
5	7	7	7		0	0	30	
10	7	6	6.5		0.707107	0.5	35	
20	6	5	5.5		0.707107	0.5	45	
40	5	4	4.5		0.707107	0.5	55	
80	4	2	3		1.414214	1	70	
160	2	1	1.5		0.707107	0.5	85	

Table 3. Results for cytotoxic effect of the ethanolic extract of leaf of C. inerme

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	6	7	6.5	10	0.707107	0.5	35	10
5	6	6	6		0	0	40	
10	5	5	5		0	0	50	
20	4	6	5		1.414214	1	50	
40	4	3	3.5		0.707107	0.5	65	
80	3	2	2.5		0.707107	0.5	75	
160	1	0	0.5		0.707107	0.5	95	

Table 4. Results for cytotoxic effect of the chloroformic extract of leaf of C. inerme

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	6	8	7	10	1.414214	1	30	9.10
5	6	6	6		0	0	40	
10	5	4	4.5		0.707107	0.5	55	
20	4	4	4		0	0	60	
40	3	3	3		0	0	70	
80	1	1	1		0	0	90	
160	0	1	0.5		0.707107	0.5	95	

Table 5. Results for cytotoxic effect of the chloroformic extract of bark of C. inerme

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	7	7	7	10	0	0	30	5
5	5	5	5		0	0	50	
10	4	5	4.5		0.707107	0.5	55	
20	4	4	4		0	0	60	
40	4	3	3.5		0.707107	0.5	65	
80	3	3	3		0	0	70	
160	1	2	1.5		0.707107	0.5	85	

Table 6. Results for cytotoxic effect of the methanolic extract of barks of C. crista

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	8	7	7.5	10	0.707107	0.5	25	10
5	5	7	6		1.414214	1	40	
10	4	6	5		1.414214	1	50	
20	4	5	4.5		0.707107	0.5	55	
40	3	2	2.5		0.707107	0.5	75	
80	3	1	2		1.414214	1	80	
160	1	1	1		0	0	90	

Table 7. Results for cytotoxic effect of the chloroformic extract of barks of C. crista

Sample Conc. (µg/ml)	Treatment-1	Treatment-2	Avg. no of alive shrimp sample	Negative control (alive)	Std. deviation	Std. error	Mortality (%)	LC_{50} (µg/ml)
2.5	8	8	8	10	0	0	20	18.2
5	6	7	6.5		0.707107	0.5	35	
10	5	6	5.5		0.707107	0.5	45	
20	4	5	4.5		0.707107	0.5	55	
40	3	4	3.5		0.707107	0.5	65	
80	3	1	2		1.414214	1	80	
160	1	1	1		0	0	90	

Test samples are showed different mortality rate at different concentrations. The mortality rate of brine shrimp was found to be increased with the increase in concentration of the sample and if we plot of percent mortality versus different

concentrations of extracts on the graph paper produced an approximate linear correlation between them. The comparative analyses of LC_{50} value of different plant extract are given below:

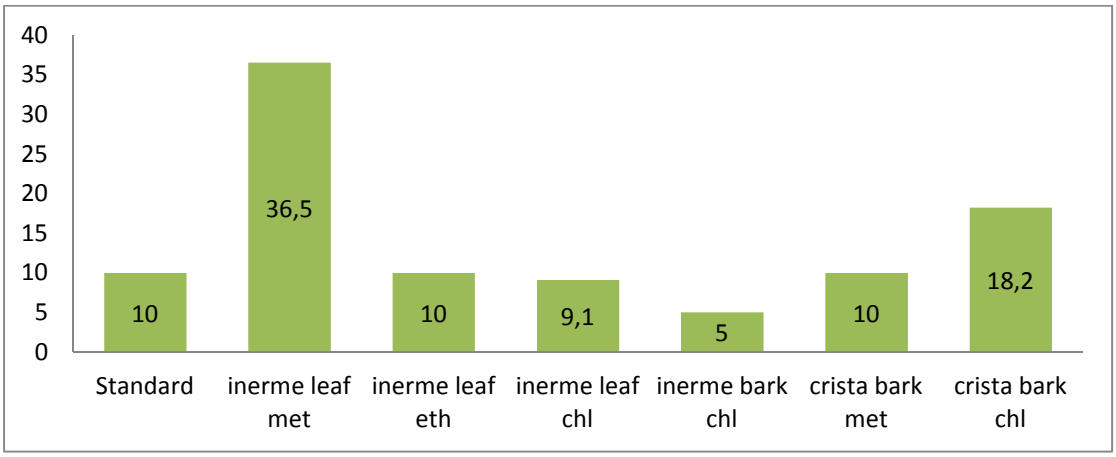


Figure 1. Comparative analysis of LC_{50} values in µg/ml among the plant extracts

LC_{50} = Lowest Concentration where mortality rate is 50%, met= Methanol, eth=Ethanol and chl=Chloroform

The chloroformic extract of *inerme* bark has the lowest LC_{50} value of 5µg/ml. On the other hand methanolic extract of *inerme* leaf has the highest LC_{50} value of 36.5µg/ml. The lower LC_{50} value higher the activity. So, the chloroformic extract of *inerme* bark has higher cytotoxic effect than the others and methanolic extract of *inerme* leaf has lower cytotoxic effect than the others. Also the chloroformic and ethanolic extracts of leaf of *inerme* and methanolic extracts of bark of *crista* shows effective cytotoxicity in contrast of chloroformic extract of bark of *inerme.* Chloroform extracts of both leaf and bark demonstrated the highest potential in cytotoxicity assay indicating the active compound(s) was extracted best with chloroform as solvent system.

4 CONCLUSION

The result shows that the cytotoxic activity exhibited by the solvent fractions was promising and this clearly indicates the presence of potent bioactive compounds and also suggests its possible antitumor activity. In future, further investigation is needed with the hope to search new bioactive compound in *C. inerme* and *C. crista* as well as initiatives are also need to be encouraged to develop any possible medicine in Bangladesh.

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Pictorial Reading Strategy and the Learning of Proverbs and Riddles among Primary School Pupils

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ABSTRACT: The study investigated into the effect of pictorial reading strategy on the learning of proverbs and riddles with view to elucidating the need to uphold making children to be well- grounded in their first language. The study adopted quasi-experimental pre-test-post-test design. Three intact classes of Primary Six pupils were assigned to two experimental and one control groups. The treatment took a period of six weeks. Data were subjected to inferential statistics of Analysis of Co-variance (ANCOVA). The results showed a significant effect with the pre-test level,($F(2, 164) = .837; p > 0.05$) and the post-test,($F(1,164)=12.668$; $p<0.05$; $R^2=0.63$). Gender was not found significant, $F(1, 164)=.007; p>0.05$.
The study concluded and recommended that proverbs and riddles, which are linguistic structure of languages, be brought to bear in the learning process because their values in the development of language skills. Teachers should employ appropriate strategies such as pictorial strategy in the teaching process to motivate children into embracing their mother tongue as this will aid the learning of the second language.

KEYWORDS: Pictorial reading strategy, learning, proverbs, riddles, primary school Pupils.

1 INTRODUCTION

Civilization or urbanization has influenced generations both positively and adversely. There is virtually no aspect of human life that has not been touched, more importantly, the culture which is the total way of life of a group of people in terms of the behaviour, beliefs or even the language that distinguishes a group from another. The influence it has on culture has therefore created a wide generational gap to the extent that many valuable aspects of culture are gradually going on extinction or rather being endangered. The most disheartening part of it is the language which has highly been affected making values in the language pathetically becoming estranged to the upcoming generations. As a result, foreign language is being esteemed above the mother tongue, especially in Africa or to be precise in Nigeria.

It needs be pointed out that language goes beyond cultural traits; it is the direct expression of a people's national character and culture in a condensed form as explained by the nineteenth century's German romanticists. It is further expatiated on by American anthropologists who identified language as the most essential carrier of the people's common culture and that there is no how a people's culture may be understood without being acquainted with the language. It is through the language that the intellectual culture of the people is constructed, shared and maintained to manifest the social identity of the people. [1] stated that when a language is taken away from its people, all that remains is mere geographical expression. In other words, language makes a people unique when it is used appropriately and adequately. There are intricate structures in language that serve as embellishment to give the language its beauty and deeper meaning to the users as well as its complexity to non- users. When these intricacies are no more there, the value of the language is completely lost and nothing but emptiness remains. These intricacies are referred to as underlying linguistic structures [2].

In the case of Yoruba language, one of the major languages in Nigeria, proverbs and riddles are some of the intricacies that are embedded in the language. The language is examined based on the policy statement that mother tongue or language of the immediate environment should be used as a medium of instruction in schools from pre-kindergarten level to

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primary three (Grade 3) while English language is to be used as a medium of instruction from primary four (Grade 4) upward [3]. The policy statement is in response to research-based evidence such as Ife-Six Years Project and linguists' standpoint that learners thrive well in the learning of the second language when they are well-grounded in their mother tongue [4, 5]. [6] further emphasized that when children learn through their mother tongue; they are not only expanding their knowledge of their mother tongue but also learning concepts and intellectual skills that are relevant to their ability to function appropriately in the second language learning. Stating further, he stressed that once a child learnt a concept in his/her mother tongue, he/she needed not to re-learn the concept rather he/she needs to acquire new labels or 'surface structures' for an intellectual skills already learnt and there would be transfer across languages in academic and literacy skills like ability to distinguish the main idea from the supporting details of a comprehension passage or story. S/he would be able to identify cause and effect, distinguish fact from opinion and map out the sequence of events in a story or historical account. [7] reiterated research evidence by stating that children's fluency and literacy in mother tongue lay a cognitive and linguistic foundation and speedy learning additional languages. Person's language is the language of thought from which novel ideas spring up in someone and that is a germane reason for advocating the acquisition of mother tongue. The implication would be that denying a child of his/her mother tongue amounts to stealing or killing ideas in a child. This is further reiterated by [6] that when a child is asked to leave his/her language at the 'schoolhouse door', it is tantamount to asking the child to leave a central part of who he/she is, that is, his/her identity out. In other words, children are given social rejection and they are likely to lack confidence and self-esteem to function actively in the class and thereby participate less in the classroom instruction. He further stated that the child's mother tongue is the child's identity that can foster intrinsic and extrinsic motivation to learn. Hence it has to be nurtured for proper educational development of the child.

Proverbs, a linguistic structure of the language, are the wise sayings used to give clearer explanations on discourse. They have both connotative and annotative meanings that are hidden but help to drive home discourse to a logical conclusion. [8] analogically referred to proverbs as the carvings on the legs of a stool that make it a pleasure to sit on, the embroidery on the garment that delights the weaver and the admirers as well as the paintings on the wall that aid the provision of a delightful atmosphere. By implication, proverbs add beauty and values to the language when the users are well- informed and versed in the usage. This is expressed by [9] that proverbs decorate speech and stand as the symbols of communication. [10] stressed this further that they are precursor of thought and when one is lost in thought, they are used to discover the basis or the nitty- gritty of the thought, they are therefore referred to as the horse of conversation. No wonder the usual song in Yoruba that;

Owe l'esin oro, (Proverbs are the horse for speech,)
Oro l'esin owe, (Speech, the horse of proverbs)
B'oro ba sonu, (If words are lost or strayed,)
Owe l'a o fi wa. (Proverbs are used to track it out).

This is to reiterate how important proverbs are in Yoruba language or culture. They are passed down from one generation to another for the purpose of continuity, and they serve as a method for the teaching and learning about historical lessons, acquisition of good morals and instilling social values from generations to generation especially among Yoruba [11]. [12; 9;13] explained that proverbs to Africans are stimulus towards imparting knowledge, wisdom, morality or code of conduct, beliefs and philosophy of live in their offspring because they touch every aspect of human endeavour and human relations. [13] reiterated further that proverbs give vivid information on the structure of the language. All these therefore show how valuable a person's language is when he/she acquires it. In the process of using proverbs in the African setting, young ones are expected to listen to elders attentively as they make use of them in speech. Riddles on the other hand, are statements with hidden meaning, to be discovered after a sharp menial review of the possibilities. It describes a person or a thing in a metaphorical form with the view to exercise the intellectual skills of the participants [14]. [13] also stated that riddles may be in question, songs, statement or description form with the purpose of sharpening the wits of children and widening their understanding. To [15] it is a method of instruction in the indigenous setting that aid in imparting knowledge and sharpening memory and reasoning ability of both the young and old. They are used to test children's judgment and problem-solving ability. [16,;14] also asserted that riddles are as a medium for developing the child's reasoning faculty and decision-making skills. On the whole, the two intricacies are referred to as the source of great intellectual ability as they are widely used as methods of teaching or imparting a wide range of knowledge in the African society, especially among the Yoruba. Using proverbs and riddles tend to increase children's vocabulary wealth, grammatical structures as well as enhancing skills of language.

Despite the values of these intricacies of language, they are becoming endangered as they appear not only as aberration to the current generation but also fading away. The trend was observed even at the international level hence the United Nations advocated cultural sustainability and so in the Convention on the Rights of the Child recognition is given to the importance of cultural identity. Therefore in Article 31, it is emphasized as the right of every child to get acquainted to his/

her cultural life and the arts [17] and by this, policies were formulated to give adequate attention to not only the child's cultural life but also the language. Even, [18] and [19] pointed out the overlooked advantages of encouraging multilingual education in the early years by stating that when children are offered opportunities to learn in their mother tongue, they are more likely to enroll and succeed in school. Children are to be taken thorough intellectual development through the use of his language or the language of his immediate environment. The goal is to make a child well-grounded in his/her culture, especially the language so that in the time of rapid change due to economic, social or even political changes, and more often than not this age of globalization, the child would be guided and guarded.

It is against this backdrop that this study was conceived to investigate the use of pictorial reading strategy on the learning of proverbs and riddles among primary school pupils. Pictorial strategy refers to the use of images or pictures to represent something. It is further defined as any two-dimensional representation in which the stimulus array contains at least one element that is not alphabetic, numeric or arithmetic [20]. It is assumed to be adequate as pictorial representations could control experience by helping in matching images to actions. [22] indicated that there is a strong relationship between image and the item or place it depicts and that the more we rely on images to communicate information, the more meaning we could get in relation to one's environment. [21] examining the truism that 'a picture is worth more than thousand words', have also pointed out that the use of imagery and illustration could serve as facilitators of learning in a variety of situations. [22] also pointed out that the contributions of pictures to the overall development of children's literate behaviour is overwhelmingly greater because, they serve as mental scaffolds to children thereby promoting children's language and literacy. [23] concluded that the incorporation of concrete-pictorial-abstract approach to teaching is a great means of increasing the chances of reaching all learners of diverse learning styles. He made this assertion after he has adopted the strategy in Mathematics learning and discovered that it helped the students to gain greater conceptual knowledge rather than mere procedural knowledge. It is therefore assumed that pictorial strategy would aid children in learning proverbs and riddles that are gradually fading out with the children's mother tongue. To carry out this research, the following hypotheses were formulated.

i. There is no significant effect of the treatment on the learning of Proverbs and Riddles among primary school pupils.
ii. Gender is not a significant factor in the learning of Proverbs and Riddles among primary school pupils.

2 METHODOLOGY

The study adopted quasi- experimental design. Three intact classes of Primary Six pupils were assigned to two experimental and one control groups. Pre-test was carried out to determine the entry point of the children before their exposure to the treatment. After which the two experimental groups were exposed to the proverbs and riddles using pictorial strategy. The control group was given **placebo** treatment. The treatment took a period of six weeks. Post-test was carried out after the treatment period. Data were subjected to inferential statistics of Analysis of Co-variance (ANCOVA).

3 RESULTS

Ho1: There is no significant effect of the treatment on the learning of Proverbs and Riddles among primary school pupils

Table 1: ANCOVA Summary of Treatment on Children's Performance in Proverbs and Riddles

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	281.464(a)	8	35.183	37.966	.000
Intercept	532.563	1	532.563	574.681	.000
PRE	2.327	2	.776	.837	.475
SCHOOL	23.479	2	11.740	12.668	.000
GENDER	.007	1	.007	.007	.932
SCHOOL * GENDER	.028	2	.014	.015	.985
Error	151.981	164	.927		
Total	6295.000	173			
Corrected Total	433.445	172			

R Squared = .649 (Adjusted R Squared = .632)

Table 1 shows the between –subjects effect of the treatment. At the pre-test level, the subjects were not different in the cognitive level before the treatment ($F(2, 164) = .837; p > 0.05$) which indicated homogeneity of subjects. The post-test shows a significant effect ($F(1,164)=12.668$; $p<0.05$; $R^2=0.63$). Therefore, the hypothesis that there is no significant effect of the treatment on the learning of proverbs and riddles was rejected.

Ho2: Gender is not a significant factor in the learning of Proverbs and Riddles among primary school pupils

Based on Table 1, gender is not a significant factor in the learning of Proverbs and Riddles among primary school pupils ($F(1, 164)=.007; p>0.05$). Therefore the null hypothesis was upheld.

4 DISCUSSION

The results of this study indicated that there was a significant effect of the treatment (pictorial strategy) on the learning of proverbs and riddles among primary school pupils. This means that the experimental groups taught using pictorial strategy performed better than the control group in the learning of proverbs and riddles. This finding is therefore corroborating the assumption of [21] that indicated a strong relationship between image and the item or place it depicts and that the more we rely on images to communicate information, the more meaning we could get in relation to one's environment. So also [22] stressed the contributions of pictures to the overall development of children's literate behaviour as pictures serve as mental scaffolds to promote language and literacy in children.

The study discovered that gender is not a significant factor in the learning of proverbs and riddles using pictorial strategy. The implication is that whether male or female, children would do well on any concept when appropriate strategy(ies) is/are employed in the teaching- learning process. This corroborated Gujarati's finding that the strategy is a great match for learners of diverse learning styles with sex no exception. Any concept can be learnt by children no matter the sex so far teachers adopt suitable strategy.

5 CONCLUSION AND RECOMMENDATIONS

The study concluded that proverbs and riddles, which are linguistic structure of languages, are fading out in indigenous languages like Yoruba because the values have not been identified in the development of language skills. It is therefore recommended that teachers should employ appropriate strategies such as pictorial strategy in the teaching process to motivate children into embracing their mother tongue. Teachers should be exposed to regular training and retraining in teaching methods so that they will be abreast of information on current teaching procedure that will enhance learning process. Government should put in place educational implementation enforcement body that will see to the implementation of the language policy statement as contained in the National policy on Education. Activities on language promotion should be organized in schools for children. Parents should be reoriented on the values of mother tongue-based education in the best interest of the child's cognitive development.

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Control Strategy for Safe Descent of Power Assisted Wheelchair on Declining Road Using Regenerative Braking

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ABSTRACT: Physically weak, senior and disabled citizens use manual wheelchairs to move around places. The electrical wheelchairs provide them this required support for movement. It is difficult to control manual wheelchairs on sloping roads and hence the use of electrical power assisted wheelchair is advantageous, which can be controlled by braking. This paper proposes a new braking control algorithm to control these wheelchairs on downhill road and during its process, it is able to regenerate some power which can be stored in a charge storing device like a battery or super capacitor.

KEYWORDS: power assisted wheelchairs, braking control algorithm, regeneration of power.

1 INTRODUCTION

This project will be a study of regenerative braking control of wheelchair on downhill roads. The project is a combination of hardware and software where both the modules complement each other to achieve the desired safe braking control of wheelchair on downhill roads. Various advanced wheelchairs are available with joysticks.The user needs to smartly operate the joystick in order to control the wheelchair motion. However they are very expensive and complex to be used by the elderly people. Therefore an intelligent system that can control itself on downhill road needs to be implemented taking the cost into consideration as well.

2 LITERATURE SURVEY

This study suggests an intelligent system that can sense a downhill road and control the braking of the wheelchair on downhill roads. This study suggests a regenerative braking circuit that switches from 'assist mode' to 'braking mode' to control the braking of the wheelchair on downhill road and ensure a jerk free motion to the user and in turn allow the user to come down the declined road safely. A small part of energy involved in this process is also fed back to the power storing device, thus ensuring a regenerative braking control of the wheelchair.

Rory A. Cooper, L. M. Widman, D. K. Jones, R. N. Robertson and J. F. Ster(2000)[1] tested wheelchairs with joysticks and proved that pointing joystick is better than position sensing joystick.

Rory A. Cooper, *et al* (2002)[2] developed a push rim activated wheelchair which required a balance between human torque and electrical torque.The results showed that the wheelchair users faced difficulties.

Seiichiro Katsura and K. Ohnishi [3] developed a wheelchair based on human control and robot control. The best possible combination of human efforts and robotic control to move on straight and circular roads was attained.

Seiichiro Katsura and K. Ohnishi (2006)[4] developed an intelligent wheelchair robot to adapt to an unknown environment.The data about the environment is fed to the robot and the robot is capable of avoiding obstacles using the adaptive algorithm on which it works.

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H.Seki, T. Sugimoto and S. Tadakuma [5] prepared a control system using two driving modes namely ''torque control mode'' and ''position control mode''. The system proposes proper mode switching between the two modes to control the driving process properly. Minimum jerk model is used improve ride quality using differential equations

H.Seki and S. Tadakuma [6] proposed a control system to improve ride quality of wheelchair. This is achieved by reducing the jerk and acceleration. The proposed control system generates velocity patterns by limiting acceleration and jerk and also determines the jerk at real time.

N. Mutoh, Y. Hayano, H. Yahagi and K. Takita (2007)[7] used braking operations for electric vehicles for safe driving. Braking is performed by equally distributing the torque to front and rear wheels.

Y.Takahashi and H. Seki [8] proposed a regenerative braking control system for electric powered wheelchair which are driven by electric motors in accordance with human operation. This study proposes regenerative braking control technique for smooth stopping motion of the wheelchair using a fuzzy algorithm.

H Seki K. Ishihara and S. Tadakuma [9] proposed a regenerative braking control scheme for electric power assisted wheelchair on sloping roads.

H. Seki [10] also proposed a novel capacitor regenerative braking control of power assisted wheelchair for safe downhill road driving. The electric motors providing the driving torque to the wheelchairs are controlled using step-up/down chopper circuit. The variable duty ratio of PWM controlled motors are used to control the braking of the wheelchair on downhill roads. Also a minimum jerk model is used to ensure a smooth motion of the wheelchair on sloping terrain .

3 PROPOSED WORK

3.1 HARDWARE

The wheelchair model is powered with a battery and its wheels are powered by 2 DC motors connected in series so that motor current and battery current in the circuit can be increased and the braking power can be also increased greatly. As the motors are connected in series, the braking power of the right and left wheels has to be controlled simultaneously. The motors are powered by a battery mounted on wheelchair. The motors used are rated at 12V for 300 rpm.

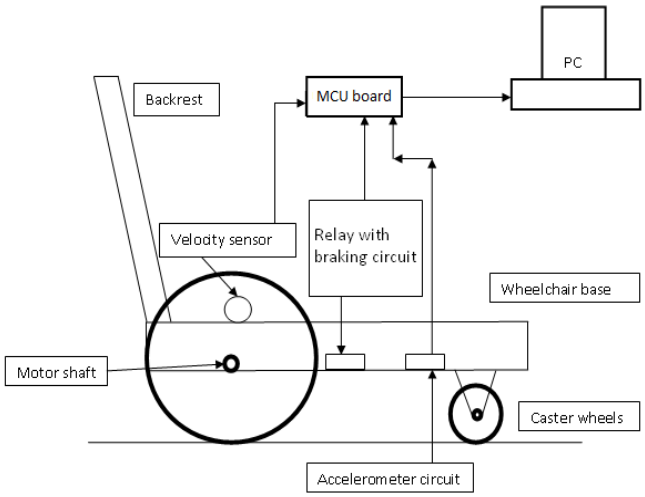


Fig.1. Experimental setup of proposed system

The experimental setup of the proposed system is shown in fig.1. The accelerometer detects the presence of sloping road and the velocity sensor calculates the velocity of the wheelchair. These sensor outputs are received by the microcontroller in which the braking control algorithm is written. Based on the sensor outputs the braking control algorithm is activated and this algorithm controls the motion of the wheelchair on downhill road.

3.2 REGENERATIVE BRAKING CIRCUIT

Figure.2 shows the primary regenerative braking circuit. The entire circuit is held together by a relay. The motors run on battery power when the wheelchair moves on horizontal road. When the accelerometer detects a declined angle of the road, a braking signal is generated by the software and is given to the coil of the relay. This braking signal energizes the relay coil causing the motor terminals to switch from 'assist mode' to 'braking mode'

3.3 ACCELEROMETER

An accelerometer module will be used for detecting the slope of the road. Once the accelerometer detects the slope on the road, the wheelchair will shift from 'assist mode' to braking 'control mode' to control the wheelchair and ensures safe wheelchair descent on the road.

3.4 PROXIMITY SENSOR

Inductive proximity sensors are used for non-contact detection of metallic objects. Their principle of operation is based on a coil and oscillator that creates an electromagnetic field in the close surroundings of the surface which senses oscillations. The presence of an actuator in the operating area causes a dampening of the amplitude of the oscillation.

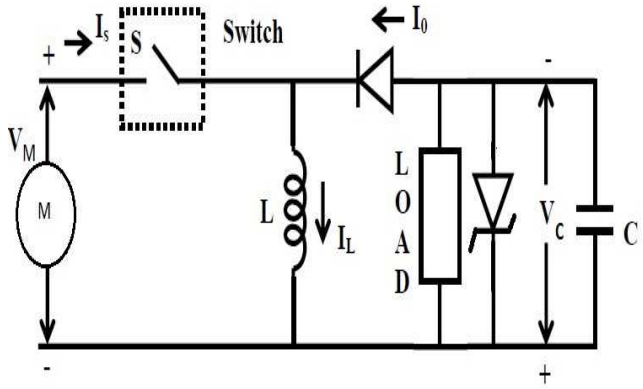


Fig.2. Primary regenerative braking circuit

The rise or fall of such oscillation is identified by a threshold circuit that changes the output of the sensor. The operating area of the sensor is dependent on the actuator's shape and size and is strictly linked to the nature of the material. This proximity sensor is coupled with an encoder to calculate the velocity of the wheelchair.

3.5 BRAKING CONTROL ALGORITHM

A new algorithm is developed to control the braking of the wheelchair on sloping roads. This algorithm will ensure a smooth motion of the wheelchair, thus ensuring the safety of the wheelchair user(fig. 3). The braking control algorithm is executed when the wheelchair is running and has detected a downhill road and keeps executing as long as the decline road exists. The ADC values are contiuously monitored to detect the occurence of a downhill road. When the occurrence of a downhill road is detected,a braking signal is generated which switches the regenerative braking circuit.The current velocity of the wheelchair is estimated at every encoder tooth edge and is compared with the reference velocity of the wheelchair.If this velocity is greater than the reference velocity then the braking signal duration is increased.Conversely, if the current velocity is lesser than the reference velocity, then braking is decreased appropriately.

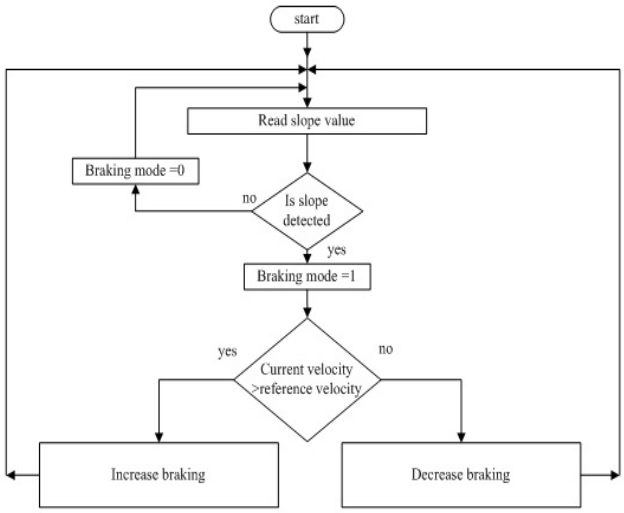


Fig.3. Braking control strategy flowchart

4 EXPERIMENTAL OBSERVATIONS

Various modules of the project were tested to study their behavior. The modules are the accelerometer sensor, PWM generation using microcontroller, the motor and the proximity sensor. A three-axis accelerometer is used to detect the occurrence of downhill road. The accelerometer has X,Y and Z axis. The acceleration of wheelchair on downhill road is monitored on Z axis. Any movement in the z-direction is detected by it as acceleration in that direction and it is the output on the axis of that direction.

The accelerometer can be represented as a set of beams attached to a movable central plate that move between fixed plates. The movable beams can be detected from their rest position by subjecting the system to acceleration. As the beams attached to the central plate move, the distance from them to the fixed beams on one side will increase by the same amount that the distance to the fixed beams on the other side decreases. The acceleration is represented by change in plate distance. The g-cell plates form two adjacent capacitors. As the center beam moves with acceleration, the change in distance between the beams changes the capacitor value.A proto board of the accelerometer is made and is tested by accelerating it in z-direction.The following Table I and fig .4 shows the accelerometer output in static position.

Table 1. Accelerometer output in static mode

Axis	Output in volts
X	1.72
Y	1.56
Z	2.4

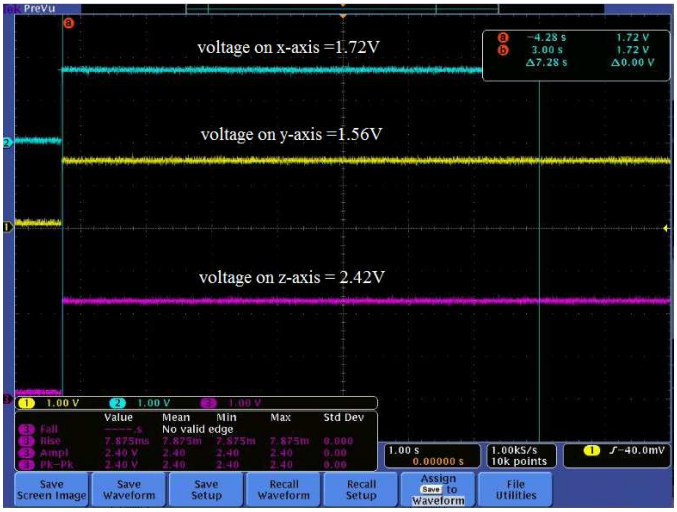


Fig.4. Accelerometer output voltages on three axes in static acceleration mode

In another experiment the accelerometer was subjected to acceleration in positive z-direction. Figure 5 is the graph of the observations of this experiment.

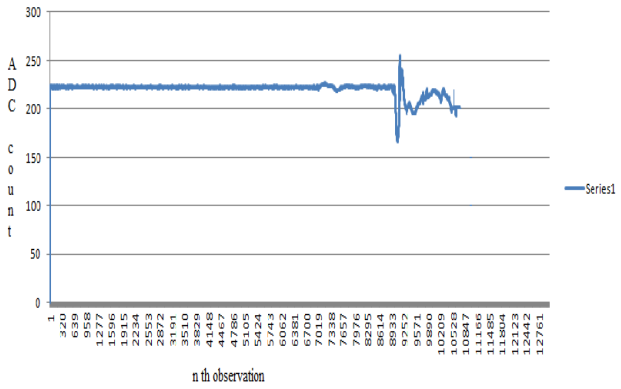


Fig.5. Digital values of accelerometer in dynamic acceleration mode

In fig.5, the vertical axis holds values for accelerometer output which are analog and are fed to the ADC for conversion to digital count so that this variation in the output can be monitored for detection of downhill roads. The converted digital values of the accelerometer are read through serial communication on a desktop computer terminal and a graph of these digital values is plotted .The horizontal axis holds values of the nth observation. From the graph it is visible that there is a considerable dip in the ADC count if there is acceleration in z direction. This decrease in values helps to detect the presence of a downhill road.

Similarly, timers of the microcontroller used are for pulse width modulation(PWM) generation for controlling the motor current of the wheelchair when on downhill roads. The digital values of the timers were also sent to a desktop terminal via serial communication to observe the correct functioning of timers. Eight or sixteen bit timers are used in the microcontroller which overflow on reaching the their maximum value.

The PWM is the most important factor that controls the motion of the wheelchair on sloping roads. This PWM controls the current through the motors to maintain a jerk free motion. PWM generation(fig.6) of 1kHz and 50% dutycycle is observed. PWM waveforms of different frequencies and duty cycles can be generated.



Fig.6. PWM generation of 1kHz and 50% duty cycle

DC shunt motor of 200 rpm was used and an external torque was applied on the motor shaft to simulate the effect of gravity on motion of wheelchair motor on sloping road. A voltage of around 5.6V was generated when the motor was made to rotate at around 100 revolutions per minute by the applied external torque(fig.7).

The proximity sensor which is to be used as velocity sensor was also tested to study its response on detection of a metal object in its sensitivity area. The operation of proximity sensor is based on a coil and oscillator that creates an electromagnetic field in the close surroundings of the sensor head. Proximity of a metallic object (actuator) in the operating area causes dampening of the amplitude of oscillation. The rise or fall of such oscillation is identified by a threshold circuit that changes the output of the sensor. The distance of operation of the sensor depends on the actuator's shape and size and is strictly linked to the nature of the material. A twelve teeth encoder disc with one missing tooth was used for the experiment. This encoder disc is mounted on one of the wheels of the wheelchair. When the proximity sensor detects a tooth, its output becomes logic HIGH and logic LOW in the tooth absence (fig. 8) .

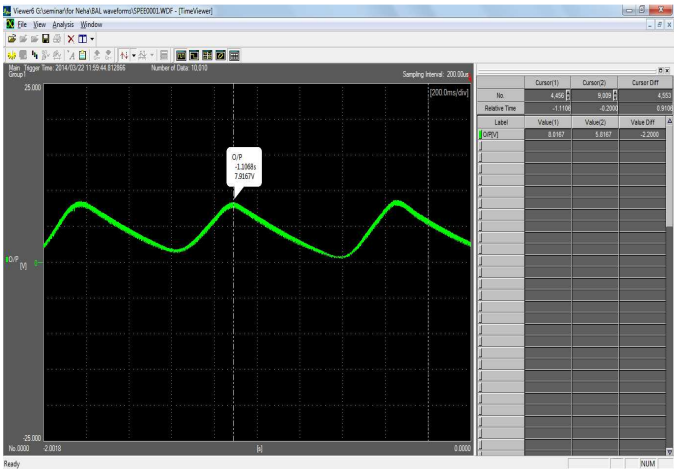


Fig.7. Voltage generated at motor terminals by applying external torque

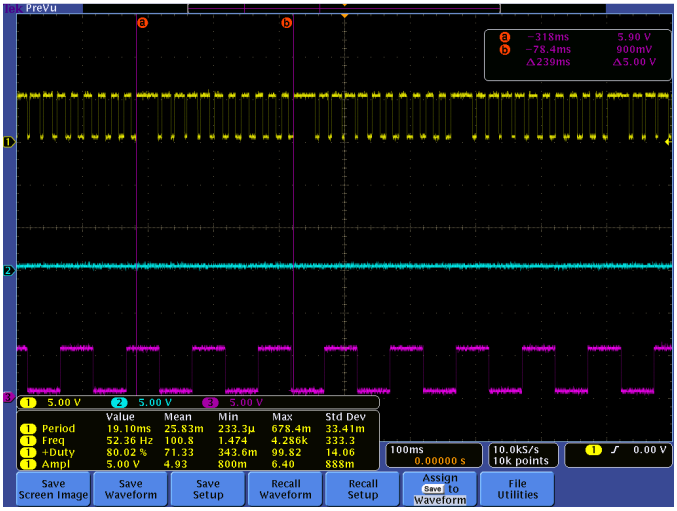


Fig.8 Response of proximity sensor on detection of a tooth of an encoder disc

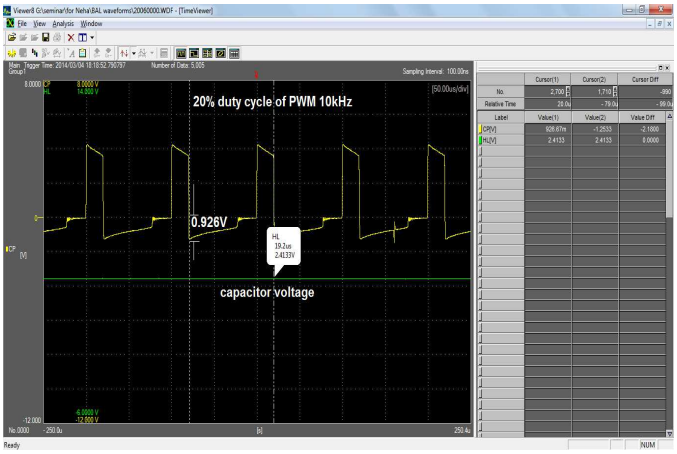


Fig.9 Inductor and capacitor response at 20%dutycyle of PWM of 10kHz

Figure 9 and fig.10 show the behavior of the inductor and capacitor voltage at different duty cycles of PWM. A PWM of 10kHz was applied to the regenerative braking circuit. At 10% duty cycle the inductor kick back is 0.926V(fig.9) and the capacitor voltage is 2.4V whereas at 80% duty cycle the inductor kick back is 2.09V and the capacitor voltage is 2.6V. It can be observed that higher the duty cycle, higher braking torque is observed. Assembly trials taken on declining road of 7 degree shows that safe motion of wheelchair can be obtained using regenerative braking and the newly developed algorithm. In fig.11 the initial burst of accelerometer value represents the motion of the wheelchair when it is on level road.

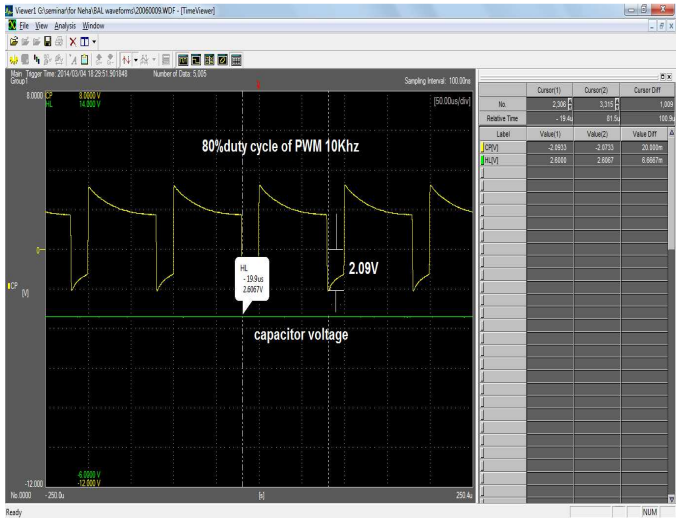


Fig.10 Inductor and capacitor response at 20%dutycyle of PWM of 10kHz

When the slope is detected using the accelerometer, the wheelchair switches to 'braking mode' from 'assist mode'. The accelerometer values can be seen to be constant in 'braking mode' which indicates the smooth, jerk free motion of the wheelchair on sloping roads. This ensures the safety of the person on the wheelchair.

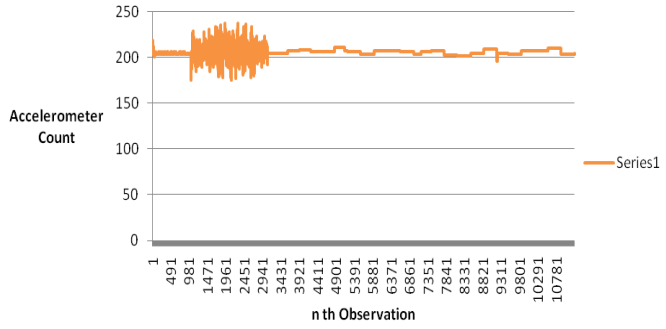


Fig.11 Accelerometer response on 7 degree declined road

Multiple trials were taken on 7 degree declined road and the results were consistent .Figure 12 shows the velocity pattern of the wheelchair on 7 degree declined road in both 'assist mode' and 'braking mode'. The graph shows the average velocity of the wheelchair in all three trials is nearly the same indicating jerk free motion on the sloping road. Another experiment was carried out on sloping road of 8 degree declined road. Similar results were obtained. Similar trials were taken on 8degree declined road and the results were consistent for all the trials taken on the same road.

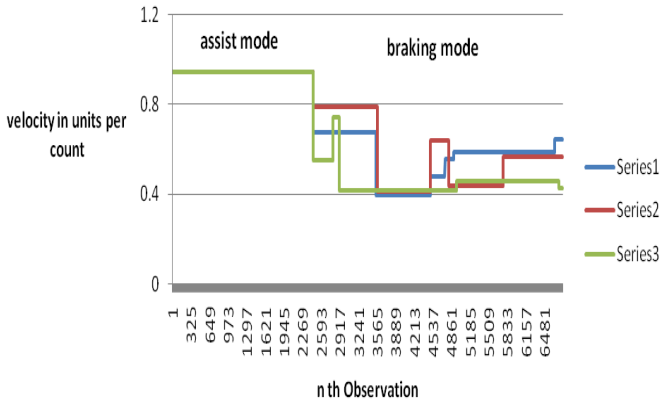


Fig.12 Velocity pattern of wheelchair for multiple trials on 7 degree declined road

Figure 13 shows accelerometer response on slope of around 8 degrees and the fig. 14 shows multiple trials observation with wheelchair on about 8 degrees.

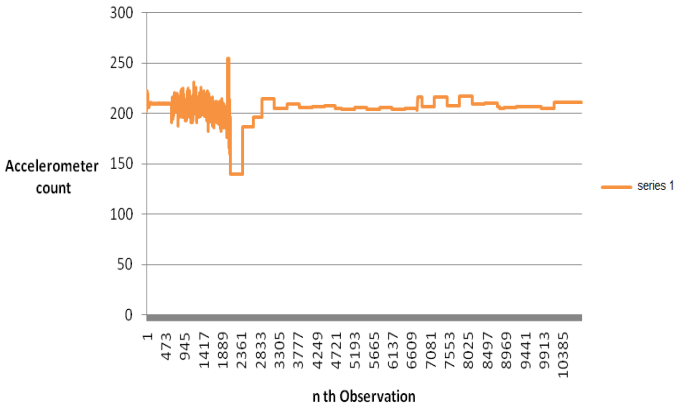


Fig.13 Accelerometer response on 8 degree declined road

5 CONCLUSIONS

Successful regenerative braking of the wheelchair is observed on declined road angles up to 8°.No jerks are observed and the motion of the wheelchair is smooth on downhill roads. Also regeneration of voltage of about 2.5V is observed in the 12V system. The code is as light as possible and no real time operating system (RTOS) is used. This proves the fact that in real time braking control can be achieved without an RTOS. The code is as light as possible and no real time operating system (RTOS) is used.

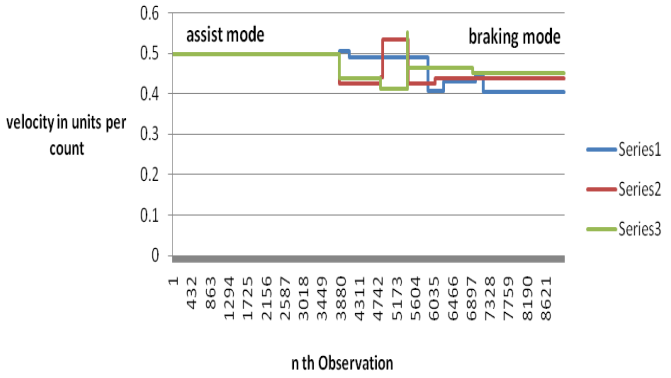


Fig.14 Velocity pattern of wheelchair for multiple trials on 8 degree declined road

This proves the fact that in real time braking control can be achieved without an RTOS. The control strategy implemented can be used to control the wheelchair motion on sloping roads. Repeated trials on various slopes show that with the implemented control strategy successful regenerative braking of the wheelchair can be achieved on downhill roads up to 8° declined angle and a smooth and jerk free motion of the wheelchair is achieved.

Further study can be done using more declined angles and multiple sloping roads. Accelerometers with different sensitivities can be used to achieve better performance. Strength and durability can be tested by conducting endurance trials. Battery performance can be averaged out by conducting trials in hot, humid, dry and cold climates. Differential braking can implemented for the wheelchair to move in curved paths. Thus different features can be still added to improve the performance of the wheelchair.

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Cycle de vie de l'entreprise et veille stratégique

[Business life cycle of the company and business intelligence]

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ABSTRACT: Analysis of the business life cycle is a tool for sustainable development, which is increasingly adopted in the public and private organizations. The critical question for the manager is: Where has our company been now? So the management of the business life cycle is to practice this approach in different departments and business of the company. On the other hand, a new approach was developed to support the development and ensure the viability of the company. This is the concept of strategic scanning pulled behind the concept of intelligence from military theories. This notion has spread to be adapted to the context of the company in its logic of environmental monitoring.
In this article, we will try to present in a first part the business life cycles and some cycles judged most outstanding. Among these lifecycles, we will mention materials lifecycles, lifecycles of technologies and social life cycles. In a second step, we will discuss the concept of strategic scanning. Finally, a presentation of the approach to strategic scanning is required followed by the presentation of the relationship between business lifecycle and strategic scanning throughout all stages of the life cycle of the company.

KEYWORDS: Strategic Scanning, Sustainable development, Environmental monitoring, Potential users, Information.

RESUME: L'analyse du cycle de vie est un outil de développement durable qui est de plus en plus adopté dans les opérations des organisations publiques et privées. La question critique des managers est : A qu'elle phase se situe notre organisation actuellement ? Ainsi, la gestion du cycle de vie vise à l'opérationnalisation de cette approche dans les différents départements et opérations d'une entreprise. D'autre part, une nouvelle approche s'est développée pour soutenir le développement et garantir la viabilité de l'entreprise. Il s'agit de la notion de veille stratégique tirée à l'origine du concept de renseignement issu des théories militaires. Cette notion, qui s'est propagée pour être adaptée au contexte de l'entreprise dans sa logique de surveillance de l'environnement.
Dans cet article, nous allons essayer de présenter dans une première partie le cycle d'évolution de l'entreprise ainsi que certains cycles jugés les plus remarquables. Parmi ces cycles de vie, nous citerons les cycles de vie matériels, les cycles de vie des technologies et les cycles de vie sociaux. Dans une deuxième étape, nous allons aborder la notion de la veille stratégique. Enfin, une présentation de la démarche de la veille stratégique s'impose suivit par la présentation du lien entre le cycle de vie et la veille stratégique tout au long des étapes de cycle de vie de l'entreprise.

MOTS-CLEFS: Veille Stratégique, Développement durable, Surveillance de l'environnement, Utilisateurs potentiels, Information.

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1 INTRODUCTION

Dans un monde de globalisation, l'économie est devenue de plus en plus complexe. La concurrence est devenue mondiale et les goûts des consommateurs changent rapidement. Cela dit, les crises économiques sont devenues répétitives, ce qui a rendu l'environnement dans lequel opère l'entreprise instable et turbulent. Dans ces circonstances, les entreprises, partout dans le monde, cherchent la pérennité et la survie.

Compte tenu du fait que nous vivons sur une planète dont la population dépasse les 7 milliards, et dont les prévisions faites aujourd'hui nous indiquent que notre futur et plein d'incertitudes et de complexités, les entreprises cherchent à se protéger contre le principal risque, celui de leurs disparitions.

Bien que les phases par lesquelles passe l'entreprise deviennent de plus en plus définissables, chaque entreprise croît à sa façon tout en adoptant des styles de direction et des outils de gestion différents. L'outil de cycle de vie de l'entreprise est un moyen d'avoir un aperçu de la situation de cette dernière et par conséquence il permet de déterminer les stratégies adéquates de son développement.

Sortie de la description marginalisée annoncé par l'approche économique classique qui décrit l'entreprise comme étant une ''Boite noire'' dont la principale fonction est la transformation de la matière première en produit fini destiné à être vendu sur le marché. Elle était réduite à : « un agent individuel, sans prise en considération de son organisation interne, transformant de manière efficiente des facteurs de production en produits et s'adaptent mécaniquement à son environnement » [1].

Le développement de la théorie de la firme a commencé à partir des essais de pénétration des analyses à l'intérieur de cette boite noir en décortiquant les entités qui se trouvent dedans. L'entreprise se présente avec l'approche organisationnelle comme une organisation mettant en œuvre différents moyens dont le but est de produire et de commercialiser des biens et des services.

L'activité économique induit la création d'entreprises diverses. Pour pouvoir fonctionner les entreprises ont élaborées des structures capables d'assurer la coordination entre ses différentes tâches. Ces structures représentent l'ossature formelle des activités de l'entreprise et qui sont soumises à certaines forces d'ordre naturel (pression du sommet hiérarchique à la centralisation…) ou contingent (environnement interne et externe). L'entreprise doit survivre et même évoluer malgré toutes ces forces.

Regardant de près le comportement de l'entreprise, les économistes ont remarqué qu'elle se comporte comme un être vivant. Il s'agit d'une organisation complexe qui subit différentes mutations durant son développement.

Face à la turbulence de l'environnement, l'entreprise devra mettre en place des outils capables d'analyser les changements ainsi que les tendances de cet environnement afin d'avoir la possibilité de réagir face à ces perturbations externes.

Dans ce contexte de choix d'outils, nous pouvons citer [2] qui a évoqué la notion de veille comme moyen de création des opportunités d'affaires et de minimisation des risques. Il définit la veille stratégique comme « Le processus collectif continu par lequel un groupe d'individus traquent, de façon volontariste, et utilisent des informations à caractère anticipatif concernant les changements susceptibles de se produire dans l'environnement extérieur de l'entreprise, dans le but de créer des opportunités d'affaires et de réduire des risques et l'incertitude en général. […].

D'une manière générale, cette veille stratégique détecte, exploite et transmet les informations dans le but d'alimenter la complexité des prises de décision dans des situations turbulentes, incertaines ou compliquées [3].

Un vaste champ d'investigations s'est développé autour des notions de cycle de vie et de la veille stratégique, sauf que la question des liens entre les deux a été moins évoquée.

Cela dit, nous présentons notre article intitulé **''cycle de vie de l'entreprise et veille stratégique'',** afin d'essayer de répondre à la problématique : '' Quel est l'intérêt de l'intégration de la veille stratégique au niveau des différentes phases de cycle de vie de l'entreprise ? ''

En effet, afin de répondre à cette problématique, nous allons procéder en trois étapes :

- Une première partie sera consacrée à la présentation du cycle de vie de l'entreprise, à savoir : le lancement, la croissance, la maturité et le déclin ou le renouveau.
- Une deuxième partie présentera la veille stratégique : définition, types et principes.

- La dernière partie présentera les intérêts de l'intégration de la veille stratégique dans les phases de cycle de vie de l'entreprise.

2 CYCLE DE VIE DE L'ENTREPRISE

2.1 LE CYCLE D'ÉVOLUTION DE L'ENTREPRISE

Selon certaines définitions qui ont accordé à l'entreprise un aspect de développement, de croissance et d'échange avec son environnement, l'entreprise peut se manifester en tant qu'organe qui passe durant son existence par un cycle de vie prévisible. L'entreprise né, croit et atteint la maturité. A ce moment elle tend vers la régression voir la disparition ou elle essai de se renouveler en élaborant des stratégies de redémarrage afin de garantir sa reprise et voir sa survie. Ce cycle nous rappel le phénomène de développement chez l'être humain qui grandit tout en subissant des changements tout au long de son cycle de vie.

La notion du cycle de vie a été consacrée au produit de l'entreprise. Plusieurs études se sont orientées vers le cycle de vie du produit afin de démontrer le rôle que joue ce cycle dans le développement de l'entreprise et même dans sa survie.

Afin d'analyser un produit, un service ou essayer d'analyser le développement d'une affaire il s'avère indispensable d'aborder le sujet de cycle de vie. C'est en connaissant à qu'elle stade se trouve le produit que nous pouvons connaitre la situation de l'entreprise ainsi que la stratégie qu'elle peut adopter.

Généralement le cycle de vie du produit est composé de 5 étapes [4] auxquelles correspondent des caractéristiques, des taux de croissances et des objectifs marketings bien différents. Pour chaque étapes l'entreprise adopte une stratégie bien déterminé afin d'optimiser son efficacité.

2.1.1 Phase de mise au point : il s'agit d'une phase de recherche et développement du produit. Durant cette phase les dépenses de l'entreprise sont plus élevées que les recettes. Et c'est le résultat de cette étape qui va orienter l'entreprise à continuer, à transformer ou à abandonner son projet.

2.1.2 Phase de lancement : c'est la phase de pénétration sur le marché afin de faire connaitre le produit. Durant cette phase aussi les dépenses sont plus élevées que les recettes vue le coût unitaire élevé ainsi que la nécessité de dépenser en communication pour faire connaitre son produit.

2.1.3 Phase de croissance : c'est la phase de réalisation des bénéfices suite à une croissance des ventes et une diminution du coût unitaire dû aux économies d'échelle. L'objectif durant cette phase est de gagner plus de part de marché tout en gardant sa clientèle initiale.

2.1.4 Phase de maturité : durant cette phase les ventes atteignent leurs maximums avec un ralentissement de leurs croissances. Le prix du produit atteint son minimum et les concurrents se multiplient.

2.1.5 Phase du déclin : c'est la dernière étape durant laquelle les ventes diminuent considérablement et des nouveaux produits mieux adaptés au besoin du marché apparaissent. Une baisse de rentabilité est ressentit et l'entreprise doit choisir entre laisser tombé le produit ou le relancer en changeant ses caractéristiques ou en le commercialisant sur des nouveaux marchés.

Nous avons énuméré ci-dessus les phases correspondantes au cycle de vie d'un produit qui peut nous fournir une idée sur la situation de l'entreprise. Essayons de voir par analogie le cycle de vie de l'entreprise qui ne devrait pas être très différent de celui du produit.

Effectivement, certaines approches ont énuméré 5 étapes de développement de l'entreprise telle que les 5 étapes du cycle de vie du produit. Nous allons retenir une répartition qui présente ce cycle en 3 étapes puisque nous voyons dans ces étapes un regroupement des différentes phases ainsi qu'une présentation qui peut orienter l'action managériale de l'entreprise. Il s'agit d'une présentation d'un partisan de l'approche systémique [5].

- **Phase préliminaire** qui se forme lors de la création des groupes du travail qui vont opérer dans l'entreprise. Durant cette phase, les personnes ou collaborateurs se motivent et investissent dans l'entreprise sans compter. Ils n'économisent ni effort ni temps ni argent pour faire réussir l'entreprise. Leur soutient est le rapprochement d'une situation plus favorable apportant satisfaction à tout le groupe. Un sentiment de solidarité et d'implication et de convivialité règne chez toutes les parties et il n'y a pas de distance hiérarchique entre les différents intervenants (absence de tout mode d'organisation et de hiérarchie qui peut être source de démotivation du groupe). L'objectif ultime du groupe et la satisfaction du client ➔ C'est la phase qui correspond à la mise au point et au lancement dans le cycle de vie du produit.

- **Phase d'acquisition** qui correspond à la période durant laquelle l'entreprise englobe un nombre important de client ce qui va lui procurer une croissance optimale. Sachant que toutes les forces de l'entreprise vont contribuer à renforcer, voir maintenir cette croissance (force financière, gestion solide, structure organisé…). Durant cette phase l'entreprise investit plus dans la technique et l'attraction des compétences en essayant d'intégrer plus du personnel qualifié et de qualité que du personnel impliqué et solidaire. Le développement de l'entreprise fait apparaitre à ce stade des divergences d'intérêt ainsi que des novelles exigences. Le groupe solidaire, impliqué et motivé durant la première phase cherche maintenant à récolter le fruit de ses sacrifices (fruit matériel et immatériel). Le maintien de l'activité ainsi que la recherche de la croissance nécessite la mise en place d'une hiérarchie et des procédures absentent lors du démarrage de l'entreprise. Ce nouveau paysage de l'entreprise ne va pas plaire à certaines personnes qui vont se sentir léser et oublié ➔ ça correspond à la phase de croissance et de maturité chez le produit.
- **Phase de revendication collective** qui est la conséquence de multiplication des niveaux hiérarchiques et des divergences des centres d'intérêts. C'est une phase ou tout devient complexe. Le marché même ne reste pas accueillant, la concurrence envahit le secteur. La motivation n'est plus spontanée et nécessite plus de valorisation. La satisfaction du client n'est plus une affaire qui attire l'attention du groupe, ce qui prime durant cette phase sont les problèmes internes et le mode de garantir un management équitable ➔ il s'agit là de la phase de déclin connu dans le cycle de vie du produit.

  Il faut noter que le cycle de vie de l'entreprise varie selon la nature de l'activité. En effet, les entreprises industrielles ont une durée de vie plus longue que celles des entreprises commerciales.

2.2 LES CYCLES DE VIE DE L'ENTREPRISE

La notion de cycle de vie est une conséquence de la prise de conscience de l'épuisement de ressources, c'est pour faire face à cette problématique de disponibilité de ressource, que les chercheurs se sont orienté vers l'analyse de cycle de vie.

Comme mentionné précédemment, les entreprises passent par des cycles prévisibles, bien que chaqu'une d'elle croit à sa façon. Durant son développement des techniques de management et des styles de leadership différents sont nécessaires pour chaque étape.

Généralement, l'entreprise apparaît en tant qu'un système c'est-à-dire un ensemble d'élément en interaction dynamique visant la réalisation d'un objectif préétablit tout en s'ouvrant sur différents environnement.

Avant d'aborder dans la deuxième partie la notion de la veille stratégique, nous allons essayer dans ce qui suit de présenter les différents types de cycles de vie qui compose l'entreprise.

Ces cycles de vie peuvent être réparti en deux parties : les cycles de vie matériels et les cycles de vie humains et sociaux.

2.2.1 LE CYCLE DE VIE MATERIEL

Il s'agit du cycle le plus important dans l'entreprise. Il est composé lui-même d'un ensemble de cycle de vie. Nous allons essayer de présenter ci après les principaux cycles de vie qui le composent, à savoir, le cycle de vie du produit, le cycle de vie des technologies pour finir avec le cycle de vie des modes de commercialisation.

2.2.1.1 LE CYCLE DE VIE DES PRODUITS

La notion de cycle de vie du produit est une notion ancienne, utilisé à l'origine dans des études marketing. Son objectif, selon ses utilisateurs, est de rationnaliser la vie économique d'un produit c'est-à-dire la période séparant son lancement de son abandon.

Pourtant, cette notion s'avère indispensable pour analyser un produit. Comparé à un être vivant, le cycle de vie du produit peut être résumé en 5 étapes essentielles (lancement, croissance, maturité et déclin ou renouveau).

- La phase de lancement

  C'est la phase de présentation du produit sur le marché durant laquelle l'entreprise cherche des consommateurs à son produit. Les coûts sont élevés dû aux investissements en recherche et développement ainsi que les dépenses promotionnelles pour inciter à la consommation du produit. Durant cette phase aussi nous remarquons que les ventes progressent lentement à cause de la nouveauté du produit.

- La phase de croissance

  C'est la phase qui connait un accroissement des ventes et une diminution des coûts grâce à des économies d'échelle. La concurrence connait aussi un accroissement durant cette phase d'où le besoin d'investissement supplémentaire de l'entreprise afin d'acquérir et de conserver une part du marché.

- La phase de maturité

  Nous assistant durant cette phase à la plus longue période de cycle de vie du produit. Les nouveaux entrants sont limité et réduit mais la concurrence est plus acharnée expliqué par la saturation de la demande.

- La phase de déclin

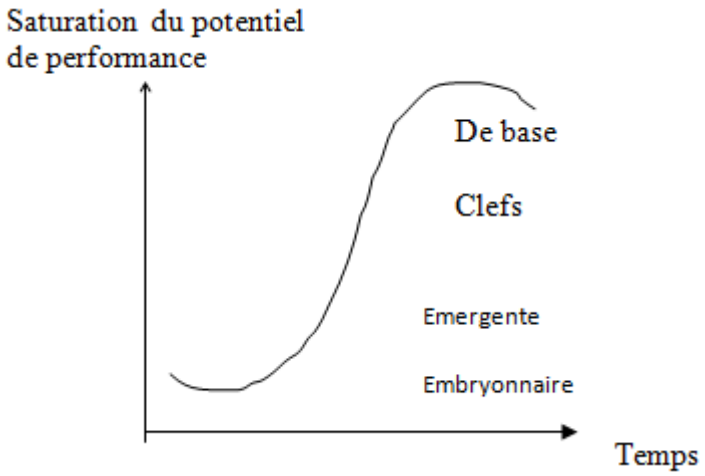
  C'est la phase durant laquelle nous assistons à une chute des ventes. D'autres produits plus adapté au besoin du marché sont commercialisé. La rentabilité de l'entreprise diminue et c'est durant cette phase que l'entreprise doit faire un choix. Soit arrêter ce produit et l'abandonner, soit le relancer en améliorant ses caractéristiques.

2.2.1.2 LE CYCLE DE VIE DES TECHNOLOGIES

Semblables aux produits, les technologies utilisées par l'entreprise possèdent un cycle de vie. En effet, une fois ces technologies sont créées, elles évoluent, atteignent un niveau élevé de succès, puis régressent, pour devenir par la suite obsolète.

La courbe en S réalisée par R. Foster [6] présente le développement des technologies en montrant la corrélation entre les performances obtenues et les investissements en R&D.

Le cycle de vie d'une technologie a été décomposé par Foster en quatre phases, comme présenter dans la courbe ci-dessous :



Les phases de cycle de vie des technologies

- Phase de technologie embryonnaire :

  C'est la phase durant laquelle l'investissement en recherche et développement est le plus élevé. Pourtant la performance de l'entreprise s'améliore lentement.

- Phase de technologie émergente :

  Ça nous rappel la phase de croissance de produit. Durant laquelle l'entreprise maîtrise ses technologies et gagne en productivité.

- Phase de technologie clef :

  L'entreprise atteint la limite de sa performance technologique en maîtrisant encore mieux ses technologies.

- Phase de technologie de base :

  A ce stade de cycle de vie, les technologies ne jouent plus un rôle différentiation par rapport à ses concurrents. Ses technologies deviennent à la porté de toutes entreprises, ce qui signifie que le moment d'abandon ou de rénovation est survenu.

2.2.1.3 LE CYCLE DE VIE COMMERCIAL

Le cycle de vie commercial est étroitement lié au cycle de vie de produit en question. En effet, le mode de commercialisation dépend du stade dans lequel se trouve le produit. Le cycle de vie commercial est similaire au cycle de vie du produit et passe donc par les mêmes étapes, à savoir, la phase de lancement, la phase de croissance, la phase de maturité et enfin la phase de déclin ou de relance.

2.2.2 LES CYCLES DE VIE HUMAINS ET SOCIAUX

Parmi ces cycles de vie, nous allons essayer de présenter le cycle de vie de personnel et le cycle de vie des modes d'organisations.

2.2.2.1 LE CYCLE DE VIE DU PERSONNEL

Une liaison étroite relie le personnel à l'organisation, il s'agit de la carrière de ce dernier. En effet, l'individu rejoint l'entreprise ce qui entrainera des dépenses relativement élevées en terme de formation et d'intégration. Il s'agit donc de la phase de démarrage. Par la suite, le personnel connaîtra une phase de croissance durant laquelle il contribuera à la réalisation des objectifs de l'entreprise en s'impliquant dans son processus de développement. Une fois la phase de croissance arrive à sa fin, l'individu atteint la limite de son potentiel de développement après plus de 35 ans de travail. Il est bien installé dans son poste en attente de la retraite. L'entreprise durant cette période devra penser à rechercher des futurs personnels. Arrivant à l'âge de la retraite, l'individu partira de l'entreprise en laissant sa place à une autre personne qui prendra la relève.

2.2.2.2 LE CYCLE DE VIE DES MODES D'ORGANISATION

Pour aborder ce type de cycle de vie, nous allons nous référer à L. Greiner qui décompose l'évolution des modes d'organisation de l'entreprise en cinq étapes dont chaque étape s'achève par une crise [7].

- La phase entrepreneuriale qui est caractérisé par une période de créativité. Le seul souci de l'entreprise est la production et la vente du produit. une crise de leadership (qui devra avoir le pouvoir de direction ?) mettra fin à cette phase.
- La phase de collectivité qui démarre en permettant à un individu de prendre le pouvoir de l'entreprise et de l'orienter vers le développement. L'entreprise se trouve cependant devant un problème de financement.
- La phase de délégation qui connait l'apparition de deux parties, une partie qui apporte les capitaux et une partie dirigeante. Ce qui entraine une crise de contrôle (qui va contrôler l'entreprise? Les importateurs de capitaux ou la partie dirigeante?
- La phase de formalisation qui connait une autonomie relative de chaque filiale de l'entreprise. Ce qui nécessite la mise en place d'une structure solide. Cette structure veillera à correspondre les objectifs de l'organisation aux objectifs de l'administration, ce qui générera une crise de bureaucratie.
- La phase de collaboration qui est le fruit de l'externalisation des activités de l'entreprise. Une collaboration se crée avec des partenaires étrangers et locaux dont l'objectif est de satisfaire la demande qui devient de plus en plus exigeante.

3 LA VEILLE STRATÉGIQUE

3.1 NOTION DE LA VEILLE STRATEGIQUE

Afin de présenter la notion de veille stratégique nous pouvons deviser le fonctionnement de son processus en deux modes, à savoir, le mode commande et le mode alerte [2].

- Le mode commande : Selon ce mode, la demande d'information est exprimée de la part d'un supérieur hiérarchique. L'application de la veille est donc susciter de la part d'un utilisateur potentiel de l'information.
- Le mode alerte : Selon ce mode, la recherche d'information n'a pas besoin d'une demande de la part des responsables ou des supérieurs hiérarchiques. Un groupe de personne sont à la recherche continue des informations (traqueurs) afin de présenter celles jugées intéressantes aux supérieurs concernés.

D'après la référence [2] '' La veille stratégique est un processus informationnel allant de la recherche des informations jusqu'à leur interprétation et à leurs utilisation pur créer une vision de l'environnement dans lequel l'entreprise veut tailler sa place''.

3.1.1 DEMARCHE DE LA VEILLE STRATEGIQUE

Dans ce qui suit, nous allons essayer de présenter la démarche de la veille stratégique comme annoncer par [2]. Cette démarche concerne le mode alerte et non pas le mode commande.

3.1.1.1 CIBLAGE DES INFORMATIONS PERTINENTES

Il s'agit de délimiter le champ dans lequel se trouvent les informations jugées importantes. Il est réalisé par un groupe de personne constitué de façon ad hoc.

3.1.1.2 TRAQUE DE L'INFORMATION

C'est le fait de se procurer des informations utiles pour le développement de l'entreprise.

3.1.1.3 SELECTION DE L'INFORMATION

L'accès à l'information est grandement facilité avec le développement technologique que connait la société. La veille stratégique a pour rôle dans cette situation de ne sélectionner que les informations susceptibles d'aider les utilisateurs potentiels au sein de l'entreprise.

3.1.1.4 REMONTEE DE L'INFORMATION

Après avoir sélectionné les informations jugées utiles, le traqueur est maintenant devant un vrai défi qui est la remontée de ces informations à la bonne personne et au bon moment. D'où la nécessité de disponibilité de moyen matériel approprié pour transmettre les informations.

3.1.1.5 STOCKAGE INTELLIGENT DES INFORMATIONS

Une fois les informations sont remontées aux bonnes personnes et au bon moment, un groupe de personne passeront au stockage de ces dernières. C'est une tache très importante car elle va mettre en commun toutes les informations en veillant à les rendre facilement accessibles à tout moment par les utilisateurs concernées.

3.1.1.6 DIFFUSION DES INFORMATIONS

Les gestionnaires de stock des informations sont maintenant appelé à communiquer avec les utilisateurs potentiels. Le maître de cette communication est le gestionnaire du stock qui a la responsabilité de transférer correctement les informations, de veiller à ce qu'elles soient claires et effectivement prises en compte par les utilisateurs potentiels.

4 LIEN ENTRE VEILLE STRATEGIQUE ET CYCLE DE VIE DE L'ENTREPRISE

L'entreprise passe par un cycle de vie dont les étapes peuvent être prévisibles mais les décisions correspondantes restent dépendantes du contexte de l'environnement dans lequel elle opère. Chaque décision prise durant chaque étape de cycle de vie nécessite une connaissance des opportunités et des menaces présentes, que se soit à l'échelle interne ou externe de l'entreprise. Cette disponibilité de l'information est le fruit de l'application de la veille stratégique de la part de l'entreprise permettant la prise de décision aux dirigeants. Ce qui nous ramène à chercher, voir à vérifier l'intérêt de la veille stratégique durant chaque phase du cycle de vie de l'entreprise.

Nous pouvons constater que la veille stratégique peut jouer un rôle très important durant chaque phase de cycle de vie de l'entreprise. L'enjeu de la veille reste toujours la survie de l'entreprise.

Phase de lancement : Durant cette phase le système de veille stratégique n'est pas bien installé puisque l'entreprise cherche à se positionner sur le marché. Pourtant des informations sont collectées afin de garantir une meilleure visibilité à l'entreprise.

Phase de croissance : Les traqueurs jouent un rôle primordial en collectant les bonnes informations capables de garantir au preneur de décision la disponibilité de l'information au bon moment. Cela fournira aux utilisateurs potentiels d'avoir un avantage par rapport aux concurrents. C'est donc la qualité de l'information et le timing qui feront la différence durant cette phase.

Phase de maturité : Le besoin de l'information existe toujours, mais le type d'information recherché change durant cette phase. Come mentionné durant la première partie, durant la maturité les ventes atteignent leur maximum donc pas besoin de rechercher des informations relatives à l'augmentation des ventes et par conséquent l'augmentation de chiffre d'affaire. L'objectif recherché de la veille stratégique durant cette phase est la recherche d'information relative à la possibilité de s'orienter vers la production d'un autre produit ou service tout en augmentant les volumes de ventes, voir à défaut les garder.

Phase de déclin : La veille stratégique gardera le même rôle que la phase précédente. Les utilisateurs potentiels chercheront dans les informations stockées ou les informations qui viennent d'être remontées des signes ou des informations claires afin de les aider à trancher entre l'abandon du produit ou le relancer après avoir moderniser ses caractéristiques.

5 CONCLUSION

La dissertation théorique que nous avons évoquée ci-dessus, même si elle présente certaines limites, nous a permit de sentir le lien entre la notion de cycle de vie de l'entreprise et la veille stratégique. Cela dit, nous avons pu détecter l'importance que peut jouer l'intégration du processus de veille stratégique tout au long du cycle de vie de l'entreprise.

Entre autre, il s'agit d'un travail de recherche théorique, qui mérite d'être compléter par une investigation empirique afin de confirmer ou d'infirmer l'importance d'introduire la notion de veille stratégique durant toute les phases de cycle de vie de l'entreprise.

Pour cela, nous pensons faire suivre cet article par une étude empirique qui visera un certain nombre d'entreprise vivant chacune une étape différente de son cycle de vie. Durant cette étude nous essayerons de montrer le rôle que peut jouer la veille stratégique durant les différentes phases par lesquelles passe l'entreprise.

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Nutritional and Microbial Analysis of Melon (*Citrullus colocynthis Linn*) Cake and its Components - A Traditional Snack in South - South Nigeria

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ABSTRACT: The nutritive value of mushroom melon cake was investigated. Our study indicates that the raw melon possessed high moisture, protein and fat content of 87.15±0.03, 45.20±0.01, and 48.83±0.01g/100 dry weight, respectively. However, it was low in fibre and carbohydrate. Another major component of the melon cake, *Pleurotus tuber regium* proximate composition gave 48.20±0.02, 15.50±0.02, 0.84±0.02, 3.31±0.02 and 1.63±0.03 for moisture, protein, fat, fibre and carbohydrate, respectively. Following 96 hours of fermentation, the protein content increased from 46.47±0.02 to 47.78±0.01 in the group aided by Baker's yeast and was higher than the natural fermentation group whose protein went from 45.55±0.05 to 47.50±0.02. Phytochemical screening showed the presence of cardiac glycosides in *Combretum micranthum* but not in *Pleurotus tuber regium*. *C. miranthum* also showed good antimicrobial activity against the isolated microorganisms from the contaminated the melon. Further work should be carried out on *C. micranthum* antimicrobial properties.

KEYWORDS: Melon Cake, *C. micranthum*, Proximate, Cardiac glycoside and Mushroom

1 INTRODUCTION

Nigeria aims to be among the top 20 economies in the world by 2020. To attain such noble objective would mean achieving food security, and also meeting the Millennium Development Goals (MDGs) of eradicating hunger and poverty in the country, among other things. As a ray of hope, the country is blessed with a variety of food crops and trees that are very rich in nutrients and other properties [1], [2], [3]. *Citrullus colocynthis*, melon is an important food crop locally and abroad and is usually grown for its seeds and not the bitter pulp. It belongs to the family cucurbitaceae [3], [4]. It is a creeping annual plant that grows well on rich light soils in the hot climates of Africa [2], [5]. The seeds are used in all part of Nigeria as a condiment in a delicacy called Egusi soup, a very popular soup in Nigeria [6], [7], [4]. Studies have shown that the seed contains oil with possible commercial importance. In addition to the oil, it has also been found to contain carbohydrate, protein, fat, vitamins and minerals. These make the seeds a complete source of balanced diet [9], [10], [8], [3], [11]. It is a popular soup thickener and flavouring agent in some parts of the country especially in the south-east and south-south [4], [7]. The seeds are also used to prepare mushroom melon cakes, a special cake and delicacy in Nigeria. This delicacy is commercially available on the streets, markets and motor parks of Nigeria but native to Akwa Ibom and Cross River State. It is an important snack served in traditional occasions. The Cake is usually prepared with grounded melon seed, sclerotium of pleurotus tuber regium, salt, fresh pepper, and a local leave called Landaga or Asakka locally(*C. micranthum*) but usually used for colouring the melon cake. The need for richer sources of foods was the impetus to evaluate and highlight the nutritive and medicinal values of mushroom melon cake and its components .The study aimed to firstly evaluate the chemical and the nutritive value of mushroom melon cake, sclerotium of the mushroom, melon seeds, the fermented melon, and the commercial melon. Secondly, to isolate potential spoilage microorganisms from the fermented melons. Thirdly, to carry out phytochemical screening of *C. micranthum* and sclerotium of the mushroom. Lastly, to test their antimicrobial activity against the isolated spoilage microbes.

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2 MATERIALS AND METHODS

Material

The leaves of *C. micranthum* were obtained from Ikot Ekpene in Akwa Ibom State. Test organisms used for the study were isolated from the melon employed in the study. Raw unshelled melon was purchased from Watt market in Calabar and was deshelled manually by hand. The commercial melon cake and Baker's yeast *Saccharomyces cerevisiae* were purchased from Watt market in Calabar. Reagents for phytochemical analysis were obtained from a reputable distributor and included Dragendroff reagent, ferric chloride, Mayer Reagent, Fehling Solution and Molisch reagent.

Preparation of Extracts and Phytochemical Screening

The aqueous and ethanolic extracts of the leaf were prepared as briefly described below. For the aqueous extract, about 8g of the properly grinded leaf were dissolved in 20ml of sterile distilled water and allowed to stand for about 24 hours, filtered, dispensed into sterile bottles, heated in a water bath to concentrate it, and kept at 4^0C. Another 8g was weighed, dissolved in 20ml of 97% ethanol and allowed to stand for 24hours. After 24 hours, it was filtered and allowed to evaporate leaving behind an oily substance.

The *C. micranthum* leaf and the mushroom extract pleurotus tuber-regium extract were tested for alkaloids, saponins, tannins, phlobatinin and cardiac glycosides using the method described by Sofowora [12]. Equally, the extracts were also tested for anthranoid and polyphenols, reducing compounds, hydromethyl anthraquinones, flavonoids and anthroquinones were also tested via a method described by Gundidza [13].

Preparation of Media and Dyes

Phenol red, lacto phenol in cotton blue, NNNN-Tetramethyl-p-phenylene diamine hydrochloride, normal saline, Gram iodine, Gram crystal violet and Gram safranin were all prepared according to manufacturers' instructions. Muller- Hinton, Malt agar, Nutrient Agar, Methyl Red Voges- Proskauer, and fermentation broth were all prepared following manufacturer's instruction.

Preparation, Treatment of Cake Components and Fermentation of Samples

Dried melon seeds of *Citrullus colocynthis* were deshelled manually and those seeds with evident fungal infections and coloured seeds were discarded to eliminate any toxin contamination risk. The whitish and healthy seeds were then grinded using a sterile electric blender and immediately placed in an air tight container to avoid rancidity of the oil and stored at 4^oC for usage. The red pepper were washed in clean water, and blended to obtain a paste. The *C. micranthum* leaves were washed thoroughly, oven dried and grinded into a fine powder. For the purpose of the study, two methods of fermentations were employed namely natural and aided fermentation. To the aided fermentation, about 5g of Baker's yeast was added to 10g of prepared melon but the natural add no yeast was added to the melon preparation. All manipulations were done aseptically to avoid contamination. The melon in each process were cut and wrapped in small clean bags and stored at room temperature for 24, 48, 72 and 96 hours.

Disk Diffusion Method

The antimicrobial effect was tested by disk diffusion method as summarised below. Filter papers of size 5mm were cut using a cork borer, wrapped with foil paper and sterilized in hot air oven. A colony of the test organisms were sub cultured on nutrient broth, incubated at 37^oC for 6 hours. After which the organisms were transferred onto solidified Muller-Hinton Agar plates. Filter papers were then soaked in the extracts and placed on the agar plates. Plates were then incubated at 37^oC for 24hours. Zones of inhibitions were then measured and recorded in triplicates. Mean values for each taken and the standard deviation calculated.

Proximate Composition

The methods for the chemical analysis of the samples were those of the Association of Official Analytical Chemist (AOAC, 1980) [14] and same was used to estimate the moisture content, ash content, crude protein, petroleum ether(lipid content), crude fibre, and carbohydrate content of samples.

Isolation of Microorganisms from samples

A gram each of both aided and natural yeast were dissolved differently in 9ml of sterile distilled water , thoroughly shaken and serial dilutions up to 10^8 were made for each samples. Dilutions 10^3, 10^4, 10^5 were then poured into separate sterile petri dishes , freshly prepared nutrient agar poured into them and allowed to solidify. The plates were then incubated at 28^oC for 24 hours and then examined for growth. Isolated colonies were sub cultured to obtain pure stock cultures. The

same method of isolation used for bacteria was also used for the fungi except that for the fungi, malt extract agar was poured into the plates and upon solidification plates were incubated at 28^{o}C for 3days and then examined for growth. The isolates were characterised by microscopic and macroscopic examinations. The macroscopic examinations revealed the colour of the aerial and substrate mycelia for the fungi and also the type shape, and solubility of pigment produced for both bacteria and fungi. A number of biochemical test were done to properly identify the isolates. They included Catalase, oxidase, coagulase, urease, utilization of carbon, methyl Red and Voges- Proskauer.

3 RESULTS

The results obtained from the study are as presented in the tables below. All values presented in the tables are mean of triplicates and standard deviations from the mean.

Table 1: Phytochemical Screening of C. micranthum and Pleurotus tuber regium

Chemical Constituents	*C. micranthum*	*Pleurotus tuber regium*
Alkaloids	+	+
Cardiac Glycoside	+	-
Saponin	+	+
Tannin	-	-
Flavonoid	+	+
Polyphenol	+	+
Hydroxymethyl-Anthraquinone	+	+
Phelobatinin	+	-
Anthraquinone	-	-

N/B: + means present while – means absent. The table above shows the results of the photochemical screening that was carried out. The C. micranthum only lacked anthraquinones and tannins while the pleurotus tuber regium lacked phlobatinin and cardiac glycosides in addition.

Table 2: Proximate composition of raw melon, Ikot Ekpene processed self processed melon cake and pleurotus tuber regium (g/100 dry weight).

Samples	Moisture	Ash	Crude Protein	Crude fat	Crude fibre	Carbohydrate
Raw melon	*87.15±0.03	3.41±0.01	45.20±0.01	48.83±0.01	3.16±0.01	0.61±0.04
Ikot Ekpene Processed	54.30±0.03	2.45±0.01	44.80±0.01	46.61±0.01	4.50±0.02	1.15±0.04
Self Processed Melon Cake	49.40±0.01	2.20±0.02	46.09±0.01	47.30±0.02	3.43±0.02	0.96±0.01
Pleurotus tuber regium	48.20±0.02	2.19±0.01	15.50±0.02	0.84±0.02	3.31±0.02	1.63±0.03

**Values presented here are expressed as Mean±SD. Raw melon was the richest in moisture, ash, crude fat. It had lowest amount of carbohydrate and fibre. Its protein content and fibre was almost same with other samples examined. The melon cake had the highest protein content while the Ikot Ekpene processed had the highest carbohydrate.*

Table 3: Composition of raw natural and aided fermented melon after 24, 48, 72 and 96 hours

Samples	Moisture	Ash	Crude Protein	Crude Fat	Crude Fibre	Carbohydrate
24 Hours						
Natural	46.46±0.01	2.44±0.04	45.55±0.05	46.47±0.02	2.71±0.03	5.09±0.20*
Aided	71.74±0.01	1.83±0.01	46.47±0.02	47.14±0.02	1.47±0.02	3.09±0.06
48 Hours						
Natural	74.43±0.03	2.54±0.04	46.20±0.02	47.65±0.03	2.43±0.03	1.29±0.26
Aided	76.32±0.02	2.14±0.03	46.91±0.03	47.80±0.02	1.10±0.02	1.41±0.17
72 Hours						
Natural	85.35±0.02	3.10±0.02	47.32±0.02	48.42±0.40	0.52±0.02	0.45±0.03
Aided	87.49±0.09	2.20±0.02	47.70±0.02	49.30±0.02	0.48±0.02	0.47±0.03
96 Hours						
Natural	88.49±0.02	3.21±0.03	47.50±0.03	48.90±0.01	0.22±0.02	0.11±0.03
Aided	93.34±0.03	2.21±0.01	47.78±0.01	50.07±0.02	0.04±0.01	0.02±0.02

**Values also expressed as Mean±SD. The melon with enhanced fermentation was richer that the natural one in moisture, protein and fat. However, the natural fermentation had more fibre and ash than the aided fermentation. For carbohydrate, aided fermentation was only slightly higher than natural after 48 hours and 72 but not at 24 and 96hours.*

Table 4: Proximate Composition of cooked and fermented melon after 24, 48, 72 and 96 hours

Samples	Moisture	Ash	Crude Protein	Crude Fat	Crude Fibre	Carbohydrate
24 Hours						
Natural	69.74±0.04	2.45±0.02	46.26±0.17	48.25±0.02	2.90±0.02	0.67±0.32*
Aided	70.35±0.01	2.24±0.02	47.30±0.01	48.38±0.01	1.67±0.06	0.43±0.05
48 Hours						
Natural	80.38±0.02	2.64±0.04	46.83±0.003	47.87±0.03	1.23±0.06	1.42±0.13
Aided	76.71±0.02	2.30±0.01	47.12±0.02	48.22±0.02	1.34±0.04	1.10±0.02
72 Hours						
Natural	80.38±0.02	2.73±0.02	47.02±0.02	48.62±0.01	1.28±0.06	0.34±0.03
Aided	79.13±0.02	2.39±0.01	47.45±0.01	49.10±0.01	0.79±0.01	0.29±0.01
96 Hours						
Natural	82.75±0.01	3.00±0.01	47.12±0.02	49.32±0.02	0.25±0.01	0.22±0.01
Aided	84.33±0.03	2.62±0.02	47.75±0.04	49.48±0.01	0.09±0.02	0.05±0.02

**Values also expressed as Mean±SD. The cooked melon with enhanced fermentation was richer that the natural one in protein and fat. However, moisture was only higher in the aided group after 24 and 96 hours. Fibre was the highest in the natural group just like with the raw melon above in table 3. For carbohydrate, natural fermentation had more than aided.*

Table 5: Inhibitory Activity of the Aqueous Extract and Ethanolic Extract of C. micranthum on Bacteria Isolates (mm).

Bacteria	Aqueous Extract	Ethanolic Extract
Staphylococcus aureus	*10.60±0.020	15.20±0.112
Escherichia coli	11.80±0.211	11.60±0.125
Staphylococcus epidermis	11.70±0.401	11.20±0.011
Klebsiella Sp	11.00±0.001	11.00±0.201
Micrococcus	11.00±0.010	11.40±0.111
Bacillus Sp	11.50±0.012	11.30±0.091
Psuedomonas Sp	11.00±0.201	11.70±0.010

Values are expressed Mean±SD. The highest zone of inhibition was seen with the ethanolic extract on S. aureus and the least zone was seen with the aqueous extract. Other organisms had fairly similar zones of inhibition as shown above.

4 DISCUSSION

A lot of studies abound on the nutritive and medicinal value of plants in Nigeria [5], [6], [7], [9], [10], [11], [15], [16]. Our study has not only evaluated the food composition of raw melon but also that of fermented and cooked melon in addition to the phytochemical screening of the melon cakes components. When compared to the raw melon, cooked melon appeared to have much lowered protein content see tables 2 and 3. Fermentation is already been established as a way of adding flavour to food, increasing its palatability and increasing its protein value [6]. Among the fermented samples, the effect of fermentation was very obvious and the samples that went through natural fermentation were slightly lower in most nutrients than the aided samples. After 24 hours, of fermentation, the protein content was 45.55±0.05 and 46.47±0.02g/100 dry weight for natural and enhanced fermentation, respectively. The use of yeast a single cell protein did increase the overall protein content of the samples. This has been also observed previously [9], [15]. The protein content of the fermented foods rose steadily with time to 47.50±0.02 after 96hours of fermentation. Even though the protein content did increase over time following fermentation, it was observed that the cakes lost their ability to be moulded into cakes after 24 hours and also it lost its organoleptic properties after 72 hours as they did not appear palatable any more. The moisture content in the raw fermented samples had more moisture and carbohydrate than the cooked samples. Crude fibre and carbohydrate also dropped in both cooked and fermented samples over time. We proposed here that the *Pleurotus tuber regium* used in processing the melon cake contributes to both the protein and probably more of the carbohydrate which were generally low in the raw melon proximate composition.

A lot of studies abound that shows that fungi and bacteria have potential to contaminate a variety of foods [6], [17], [18]. Fungi isolated from our study included *Aspergillus niger*, *Aspergillus* species, and *Penicillium* species. Bacteria isolate included *Staphylococcus aureus*, *Esherichia coli, Bacillus* species, *Staphylococcus epidermidis*, *Klebsiella* species, *Micrococcus* and *Pseudomonas* species. In an earlier study, *Penicillium, Fusarium, Rhizopus and Aspergillus* were isolated from unfermented and fermented melon [6]. In the same study, Bacillus, Lactobacillus and Leuconostoc species dominated the bacteria isolates and varied with time of fermentation. The highest contamination of the melon was seen in those samples sought from the market and this could be as a result of aseptic handling of the melon by dealer in the market. The zone of inhibition shown by both the ethanolic and aqueous extracts of the *C. micranthum* leaves indicate that its addition to the melon cakes together with the *Pleurotus tuber regium* may have had some antimicrobial effect on the microorganisms that could cause contamination and spoilage of the melon cake. The extracts of *C. micranthum* inhibited all the isolates from melon. A lot of plants are known to contain phytochemical and show good antimicrobial properties [12], [13], [19], [20]. Both *C. micranthum* and the *Pleurotus tuber regiu*m on analysis contain alkaloid, polyphenol, flavonoid reducing compounds and other phytochemical bases that could be used as potential precursors of various drugs and other important properties

5 CONCLUSION

Our findings show that melon cakes both fermented and raw melon contains basic diets such as protein, carbohydrate, oil, fibre and moisture and if properly processed, could help the country in its drive for attainment of food security and vision 2020.

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Quelques dimensions d'incohérence de la politique commerciale du Maroc avec ses politiques sectorielles internes

[Some dimensions of incoherence of Moroccan trade policy with its internal sectoral policies]

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ABSTRACT: Morocco signed a range of preferential agreements with more than fifty partners. However, the balance of trade with them, benefits to the partners of Morocco against the interests of Moroccan firms. Similarly, the conclusion of new trade agreements such as that with Canada or UEMOA will degrade the trade balance of Morocco and will worsen its deficit.
The present paper aims to show the problem of inconsistency between trade policy of Morocco and its sectoral policies: agricultural, industrial and fisheries; since for foreign trade policy, a tariff reform based on the reduction of tariffs was implemented while the effort to promote and diversify the industrial and agricultural supply has not received the same necessary logical care. The causes of incoherence relate in particular to the existence of a dislocated economic sector, disintegrated and weakly competitive. In other words, The lack of competitive firms, able to satisfy, at competitive rates, domestic demand, to able to satisfy, at competitive rates, domestic demand, to compete internationally, to create employment for young people and promote social progress. The existing mechanisms of action as sectoral plans implemented since a good ten years have failed to boost economic growth and to achieve the objectives of intended development.
The role of the state at this time should focus on two points: first to support financially businesses and second, to support the cost of poorly studied and less thoughtful trade openness. This is based mainly on free trade with powerful and competitive markets.

KEYWORDS: trade deficit, preferential agreements, sectoral policies, moroocan trade policy, competitive capacity of Moroccan companies, tariff reform, role of the state, economic diplomacy.

RESUME: Le Maroc a signé une panoplie des accords préférentiels avec une cinquantaine de partenaires. Toutefois le bilan des échanges avec ceux-ci profite aux partenaires au détriment des intérêts des entreprises marocaines. De même la conclusion de nouveaux accords commerciaux tels que celui avec le Canada ou l'UEMOA dégradera davantage la balance commerciale du Maroc et aggravera son déficit.
Le présent papier vise à montrer le problème d'incohérence entre la politique commerciale du Maroc et ses politiques sectorielles : agricole, industrielle et de la pêche ; puisqu'en matière de politique de commerce extérieur, une réforme tarifaire fondée sur la réduction des droits de douane a été mis en place alors que l'effort de promotion et de diversification de l'offre industrielle et agricole n'a pas reçu le même soin logique nécessaire. Les causes d'incohérence sont liés notamment à l'existence d'un secteur économique désarticulé, désintégré et faiblement compétitif. Autrement dit, l'absence d'entreprises performantes aptes à satisfaire, à des conditions compétitives, la demande intérieure, à affronter la

concurrence internationale, à créer l'emploi aux jeunes et à favoriser le progrès social. Les mécanismes d'action existants et concernant les plans sectoriels mis en œuvre depuis une bonne dizaine d'années n'ont pas permis de relancer la croissance économique et d'atteindre les objectifs de développement escomptés.
Le rôle de l'Etat à l'heure actuelle doit être axé sur deux points : premièrement soutenir financièrement les entreprises et deuxièmement prendre en charge le coût d'une ouverture faiblement étudiée et réfléchie. Celle-ci est basée principalement sur le libre échange avec des marchés puissants et compétitifs.

MOTS-CLEFS: déficit commercial, accords préférentiels, politique commerciale marocaine, politiques sectorielles, capacités compétitives des entreprises marocaines, réforme tarifaire, rôle de l'Etat, diplomatie économique.

1 INTRODUCTION

Le Maroc a entamé une politique de libéralisation économique depuis mi-1980, consacrant l'insertion du Maroc dans les courants d'échanges et d'investissements internationaux comme choix stratégique déterminant.

La politique commerciale extérieure du Maroc associe à la fois le cadre bilatéral et le cadre multilatéral. En effet, le Maroc a participé au système commercial multilatéral en adhérant au GATT en 1987 et à l'OMC en 1994. En même temps, des accords de libre échange avec des puissances économiques mondiales ont été signés.

De même, le Maroc est une économie qui a consenti, ces dernières années, des efforts importants en faveur de la diversification sectorielle. En effet, nous avons assisté à la mise en œuvre de plans sectoriels anticipant quelques effets de relance de l'économie. Aujourd'hui, On recense au moins 14 stratégies sectorielles lancées en majorité après les premiers ALE. Il s'agit notamment du Plan Emergence (2005-2009), puis le Pacte National pour l'Emergence Industrielle (PNEI) à horizon 2015,le Plan Maroc Vert pour l'agriculture à l'horizon 2020, le Plan *Halieutis* pour le secteur de la pêche maritime à l'horizon 2020, la vision 2010 puis 2020 pour le tourisme, la Vision 2015 pour l'Artisanat, …Etc.

Le potentiel de l'économie marocaine est très élevé; toutefois, il est clair que depuis l'entrée en vigueur des accords commerciaux, nous assistons à un déficit commercial chronique et quasi général avec comme corollaire une diminution de la croissance économique et une aggravation du chômage des jeunes.

C'est dans ce contexte que s'inscrit l'évaluation de la politique commerciale marocaine et sa compatibilité avec les politiques internes. Evidement, cette recherche vise à étudier quelle cohérence existe-il entre cette politique commerciale et les politiques sectorielles dans le contexte de l'application des accords commerciaux préférentiels qui prévoient des exonérations voire des réductions de tarifs douaniers à l'import et à l'export.

Face à des firmes étrangères puissantes et à leurs stratégies d'envergure, et dans les conditions d'une ouverture principalement axée sur le libre-échange, l'économie marocaine peut –elle résister et être compétitive ? Comment le Maroc réagit-il aux contraintes du libre échange ? De quelles capacités compétitives dispose t-il ? Les différents accords conclus servent-ils pleinement les intérêts des entreprises qu'elles soient exportatrices ou importatrices ? Quelle pertinence des politiques publiques qui doivent accompagner ces choix ?

Dans ces conditions, il est temps de songer sérieusement sur les instruments susceptibles de renforcer la cohérence entre les négociations commerciales futures et les intérêts des entreprises. La démarche suivie dans ce travail est exclusivement qualitative.

2 FONDEMENTS DE LA POLITIQUE COMMERCIALE EXTERIEURE MAROCAINE

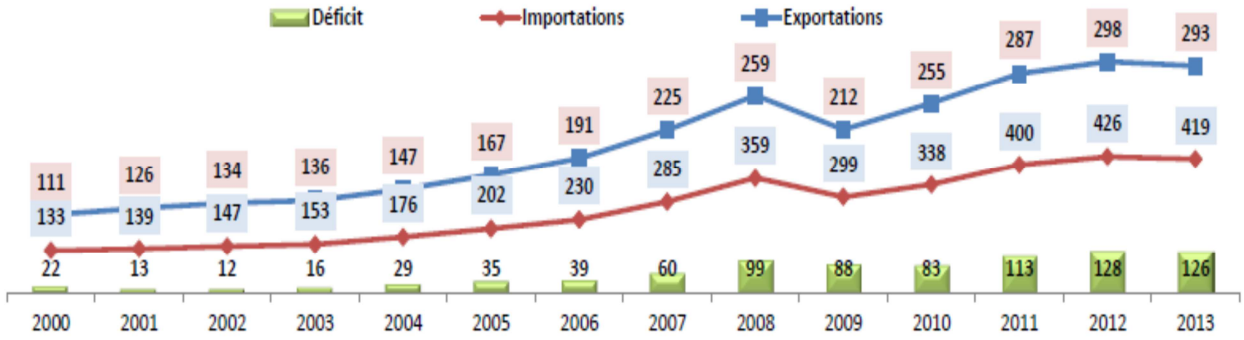
La politique commerciale du Maroc est basée sur la conclusion d'un réseau multilatéral, bilatéral et régional des accords commerciaux. Il s'agit en premier lieu de l'adhésion et la participation au système commercial multilatéral. Deuxièmement, la signature des accords commerciaux avec des partenaires commerciaux les plus puissants tels que l'accord avec l'UE et celui avec les Etats-Unis. Troisièmement, une volonté de renforcer les relations commerciales avec les pays du Sud : Accord de libre échange avec la Turquie visant à dynamiser le commerce régional en Méditerranée ; Accord d'Agadir avec la Tunisie, l'Egypte et la Jordanie, créant un espace sous-régional à grand potentiel;

Et enfin le développement des relations commerciales avec des regroupements régionaux en Afrique: Union Economique et Monétaire Ouest-Africain (UEMOA) et la Communauté Economique et Monétaire de l'Afrique Central (CEMAC) ;

Néanmoins, les résultats économiques de ces accords sont loin d'être bénéfiques pour le Maroc.

2.1 IMPORTANCE DU DEFICIT COMMERCIAL DE L'ECONOMIE MAROCAINE

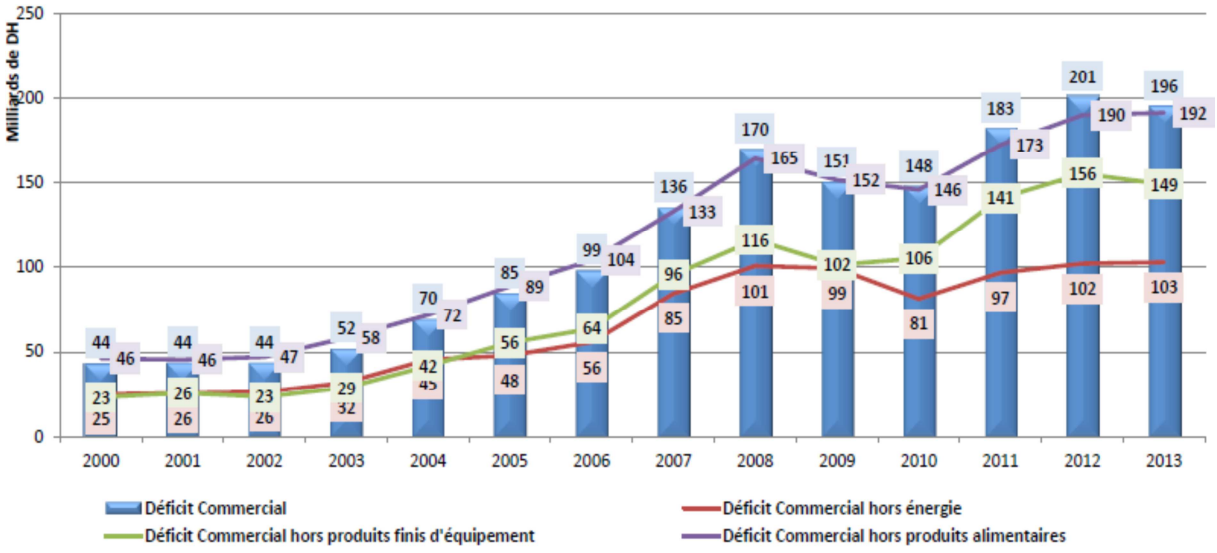
Graphique 1 : Evolution de la balance commerciale des biens et services (Milliards de DH)



Source: Office des Changes 2013

Comme le montre le deuxième graphique, la politique d'ouverture commerciale du Maroc est une ouverture par l'importation plus que par l'exportation.

Graphique 2 : Evolution de la composition du déficit commercial



Source: Office des Changes 2013

Les principaux produits participants à ce déficit sont l'énergie avec une contribution à raison de 8 points, les biens finis de consommation avec 3 pts, les Biens d'équipement 2,85 pts et les produits alimentaires à raison d'un (1) pt.

Le déficit commercial n'est que la résultante des différentes politiques économiques notamment la politique commerciale extérieure et les politiques budgétaire et monétaire adoptées par le gouvernement. Il est lié, en effet, à une politique budgétaire axée sur l'encouragement de la demande, et une politique de change fixe ajustée par les réserves de change.

Les déterminants de ce déficit commercial sont liés aux aspects concernant essentiellement la politique d'ouverture par les accords de libre échange adoptée par le Maroc, les effets de la conjoncture mondiale actuelle marquée par la flambée des cours mondiaux des matières premières et de l'énergie, une offre exportable peu diversifiée et peu élastique, un décalage conjoncturel entre la dynamique de croissance de l'économie marocaine et celle de ses principaux partenaires étrangers, sans nier bien sûr le fait que la dynamique de croissance de l'économie marocaine est tirée par la demande intérieure.

2.2 INCOMPATIBILITE DE LA POLITIQUE TARIFAIRE MAROCAINE

2.2.1 AU NIVEAU DU TARIF NON PREFERENTIEL (NPF)

Dans la structure tarifaire actuellement en vigueur, le nombre de lignes tarifaires a augmenté de 16 676 en 2002 à 17 735 en 2009[1]. À l'exception de 37 lignes avec des droits de douane variables, toutes les lignes portent des droits ad valorem, perçus sur la valeur CAF (cout-assurance-fret) des marchandises importées[2].

En 2002, le tarif appliqué par le Maroc se compose de 42 quotités différentes. Depuis cette année et à la suite de plusieurs réformes, le nombre de quotités applicables aux produits non-agricoles a été réduit de 13 à 6 en 2009 (en plus du taux zéro), soit généralement: 2,5; 7,5; 10; 20, 27,5; et 35 %.

Tout récemment une nouvelle réforme tarifaire telle que présentée au tableau 1 s'appliquant aux produits industriels et certains produits agroindustriels a été mise en place. Cette réforme a permis de réduire la dispersion des quotités tarifaires en les ramenant à quatre taux seulement : 2,5, 10, 17,5 et 25% sur les produits non-agricoles et d'abaisser le taux du droit d'importation à un maximum de 25% et un maintien du taux minimum de 2,5% pour les produits industriels.

Tableau 1 : Réforme tarifaire pour la période 2009-2012

Quotité en vigueur **2008**	**2009**	**2010**	**2011**	**2012**
2,5 %	2,5	2,5	2,5	2,5
10,0%	7,5	5,0	2,5	2,5
17,5%	10,0	5,0	2,5	2,5
25,0%	20,0	17,5	10,0	10,0
32,5%	27,5	27,5	25,0	17,5
40,0%	35,0	35,0	30,0	25,0

Source : Administration des douanes et impôts indirects, Services des études tarifaires (2012)

Aussi, le taux tarifaire sur les produits pétroliers a été ramené en 2009 à 2,5 pour cent dans le cadre du démantèlement tarifaire prévu par le cahier de charges pour la privatisation des sociétés de raffinage; ces produits bénéficient néanmoins actuellement d'une suspension du droit de douane. Les produits agricoles n'obéissent pas à cette structure tarifaire et sont soumis à des taux allant jusqu'à 304% ainsi qu'à des droits variables.

Il est à signaler que cette réforme tarifaire vise à engager un processus de réduction progressive des niveaux des quotités du droit d'importation afin d'éviter un différentiel de taxation excessif avec celui de L'UE à l'horizon 2012, année coïncidant avec la libéralisation tarifaire totale prévue par l'accord préférentiel Maroc-UE et éviter des détournements de trafic.

Outre la réduction des taux du droit d'importation, cette réforme tarifaire vise également deux autres objectifs: (i) lutter contre les fausses déclarations d'espèce et les manœuvres frauduleuses en matière de l'origine et (ii) diversifier les sources d'approvisionnement en évitant la polarisation des échanges sur les origines préférentielles.

Par ailleurs, le schéma de réforme tarifaire, présenté ici, se caractérise par un rythme de réduction tarifaire plus rapide pour les intrants comparativement aux produits fabriqués localement. « C'est une stratégie permettant de renforcer la compétitivité du secteur industriel marocain et d'améliorer sa productivité et dans le même sens affronter la concurrence des entreprises étrangères »[3].

Par produit[4], il parait que les tarifs sont caractérisés par une dispersion assez grande, avec des tarifs allant de 2,5% à plus de 300% pour les produits agricoles. Les biens d'équipement, l'outillage et leurs parties bénéficient d'un taux de 2,5%.

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[1] Selon les autorités douanières marocaines, cette hausse est due à l'introduction de nouvelles lignes tarifaires (i.e. l'individualisation des lignes) pour certains produits (tels que les produits chimiques appauvrissant la couche d'ozone) afin de respecter les engagements du Maroc dans le cadre de l'Accord de libre-échange avec les États-Unis d'Amérique et d'autres conventions internationales.

[2] Elle comprend le coût, l'assurance et le fret. Cf. Les Incoterms de la CCI (2010).

[3] Selon un entretien avec le responsable des études tarifaires. Administration des douanes, 2012.

[4] Définition de l'auteur d'après les sections et chapitres du tarif des droits de douane de l'ADII (2011).

Les tarifs les plus bas s'appliquent aux matières premières textiles, à la machinerie, les minéraux, les produits chimiques, les équipements de transport et les appareils de précision (tableau 2).

Il s'agit dans tous les cas de biens qui ne sont pas produits au Maroc et qui sont nécessaires pour l'intégration de l'appareil productif.

Les produits ayant un niveau de protection élevée sont pour la plupart des manufactures qui font concurrence à la production marocaine, tels que les produits de l'industrie agroalimentaire, les plastiques, les cuirs, articles en bois, papeterie, articles d'habillement, chaussures et bonneterie, articles en pierre, produits métalliques et autres manufactures. Les tarifs les plus élevés s'appliquent aux céréales et à la viande, et sont le résultat de la tarification des restrictions quantitatives dans le secteur agricole, ce qui implique que les tarifs douaniers introduits en substitution des licences ont augmenté pour les produits laitiers, les céréales, les huiles végétales et le sucre.

Pour les animaux vivants, des tarifs dépassant parfois les 300% sont appliqués, et certains encore plus élevés pour la viande.

Tableau 2: Protection tarifaire par secteur au Maroc

Code SH	SECTEURS	Tarifs douaniers MFN, Moyenne Simple (en valeur nominale) %	Dispersion tarifaire, (déviation typique)
	Année	2011	2011
CH1 au CH5	Animaux vivants et produits du règne animal	60, 48	73,51
CH6 au CH14	Produits du règne végétal	37,18	55,16
CH15	Corps gras	27,23	53,37
CH16 au CH24	Produits des industries alimentaires	38,51	44,46
CH25 au CH27	Produits minéraux	5,54	43,73
CH28 au CH38	Produits chimiques	6,37	36,99
CH39 au CH40	Matières plastiques et caoutchouc	18,64	33,93
CH41 au CH43	Peaux, cuirs pelleteries et fourrures...	7,84	33,22
CH44 au CH46	Bois, charbon de bois et ouvrages en bois	19,84	32,22
CH47 au CH49	Pâtes de bois, papier ou carton à recycler	18,15	31,54
CH50 au CH59	Matières textiles et ouvrages en ces matières	6,97	28,36
CH60	étoffes en bonneterie	10,43	28,14
CH61	Vêtements en bonneterie	29,23	27,86
CH62	Matières textiles et ouvrages en ces matières	27,63	27,52
CH63	Autres articles confectionnés	19,36	27,33
CH64	Chaussures	25,84	27,15
CH68	Ouvrages en pierre	24,22	9,74
CH69	Produits céramiques	21,61	10,59
CH70	Verre et ouvrages en Verre	11,78	13,12
CH71	Métaux précieux	2,5	13,05
CH72 au CH83	Métals de base	11,54	12,77
CH84 au CH85	Machinerie	6,68	11,88
CH86 au CH89	Matériel de transport	13,94	12,06
CH90 au CH92	Instruments de précision	2,87	11,77
CH93	Armes, munitions et leurs parties	2,5	11,72
CH94 au CH96	Machinerie et produits divers	16,23	11,98
CH97	Objets d'art, ou d'antiquité	2,5	11,97
	Total	**15,96**	**27, 23**

Source : Traitement des auteurs, base de données : Tarif des droits de douane au 01/01/2011, Service des études tarifaires, Administration des douanes (2011).

L'analyse de ces données de la protection tarifaire par secteur telle que présentée par le tableau 2 permet d'observer l'existence d'une plus grande protection pour certains produits agricoles et leurs dérivés (chapitres 1-20). Une protection faible est appliquée aux produits chimiques et minéraux (chapitres 25-38) et à certains produits intermédiaires tel que les

peaux bruts du chapitre 41, tandis que les produits intermédiaires des chapitres 42 à 59 sont moyennement protégés, avec des tarifs qui atteignent 30 %. Les produits textiles finis (chapitres 60-67) enregistrent des tarifs encore plus élevés afin de protéger la production nationale[5], tandis que les produits métalliques, l'outillage, les biens de capital et les biens de consommation ayant une grande valeur ajoutée et qui ne sont pas produits au Maroc (chapitre 82 et suivants) sont parmi les moins protégés, avec l'exception des produits de consommation fabriqués au Maroc, qui enregistrent des tarifs très élevés.

Ce volet relatif au tarif non préférentiel a largement été critiqué pour ses incohérences avec les priorités sectorielles définies par le Maroc. Ces critiques ont généralement porté sur le caractère insuffisamment protecteur des niveaux de droits de douane dans l'objectif de soutenir le développement de filières locales identifiées comme stratégiques.

2.2.2 AU NIVEAU DU TARIF PREFERENTIEL

Parallèlement au tarif NPF, le Maroc accorde, sur une base réciproque, des préférences tarifaires à ses partenaires commerciaux sous condition du respect des critères d'origine. Ce traitement préférentiel concerne les importations en provenance de la Grande Zone de libre-échange arabe, l'UE, l'AELE, les pays de sa région tels que l'Égypte, les Émirats arabes unis, la Jordanie et la Tunisie, et plus récemment la Turquie et les États-Unis. Or les problèmes de compréhension et d'interprétation de certaines règles spécifiques contenues dans ces accords, notamment les règles encadrant l'accord d'Agadir et celui de la GZALE, sont une source de conflits entre l'administration douanière marocaine et les douanes des pays partenaires.

De même, les données officielles[6] montrent une sous utilisation des préférences tarifaires accordées par les accords conclus. Les taux d'utilisation de ces préférences dans le cadre de l'accord avec l'UE par exemple sont alarmants pour l'économie marocaine.

Tableau 3 : Utilisation de l'accord préférentiel Maroc-UE en %

	2007	2008	2009	2010	2011	2012
Par les exportateurs marocains	***9,2***	***13,0***	***16,6***	***24,9***	***30***	***35***
Par les exportateurs des pays membres de l'UE	***39,8***	***38,9***	***47,3***	***45,5***	***45***	***50***

Source : élaboration des auteurs sur la base des données disponibles de l'Office des changes

Le commerce avec l'UE représente en 2010 près des deux tiers des transactions commerciales globales du Maroc (données de l'Office des changes). D'après le tableau 3, la part des exportations bénéficiant du traitement préférentiel dans les ventes totales du Maroc vers l'UE en 2010 s'établie à **24,9%**. Par contre les importations sous régime préférentiel représentent 45,5% des importations totales du Maroc en provenance de l'Union Européenne. Ces importations couvrent une gamme assez large de produits. Il s'agit des voitures industrielles et de tourisme, des produits chimiques, des machines et appareils divers, du fer et d'acier, des matières plastiques et des médicaments.

L'augmentation remarquable des importations préférentielles en provenance de l'UE est liée à augmentation de la consommation des ménages en faveur des produits importés. Cela est favorisé également par la forte demande émanant d'un développement important des secteurs rentiers qui n'apportent pas un surplus de richesse pour l'économie nationale à savoir le tourisme et le BTP.

Dans le cadre du commerce préférentiel de l'UE, il faut constater que les pays membres de l'UE facilitent l'accès à leur marché en faveur des produits en provenance de certains partenaires tels qu'Israël, l'Egypte, le Liban, la Jordanie et la Turquie. Ces pays bénéficient des réductions tarifaires importantes comparativement aux avantages tarifaires accordés au Maroc, l'Algérie et la Tunisie.

[5] Il est à remarquer que le Maroc enregistre un fort avantage comparatif dans la branche habillement qui regroupe la confection et la bonneterie (avec des tarifs encore élevés), alors qu'il subit un moindre avantage comparatif dans le textile (avec des tarifs très faibles), du fait du manque de matières premières, de main-d'œuvre qualifiée et de technicité de la branche et de la nécessité d'investissements lourds pour rester compétitifs.

[6] Office des changes. Commerce extérieur sous régime préférentiel des accords de libre échange. 2007-2012.

Tableau 4: Droits préférentiels appliqués par chapitre du SH en 2011 (en %)[7]

	Chapitres 01 à 97 du SH	Chapitres 01 à 24 du SH	Chapitres 25 à 97 du SH
NPF	**4,83**	**10,10**	**3,63**
Algérie	1,12	5,84	0,05
Égypte	0,02	0,10	0,00
Israël	0,20	0,81	0,03
Jordanie	0,46	1,95	0,00
Maroc	**1,06**	**5,53**	**0,03**
Liban	0,10	0,34	0,03
Turquie	0,46	2,32	0,03
Tunisie	1,12	5,87	0,03

Source: Estimations du Secrétariat de l'OMC, d'après les données de la Commission européenne et traitement des auteurs.

D'après les données du tableau ci-dessus, il faut constater que les exportateurs marocains de produits agricoles et agro-alimentaires souhaitant franchir le marché de l'UE, en bénéficiant des avantages de l'accord préférentiel, doivent payer un taux moyen de droits préférentiels de l'ordre de 5,53 %. Les droits préférentiels accordés aux produits made in Israël (0,81%) sont presque 7 fois moins cher que ceux fixés aux produits marocains.

Le tarif préférentiel des droits de douane de l'UE est fortement protectionniste pour les produits européens sensibles, notamment agricoles et agroalimentaires.

2.3 INCOMPATIBILITE DE LA POLITIQUE NON TARIFAIRE

Le tissu productif marocain est parmi les plus fragiles : le marché marocain est peu protégé, notamment par des normes et des réglementations sanitaires, environnementales et de sécurité. Cela met les producteurs marocains face à une concurrence rude avec le secteur importateur, dont les fournisseurs bénéficient souvent de mesures d'aides à l'export, formelles ou non, de la part de leurs pays respectifs, sans compter les barrières non tarifaires protégeant leurs marchés intérieurs.

Dans les pays en développement dont le Maroc, les barrières non tarifaires portent de plus en plus sur des mesures procédurales liées notamment à la bureaucratie et le manque de transparence.

D'après les résultats de l'étude sur les mesures non tarifaires dans les pays du sud et l'est de la Méditerranée, réalisée par le Laboratoire d'économie appliquée au développement de l'université de Toulon pour le compte de la Banque mondiale, «Beaucoup de mesures non tarifaires sont concentrées dans le secteur agricole et celui de l'agroalimentaire, notamment en Tunisie et au Maroc». Au Maroc 50% MNT concernent ces deux secteurs et 75% en Tunisie. D'autres secteurs sont également concernés comme le textile, les produits chimiques et le matériel électrique. En nombre, l'étude a identifié près de 10.000 MNT au Maroc contre 75.000 en Tunisie.

3 INEFFICACITÉ DES PLANS SECTORIELS ADOPTÉS ET LEUR INCOHÉRENCE AVEC LES ACCORDS CONCLUS

Depuis plus d'une dizaine d'années, le Maroc a basé sa politique de développement sur la mise en place d'un bon nombre de stratégies sectorielles. La définition de ces stratégies sectorielles a été faite en général après la définition de la politique commerciale et la signature des ALE. Ces stratégies sectorielles n'ont pas intégré dans leur conception les opportunités et les défis liés à la signature de ces ALE. Chacune de ces stratégies comporte des objectifs chiffrés d'impact sur la croissance additionnelle du PIB, la création d'emplois et l'amélioration des conditions de travail.

Aujourd'hui, l'examen des résultats de ces différents plans sectoriels fait ressortir des carences en matière de coordination et de suivi qui sont autant d'entraves à leur mise en œuvre, sans compter l'importante hétérogénéité au niveau des bases de travail, du chiffrage des besoins en investissement et en ressources, de l'analyse et des horizons de temps de ces stratégies sectorielles nationales.

[7] *OMC (2011), Examen des politiques commerciales, WT /TPR/S/ 248*

En effet, lors de la phase de conception, chaque secteur développe sa stratégie de manière indépendante, sans chercher à capitaliser et à s'appuyer sur les effets d'entraînement des autres stratégies ainsi qu'à garantir une cohérence intersectorielle et des synergies avec les départements et institutions concernés.

De plus, la contribution des stratégies sectorielles à la croissance économique du pays reste limitée. En effet, les niveaux de croissance marocaine au cours des dernières années sont de l'ordre de 4,8% en moyenne sur la période 2001-2012[8] et sont essentiellement basés sur la part du PIB agricole, qui reste conséquente et explique la relative volatilité de la croissance, impactée par les aléas de la pluviométrie sur les campagnes agricoles ;

3.1 QUELQUES CAS D'INCOHERENCE LES PLUS ILLUSTRATIFS DANS LE SECTEUR AGRICOLE

Le secteur de l'agriculture est un élément important du tissu économique et social marocain. En 2012, il représente 15 % du PIB avec 43 % de la population active et plus de 78 % des emplois en zone rurale. Il demeure la principale source d'emplois du pays. Le salaire horaire moyen au Maroc se situe entre 0,55 et 0,65 euro, les travailleurs saisonniers n'ont pas pu bénéficier pleinement des droits du travail et la main-d'œuvre infantile est présente dans les exploitations agricoles marocaines. Le secteur de l'élevage est également important pour l'économie agricole du Maroc; il représente 30 % de la valeur ajoutée agricole et 20 % de la main d'œuvre rurale.

Le secteur agricole du Maroc dépend de plus en plus des importations de matières premières telles que les céréales, le lait, le sucre et l'huile alimentaire, ce qui a des répercussions négatives sur la souveraineté alimentaire.

3.1.1 CAPACITES AGRICOLES DU MAROC ET DEFIT DE LA SECURITE ALIMENTAIRE

Aujourd'hui, nous assistons à une transition nutritionnelle aussi bien en milieu urbain que rural. En effet, le profil nutritionnel par pays de l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO) conclut qu'au Maroc, «l'alimentation se diversifie progressivement, surtout pour les ménages urbains et les classes plus aisées».

En milieu urbain, les aliments prêts à consommer et la restauration hors domicile couplés à une réduction de l'activité physique deviennent plus courants dans la société marocaine favorisant ainsi la consommation d'aliments riches en sucre et en graisse et conduisant à la progression du surpoids et de l'obésité dans la population adulte.

Aussi, le Maroc dispose d'un important potentiel agricole inexploité. Bien que, le pays est producteur de primeurs et d'agrumes destinés à l'export, avec des disponibilités importantes en viande et en poisson qui lui procure une satisfaction de ses besoins à 100% dans les bonnes années de récolte[9], la production marocaine en blé et en orge reste insuffisante pour satisfaire la forte demande intérieure.

En effet, le Maroc, est structurellement déficitaire en produits de base comme les céréales, le sucre et les oléagineux. De mauvaises récoltes suite à des sécheresses associées à la forte augmentation du prix des céréales expliquent les dégradations importantes du solde commercial d'une année sur l'autre. « Le taux d'autosuffisance varie de 30 à 75 % pour les céréales et s'élève en moyenne à 50 % pour le sucre. Mais en termes d'exportations, les recettes en devises que procurent l'agriculture, la pêche et les industries agroalimentaires représentent ensemble 35 % des exportations marocaines globales »[10].

La balance commerciale pour les produits agroalimentaires est déficitaire. « En 2012, le Maroc a exporté pour 2,5 milliards d'€ de produits agroalimentaires, et en a importé pour 4,4 milliards d'€, soit un solde déficitaire de 1,9 milliards d'€ »[11].

« Les exportations marocaines sont constituées des produits de la mer et des préparations de poissons (conserves de sardines en particulier) avec 1,3 milliard d'€ (soit plus de 40%). Viennent ensuite les légumes avec 643 millions d'€ (dont tomates 314 millions d'€) et les agrumes avec 281 millions d'€.

[8] *Conseil Economique, Social et Environnemental, (2014). Cohérence des politiques sectorielles et accords de Libre-échange : fondements stratégiques pour un développement soutenu et durable, Rabat, Mai, Page 37.*
[9] *Ministère de l'Agriculture et de la Pêche Maritime 2012.*
[10] *Ministère de l'agriculture de l'agroalimentaire et de la forêt France. Les politiques agricoles à travers le monde, quelques exemples. Page 4. Adresse consultée le 12 Août 2014 : http://www.agriculture.fr*
[11] *Idem.*

Les importations marocaines ont atteint 4,4 milliards d'€ en 2012. Le premier poste des importations est de très loin les céréales (1,7 milliard d'€, dont blé 1,1 milliard d'€, maïs 500 millions d'€, pour lesquelles les principaux fournisseurs sont la France, le Canada, l'Ukraine et l'Argentine). Viennent ensuite les huiles et corps gras (435 millions d'€, dont 372 millions d'€ d'huile de soja, importée surtout des États-Unis et d'Allemagne) et les sucres (463 millions d'€), essentiellement du sucre de canne importé du Brésil[12].

Certes, les pouvoirs publics ont pris conscience des défis auxquels l'agriculture marocaine est exposée. En témoigne la mise en place du plan Maroc vert. Toutefois cette même agriculture reste peu valorisée. D'après une étude prospective du HCP[13], les productions agricoles restent dans l'ensemble peu valorisées et peu valorisantes. L'intégration de l'agriculture et de l'agro-industrie peut être considérée comme faible puisque les agro-industries ne représentent que 5% du PIB contre plus de 15 % dans les pays plus avancés.

Les productions à signes de qualité : produits de terroir, biologiques, labels et identification géographique, sont encore marginales. Le maraîchage et les plantations ne représentent chacun que 15% de la valeur ajoutée de toutes les productions végétales contre 55 % pour les céréales. Pour les exportations, elles restent concentrées sur quelques produits de base et quelques marchés. Les cultures maraîchères et agrumes, principales productions destinées à l'export, n'occupent respectivement que 3 et 0,85% de la surface agricole utile (SAU)[14], et les prix à l'export sont inférieurs à ceux enregistrés dans d'autres pays méditerranéens. L'étude note également que «L'offre exportable limite aussi l'accès à de nombreux marchés et la pleine exploitation des préférences obtenues».

La structure des exploitations marocaines est relativement duale, même si des catégories intermédiaires existent. Les petites exploitations familiales de moins de 5 hectares dominent le paysage agraire (plus de 70% du total des exploitations marocaines couvrant moins du tiers de la surface agricole hors parcours), mais ce sont les plus grandes qui assurent l'essentiel des exportations.

Le morcellement du foncier agricole rend difficile la pratique d'une agriculture performante, et entrave considérablement l'introduction de technologies avancées dans la gestion de l'eau, le traitement des terres et l'encadrement technique des agriculteurs, d'autant plus que le taux d'analphabétisme avoisine 70 % en milieu rural. Les unités industrielles agroalimentaires marocaines mettent souvent en avant le problème de l'approvisionnement des unités de transformation comme obstacle important à leur développement.

L'agriculture marocaine se caractérise par la rareté des terres arables. Seules 12% des terres sont considérées comme surface agricole utile (S.A.U).

Afin de surmonter ces défis, la FAO recommande un certain nombre de mesures telles qu'une meilleure valorisation des terres bour, l'aménagement des bassins versants pour réduire les pertes dues à l'érosion et de façon générale l'adoption de techniques d'agriculture durable.

3.1.2 EFFETS LIMITES DE L'ACCORD MAROCO-EUROPEEN SUR L'AGRICULTURE ET DU PLAN MAROC VERT

L'Accord agricole UE-Maroc signé en 2012, consacre des relations bilatérales difficiles pour le Maroc du fait de la concurrence des fruits et des légumes des pays d'Europe du sud, de polémiques sur les dépassements de quotas et des allégations de non-respect, à certaines époques, des prix d'entrée des tomates marocaines, produit phare de l'accord.

La modification du système de prix d'entrée des fruits et légumes marocains sur le marché européen adoptée par la commission de l'agriculture en 2014 au sein du Parlement Européen remet en cause l'accord sur l'agriculture qui vient d'entrer en vigueur et aura des conséquences néfastes sur les opérateurs ayant investis et cru à un partenariat sérieux et à un marché porteur.

Certes, cet acte concerne aussi bien le Maroc que les autres partenaires de l'UE, toutefois c'est le Maroc qui sera le plus touché et ce en raison de la nature de ses échanges avec l'UE composées principalement des fruits et légumes. Par suite,

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[12] Idem

[13] Haut Commissariat au Plan. « Agriculture 2030, quel avenir pour le Maroc ? ». Adresse consultée le 12 Août 2014 : http://www.hcp.ma/

*[14] La **surface agricole utile** (SAU) est un instrument statistique destiné à évaluer la surface foncière déclarée par les exploitants agricoles comme utilisée par eux pour la production agricole. Elle se compose par exemple de la grande culture, des cultures maraichères, des cultures fourragères, surfaces toujours en herbe, jardins familiaux des agriculteurs…Elle n'inclut pas en revanche les forêts.*

cette démarche européenne n'est pas de nature à créer un climat de confiance et de sérénité favorable à l'établissement d'un partenariat équitable et durable notamment pour l'accord qui est en cours de négociation actuellement, l'ALECA.

Aussi, cet accord agricole est doublement injuste. Car l'accord de libre-échange passé entre l'Union Européenne et le Maroc dans le domaine agricole se fait clairement au détriment des agricultures familiales et paysannes du Maroc. Les principaux bénéficiaires sont les grands groupes multinationaux notamment français (Soprofel IDYL implanté à Agadir et Dakhla, SOFIPROTEOL[15], CASTEL[16], BEL[17] et DANONE[18]), centrés sur une agriculture exportatrice, en défaveur du droit à la souveraineté alimentaire des populations concernées, du respect de l'environnement et du droit social (travail des enfants, interdiction des syndicats…).

En outre un tel accord encourage le développement de formes d'agriculture capitalistique, et incite à l'accaparement des terres. Enfin, un tel accord met donc en concurrence deux types d'agriculture de part et d'autres de la Méditerranée, mais par le jeu des contreparties liées à cet accord, il oppose également par exemple les producteurs de légumes et les céréaliers, au détriment des premiers. Un tel accord devrait donner lieu avant signature à une analyse précise des conséquences économiques, sociales, et environnementales, ce qui n'est pas fait.

L'accord agricole est complété par l'adoption en 2008 d'une politique agricole tournée vers l'avenir : le Plan Maroc Vert à l'horizon 2020. Les enjeux du Plan Maroc Vert sont le développement économique du pays, la réduction de la pauvreté et la lutte contre l'exode rural.

Le plan est fondé sur deux piliers, correspondant à un double enjeu pour le Maroc. Ces deux piliers visent respectivement:

1- la création de grands pôles économiques dans les régions agricoles riches. Il s'agit de développer une agriculture moderne et à haute valeur ajoutée, orientée en grande partie vers l'export afin de générer des devises, en s'appuyant sur l'investissement privé, ce qui nécessite d'attirer des capitaux extérieurs et de mobiliser l'épargne.

2- le développement d'une petite agriculture orientée vers le marché intérieur et la lutte contre la pauvreté : ce volet plus délicat, concerne les petites exploitations situées dans des zones difficiles (montagne, zones sahariennes,...). Trois cent à quatre cent projets sociaux visant la reconversion des exploitations fragiles devraient être financés.

Face à cette stratégie agricole, les bailleurs de fonds internationaux se sont mobilisés telles que l'Agence française pour le développement (AFd) et l'Union européenne. En effet, le Maroc a pu bénéficier d'un programme européen d'appui à la politique sectorielle agricole (« PAPSA ») doté d'un budget de 70 m€ en faveur du pilier II du Plan Maroc Vert, c'est-à-dire consacré au développement de la petite agriculture. Ce premier Plan sera suivi d'un second doté de 60 M€.

Ce Plan vise quelques objectifs ambitieux : faire hausser la valeur ajoutée de son produit intérieur brut (PIB) agricole, quadrupler la production d'huile d'olive d'ici 2020 pour atteindre le chiffre de 340 000 tonnes, porter à 3,7 millions de tonnes la production d'agrumes au lieu de 1,5 million actuellement et à 10 millions de tonnes celle des fruits et légumes contre 4,45 millions à l'heure actuelle. Dans le même temps, la superficie destinée aux céréales passerait de 5,3 millions d'hectares à 4,2 millions. Le gouvernement marocain affirme vouloir augmenter la productivité, bien que les investissements étrangers soient orientés vers le secteur des fruits et légumes, fer de lance des exportations marocaines.

Néanmoins, la priorité donnée à ce secteur n'a pas conduit à faire disparaître l'agriculture vivrière au Maroc. Cette stratégie n'a pas non plus permis au Maroc de garantir sa sécurité alimentaire.

Après quelque années de la mise en œuvre de cette stratégie agricole visant à développer l'économie agricole marocaine, il est important de souligner que les objectifs du Ier pilier du Plan vert, à savoir une augmentation des exportations de fruits et légumes, surtout ceux provenant de cultures irriguées ont été relativement atteints. En effet, les résultats de l'étude d'évaluation d'impact menée par le Cabinet de conseil ECORYS en 2013, sont illustratifs.

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[15] SOFIPROTEOL est devenu en 2012 actionnaire de référence du groupe marocain « Lesieur Cristal », numéro un national de l'huile alimentaire et du savon avec le rachat de 40 % du capital de Lesieur Cristal Maroc.

[16] Le groupe CASTEL est notamment propriétaire des Brasseries du Maroc, d'une usine d'eau minérale, de vignobles et de plantations d'oliviers.

[17] BEL, dont les produits sont très présents sur les marchés marocains, possède une usine à Tanger. (1 300 personnes, 40 000 tonnes de fromage fondu et frais fondu dont 50 % à l'export.

[18] DANONE a pris le contrôle début 2013 de la Centrale Laitière avec 65 % du capital, est le n°1 du marché des produits laitiers au Maroc, avec un chiffre d'affaires de plus de 6 milliards de MAD et une part de marché de plus 60 %. C'est également un très gros acheteur de génétique animale française.

Les modèles employés dans cette étude montrent une possible expansion du secteur des fruits et légumes et des produits d'origine végétale traités grâce à la mise en place d'une zone de libre-échange approfondi et complet. Par contre, en ce qui concerne les céréales et autres cultures devrait être les plus grands perdant de l'ALECA (2,7 % de réduction de la production à long terme), principalement dû à l'alignement des MNT du Maroc à celles de l'UE[19].

Mais l'agriculture marocaine et le plan vert demeurent entravés par la **rareté des terres cultivables**. En effet, seuls 12 % du territoire sont classés comme superficie agricole utile, avec un fort pourcentage de terres non irriguées. Les petites exploitations familiales de moins de 5 hectares dominent le paysage agricole : plus de 70 % du total des exploitations marocaines occupent moins d'un tiers de la superficie agricole[20].

Par produit, les céréales occupent 65 % de la superficie agricole, suivies par les vergers – agrumes- oliviers avec 11 %, puis les cultures industrielles – betterave à sucre- canne à sucre avec 4 %, les légumineuses 4 % également et les cultures maraîchères – tomates- fraises et melons 3 %.

3.1.3 RESULTATS INSUFFISANTS DU PLAN HALIEUTIS DEDIE A LA PECHE MARITIME

Le secteur de la pêche contribue pour un peu plus de 1% au PIB national et pour la moitié environ des exportations des produits alimentaires. Il emploie près de 450 000 personnes dont 150 000 marins. La production globale moyenne au cours des 5 dernières années s'élève à plus de 900 000 tonnes.

Dans le secteur de la pêche, le Maroc a adopté en 2009 une stratégie de développement du secteur à l'horizon 2020, le plan Halieutis, avec pour objectifs l'exploitation durable des ressources halieutiques, l'amélioration des performances des acteurs et la compétitivité des entreprises en termes de valorisation, de qualité et de prix de revient des produits. Les résultats se font encore attendre, avec peu de projets et un faible niveau de concertation avec les professionnels.

Cependant, le Maroc est sérieusement touché par la raréfaction de la ressource autour des grands ports de pêche (Safi), notamment dans l'Atlantique au nord du pays. Cela explique la fermeture d'unités de transformation.

Aussi, l'aquaculture (Pisciculture et Conchyliculture – Algoculture) peine à se développer. Soulignons que l'objectif était d'atteindre une production aquacole significative, au vue du potentiel marocain, de manière à atteindre une production de 200.000 Tonnes pour une valeur de plus de 2 Milliards de DH en 2030. Actuellement seuls 450 tonnes de poissons et de coquillages sont produits par les trois sites en exploitation à Mdiq, Oualidiya Et Dakhla[21].

3.2 QUELQUES CAS D'INCOHERENCE LES PLUS ILLUSTRATIFS DANS LE DOMAINE INDUSTRIEL

L'un des enjeux majeurs de l'industrie nationale, les accords préférentiels conclus se présentent comme un facteur de risque pour le secteur industriel. En effet, déjà faible, ce secteur aura du mal à faire face à la concurrence du secteur industriel des partenaires européens et américains biens préparés.

La notion de la cohérence suppose que la politique industrielle et la politique commerciale doivent être intégrées dans la politique globale de développement du pays. Il est aussi important d'harmoniser la mise en œuvre des accords de libre échange avec les stratégies et programmes de développement industriel national. Or, dans le cas marocain, les stratégies nationales ont été adoptées plusieurs années après la libéralisation de l'économie et des échanges extérieurs.

La consolidation de l'offre exportable en même temps que « le développement des forces productives » pour reprendre les mots de F. List représentent des priorités pour un pays donné avant l'ouverture de son marché. Dans le cas de certains pays, la mise en place de la politique industrielle s'est faite naturellement avant la mise en place de la politique commerciale, pour être en adéquation avec les besoins et les objectifs de développement du pays.

La Turquie par exemple possède-t-elle une stratégie sectorielle entièrement dédiée à l'exportation, en adéquation avec ses prévisions de croissance et l'augmentation de ses ALE. L'élaboration de cette stratégie s'est faite en collaboration étroite

[19] *ECORYS, (2013). Evaluation de l'impact commercial durable en support des négociations pour un Accord de Libre-échange Complet et Approfondi entre l'Union Européenne et le Maroc. Résumé analytique, Rotterdam, Page 8.*

[20] *Conseil Economique, Social et Environnemental (2014). Cohérence des politiques sectorielles et accords de Libre-échange: fondements stratégiques pour un développement soutenu et durable, Page 213.*

[21] *Données du département de la pêche maritime 2012.*

avec le secteur privé pour lui permettre une meilleure opérationnalisation et en prenant en compte les besoins sur le terrain. La Turquie conçoit le commerce extérieur comme un moteur de croissance et adapte son économie en fonction de cela. La diversification de ses partenaires s'élabore en fonction de son offre exportable.

De plus, la Corée du Sud a investi fortement dans le capital humain et la recherche et développement (R&D) pour accompagner ses stratégies sectorielles. L'excellence a été mise en avant par le décernement de plusieurs prix par le Président de la République. A titre d'exemple, dès 1964, le prix présidentiel du meilleur exportateur a été mis en place, lors de la journée de l'Export, l'Export Day. Promouvoir les PME et la fabrication de produits à très forte valeur ajoutée et innovants fait partie des objectifs phares des stratégies sectorielles observées en Corée de Sud. L'investissement dans la R&D est un élément clé de la réalisation des objectifs de croissance et permet au pays de se distinguer de ses concurrents.

Tous ces pays sont dotés de dispositifs de contrôle de la qualité des produits pour promouvoir leur label à l'international et fournir des produits conformes aux standards internationaux. Là encore, la question de l'image et l'association à un label de qualité sont cruciales, lorsqu'on construit et compte préserver une réputation qui constitue un argument de vente.

Au niveau de la négociation des accords de libre-échange, les pays disposent de personnels qualifiés et spécialisés dans les techniques de négociation. La collecte sur le terrain de l'information stratégique leur permet de disposer d'informations cruciales, déterminantes dans le rapport de force. Ainsi le Chili a-t-il mis en place un comité interministériel pour les négociations économiques internationales et un comité pour la participation du secteur privé aux négociations. La question du renseignement au service de l'appareil industriel et commercial de l'Egypte est sous-jacente au regard des prérogatives de l'Unité de renseignement industriel (IIU) et de la Trade Agreements Sector (TAS)[22].

Une fois les ALE effectifs, les pays en retirent un réel profit. Le Chili mise sur les accords commerciaux régionaux et sait en tirer avantage pour développer le commerce intra-régional (92% du commerce de marchandises avec ses partenaires préférentiels). Les Etats-Unis ne négocient des ALE que dans des zones où ils sont certains de pouvoir disposer d'un avantage comparatif absolu, en matière d'échanges commerciaux. Ils redoublent d'efforts pour surveiller et faire appliquer rigoureusement les ALE existants, à travers l'Interagency Trade Enforcement Center, créé en 2012.

Au niveau de la défense commerciale, l'ensemble de ces pays a mis en place des mécanismes pour se protéger contre les importations déloyales. La Turquie dispose d'une direction générale des importations, qui défend les intérêts des producteurs nationaux en utilisant les outils de défense commerciale contre les importations qui causent un préjudice à la branche de production nationale. L'Egypte a créé le Trade Agreements Sector, un organisme au sein du ministère du Commerce et de l'Industrie, qui protège l'économie égyptienne des pratiques commerciales déloyales et, en même temps, négocie et administre les accords bilatéraux, régionaux et multilatéraux. La Malaisie s'est dotée de mécanismes contre les pratiques déloyales dès 1993, la Tunisie en 2000.

Quant au secteur privé, non seulement il est impliqué dans la négociation des accords, mais il reçoit également des formations et les explications nécessaires pour comprendre les implications des ALE effectifs et savoir en tirer profit.

Inversement, si on revient au cas marocain, les acteurs économiques et sociaux ne participent pas de manière active à la conception, au suivi et à la mise en œuvre des accords commerciaux. Pire encore, le parlement lui aussi est largement écarté de l'ensemble de ces sujets en raison de l'absence des moyens humains et matériels suffisants ou probablement à cause du caractère hautement politique de certains accords.

Aussi, une fois le libre échange est mis en place, il est constaté que la réaction marocaine s'est caractérisée par de nombreuses contradictions, notamment:

Premièrement, la réaction est impulsée de l'extérieur. Elle n'est pas l'aboutissement d'une dynamique interne. « Le programme d'ajustement structurel dont l'application a inauguré le processus de la libéralisation de l'économie marocaine a été conçu et piloté par les instances internationales le F.M.I et la Banque mondiale. Quant au projet de libre-échange, consécration de la libéralisation, il a été confectionné et proposé par l'Union Européenne à l'ensemble des pays de la méditerranée dont le Maroc »[23].

Deuxièmement, une contradiction de la politique économique marocaine : d'un coté le secteur privé est officiellement déclaré comme principal acteur de la croissance économique et, de l'autre côté, les pouvoirs publics privent ce même

[22] *Rapport CESE (annexe), Op cit.*
[23] *DKHISSI, S (2014). Le Maroc à l'épreuve de la mondialisation, plaidoyer pour un ajustement historique, P35. UM5-Rabat.*

secteur de la condition naturelle à son développement a savoir le marché local, en adhérant à la zone de libre-échange euro-méditerranéenne qui condamne le secteur à une concurrence inégale sur son propre marché local.

La troisième contradiction provient de l'esprit dans lequel ont été administrées un ensemble de réformes et mesures telles que la libéralisation du commerce extérieur, les privatisations, la libéralisation bancaire et financière, la réforme du cadre juridique des activités commerciales et la création des zones off-shore. En effet, comme la nature de celles-ci le montre bien, l'objectif recherché est l'attraction des investissements extérieurs.

Car, tant que les véritables réformes structurelles demeurent écartées en l'occurrence une refonte institutionnelle profonde et l'instauration d'un système national public et privé de gouvernance, le recours à ces investissements s'avère nécessaire pour remédier à la faiblesse des investissements intérieurs et pour financer les déficits extérieurs.

D'autres formes d'incohérence les plus significatives sont liées à une transformation insuffisante de la production locale au profit de l'exportation des matières premières à l'état brut et de certains produits agricoles: phosphates, olives, arganiers…, alors qu'à partir des années 1980 jusqu'à maintenant les cours de ces matières premières ne cessent de chuter.

Aussi, constituées essentiellement de micros, de petites et de moyennes entreprises, le tissu productif marocain souffre de plusieurs contraintes. Il est entravé par la sous-capitalisation, le manque de formation, le faible niveau d'encadrement, et le développement rapide du secteur informel (demeurant concentré dans quelques grandes villes : Grand Casa, le Nord et l'oriental), qui fragilisent sa situation.

Les échanges commerciaux avec l'Europe dans le domaine industriel favorise majoritairement le transfert d'activités à fort contenu de main d'œuvre et à faible valeur ajoutée. C'est un commerce qui favorise peu l'émergence d'activités pourvoyeuses d'emplois de haut niveau, en adéquation avec les aspirations et les qualifications d'une jeunesse marocaine de plus en plus ambitieuse et ouverte sur le monde.

4 MECANISMES D'ACTION EN FAVEUR D'UNE CORRECTION DE LA TRAJECTOIRE DU COMMERCE EXTERIEUR MAROCAIN DESEQUILIBRE ET LIMITE

Plusieurs issues peuvent être mises en évidence :

4.1 OBLIGATION DE COHERENCE ET DE COORDINATION ENTRE LES ACTEURS PRIVES ET LES NEGOCIATEURS PUBLICS DES ACCORDS FUTURS

La question des accords commerciaux préférentiels est fondamentale pour les entreprises marocaines. Ces accords de manière directe ou indirecte ont un impact sur leurs activités.

Les accords sont négociés essentiellement sous l'angle des relations entre quelques institutions de l'Etat Marocain et les institutions des partenaires extérieurs. L'approche strictement juridique de ce processus ne laisse que peu de place à la participation ou à l'influence des acteurs privés.

En principe, la multiplication des accords préférentiels doit se faire en accord avec l'industrie. Or, en l'état actuel des choses, il semble que cette dernière soit insuffisamment consultée et que les accords résultent davantage de stratégies politiques. Aussi, il est à signaler que les négociations bilatérales semblent se faire avec moins de transparence que celles menées au sein de l'OMC.

Selon les résultats d'un sondage reposant sur un panel de 102 entreprises réalisé en 2011 par nous même, plus de 40 % des entreprises avaient l'impression que le gouvernement n'était pas assez attentif à leurs intérêts et ne les écoute pas. Les responsables ont une oreille sélective, ils écoutent avant tout les grandes multinationales.

Ainsi par cohérence, l'Etat marocain aurait un « devoir de réparation » et devrait financer les coûts de sa politique d'ouverture. Il devrait mettre en place des mécanismes spécifiques à même de développer la compétitivité des entreprises et les inciter à préserver l'emploi sur le territoire marocain. Il se doit de soutenir les petites entreprises qui ne disposent souvent que de faibles moyens. Dans ce sens, il faut saluer le récent dispositif préférentiel d'accès des PME aux marchés publics comme un puissant facteur de développement des PME marocaines, notamment les plus innovantes. Du coté des entreprises, au lieu de « se plaindre », elles se doivent d'anticiper, c'est-à-dire pratiquer un système de veille économique, commercial et technique.

Aussi, il serait souhaitable qu'en plus d'une amélioration des procédures d'association aux négociations, la réalisation d'une évaluation à priori de l'accord de libre-échange tant sur le plan macro-économique qu'au niveau des différents secteurs d'activité ainsi que la tenue d'une série de consultations interministérielles avec le secteur privé pour examiner les différents contours et dimensions possibles de l'accord est indispensable.

La généralisation du recours à des études d'impact aura pour effet de satisfaire au mieux les intérêts des entreprises. En effet, avant de commencer la négociation d'un accord de libre échange, il est indispensable de collecter le maximum d'informations par rapport au partenaire mais aussi par rapport à l'économie nationale, ses besoins, les problèmes dont souffrent l'industrie nationale et les secteurs aptes à confronter la concurrence internationale.

Au niveau des actions futures en matière de pilotage de la politique commerciale extérieure, il est judicieux de rationnaliser le processus de conclusion des accords de libre échange, en instaurant une structure efficace dédiée à la négociation[24]. Cette structure à l'image de celle de l'Europe et des Etats-Unis, se chargera de négocier tous les accords sur la base des compétences et du professionnalisme de ses membres. Bref, il s'agit d'une équipe composée d'experts qui maîtrisent parfaitement leur dossier, connaissent bien leurs intérêts et domine à la fois au niveau technique et tactique pour une collaboration fructueuse, productive et qui servira au mieux les entreprises marocaines.

A titre de comparaison, lors des négociations pour la conclusion de l'accord entre le Maroc et les Etats-Unis par exemple, les équipes ayant négocié cet accord sont asymétriques. Cette asymétrie s'exprime par le fait que « les Etats Unis disposent d'une structure professionnelle, l'USTR (*United State Trade representative* : Représentant des Etats-Unis au commerce) rattachée directement au président américain et formée de quelques 200 cadres de haut niveau rôdés aux questions des négociations bilatérales et multilatérales. Cette structure est dédiée exclusivement aux négociations commerciales internationales. En contrepartie, l'équipe marocaine ne bénéficie aucunement d'une structure similaire et ses composantes ne sont pas spécialisées dans les négociations commerciales »[25]. Il s'agit d'une équipe composée plutôt de cadres ministériels aux spécialités diverses et multiples, sous la coordination générale du ministère des affaires étrangères. Les membres de chaque groupe avaient pour mission de communiquer la position de leurs départements ministériels sur le thème considéré.

4.2 Optimiser Et Redynamiser Les Echanges Dans Le Cadre Des Accords Preferentiels En Vogue

Cela peut passer par un ensemble de mesures. Premièrement une articulation judicieuse entre la politique commerciale et les différentes stratégies sectorielles mises en œuvre par le Maroc en vue de garantir un séquençage adéquat des politiques publiques destinées à rehausser le profil de spécialisation de l'économie marocaine. Cela passe par l'amélioration de la qualité et du contenu technologique de son offre productive et l'accélération de la diversification sectorielle et géographique des exportations pour s'adapter à l'évolution de la demande extérieure adressée par les partenaires.

La deuxième mesure importante c'est d'assurer une meilleure régulation des importations pour atténuer leur effet déstabilisateur sur la balance commerciale. Cela ne peut être possible que grâce au renforcement de l'arsenal juridique et réglementaire relatif au contrôle de qualité et de conformité, la lutte contre les pratiques frauduleuses qui nuisent fortement à la production locale (*la mise en application rapide de la loi sur la défense commerciale serait, à cet égard, une réponse appropriée*), le développement du système national de normalisation en vue de réduire significativement les importations de produits ne répondant pas aux normes de qualité et d'encourager la consommation des produits fabriqués localement.

La troisième mesure concerne les exportations et consiste à remédier à la faiblesse du taux d'utilisation des préférences accordées par les accords. En effet, il est judicieux de faire l'effort de communication sur les opportunités offertes par les accords préférentiels et leurs règles d'origine respectives auprès des opérateurs économiques et de leurs associations professionnelles.

La quatrième mesure, et non des moindres, consisterait à accélérer le processus des réformes destinées à améliorer davantage le climat général des affaires : L'amélioration de la qualité de l'environnement des affaires est indispensable pour entretenir la dynamique de l'investissement privé domestique et pour améliorer l'attractivité du Maroc pour les investissements étrangers, aussi bien en provenance des pays signataires d'ALE que d'autres pays qui pourraient profiter de ces accords. Parmi les actions prioritaires : moderniser la justice, lutter contre la corruption, améliorer l'accès aux financements notamment en faveur de la PME, Simplifier les procédures administratives et bien d'autres.

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[24] *Bien qu'il existe un Comité national des négociations responsable de la négociation des accords commerciaux menées par le ministère des Affaires étrangères en association avec le Ministère du Commerce Extérieur, son rôle est réduit à la coordination entre les différentes entités professionnelles concernées par la négociation : CNCE, CGEM, ASMEX, GPBM (Groupement Professionnel des Banques du Maroc), FCMCIS (fédération des Chambres Marocaines de Commerce, d'Industrie et de Services).*

[25] *Mohamed Bensaid et Abid lhadiyan, 2008. Le contexte économique et géopolitique de l'accord de libre-échange Maroc-USA. Revue Critique économique n° 21, Rabat, hiver, Page 27.*

Concernant le choix des partenaires, il est judicieux d'accorder la priorité à des régions avec lesquelles le Maroc dispose d'un avantage concurrentiel. L'avantage d'une telle option réside, principalement, dans ses effets concurrentiels réduits sur les structures productives locales et dans les opportunités d'investissements auxquelles pourrait donner lieu : l'Afrique au regard du potentiel énorme dont recèle ce continent et de l'expérience positive déjà acquise des opérateurs marocains, notamment en Afrique de l'Ouest ainsi que le CCG (Conseil de Coopération du Golfe), en prenant en considération les perspectives offertes dans le cadre du partenariat stratégique liant le Maroc au CCG.

La dernière mesure vise essentiellement le renforcement des capacités de veille et d'anticipation en matière de politique commerciale extérieure : l'optimisation des retombées des accords de libre échange conclus par le Maroc rendrait impératif le développement d'un système de veille économique[26] performant, en recueillant et en communiquant instantanément les informations économiques pertinentes au secteur privé. Ce système servirait d'appui aux capacités marocaines en matière de conduite de la politique commerciale extérieure du pays.

Car dans l'état actuel des choses, l'accès à l'information et la maitrise des sources d'information constituent une entrave majeure pour les opérateurs économiques marocains souhaitant entretenir des relations économiques avec le reste du monde. Le manque d'informations au sujet du cadre préférentiel du commerce avec les pays partenaires est un handicap sérieux. Ce déficit informationnel concerne le manque de diffusion d'informations sur les opportunités et les facilités offertes aux opérateurs économiques par les accords.

4.3 ROLE DE LA DIPLOMATIE ECONOMIQUE MAROCAINE

La diplomatie économique marocaine qu'elle soit d'aide[27] c'est-à-dire celle qui prend la forme de l'aide publique au développement et à l'accompagnement de l'économie d'un pays et de ses entreprises ou de la diplomatie d'influence c'est-à-dire celle fondée sur la capacité d'un acteur à faire triompher ses vues ou à produire du changement par des outils alternatifs : le rayonnement, la culture, l'image…… peut être un moyen pour réduire le déficit structurel de la balance commerciale, attirer les investissements étrangers et accompagner les investisseurs marocains dans leur quête de marchés étrangers.

Concernant la première forme, il est clair que le Maroc est parmi les pays donateurs de l'aide au profit de plusieurs pays. L'Afrique en reçoit particulièrement une grand part. Sa politique de l'aide est fondée sur l'assistance à la réalisation des projets de développement au profit des pays africains. Le Maroc participe brillement dans le développement des infrastructures de base en Afrique. Cette diplomatie d'aide est à même de permettre aux entreprises marocaines de se positionner sur les marchés africains bénéficiaires de l'aide et de profiter des opportunités économiques offertes par ces marchés. En instrumentalisant l'aide publique fournie, le Maroc peut permettre aux entreprises marocaines d'internationaliser leurs activités sur les marchés Africains.

Aussi, les marchés de l'Afrique subsaharienne, qui sont appelés à gagner en profondeur du fait de la montée en puissance de nouvelles nations (Chine, Inde,…), pourront donc servir de plates-formes de définition des stratégies internationales des entreprises marocaines, notamment des services. En effet, plus les économies africaines accélèreront leur rattrapage économique, plus leurs activités économiques prendront de l'ampleur, ce qui signifie davantage de besoins de services susceptibles de servir le développement du marché intérieur[28].

A titre d'exemple, la Chine, à travers des conventions d'aide et d'assistance, essaye de gagner en contre partie des contrats d'exclusivité ou tout simplement des possibilités d'accès vers les marchés. Aujourd'hui, sa présence économique en Afrique est due principalement à sa diplomatie d'aide. Même si, ce sont plutôt les Etats-Unis, la France ou la Grande-Bretagne qui ont le plus utilisé, ces quarante dernières années, leurs budgets d'aide pour satisfaire des buts géostratégiques, la politique chinoise semble être plus bénéfique vu qu'elle est intégrée dans une logique gagnant-gagnant.

[26] La notion de veille économique est définit comme un processus consiste à rechercher, traiter et distribuer de l'information stratégique utile aux acteurs économiques en vue d'une prise de décision efficace au moment opportun. Cf. la Documentation Française. Le rapport Martre, œuvre collective du Commissariat du Plan intitulée Intelligence économique et stratégie des entreprises, Paris, 1994

[27] Claude Revel (2013). La diplomatie économique au cœur de l'influence. Interview dans "l'Echo des continents", revue de l'Agence française de développement, février.

[28] Alaoui, N (2010). La projection économique des pays du Maghreb sur l'Afrique subsaharienne. IFRI.

Quant à la seconde forme, la diplomatie d'influence, son intérêt réside dans sa capacité à améliorer l'image de marque du Maroc, de ses produits, de ses entreprises et de sa notoriété comme une destination des IDE.

L'influence est considérée comme étant le stade le plus abouti de l'intelligence économique dans la mesure où elle s'appuie sur une connaissance aussi parfaite que possible du terrain de jeu, de ses risques, de ses menaces et de ses opportunités[29].

L'influence regroupe une panoplie de méthodes qui peuvent être étatiques ou non étatiques, utilisées au service des intérêts économiques en vue de s'imposer sur la scène internationale. Les instruments d'influence diffèrent selon les pays. Certains mettent l'accent sur l'initiative publique telle que la mise en place de centres culturels. D'autres privilégient des actions privées plus rentables telle que par exemple l'industrie cinématographique.

La diplomatie d'influence repose souvent sur le volet multilatéral qui requiert une stratégie plus volontariste auprès des organisations internationales, au travers desquelles passe une partie essentielle de l'élaboration des principes, des règles de droit, des stratégies de développement et des normes techniques.

Dans le cas marocain, l'existence d'une diaspora importante de marocains résidents à l'étranger peut être une opportunité certaine pour le Maroc. Néanmoins, il est important de constater que l'utilisation, comme action d'influence, de la présence de cette communauté à l'étranger est très limitée. De même, le Maroc ne profite pas de l'expérience des fonctionnaires marocains détachés et en poste dans les organisations internationales pour promouvoir les intérêts économiques du pays.

Aussi, le déplacement de chercheurs et spécialistes marocains et étrangers dans le cadre de colloques internationaux est une occasion qui permet de produire plus de documents de référence sur tous les problèmes économiques qui seront discutés dans les cénacles mondiaux.

Or, les universitaires et les chercheurs marocains peuvent préparer des études avec leurs collègues étrangers mais aussi avec des organisations internationales sans que les responsables marocains profitent de leurs connaissances et leurs recommandations.

La troisième forme de la diplomatie économique, la plus rentable aujourd'hui, est celle qui est orientée contrats. En effet, la diplomatie des contrats est généralement étatique, visant à garantir à ses entreprises publiques ou privées des marchés ou des grands contrats sans passer par des appels d'offres. Elle permet d'appuyer les entreprises et de défendre la production nationale ; et se base sur des outils tels que l'intervention directe du chef d'Etat ou un de ses conseillers ou suite à une rencontre entre ministres ou lors d'une visite officielle intégrant des chefs d'entreprises.

Les contrats sont obtenus souvent soit par pression soit par l'offre d'avantages politiques ou économiques et font l'objet de milliards de dollars et s'inscrivent dans la cadre des durées assez longues.

A titre d'exemple, « entre 2007 et 2012, Angela Merkel, la chancelière allemande a effectué pas moins de 274 déplacements à l'étranger : 168 en Europe, 59 en Asie, 29 en Amérique du Nord, 11 en Afrique et 7 en Amérique latine. Dans cet agenda surchargé, la diplomatie des contrats est très présente dans ses préoccupations majeures »[30].

Un deuxième exemple illustratif de ce genre de diplomatie c'est la diplomatie française agressive au Maroc qui a aboutit à la mise en place du TGV. La France tire des profits commerciaux et économiques importants de l'appui politique français au dossier du Sahara.

Pour le cas de la diplomatie marocaine, on assiste à une multiplication des visites officielles à l'étranger présidées par le Roi ou par le Chef du gouvernement marocain et intégrant des représentants du secteur privé marocain. La dernière visite du Roi Mohamed VI en Octobre 2012 aux pays du Golfe s'inscrit dans une tendance de défense des intérêts économiques du pays. Plusieurs contrats et projets vont être financés par les entrepreneurs de la région. Une coopération qui permettra au pays de trouver des financements pour ses projets de développement et de gagner en influence politique au Moyen-Orient. Les membres de la délégation marocaine ont pu présenter une série de projets de développement et d'investissement à

[29] Revel, C (2011). Diplomatie économique multilatérale et d'influence. Revue Géo-économie. Article rapporté par Dafir Amine. La diplomatie économique marocaine : formation, acteurs et actions. Thèse de doctorat, FSJES de Rabat juillet 2014.

[30] Article dans le monde, Adresse consultée le 05/08/2013: http://www.lemonde.fr/international/article/2013/03/29/merkel-et-la-diplomatie-de-lexport_3150497_3210.html.

caractère prioritaire au niveau national. Ils ont aussi exposé les grandes opportunités et les avantages d'investissement offerts par le Maroc.

5 CONCLUSION

Le point de départ de cette recherche est le constat selon lequel le déficit commercial du Maroc ne date pas d'aujourd'hui. Il est structurel depuis le milieu des années 60. Il résulte de plusieurs facteurs endogènes et exogènes. Le choix de l'ouverture du Maroc et la signature de nombreux accords de libre- échange, Nord -Sud et Sud -Sud , ont aggravé ce déficit et impliqué une insertion de l'économie marocaine, dans le marché mondial, davantage par les importations que par les exportations. Une analyse approfondie du commerce extérieur marocain, dans le long terme (entre 2000 et 2013), permet de mettre en évidence la dépendance du système productif marocain à l'égard d'intrants importés, compressibles et incompressibles, qu'ils soient productifs ou non productifs. Ce qui nous a permis de poser les questions importantes suivantes: d'abord les différents plans sectoriels adoptés sont-ils cohérents et sont-ils en mesure de contenir le déficit commercial voire le supprimer? Ensuite, dans une logique de recherche de cohérence, est ce que les accords signés sont cohérents entre eux ? Enfin est ce que les plans sectoriels sont cohérents avec les accords signés pour que ca soit efficace et profiter aux entreprises marocaine ?

Ainsi, il ressort de cette étude, **trois** conclusions importantes :

Premièrement, l'amélioration de la compétitivité des produits marocains sur les marchés cibles est une voie incontournable à la réduction du déficit commercial à des niveaux soutenables. Les politiques publiques visant cet objectif doivent être axées impérativement sur l'encouragement de l'intégration du tissu économique. Dans certains secteurs comme le textile et vêtement, figurant parmi la liste « des métiers mondiaux du Maroc », on importe pratiquement tous les éléments de la chaîne de valeur : fils, tissus et accessoires. De même, l'agriculture marocaine demeure peu valorisée et peu valorisante. L'intégration de l'agriculture et de l'agro-industrie est considérée comme étant très faible.

Deuxièmement, les plans sectoriels adoptés depuis une bonne dizaine d'années ne sont pas capables, à eux seuls, de réduire le déficit commercial car ils sont incohérents avec la politique commerciale du Maroc qui reste principalement axée sur le libre échange. Chaque plan est ambitieux en termes d'impact positif possible sur l'économie marocaine. Néanmoins, nous constatons que les modalités de conduite de ces stratégies et leur interaction n'ont pas été réfléchies et suivies de manière satisfaisante. C'est donc le mécanisme de gouvernance qui pose un sérieux problème.

Troisièmement, les accords de libre échange offrent des avantages tarifaires majeurs, mais aussi des menaces de concurrents étrangers souvent mieux préparés et plus agressifs, très biens soutenus par leurs pays d'origine.

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The Response of Al- Quran against to the Previous Scriptures

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ABSTRACT: Since it taken down to the Prophet on Muhammad, the Qur'an has always been challenging the creation of the human brain, even at a certain level, the Qur'an has stated that human intellect are not able to diving the content the Qur'an thoroughly. By The method used in this research that is a descriptive research method knowen that All Scripture that also known as the Apocalypse that mentioned in the Qur'an and degraded to the prophets, are not a human creation, but they really are the creation of God, which was created to bring a human into the space of peace and harmony that accordance to their fitrah. The similarity degree of the substance, the mission is evidence of the truth authentic of oneness of God who since it created humans, God keep one and God is to be worshipped.

KEYWORDS: Response, The Qur'an, Against, Previous Scriptures.

1 INTRODUCTION

Talking about the Qur'an, such as a watercourse that flow without the estuary, because the book that has purified by Allah SWT is always popular in the intellectual dynamics of all time. Since it taken down to the Prophet on Muhammad, the Qur'an has always been challenging the creation of the human brain, even at a certain level, the Qur'an has stated that human intellect are not able to diving the content the Qur'an thoroughly, because indeed, the Qur'an is not the result of creativity product of the creatures (qaul al bashar), though the Qur'an is the creation of Allah SWT.

Nevertheless, it does not mean that the Qur'an is slack from the scholarly review, as all records of history, the writing about the Qur'an is very diverse. Balijon in his work "the Qur'an In Interpretsi Modern", tried to pour his thinking about interpretation of the Qur'an in the context of modernity. However the works is not necessarily able to represent the will of the Qur'an about it. In this respect, Fazlur Rahman is sighted, that humans do have the capabilities that are not unrivaled in generate the new knowledge, but they have a weakness in the field of morals. The Duty of the Qur' an is helping them about this field, so the Qur'an mentioned itself as "guidance for the human."

As an instruction, the Qur'an has a very vital functions in the human life. It is visible from the indication of the Qur'an that said the word of people about 63 times, said bani Adam by 6 times, and al-Nas of 240 times in verses Makkiyah nor madaniyah. Based on these facts, al-Nazi concludes, that the Qur'an is the book of al-insan, it means, discloses to the human or the expression of the human. The mention of Human is the appreciation that strictly mentioned by God in his Holy Book (Q.S. A1-Isra ', 70), because humans are given by the privileges with common sense, and other advantages.

The References to human beings in general, means the Qur'an has not limiting the time to make it as an instruction for the human, although as the chronology, the Qur'an makes the past events as the reason for the revelation of Verses. But the factors of its historical of the chronology does not mean the Qur'an has binded the time to the past.

The Entitity of Qur'an as the revelation that became the instruction of the creature named the human is a customary thing, remembering the Qur'an is the book assigned to Islam brought by Muhammad SAW who also referred as the last Prophet. Assertion of Muhammad as the last Prophet at the same time, clarify the position of the Qur'an by the previous scriptures, because the prophets before Muhammad, among of them there is one who got a ' guidance set ' from the creator of do this trust be used to convey the teaching of Allah SWT to their people. In this case, the Qur'an as complement that

criticize the Scriptures in earlier generations, even if the criticism is on the level of the doctrine or or at the level of "politics", it means such as the critics that put forward by Islam in the framework of competition between the new religion that is looking for the followers and the old religion was already well-established.

The teachings (shari'at) of Allah SWT. That delivered to the human has recorded in the previous Scriptures through the prophets, is the reference, guidelines and also guidance for the humans in stepping on the escalation of their life's journey, to fit the lanyard and the norms prescribed by Allah SWT. The scriptures of the Allah are often called by revelation. Here, the author will elaborate the various names of the revelation as have been revealed to the Prophets and tried to examine the attitude and the response the Qur'an-as a closing revelation, towards the earlier scriptures.

2 METHOD

The method used in this research is a descriptive research method, that is the method that discuss about several possibilities to solve the actual problems with collecting data, compiling or classifying, analyze, and interpret it. Kutha (2010) in Gindarsyah (2010) explained, this descriptive analysis is done by way describing the facts, then followed by the analysis, it has not only outlined, but also provides the adequate understanding and explanation. The reason of the authors to use this method is, because basically this review is qualitative observations. In addition, this method is considered precise enough to do the approaching the examining problems. The data collection is done by assembling and analyzing the documents, such as written documents, pictures and electronics

3 FINDINGS AND DISCUSSION

3.1 THE SCRIPTURES, REVELATION AND SHUHUF

According to the some miraculous, that all scriptures revealed by God is in the same month, that is Ramadan month. The Qur'an has been revealed from Lauhul Mahfuzh to the sky of world during Ramadan. Then gradually revealed, according to its occurrence is about 23 years. In addition, Ibrahim received his shuhuf (Scripture) on 1 or 3 Ramadhan. Prophet Dawud as. Accept the Psalms on 18 or 12 Ramadan. The Prophet Moses received the Torah on the 6th day of Ramadan, the Prophet Jesus As the Gospel on the day receives 12th or 13th in the month of Ramadhan. Allah SWT acknowledge the Ramadan is over the other months, by select it as a month where all the Scriptures written is taken down with it.

The scriptures is an entry that is spoken by God to the prophets. Muslims are obliged to believe, because by believing in the Scriptures is accordance with the one of the five pillars of the faith. In the Qur'an, God's word that meant: before (Al Quran), a guidance for mankind, and he sent down Al furqaan. Those who disbelieve the revelations of Allah will get the heavy smote; and Allah SWT, yet have replies (smote).

From here, it can be known if there are close linkages between the Scriptures that God has revealed to his Prophets. The scriptures revealed have variety of names, but all scriptures is also can be referred as a revelation. In lexical, revelation has a more general meaning than the scripture, considering the scriptures is constructed from revelation revealed by God to his prophets. According to Majd al-Din al-Fairuz, the meaning of revelation is a cue, writings, pamphlets, ilham, the hiding word (al-kalam al-khafy) and each of the expressions passed to the others. This sense is similar to the opinion of Ibn Manzur's who has defined that revelation as al-maktub, al-kalam and al-khafy. Whereas the word "auha" is originated from word "waha" (original words of revelation) could mean kataba which means write. The term revelation is also means the idea or dream that really happened or something delivered through the Angel Jibril that referred by scholars with al-wahyu, al-jaly, which means the really clear and devenitife.

However, the meaning of revelation as above has suffered the bias, during the identification process of the adherents, this seen from the meaning of revelation among the Gregorian (Christian) that has limited the terms of revelation are only in two areas, that is; First, something preached by Jesus Christ about of Gregorian creed. Second, something revealed by the Holy Spirit to someone who has attained a purity degrees, namely Paul Patikan, Betrik Orthodox and resembling them in several clusters of the Gregorian religion. This view is clearly rejected by Islam, because al-Qur'an also known as revelation. So, according to Shamah, the revelation is a something brought by Jibril from God to the Prophet Muhammad and ordered to deliver it.

In lexical, revelation means a quick signals that could be from the types of words, codes of conversation, a single voice and no double, signal, and so on. Meaning and its use are also very varied in the Qur'an, so it's very necessary to scrutiny of some of the things that regarding to an entity, meaning and its scope. First: the revelation is not only specifically about a human thing, but also related to the existences of non-organic, plants, animals, and so on (Revelation revealed to this kind

existences is none other than is a miracle and a guidance that are essential and instingtif, or in other words is takwiniyah's miracle. The Lord, who will usher toward the perfection of their existence, but the highest degree is about the revelation to only the prophets and the Trustees of God, and that meaning of this type of revelation was the presentation of the meanings into the heart of the Prophet and "the talk" of God to him.

The conclusion is, that in principle "the presentation of" the meaning of the essence and truth side, is not different with the meaning, then absorbed in the heart of normal humans, but from the sight of degrees and the level they have a difference. The lowest degree of revelation related to the existence of non-organic and plant, and the highest degree is specifically for the prophets.

Second: the revelation is also used in different meanings, such as by the meaning of the cue, misgivings, the inspiration in understanding that acquired through the instinctive or through the dream, where the highest degree is located in the conversation of God to the prophets.

Meanwhile, the characteristics of the revelation are: 1. The natures are internal and intrinsic (internal); 2. The assistance of teachers and advisors; 3. Istisy'âr and awareness; 4. Understanding about the existence of intermediaries revelation.

There are three forms of methods in the declining of its revelation to the prophets, although it accordance with what Thabathabai has said, if the form of this will be returned to a form that is the direct acceptance of revelation from God, namely: 1. The speech of God without an intermediary (directly); 2. The conversation behind the scenes, hijab, or a deterrent; 3. By sending the messengers, through the Angel of messenger the revelation.

The philosophical Explanation from the lowered of revelation and the role of angels are remaining to the point of: that basically the Angel is not an intermediary, by the meaning that if they received the revelation from God then deliver it with the especially language of the prophets. Angel is none other than a manifestation media of God order, because of that, there is no the real intermediaries here, so it can happen the mistakes to him when delivery up of the divine message.

The Acceptance of revelation in the first form is direct, it is not through the any intermediary, while at the second and third form, if the Messenger at that time did not receive the revelation through the intermediaries or from back scenes, the revelation must be received directly to him. The last point is, that the fact of revelation is just like of knowledge syuhudi (witness the mystical), because of that, it is contrasted to the hushuli knowledge (knowledge gained through filming mind), this revelation does not have any capability to be confused or wrong. Thus, the human by rhyme of su'udi (upward motion) and the motion of futon, will be able to reach a place, that allows it to receive the Divine knowledge in directly, without through the intermediaries.

As for as meaning of al-kitab by lexical means something written or sahifah which is written on it, and in some places, al-kitab could mean al-Torah or al-Hukm. From this sense, then among of clear names of the a1-Qur'an is al-kitab as has stated in the surah al-Baqarah verse 2. But the use of al-kitab also refers to a revelation that revealed to the Prophet Musa AS. (QS: a1-Anbiya, 48) and to the other prophets (QS: Ali Imran 81).

From there, the scriptures are a group of revelation that conveyed to the Apostles, to be taught to the human as an instruction in their life. Additionally, the naming of revelation within the wide meaning is also includes the Suhuf that also account in the revelation of God that revealed to the Messenger, but it still in the form of a separated sheets. So from this perspective, the scripture and Shuhuf are together included as the revelation that have any similarities and difference. The similarity is the both of them are include to revelation. While the differences are: 1. The content of the scripture is more complete than suhuf; 2. the book documented while the suhuf is not.

For Muslims, God has clearly stated that Muslims should be believe the existence of the scriptures that has taken down before Al Qur'an, as mentioned in the word of God: meant: "o believers, you must be still in believe to Allah SWT and his Messenger and the book which revealed by him to his Messenger and the book which he sent down before". Beside he taken down the Scriptures, God is also revealed the sheet named suhuf in the form of sheets that have been revealed to the prophets like Ibrahim a.s and Moses. It is according to the word of God SW: Meant: "(that is) suhuf-suhuf (Scriptures) that has revealed to Ibrahim and Musa"

Regardless of the meaning of the above, the scriptures or revelation are things that exist and even obliged to believe him. Meant, we are required to believe the entity of revelation previously, where its contents have settled in detail and completing by the Qur'an. The scripture or that revelation, judging from the names that revealed by Allah SWT to the prophets mentioned in the Qur'an such as Torah, Zabur, psalms and the Qur'an itself.

As the complementary scripture or revelation from the previous one, the Qur'an mentions the scriptures are quite a lot. The Gospel mentioned about l2 times, Psalms 3 times danTaurat l times, whereas the Qur'an is about 70 times. But other

phrases indicated that the Qur'an is quite a lot, such as scripture sentences and others that accordance to the scholars as the name of the miracle of the Prophet Muhammad SAW.

3.2 THE PREVIOUS SCRIPTURES

Scripture is a cornerstone in the religious, and of all religions must be have a source of the religious. This is because, according to Edward B Taylor, religion came from philosophical thinking of primitive tribes who have potential. This case is because humans are understanding and thinking creatures. With their thought and reason, human want to find the description about causal relationship of things in surrounding of nature, then they would like to find where is their position in the existential world. From this, then emerged the new religion in primitive tribes. Thus, the religion is not sourced from the revelation, but it sourced from the creativity of the human intellect.

According to the author, the religion is actually not that like, because basically the human creativity is only a medium in the process of finding God (religion), and in that process, God gives the truth way by the instruction of his revelation, as happened to prophet Ibrahim a.s. The role of revelation and Scripture appeared that have mentioned in the Qur'an, namely al Qur'an, gospel, Torah, and Psalms. However, in reality, of the history, some of the scriptures above have experienced the interpretation that is very deviated from the requirements and its original purpose of the revelation. Bible and the Torah are the two scriptures that many experienced the deviation.

a. Torah

Torah in Hebrew is the five same books of the Tanakh or Old Testament of the Bible. Torah in Greek called as Pentateukh. The Torah has revealed at Sinai hill and then it contained the law of God that known by the ten of the commandments. The Torah is God's teachings and it is a true direction of the children of Israel. The Torah is the book that revealed by God to Prophet Musa AS. In the modern understanding of the experts, both Jews and Christians, the Torah is consisted by five Asfar of Musa, namely; al-Takwin, al-Khuruj, al-Lawiyin, al-Adad and al-Tathniyah. As for the Asfar made after the five of Asfar there. According to historians of the book, the Prophet Moses published the Torah in thirteen nuskhah, until the al-Babily era, the jews have fought and crushed by Nasser Nabukhaz from Government of Balbil, Torah is still original without any changes. But after that, happened the consensus with the Jews in the city of Babil in 86 BC to transform the text of the Torah. Among the changes made by them, are: 1. That Allah SWT is an only God, but not for the universe, but only for the children of Israel that is Jewish. 2. That the Torah laws are specifically for children of Israel, not for others beside them. 3. The prophets who awaited on future by the mankind as has declared by Musa as is not from the group of Isma'il but from group of Israelis. In the Greek expression, the Torah called a Pentateuque that mean consists by five parts (juz). A book of the old testament is consists of 39 volumes. According to the Jews and the Gregorian, the author of the Torah is Musa AS itself, but at 16th century the Carlstadt considers that impossible if the scripture written by Moses.

b. Gospel

The Gospel in Greek means Euangelion that means a "good news" or " joyous news ". This term used to refer to the four first book in the New Testament. Those Scriptures are: Gospel of Matthew, Gospel of Mark, Gospel of Lukas, and the Gospel of John. The Gospel itself is derived from the Arabic Gospel that usually contain a meaning: 1. The Information about the activity of God rescue in the Jesus from Nazaretatau news that's delivered by Jesus of Nazareth. This is the origin of use the word "Gospel" according to the New Testament. 2. Within the meaning that more popular, this word refers to the fourth Canonical Gospel, (Matthew, Mark, and John Lukasda) and sometimes also refer to other non-canonical works such as the Gospel of Tomas, which presented the story of life, death, and resurrection of Jesus. 3. A number of modern scholars used the term of "Gospel" to pointing a genre of hypothetical from the first Christian literature, and also in English: The Gospel and the Gospels that are given to Jesus by the outline is similar to the book of Allah SWT in previous one.

The bible is the Gregorian scripture that a part of the New Testament. This scripture has experienced a lot of change, so many of its readers felt confusion in understanding it, because there are many narrations at one problem with a various bibble. At least as that felt by RR Roguet in his book "lnitation a I Evangi1e".

In the early of christian development, a difference and disputes hit to this religious converts. The Various of sect accused astray to the that other sect, and claimed that sects and the Gospel of they version is the most true one, whereas the others are wrong. Just like with Marcion and Bardaisan are only recognized their gospel and reject the other. The proof existence of a difference Gospel have been existed since Paul was alive, while the existence of the original bible belonging to Jesus is unknown until now. The dispute of which Gospel is Truth, narrated by the Gospel itself and the letters of Paul orders to his residents.

Actually, the book of the new testament nowadays, at the past time is unofficially included in the Scriptures. But after the fourth century, by the results of consiliation of Nikea at years 325 A.D, it's regarded as scripture. After the consiliation, the christian congregation in a various of districts has selected as approprate with the decision. While the other congregation should be burned. Although the conciliation of Nikea has been established the trinity of dogma and four official Gospels and reject the others Gospel, actually the East Church until this time is still considered to Bible rejected by conciliation.

From the explanation, reflected that happened the misdirection (tahrif) of understanding in both of the Scriptures above, both the Scriptures believed by its adherent as the word of God that holly and sacred, although sometimes this honoured scripture is a masterpiece of the human creation that have experienced of reduction and interpretations that is very hard to be proved authenticaly, scholarly and faith instinctively. This is reflected in the Scriptures that claimed as the divine Scripture besides the Qur'an, that according to its history has undergone the process of revision, even it bias from the human mind and the writer. However, it should be recognized that there is some moral suggestion that are considered eligible still for categorized as God's Word.

In the Qur'ân, there is some evidence that offensive about the problems of tahrif above. The term tahrif in the etymology means perverted, corruption, incorrect understand, modification and misinterpretation. This term is often used to identified of the Jewish devotees and christian who have already misunderstood and misinterpretation of the contents of their holy book. Some others thought, that the Jews and christian have changed (baddala) the authenticity of them Scripture, especially by deleting and eliminating of information about arrival news and the features of Muhammad, as the Last Prophet that has noted by the Qur'an.

The statement above pointed that the Jews had changed the information of their Scriptures (yuharrifûna) or the revelations that they received from Allâh SWT. About the Jewish scriptures, the Qur'ân has mentioned that there are some of those who wrote the scripture with their own hands and then they claimed that, the book is derived from the Lord "(hâdzâ min ' ind-i-llâh). That statement is also same with what's contained in another verse that Stated if Jews had changed the word from its position (yuharrifûna al-kalima ' an mawâdhi'ihi). By using of other pronunciation, Qur'ân stated that christian were intentionally forgotten (fanasû) some of what was given to them as a reminder of Allâh. In addition, the Qur'ân used the term Twisting the tongue, or distortion (yalûna alsinatahum or layyan bialsinatihim). On the other evidence, mentioned that the Jews and christian or referred by the community of the book (Ahl al-kitâb) was "hiding the truth" (layaktumûna al-Haqq).

However, the existence of scriptures that have been perverted are still mentioned in the Qur'an, because the original of the previous Scriptures are same in their substance, Although until that time, it is too hard to say that the originality of it still persist, because between of its adherents acknowledge that the present book does not suitable with the original one. It proves from the differences of each printing edition. The similarity substance of the Qur'an teachings in the original book (Revelation) previous is as mentioned in a few sentences, even necessary for followers of the Qur'an to recognize it. This following revelations about previous scripture may can be present from much that stated in the qur'an

c. Psalms

Psalms is the Scripture revealed by God to Prophet David as instruction for his adherents, that is children of Isreal. According to a part of scholars, the holy books of Psalms equated with mazmur, that according to Islam, is the one of the holy books revealed before the Qur'an besides the Torah and the gospel. the term of zabur is the equation of the term of Hebrew zimra, meaning "song, music." It, along with zamir ("song") and mizmor ("Psalm" or the psalm), is derivation of zamar, meant "sing, sing the praise, create the music."

In Islam, the Psalms is the Scripture that revealed to the children of Israel through his messengers called Prophets david. The word Psalms have been described in several verses of the Qur'an, which meant:

"We have given you revelation as we have given to Noah and the prophets, then, and we have given the Revelation (also) to Ibrahim, Isma'il, Isaac, Ya'qub and his grandson, ' Isa, Ayyub, Yunus, Harun and Sulayman. And to David we gave the Psalms".

And thy Lord knows who (have) in the heavens and on Earth. And indeed we have exalted some of the prophets on some (others), and to David we gave the Psalms.

And so we wrote in the psalms after then (we write in) lawh Mahfuzh, if the Earth as belong to my servants who obedient.

d. Suhuf Ibrahim

The Suhuf Ibrahim or Ibrahim sheets is the Scripture which is also revealed by God to Prophet Ibrahim. Suhuf is a small Scripture revealed by God and delivered through the intercession of angels Jibril, it contains a Guide and the religious

teachings that are appropriate to the needs of the era. This Suhuf is a guide used by Ibrahim in spreading the religious teachings that his brought. The teachings of this Prophet Ibrahim, known as Hanif religious, was already there before the arrival of the Prophet Muhammad SAWThere are a part of Arabian who still follow this Religion and after the advent of Islam brought by Messenger Muhammad SAW, this religious deleted and cancelled. It's a story mentioned, that before the Messenger Muhammad SAW received the revelation of the Qur'an is from Allah SWT, he adopted a religious teachings of Hanif brought by Prophet Ibrahim. And also there is some Prophet besides Ibrahim who also received the suhuf namely Prophet Idris, the Prophet Syits and Musa.

3.3 THE VERSES OF THE QUR'AN ABOUT PREVIOUS SCRIPTURES

In connection with the Scriptures that were revealed to the prophets before Muhammad SAW, and in the confidence of Islam, there are some scriptures like the Torah, Psalm, gospel, Ibrahim sheet, that clearly stated by the Qur'an in several lines, stressed the position against to the Scriptures.

These are the statement of the Qur'an that also become the doctrine for the Moslemms about the relationship of the Qur'an with the other Scriptures:

1. That the Qur'an sued to the belief of Moslems about the existence of those Scriptures. Q.S (2: 4).
2. That the Qur'an positioning itself as justificator and verifikatorfor to the previous Scriptures.Q.S (5: 48).
3. That the Qur'an is also to be referenced to remove the disagreement between adherents that were different. Q. S (16: 63-64).
4. Further the Qur'an set straight the history that contained the stories about the adherents and the previous messengers, and also about some part of the life of that Apostles. The story on a few important aspects, there are differences with the version that found in other texts, either that owned and by jews or christian.

Ideologically, there are so many verses of the Qur'an that mentioned about the previous Scriptures that revealed to his Messenger before the Prophet Muhammad SAW. The References to that Scriptures is also higlights the existance of the comunity tha belive to the previous Scriptures then called as ahl al-kitâb, besides it also highligt the other community outside the Islam such as Shâbiâns (al-shâbiûn) and Zoroastrians (al-majûsiyah). The preliminary generation of historians Muslim has elaborated the existence, status, and the position the religions through the Islamic perspective.

Quite a lot of discussion in the Qur'an about the Scriptures earlier, but here, the author has only taken a few verses that could be include the discussion about those Scriptures. Then the verse will be arranged according to the its Chronology (asbab al-nuzul) based on the arrangement standard that narrated by Ibn ' Abbas.

a. Makkiyah Verses

There are a few Makkiya verses that explained about the earlier scriptures. The revelations will mention the name of the Psalms, as in surah al-Isra, verse 55, and in al-Anbiya verse 105. Meant: and your Lord knows about what things exist (there) in the heavens and on Earth. And really, we have exalted some of the prophets on some (others) and to David we gave the Psalms (QS.al-Isra' 55). Then in another verse is also mentioned about Psalms that revealed by God to the human community. As the word of God: Meant: and really we have written in the psalms (we wrote in the lawh Mahfiz) if the Earth is belong to my servants who obedient.(QS. Al-Anbiya 105)

b. Madaniyah Verses

In the verses of Madaniyah, there are also many explanations about the previous Scriptures. This clarification, besides has already described in a verses Makkiyah as above, this showed that in the two revelation phases of the verses of the Qur'an, is still going the strong relationship between the teaching mission of the Qur'an with Scripture before. It is as what have explained that the Qur'an became as the " musaddiqan lima baina yadaidi" which justify the previous scriptures. And then, in the letter al-Nisa, the Qur'an mentioned the names of the prophets and Messengers, which concluded by naming the name of David with him scripture is Psalms. In another verse, God is also representing the content of Torah with the Gospel "matsaluhum fi al-taurat wa matsaluhum fil injiil"

There are so many other verses of the Qur'an in Madaniyah which mentioned the previous Scriptures, such as in the letter al-Tawbah: 111, Ali Imran 48 al-Mā ' Idah: 66, and al-Mā ' Idah 68. The purpose and the clearer understanding of these verses explained in interpretation that fit for the some books of Tafsir that have been referred.

3.4 INTERPRETATION OF THE VERSES

The prophets, both originally from the children of Israel, or belonging to another group of their tribe, has the same task of delivering the treatise of God, as have been described by the Qur'an in a Surah al Nisa 163. The Real faith of the children of Israel that is faith in Allah SWT, the one, that also a God for the whole mankind. Further, the faith to the angels and messengers, the Scriptures of God and the day of judgment. Also day of charity enumeration (hisab), reward and punishment of the hell. This equality of the beliefs reflected of from the word of God through the word of the Prophet Ibrahim in the Qur'an surat al-An'am 79-86.

The discussion about the order with Faith to the Qur'an is an implicit explanation of strong ties to towards the previous Scriptures that revealed to the prophets before Prophet Muhammad SAW as in the verse al-Baqarah 126. There is a strong correlation in the similarities of faith taught by the Scriptures of Celestial, that evidenced by the Qur'an in a verse al-Nisa 163, because the revelation chronology of this verse occurred when Udai Bin Zaid said "we do not know that God has revealed something to someone after Musa, then the revelation of this verse is an answer.

According to Zuhaily, that the revelation essentially is one, and the Union of revelation looked from the beginning that deliverd by Nuh Nuh, because he is the first Prophet who received the laws through his word, and then, Prophet lbrahim referred to as father the prophets and the Prophet of Isma'il as the gradfather of Prophet Muhammad SAW, also lshak, then the Prophet Luth and Ya'kub then his grandson Joseph, Moses, Aaron, Ayyub, Dawud, Sulaiman Bin Daud and Yunus and Jesus AS, that all of them were betrayed by Jews. This mentioning in this verse is not based on sequence, but as a tribute to the Prophet coz their wisdom and the goodness.

At the end of this verse, explained by God, taking down the book of Psalms to Prophet David that consist by 150 surah, there is no law of halal and haram in it, but only the form of expression advice and wisdom. The word Psalms means written and named Psalms because of the originality of the truth that consiting in it. The Analogy of the Union revelation and the equality of status of the prophets as messengers of God reflected in surah al-Fath 29. In this surah, Allah SWT exemplified that the prophets with the crops that issued the shoot, then the shoots make the plants to be strong, then it become great and it upright straight on its roots and it makes pleasant the gardener.

According to al-Razi to his al-tafseer al-Kabeer, the parable of the prophets with the germinate plants, as well as mentioned in the Torah and lnjil, caused by the first shoots is growing in weak condition and it grew up to the limit of perfection until it finally becomes clear and strong. So the plant was to be perfect the it has amazed the gardener. a common mission of all the scriptures which was revealed to the Prophet are also seen in the earlier surah of Ali Imran, verse 3 where the truth contained in the Qur'an is justified by the previous books. On two previous verses, God described the existence of his oneness, standing with his own substance which does not require other than him, and also the about the oneness of him as a God. This affirmation is a requirement of the previous verse..

The common mission in revelation that called before is explaines about the guidance, it clarifes between instructions and error, the truth and falsehood, and evidence of a clear and definite in the worship of God. Furthermore, the paragraph after it describes the knowledge of Allah SWT. that covers everything. This affirmation is also show that the real God must be know everything, because it is not possible without knowing, God can be standalone.

As for al-kitab in this verse, according to Ridha, is a writing, while the wisdom is the correct knowledge that generate the inspiration then it translated to the Praxis space above the straight path and there is the power of sight in it (basirah), the fiqh laws and secrets of some of the issues. And the law is a concrete form of the book which was revealed to Moses. He is very understanding of its contents and then explaining to his people with a rational proof text. This is similar to the Gospel that has taken down to Jesus self.

At the level of the command to effort the teachings of God, that exisit in Celestial Scriptures, there are also similarities in the running of order the obligations that has stated in the those scriptures. for example In surat al-Maidah verse 44-45 and 47, there is a censure for the human who not realizing the law of Almighty. According to a most exegetes, the command in verses 45 Surah al-Maidah is a command to the Christians were not implementing the law of God that exists in lnjil. Whereas, in paragraph 47 is a command for the Jews who do not carry out the teachings of the Torah. Because God is expressly said "Verily We have revealed the Torah, there is guidance and nur in it.

Of some interpretations of the verses text above, seen clearly that there are relation of substance, mission and commands that exist in all the scriptures of God, not only that was revealed to Muhammad or the earlier one. Here aslo seems if the response and attitude of the Qur'an are as the complementary and the enhancement of the teachings of the previous scriptures. This thing is expressly ordered by the Prophet who portrays himself with the previous prophets such as

building (ka al-bunyan) who strengthened each other and then the Prophet is also asserted that he is a complementary and the cover from from the teachings of the earlier prophets..

4 CONCLUSION

All Scripture that also known as the Apocalypse that mentioned in the Qur'an and degraded to the prophets, are not a human creation, but they really are the creation of God, which was created to bring a human into the space of peace and harmony that accordance to their fitrah. The similarity degree of the substance, the mission is evidence of the truth authentic of oneness of God who since it created humans, God keep one and God is to be worshipped.

As an adherents who carrying out the treatise of the last Prophet and also required to believe to the previous scripture are:

1. believes that all the scriptures comes from God.
2. Makes the scripture as a guide (hudan) especialy the scripture which was revealed to us
3. Understand the contents of their subjects.
4. Practicing it in the dialy life about everything that has been instructed by God in his holy books. Mankind, in particular of Muslims should be believe that Allah has sent down the scriptures to the prophets or Messengers as a guideline of life for his people, The Qur'an as the last scripture and complement for the previous some, has been revealed to the Prophet Muhammad.

The prophets/Apostles who received that scriptures, have responsiblity to deliver the messages that contained in it, and should be able to be a savior for the people, as God commanded against all the things that need to be delivered. So the Prophet Ibrahim was a Savior of his people, Moses is the Savior of the children of Israel, then by the other prophets (which is not reported by the Qur'an) and followed by the Prophet Isa Al-Masih AS.

The prophets or all Apostles are the rescuer or Savior for their people, because they received a revelation and the Apocalypse and also explaining that for the safety of his people in a life of the world and in the hereafter.

The Qur'an as the final revelation, addressed to all mankind that brought by Prophet Muhammad SAW, contains all summary and justify of the previous scripture, as directions, and the distinguishing between the false and the right, as the lights because it contains everything needed by humans. The whole of science is found in the Qur'an, the social, economic, State, technology, trading (business), private law and others. Therefore, the Qur'an is fitt to be a guidance for the whole of mankind, along the time until the day of resurrection. So, who want to seek the safety, just study the Quran, follow its instructions!! Prophet Muhammad as the carrier task to delivery the last revelation can be said has a function as a saviour of all humanity, Yes, the Prophet Muhammad is the Savior of all mankind.

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Towards a socioconstructivist and collaborative Learning Design approach to modeling pedagogical contents used in e-learning: Implementation and experimentation

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ABSTRACT: The evolution of e-learning technology has pushed pedagogy actors to renew its teaching modes. However, the quality of these new forms of teaching depends on their capacity to be provided with pedagogical contents and learning paths adapted to the current e-learning context (collaborative, socioconstructivist, etc.).
This paper highlights some of the major issues faced in implementing pedagogical contents adapted to the actual context of e-learning. The aim of this research work is to propose a reference model for production of e-learning contents adapted to the socioconstructivist learning context. Thus, this work proposes to develop a Socioconstructivist Model of Collaborative Learning Design (SMC-LD) of e-learning contents, which is articulated around the two main aspects of production of learning contents: "design" and "development". At the level "design", SMC-LD suggests a collaborative design process based on the concept of life cycle. At the level "development", SMC-LD proposes a process for educational modeling, upstream of SCORM and IMS-LD standards, describing a pedagogical content using scenarios and activities. The modeling process is facilitated by an author tool to produce interoperable and reusable learning objects.
To validate its applicability, SMC-LD is implemented with Java and XML technologies and is experimented in real teaching conditions. The results found are satisfactory and encourage us to pursue this research. Teachers have appreciated the collaborative learning design approach to produce e-learning contents. On the other hand, the model has brought important educational benefits at the learners' performance.

KEYWORDS: Socioconstructivism, collaborative learning design, development, learning object, e-learning, norm and standard.

1 INTRODUCTION

Web technologies are increasingly used in a variable way by educational institutions across the world. They are integrated as much in a presential learning than in e-learning. These technologies induce significant changes in pedagogical practices. In this context, the changes performed by digital technologies are particularly determinant when it comes to the subject of educational act: the pedagogical content.

However, mediatization of pedagogical contents, suited to current learning context (online, socioconstructivist, collaborative, etc.), raises many questions. At the level "design", various studies show that, although most of what we see as individual learning becomes collaborative, and spite of the diversity of actors involved, the design of e-learning contents is effected in most of the time individually [1][2]. The design of such contents does not take into account the collaborative side,

which generates contents not fulfilling their pedagogical function [3] [4], and unsuited to the socioconstructivist vision, increasingly advocated in the world of e-learning.

At the level "development", research works show that the relevance of several norms and standards of educational modeling had been the subject of continuous debates and controversies [5]. These standards continue to privilege the documentalist approaches (case of LOM and SCORM) or show a complexity of use for no-specialists (case of IMS-LD) because they have a strong interest in standardization and issues of reuse [6] [7] [8].

The work presented in this article fits in this issue of design and implementation of pedagogical contents used in e-learning. It relates of the work on learning design and is focuses mainly on the processes of design and development of pedagogical contents of e-learning by means of Learning Objects (LO). This problematic makes complete sense when large volumes of e-learning contents exist, and therefore the question of their pedagogical quality becomes critical [3].

This work has as main objective to search conceptual and computer solutions, both at the theoretical, pedagogical and technical levels, for computer modeling of pedagogical knowledge, which should be in adequacy with current learning practices (socioconstructivist, collaborative, etc.). It comes to implement an online system of collaborative design and development of pedagogical contents, based on the socioconstructivist approach, and taking into account the whole process of learning design.

The paper is organized as follows: after having reviewed the main characteristics of the socioconstructivist approach, on which is based the proposed model, and the main characteristics of norms and standards of educational modeling, this article describes generally the proposed model and explains the theoretical and methodological foundations on which it relies by describing the design process and the development process of pedagogical contents. The article goes on to describe the conceptual structure, the software architecture well as technical choices adopted to implement the model. Finally, the paper describes the experimentation conducted, presents the main results and concludes with future works.

2 SOCIOCONSTRUCTIVISM

Like behaviorism, cognitivism and constructivism, socioconstructivism is one of the most recent learning theories. Developed by Lev Vygotski (1896-1934), and derived from constructivism of Jean Piaget (1896-1980), socioconstructivism can be defined as an approach to learning according to which knowledge acquisition is facilitated by the inclusion of social field of learner [9]. The social world is a central concept in socioconstructivism and includes people who directly affect the learner.

In a complex situation where at least two persons try to solve a problem, socioconstructivism then introduces an additional dimension in the construction of knowledge and the development of skills: the multiple social interactions (Fig. 1).

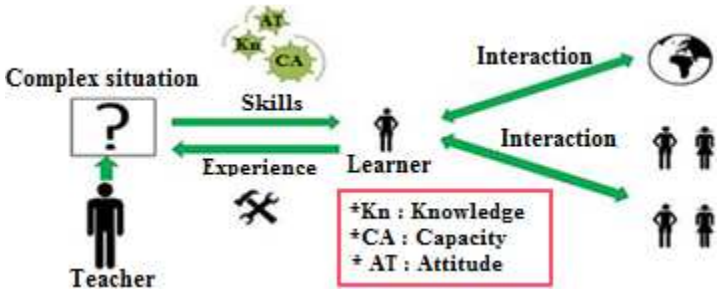


Fig. 1. Learning according to the socioconstructivist model

Socioconstructivism is an approach increasingly favored in the world of education [10]. This approach demonstrates superior efficacy compared to more traditional approaches (behaviorist model, transmissive model). Let us also note that if socioconstructivism seems to be advocated at the present time, it is far from being opposed to other educational models but it allows bringing together the common points between these models.

Today, and in the context of rapid technological evolution, e-learning constitutes a privileged field of application of socioconstructivist approach [11]. Digital spaces on Internet offer many tools for sharing and exchange allowing to develop all the fundamental concepts on which is based this approach: Zone of Proximal Development (ZPD), socio-cognitive conflict, metacognition and shoring process [12].

3 E-LEARNIN NORMS AND STANDARDS

The growing number of distant learning systems has stimulated research on systems interoperability and learning content reuse. In this context, various standards have been mainly developed to ensure the accessibility, interoperability and reusability of LO produced. These specifications can be classified according to different levels of operations [13].

3.1 LOM (LEARNING OBJECT METADATA)

LOM is a data model published in 2002 by the LTSC (Learning Technology Standardization Committee) of the IEEE and used to describe a learning object and similar digital resources used to support learning. The purpose of learning object metadata is to support the reusability of learning objects, to aid discoverability, and to facilitate their interoperability, usually in the context of online learning management systems (LMS).

The LOM comprises a hierarchy of elements containing nine categories at the first level: General, Life Cycle, Metadata, Technical, Educational, Rights, Relation, Annotation and Classification. Each of which contains sub-elements; these sub-elements may be simple elements that hold data, or may themselves be aggregate elements.

3.2 SCORM (SHARABLE CONTENT OBJECT REFERENCE MODEL)

SCORM, proposed by the Advanced Distributed Learning, is one of the most popular standards for learning contents. It is a set of specifications for developing, packaging and delivering high-quality education and training materials whenever and wherever they are needed. This specification promotes reusability and interoperability of learning content across LMS [14].

The SCORM has releases dating back to 2000 with SCORM 1.0. SCORM 1.2, released in 2001 is the final version of SCORM before the integration of sequencing. Beginning in 2004, SCORM began to version with different editions of SCORM 2004. The most recent release (2009) is SCORM 2004 4th Ed. SCORM is composed of three sub-specifications: Content Packaging section, Run-Time section and Sequencing section.

3.3 IMS-LD (INSTRUCTIONAL MANAGEMENT SYSTEMS-LEARNING DESIGN)

IMS-LD was firstly called Educational Modeling Language (EML) and proposed by Open University of the Netherlands. The work about EML is actually standardized in the IMS-LD specification [15]. This standard allows specifying formally learning unit corresponding to the description of the resources and the scenario managing them.

The IMS-LD specification concerns pedagogical engineers who are expert of this language [16]. Although IMS-LD was finalized, some initiatives already propose prototypes of authoring-tools. However, no authoring-tool addresses the multidisciplinary team in charge of the design of the learning unit: the non-expert end-users. The elaboration of models with IMS-LD concerns the latest of the design phase; it is required that a scenario was already pre-established. Models examples based on the UML language, and more particularly the activity diagrams, illustrate well how the results of analysis, the stories, could be graphically described as virtual learning scenarios on which formal models using the IMS-LD language will be specified. So, IMS-LD encourages the use of activity diagrams from UML for these upstream steps of the design process [17].

4 PROPOSITION

Starting from the fact that, for any creative process, the most important work resides at the design [18], this contribution intervenes at the level of the design phase of the instructional design process of e-learning and proposes a Socioconstructivist Model of Collaborative Learning Design (SMC-LD) [19]. The model supports the design phase for the steps of initial requirement, analysis, design and detailed design (Fig. 2).

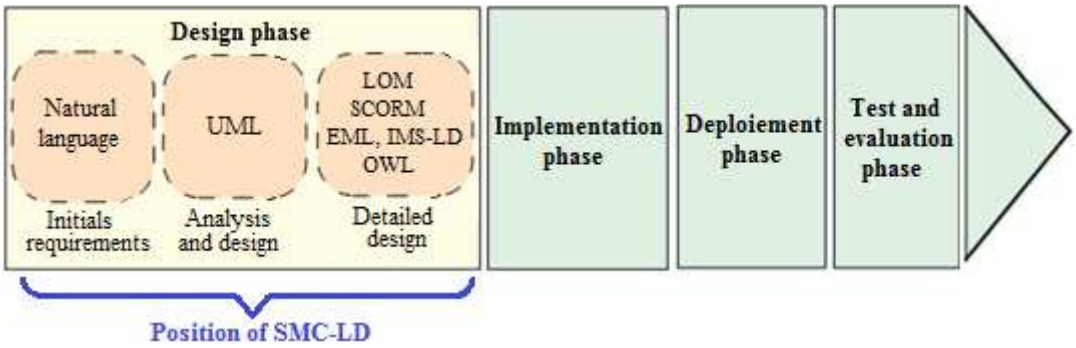


Fig. 2. Position of the contribution within the instructional design process

SMC-LD is a model dedicated to the design and elaboration of LO. It is a method of collaborative design and modeling of learning units, upstream of SCORM and IMS-LD models, and is focused on strategies based on the socioconstructivist approach. This proposal comprises two complementary parts (Fig. 3).

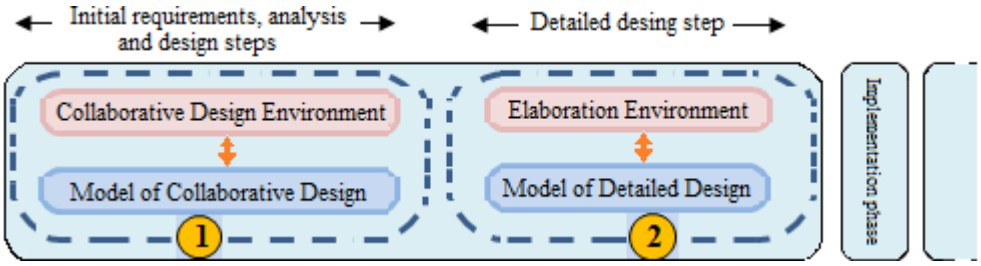


Fig. 3. The two parts constituting the SMC-LD

In the SMC-LD, the two parts cover respectively the two mains aspects which the model is interested: “design” and “development”. The following text describes each of the two parts of SMC-LD.

4.1 First part of SMC-LD

To accompany the sliding of learning practices from the individual toward the collaborative, and therefore produce pedagogical contents adapted to this new learning context, this work proposes as a first contribution to establish a model of collaborative design (and not individual design) of pedagogical contents used in e-learning. The objective is to take into account the socioconstructivist approach in the design process, since this approach considers that the content to be learned always wears the color of the context in which it is designed.

This model covers the first three steps of the design phase of the learning design process (Fig. 3). The design is assured according to a well-defined approach, based on a generic life cycle adapted to the design of content according to an incremental process broken down into tasks to be completed collaboratively.

The design, which takes place in an online *Collaborative Design Environment*, is becoming less the fruit of an isolated author, but it is team work consisting of a pedagogical coordinator and several authors in charge of the design of pedagogical contents. The authors, freed from the constraints of time and place, should collaborate and exchange. Pedagogical content does not stay frozen in time, it evolves and can be revised by a succession of authors. Likewise, the content, that becomes unified, is segmented into elements finer granularity in order to distribute the design work between different authors.

4.2 Second part of SMC-LD

The second proposal is based on the finding that at the level of detailed design step (Fig. 2), the relevance of several norms and standards of educational modeling been the subject of continuous debates and controversies [5]. This step (detailed design) of the learning design process is the subject of the second proposal.

Thus, we were inspired of works on these educational standards for provide a method of modeling of LO upstream of SCORM and IMS-LD models. The method proposes to extend and restructure SCORM model by incorporating aspects derived primarily from work on IMS-LD: add activities and take into account the social dimension by adding a new role: the “group”.

All the pedagogical functions described above are implemented in the form of an author tool that allows facilitating the generation of LO compatible to SCORM format. This tool, which represents the *Elaboration Environment*, is designed as a module integrable to the online *Collaborative Design Environment* or to any LMS.

This second contribution is a complement to the first. It constitutes the second part of the SMC-LD and covers the detailed design step of the design phase of the learning design process (Fig. 3).

5 THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF SMC-LD

In the SMC-LD, the modeling of a Learning Unit (LU) follows a process consisting of two complementary phases (Fig. 4):

- *Collaborative design phase*: it covers functionalities of the first part of SMC-LD and it is taking place in three steps: initial requirements, analysis and design. It is done collaboratively and in natural language according to the V life cycle, and through an online "*Collaborative Design Environment*".
- *Development phase (detailed design)*: it covers functionalities of the second part of SMC-LD and it is taking place in three steps: structuring of content, creation of learning path and creation of didactic scenario. In this phase, the content development is done through an "*Elaboration Environment*", developed in the form of an authoring tool.

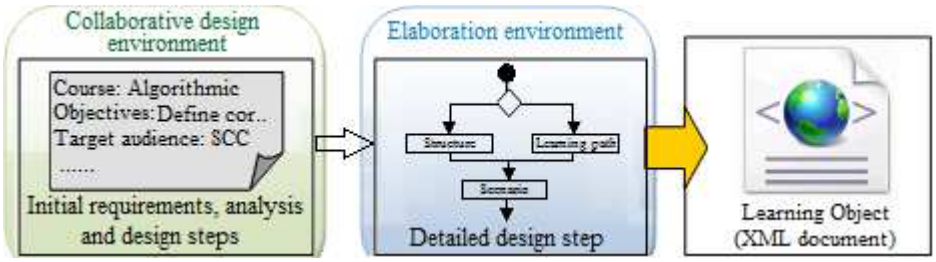


Fig. 4. Process of design/development of a LO using SMC-LD

The result of the modeling process, which includes the two phases described above, is an interoperable and reusable LO, formalized by an XML document. In the following are described each of the phases.

5.1 COLLABORATIVE DESIGN PHASE

This phase is a process of collaborative design of contents similar to what we find in software engineering. Design is ensured according to a life cycle that brings several advantages [20]: promotes traceability, improves the visibility on the content evolution, promotes the collaborative work, etc. Considering its advantages, the choice fell on the model known as "V-Cycle". Fig. 5 illustrates the steps of the collaborative design process of contents.

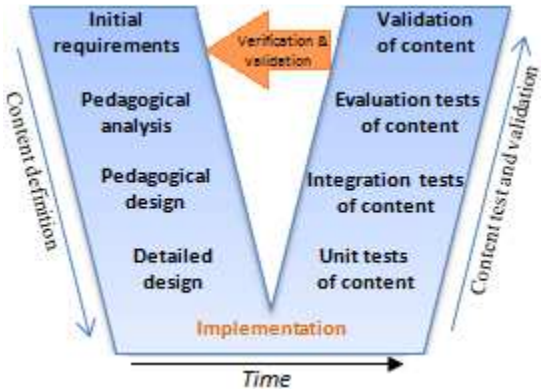


Fig. 5. Life cycle of collaborative design process

The design process takes place in an online "*Collaborative Design Environment*" and is done in natural language and through descriptive texts and schemas. On completion of this process, the authors must have a database of detailed resources in order to deduce the graph of the sequence of activities of learning unit and their staging by role.

5.2 DEVELOPMENT PHASE

This phase is a process of modeling of contents designed (in collaborative design phase) as a LU and then development of these contents as a LO. In SMC-LD, the structure of a Learning Unit (LU) is constructed from three components: objectives & prerequisites, components & and method. To take into account socioconstructivist approach, this structure introduces, in addition of the usual roles: "learner" and "teacher", a new role which is the “group” (Fig. 6).

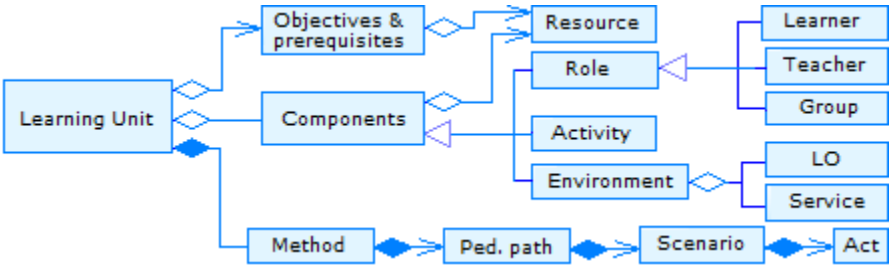


Fig. 6. General structure of a learning unit

The process of developing an LO therefore consists in describe the structure of the LU in terms of objectives and prerequisites, components (roles, activities, environment, etc..) and method necessary for the implementation of this unit. This process is composed of three main steps:

- *Structuring of content*: consists in structuring the LO. The comparative study of main pedagogical standards allows us to say that the structure the more apt to represent a LO is the hierarchical structuring. The LO is structured as a tree whose root is the LU and the branches are composed of concepts: sub-LU, activity, sequence and act.
- *Creation of learning path*: consists in creating learning paths in order to organize transitions between activities. Transitions can be expressed through four types of links: default, prerequisite, conditional and empty link.
- *Creation of didactic scenario*: consists in creating didactic scenarios in order to plan sequences relating to an activity. The scenario organizes the knowledge of activity in a series of pedagogical acts, sequentially executed on mediatic resources used. A sequence has an initial state of start and a final state to meet. Transitions made between two acts are performed in accordance with the rules of precondition and post-condition.

6 CONCEPTUAL ARCHITECTURE OF SMC-LD

The general architecture of SMC-LD is based on the main functionalities ensured by the model: collaborative design and development of e-learning contents (Fig. 7).

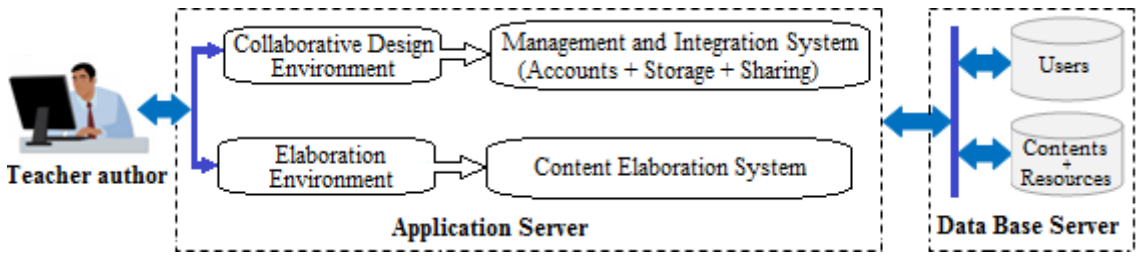


Fig. 7. General architecture of SMC-LD

In this architecture, we can distinguish two constituent parts of SMC-LD: "*Management and Integration System*", which ensures collaborative design of contents, and "*Content Elaboration System*" which ensures contents development. In what follows, are described each of the two systems.

6.1 CONTENT ELABORATION SYSTEM (CESYS)

CESys is a teacher environment allowing to modeling, creating or editing LO according to the development process defined above (section 5.2). This system offers to authors four types of tasks:

- Pedagogical task: creating the structure and the learning path;
- Didactic task: didactic planning;
- Mediatic task: mediatization of scenarios and designing the interface of the LO;
- Technical task: indexing, storage and import of resources.

At the end of the development process, the CESys generates the executable version of the LO produced.

6.2 MANAGEMENT AND INTEGRATION SYSTEM (MISYS)

MISys aims to make available to teachers an online environment allowing multiple possibilities. This is an LMS that ensures two main functions:

- *Management function*: MISys serves to manage the database of LO, resources, users accounts, training, etc. It also offers the possibility to test the developed content and simulate its use.
- *Integration function*: MISys brings together the functionalities of SMC-LD by:
    - integrating the Collaborative Design Environment of contents. The collaboration is facilitated by the exchange and sharing by using communication tools (chat, forum, video conferencing, etc.);
    - integrating the CESys as an additional module, which enables online creation of LO.

MISys is used by three types of actors: administrator, teacher and learner. The identification allows the user to access the interface that is dedicated to him. In the case of the teacher, it will eventually pass to CESys.

7 TECHNICAL CHOICES AND IMPLEMENTATION

To implement the two systems (CESys and MISys) that compose SMC-LD, software architecture adopted is based on evolved technological choices, used in the development of modern forms of e-learning (Web 2.0 technologies. The implemented prototype includes a “teacher environment” offering the possibility of collaborative design and development of contents, and a “learner environment” giving the opportunity to attend training paths (Fig. 8).

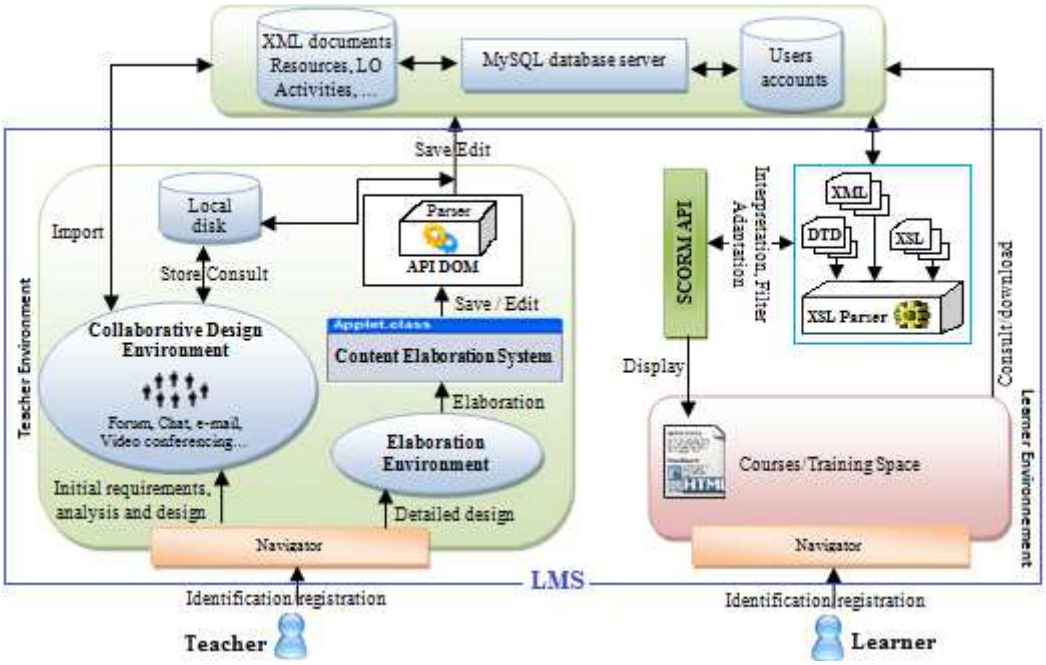


Fig. 8. Software architecture of the prototype implemented

This architecture, open and scalable, allows to customize and to develop the system in order to extend its basic functionalities. Many modules and extensions that allow enhancing the prototype can be downloaded and integrated freely. In what follows, the different software tools adopted in this architecture will be presented and justified.

7.1 MANAGEMENT AND INTEGRATION SYSTEM

MISys is implemented using an LMS because the work realized in this article is a work of learning design and not a work aimed the establishment of a new platform. Thus, following the comparative study of the main existing LMS, and view ease of use and pedagogical flexibility it brings, the choice fell on the Dokeos LMS.

MISys is therefore set up using Dokeos (version 2.1). This LMS works under Linux, Windows and Mac, according to the combination Apache (HTTP server), MySQL (database server) and PHP (development language). It incorporates a tool of Mind mapping, called Dokeos MIND, very useful in collaboration between authors.

7.2 CONTENT ELABORATION SYSTEM

Given the functionalities that the CESys must offer, the choice of programming language is directed to Java. It is an object oriented language, portable and having a great richness of basic libraries. These qualities seem appreciable to develop the CESys in the form of a Java applet that can be integrated into MISys or any LMS.

7.3 STRUCTURING AND INDEXATION OF LO

To describe the structure of LO, it was agreed to use XML. Indeed, XML is adapted for the storage and manipulation of documents representing the LO, and this through the markup syntax very suitable for the hierarchical structuring adopted. XML separates content from the presentation by using XSL and allows to standardize description of LO produced.

Thus, the LU produced includes resources, activities, roles, acts, sequences, etc, assembled in a Zip file. All of the tags related to the structure and the type of their content will be defined using the Document Type Definition (DTD) or XML Schema. The rules of display will be defined in the XSL stylesheets (eXtensible Stylesheet Language).

To index LO produced, an LOM application profile was used. The choice of this standard is justified by its implementation in most storage systems of LO [21] and its capacity to facilitate the sharing and reuse of LO. The LOM application profile

chosen allows to overcome the criticisms worn on this standard (abstraction, genericity, etc.), and responds to our LO classification that aims to distinguish between pedagogical resource, didactic resource and mediatic resource.

7.4 JAVA API FOR XML PROCESSING

To edit XML documents (that represent LO) from the CESys, the passage XML-Java is done using the Java DOM (Document Object Model) API. Java DOM is a standard proposed by the World Wide Web Consortium (W3C) and plays the role of interface to edit an XML document. This parser is perfectly suited to the programming of interactive applications.

Finally, in order to render available and to test the SMC-LD, the prototype implemented has been hosted on a Web server that runs under Linux (http://www.socio-foad.org/).

8 EXPERIMENTATION

This section consists in testing the use of the proposed model in real teaching conditions in order to validate its applicability. Although SMC-LD aims to provide generic solutions to all areas of education, the experimentation conducted focuses on our field of teaching which is computer science, and concerns the design and development of learning objects for teaching the "algorithmic and programming" in scientific common core of the Moroccan secondary cycle.

This exercise of experimentation was established during the second semester of teaching in the spring 2014 and took place alternately between two phases: (1) an experimentation of the SMC-LD on the field, with a team of teachers, and (2) a practical test of contents (produced with SMC-LD) with a group of learners. In what follows, the paper presents the characteristics, the methodology and the results of the two experimentations.

8.1 EXPERIMENTATION OF SMC-LD

This first experimentation, which lasted two weeks, consists in test on field the collaborative learning design approach. Its purpose is to highlight the strengths of our approach to consolidate and its weak points to correct.

8.1.1 PARTICIPANTS

The process of collaborative design and development of pedagogical contents is experienced with a group of five teachers of computer science coming from secondary cycle. This choice is justified by the fact that the methodology used to test the model is based on the method of Nielsen that proposes to use a small number of test users (5 participants) for lifting more than 80% of the problems of a software system [22].

During the collaborative design of pedagogical contents, teachers were completely distant from each other. The guidelines formulated indicate that the design must be done collaboratively according to the V life cycle: pass to the test, and then validate each step of design completed. The coordination between teachers is assured by ourselves since we're in charge of the administration of the design space.

8.1.2 METHODOLOGY

The adopted approach is based on the analysis of empirical data coming from two types of sources: (1) a survey conducted among teachers which play the role of content designers, and (2) the observation of the behavior of these teachers in the experimentation sessions through analysis of recorded traces.

The survey is based on the technique of "usability test" of Nielsen which consists in measuring the degrees of usefulness, usability and acceptability of a software solution by end users [23]. It is conducted using a questionnaire developed from heuristics Nielson [24] and administered online. The questionnaire, submitted to teachers at the end of the experimentation, evaluates aspects related to the design of pedagogical content and to the usability of the proposed solution. It is built with a limited number of questions (12 questions). The majority of questions are multiple choice types. The items were measured using Likert scale [25] of 5 points: 1: unsatisfied, 2: neutral, 3: somewhat satisfied, 4: satisfied, 5: very satisfied.

The observation of the behavior of teachers participating in the experimentation rests in turn on capabilities of tracing offered natively by the Dokeos platform. We focused on a quantitative analysis of traces collected (number of open sessions, usage statistics for each tool, number of connections, etc.).

8.1.3 RESULTS AND INTERPRETATIONS

The experimentation conducted has given an overview of the relevance of our proposals and has highlighted new perspectives. Thus, the initial objective concerning teacher motivation has been reached. Teachers have preferred to work with this technique of collaborative design rather than traditional and individual design. They were very enthusiastic about this type of experience.

8.1.3.1 OBSERVATION OF TEACHER BEHAVIOR

The access to the teachers' traces is done using the "Tracking" tool included in Dokeos. Analysis of these traces has allowed us to note that, of the five teachers of the overall population, 5 have used the platform (a utilization rate of 100%).

At the level of collaborative design environment, a very dense activity was observed. Thus, we counted a total of 113 connections with an average of 22.6 connections per teacher. The number of connections has evolved during the second week of the experimentation. So, we counted 44 connections made during the first week. The number of connections began to increase in the second week during which we identified 69 connections (Fig. 9).

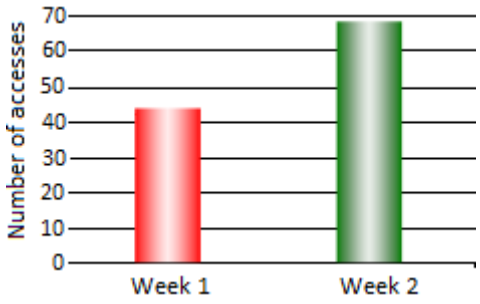


Fig. 9. Evolution of number of connections to the platform during the experimentation

The evolution in terms of number of connections is likely due to the fact that the second week of experimentation includes the course ends, period during which teachers are engaged in the pedagogical planning and the preparation of courses for the next quarter.

Besides the number of connections, we have analyzed the distribution of traffic of access to the tools offered by the platform. Thus, we found that teachers have mainly used the tools: "Documents" to manage files which are content resources (transmit, download, consult, etc.), "Forum" to communicate (write, view and reply to messages received), "Wiki" (write and illustrate documents into web pages collaboratively), "Learning path" (create and edit learning path), "Mindmap" (create, send and receive concept maps describing the pedagogical content). Overall statistics found are shown in Fig. 10.

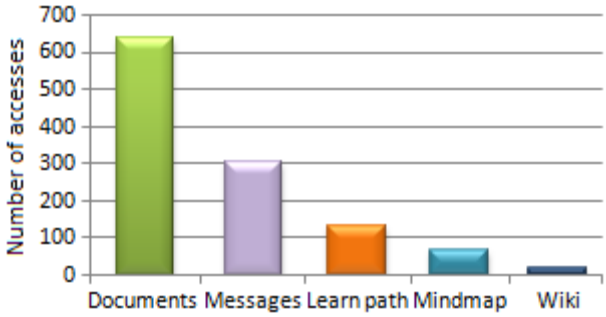


Fig. 10. Traffic distribution of access to tools consulted

In the distribution of Fig. 10, an extensive use of the functionalities of document management, of communication and collaboration, compared to other functionalities, is remarkable. This indicates that, in the activity of design/development of contents, teachers have frequently interacted among themselves and with the resources placed at their disposal. In the same

context, trace analysis conducted shows that many inter-teacher interactions took place with the communication tool "Chat" native to Dokeos. These statistics can be explained by the fact that teachers had need the tools of communication and collaboration to help each other to understand, design and develop course's contents and resources, but also by the fact that the test period was short for effective use of some tools.

We also note that the testers have not had recourse to communication tools offered by Dokeos only, but they have used other means of communication (social networks, email, etc.). This allows us to affirm that the experimenters did not have a concern about the workspace, but working collaboratively is the main lever for improving practices in design / development of educational contents.

8.1.3.2 SATISFACTION SURVEY

The first survey results obtained among teachers are encouraging and confirm our interpretation of the traces' analysis presented in the previous section. These results show that teachers have appreciated this service that has helped them to develop learning objects collaboratively.

The results obtained show that the teachers involved have never participated in this type of process of collaborative and online design/development of pedagogical contents. For this group of teachers, the proposed method represents a new approach to be tested.

Concerning teacher satisfaction toward the proposed approach, 80% of respondents have expressed their satisfaction: 40% are satisfied and the other 40% have expressed a total satisfaction. Only 20% of respondents have expressed an average satisfaction whereas no response expresses a neutral or unsatisfactory position (Fig. 11).

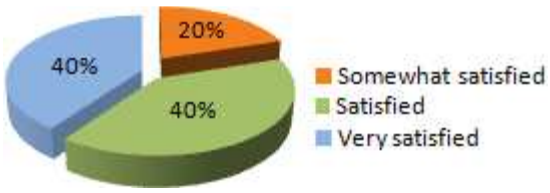


Fig. 11. Satisfaction of teachers toward the SMC-LD approach

The high rate of responses who express satisfaction toward SMC-LD is explained by the fact that the online team work, offered by the process of collaborative design and development of contents, has well assured the support of teachers. However, responses expressing an average satisfaction reflect the fact that teachers do have not had (or have not taken) enough time to fully engage in the experimentation.

At the level of MISys, teachers are particularly satisfied with the collaborative design space and the means of exploration of contents, thanks to the tools of communication and management available. They consider that the tools of synchronous and asynchronous communication facilitate communication among teachers (80%) and amplify the opportunities for collaboration and exchange between them, which are done rarely or are not done with the traditional means of communication. The opinions of teachers also show that the communication is done with flexibility and suppleness and that this way of working has facilitated the flow of information and updating knowledge in solving problems related to the isolation of teachers working in geographically dispersed areas (100%).

At the level of CESys, teachers have expressed their satisfaction toward the effectiveness of the tool available for achieving the tasks expected. Thus, 60% of teachers are highly satisfied with the authoring tool and the rapid handling of the window "Creation Wizard" that ensures the creation of LO. Only 20% of respondents expressed an average satisfaction toward the developed authoring tool (Fig. 12).

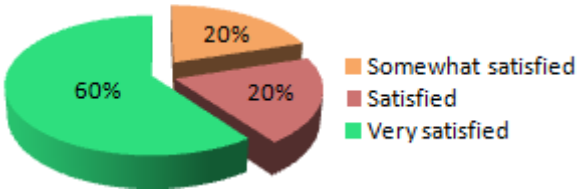


Fig. 12. Satisfaction of teachers toward the CESys (authoring tool)

From design point of view, the reactions are not from the same level, but 60% of teachers assume that this is a good compromise between the complexity of pedagogic functions and the richness of the interface by elements associated with these functions.

Concerning the LO produced, most of the actors is totally satisfied with the organization of activities elaborated. They consider that pedagogical contents produced are adapted to socioconstructivist context of learning, which is favored in e-learning practices.

In addition to the results presented above, the free answers to the last question comfort us, but draw our attention to some problems to solve, particularly: add more functions such as the demand to taking control of a session, realize a bank of digital resources useful for course development and productivity of contents, etc.

8.1.4 CONCLUSION

The aim of this first experimentation was to examine the effectiveness of the proposed model. In this experiment, the methodology adopted is based on two techniques of data collection: a survey conducted among teachers (designers) and the observation of their behavior during the experimental sessions.

The results found show that teachers are massively satisfied with this approach. They appreciated the service that has helped them to develop digital documents such as the plans of courses, learning activities, learning situations, pedagogical scenarios, etc. On the other hand, the tracking of teachers in the collaborative design sessions shows that the tools on the platform have well amplified opportunities of communication, exchange and collaboration among teachers.

Teachers involved in this experimentation proved in practice the efficiency of the device that implements the model of collaborative design/development of pedagogical contents. All of the proposed tools can play an important role in designing quality pedagogical content, by reducing the effort, time and distance between teachers.

8.2 PRACTICAL TEST OF CONTENTS PRODUCED WITH SMC-LD

This second experimentation, which lasted one month, consists to test, in a real learning situation, contents (learning objects) produced according to the approach proposed by SMC-LD. It aims to measure the impact of the model on learnings.

8.2.1 PARTICIPANTS

The team of learners who participated in this experimentation is composed of 36 learners of the scientific common core in the context of Moroccan secondary education. This team is divided into two groups:

- Control group: the learning situation unfolds in presential with a classroom of learners;
- Experimental group: the learning situation unfolds in presential but it is enriched by the e-learning platform.

Table 1 summarizes the characteristics of learners participating in the testing of contents produced.

Table 1. Characteristics of learners participants in testing of produced contents

Elements	Modalities	Experimental group	Control group	Total
Learners	M/F	18	18	36
Sex	Male	10	11	21
	Female	8	7	15
Study level	Scientific common core	18	18	36
Frequency of computer use	Several times per day	11	13	24
	Once per day	7	4	11
	Several times per week	0	1	1
Computer science prerequisites	Yes	15	13	28
	No	3	5	8

In an experimentation session, a group of nine learners were present in the classroom equipped with 9 computers. Learners had about 16 years and were more or less familiar with the use of computer science. In the two groups chosen, there was an almost even split between boys and girls because specific gender aspects must be taken into account [26].

8.2.2 METHODOLOGY

To test the LO produced according to the SMC-LD model, the adopted approach is based on a very simple method of experimental class and control class that, on the basis of a comparison between the results of evaluations relating to targeted skills, allows measurement of the impact of the model on learnings. The comparison of evaluation results of the two groups allows to distinguishing possible differences, from which we will show the influence of the model on learnings. For this, we chose to address two situations:

- "presential situation": devoted to control group that received a traditional presential teaching. Each session is divided into two parts: a first part of theoretical course devoted to one or more concepts, and a second part devoted to a series of practical exercises. The teacher relies on visual support using a "data show" for better visibility, especially when it comes to examples of computer programs to run.
- "enriched presential situation": devoted to experimental group. The learning sessions are made in a hybrid way (in presential and at a distance). Each learner has had access, through his workstation, to the learning environment in which it can start a learning path. The recommendations on how to use tools (communicate, exchange, share, etc.) integrated to the platform were provided. Learning is done in socioconstructivist way through the learner-teacher and learner-learner interactions.

8.2.3 EVALUATION PROCESS

The evaluation process is prolonged over the entire period of contents testing. Evaluation consists to a common summative test at the end of each session for the two groups. The choice fell on "multiple choice questions". This type of evaluation measures the sum of the knowledge acquired during the session, errors are then sanctioned as weaknesses. This evaluation is sanctioned by a note that will account for the average or the successful of learning. This evaluation is based on an evolved synthesis of exercises realized at various stages of course, a principle to help to avoid simple memorizations.

8.2.4 RESULTS AND INTERPRETATIONS

The comparison of the success rate was performed on the basis of evaluations results of two groups for all experimentation sessions. Generally, results show that, for the two groups, there is a significant difference in terms of number of learners having the average. Statistics obtained in the eight evaluations/tests are shown in Table 2.

Table 2. Recapitulative of tests results of the two groups

N° Test/ Evaluation	Experimental group		Control group	
	Number of learners whose average is:			
	<10	>10	<10	>10
1	10	8	8	10
2	9	9	9	9
3	7	11	10	8
4	6	12	9	9
5	5	13	8	10
6	6	12	10	8
7	8	10	9	9
8	5	13	7	11

The data in Table 2 show that, for the group of online learners (with SMC-LD), an average of 11 learners out of 18 have obtained an average or more, which means that the success rate for this group has reached 61.11%. For group of learners in presential (without SMC-LD), an average of 9.25 out of 18 have obtained an average or more. This means that the success rate for this group has decreased to 51.39%. Fig. 13 illustrates to best the success and failure rates for the two groups.

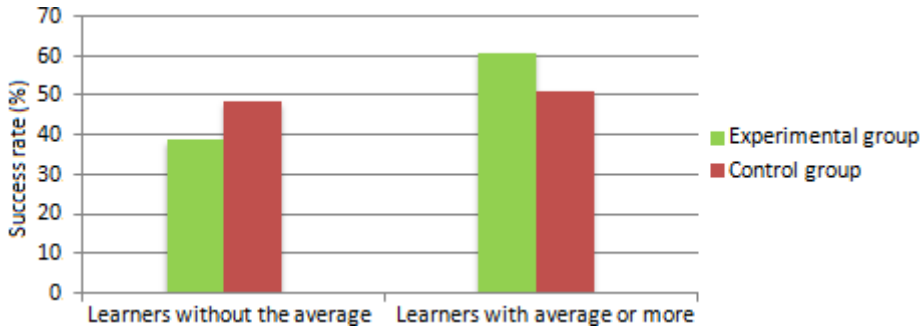


Fig. 13. Success and failure rates for the two groups

Test results show that there is a quantitative and qualitative difference between learners of experimental group and those in the control group. From the quantitative point of view, the use of SMC-LD model has allowed to learners, initially weaker, to enhance their implication in learning , what has led to a significant increase in success rate from 51.39% (for the control group) to 61.11% (for the experimental group).

From a qualitative point of view, we found that, in terms of skills development, the proposed educational model has contributed to the perfection of students' learnings. The model places learner at the heart of the learning process. It promotes the emergence of an interactive educational approach in which learning is built in a socioconstructivist way, through a relation of mediation of teacher with learner.

The results of this second experimentation can thus constitute a starting point to address the needs (of teachers or learners) formulated in the framework of this research work. Thus, adopting a collaborative approach in the design and development of pedagogical contents leads to the production of quality contents, adapted to the current context of e-learning which fits into socioconstructivist approach. The use of these contents in collaborative learning activities then brings important educational benefits and allows obtaining a higher success rate.

In addition to the results of evaluations carried, the possibility of access to traces of various working sessions of learners on the platform allowed us to found a very dense activity at the level of use of tools: "Chat", "Learning path" and "Quiz". This allows us to visualize also the progression, the success rate and the number of attempts for each learner.

8.2.5 CONCLUSION

The aim of this second experimentation was to evaluate the pedagogical contribution of e-learning contents designed collaboratively according to the SMC-LD model. The evaluation was conducted according to an experimental study methodology, based on comparison of results of tests performed for two groups: experimental group and control group.

Based on this methodology, we have compared the performance of learners in the online environment, which offers contents designed collaboratively, with learners who followed a presential and traditional situation. The results show that the contents designed collaboratively according to SMC-LD model have provided significant pedagogical benefits at the level of learners' performance. This confirms the effectiveness of the proposed model in terms of skills development.

On the other hand, analysis of the use of collaboration and communication tools, offered by the online learning environment, also shows that these tools have been fully exploited. This confirms the hypothesis of the necessity to integrate these tools within these interfaces for increased collaboration and effective learners tracking.

9 GENERAL CONCLUSION AND PERSPECTIVES

This article has presented design, implementation and experimentation of a generic model adapted to collaborative design and development of e-learning pedagogical contents. The introduction of such a model seeks to assist and guide teachers in implementing pedagogical contents best suited to the current e-learning context (socioconstructivist, collaborative, etc.).

The establishment of SMC-LD is focused on two main aspects: (1) “Contents design”, where SMC-LD proposes to establish a collaborative design process of e-learning contents. (2) “Contents development”, which is confronted to the problem of the relevance of norms and standards of educational modeling. Thus, SMC-LD proposes a method for modeling LO upstream of SCORM and IMS-LD standards.

To validate its applicability, SMC-LD is implemented through a representative prototype and then experimented in real teaching conditions. The experimentation was conducted in two phases: an experimentation of SMC-LD on field, with a team of teachers, and a practical testing of contents (produced with SMC-LD) with a group of learners. The results found are satisfactory and encourage us to pursue this research. Teachers have appreciated the collaborative learning design approach. On the other hand, the model has brought significant pedagogical benefits at the performance of learners.

As a teacher, we could confirm the relevance of the SMC-LD model. In the future, experimentation of SMC-LD continues well as its development. The different returns resulting from the experimental study will be considered in order to improve efficiency of the model on the technical, ergonomic and pedagogical plan. On the other hand, in short and in medium term, deployment of our approach in other contexts of learning and other disciplines will contribute also to the validation of our generic proposals.

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Dynamics of a Nonlinear Automatic Door Closing Torsional Mechanism

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ABSTRACT: Door closing mechanisms are used in all building venues using air conditioning systems to reduce thermal losses. One of the closing mechanisms is the torsional type. The visco-elastic characteristics of the closing mechanism may exhibit certain sort of nonlinearities from its linear characteristics. The dynamics of the door with nonlinear characteristic with positive and negative deviation from the linear characteristics of the door closing mechanism are studied. The system dynamics are defined by a nonlinear ordinary second-order differential equation which is solved using Runge-Kutta 4 technique through the MATLAB environment. Two types of nonlinearity are considered depending on the deviation from the linear characteristics of the closing mechanism. One type reveals dynamic behaviour similar to that of overdamped linear dynamic system while the other type reveals dynamic behaviour similar to that of underdamped linear dynamic system. The second type has large effect on the door dynamics where the maximum deviation in the door dynamic response may exceed 700 % from the linear characteristics of the door.

KEYWORDS: Automatic door closing mechanism, Nonlinear mechanism characteristics, Door dynamics.

1 INTRODUCTION

Door closing mechanisms are required when building doors are required not to be open in its default condition. Application of this is air-conditioned building where energy saving is a requirement. This covers conference rooms, classrooms, administration buildings, airports travel terminals, banks, and other many applications. In such applications, the door has to close automatically in a minimum time to minimize heat transfer from outside to inside the building and vice versa. Others may require the door to close slowly not to heart the other users. A mechanical recoiling mechanism is used for this purpose consisting of a parallel spring and damper connected to the door at its joints. Two styles are available: the translational type and the torsional type. Only the second type is considered in this work where torsional spring and torsional dampers are used.

Clabaugh (2004) set an important guidelines for designing, constructing and renovating instructional spaces in educational classrooms. Regarding the classroom doors he stated that the doors should be equipped with hardware for slow and quiet closure [1]. Al-Bassiouny (2005) investigated the effect of quadratic and cubic nonlinearities in elastomeric material dampers to quiet torsional vibrations of internal combustion engines shafts. His study covered the effects of damping, nonlinear terms and excitation magnitude on the system dynamics [2]. Tjahjowidodo, Al-Bender and Brussel (2006) offered a model for torsional compliance of harmonic drives. The characteristics of the system compliance were highly nonlinear as shown experimentally [3]. Meirelles, Zampieri and Mendes (2007) studied the crankshaft torsional vibration in internal combustion engines. They considered a rubber and a viscous damper assembled to the crankshaft front-end [4]. Filipowicz (2007) studied experimentally the characteristics of a torsionally flexible metal coupling. He showed that it has linear characteristics during loading and unloading with different torsional stiffness [5]. Lee and Hsieh (2009) designed a motor-gear transmission system based on analysis and design theory for motion of a gear train for the automatic opening and closing of a car door [6]. Bayly et. al. (2010) set a classroom design guide including door design requirements. They pointed out the door dimensions and direction of opening and to have visual identification, opening force and hardware confirming to ADA standards [7]. Homik (2010) described methods of diagnosing, maintenance and regeneration of torsional vibration dampers used in ship building. He illustrated the types of failures occurring in viscous and spring torsional vibration dampers [8]. Homik (2011) presented means fo damping the torsional vibrations and methods for selection of viscous torsional vibration dampers for a given type of engine [9]. Filipovic et. al. (2012) presented a possible approach to define the parameters of torsional vibrating systems of internal combustion engines needed for a preliminary selection of the basic parameters of viscous type torsional vibration dampers such as the elastic damper, the balance weight damper and the dual mass flywheel [10]. Carpino et. al. (2012) presented the design of a compact torsional spring to be used in a compliant system for series elastic actuators. They considered the designed spring having linear characteristics with error up to 6 % [11]. Mahdi (2013) developed a software system to lock doors using electromagnetic door lock for security purposes [12]. Yang et.al. (2013) used a torsional spring in a spring-loaded antibacklash gear transmission to improve the transmission precision. They investigated th dynamic characteristics of the system with study of the effect of the torsional spring stiffness using damping rational preload on the dynamic transmission error [13]. Soni and Roy (2013) described the design , calibration and characterization of a thrust stand capable of nano-Newton resolution. They employed a passive eddy-current non-contact and vacuum compatible damper [14]. Joshi, Hung and Vengallatore (2014) presented an overview of recent advances in damping from viewpoint of device design. They connected and organized techniques for the rational and effective control of linear damping in miniaturized mechanical resonators [15].

2 ANALYSIS

The automatic door is a door hinged with the wall with a number of revolute joint allowing only one rotational motion θ as shown in Fig.1 (plan view). The revolute joint is at O and a closing mechanism consisting of a torsional damper and a torsional damper is attached to the door at the centreline of the revolute joint.

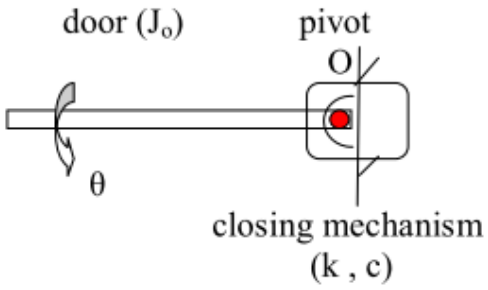


Fig. 1. Automatic door closing mechanism.

The dynamic system of Fig.1 has the parameters:

- Door mass moment of inertia about the joint centerline, J_o.
- Closing mechanism torsional stiffness, k.
- Closing mechanism torsional damping coefficient, c.

The differential equation of the dynamic system in Fig.1 in terms of the dynamic motion θ is:

$$J_o\theta'' + c\theta' + k\theta = 0 \quad (1)$$

The damping and elastic torque of the closing mechanism against the door motion are assumed nonlinear. The variation of the damping torque with door angular velocity θ' and the spring torque with the angular motion of the door θ is shown in Figures 2 and 3 for 3 levels of nonlinearity and negative and positive deviations respectively.

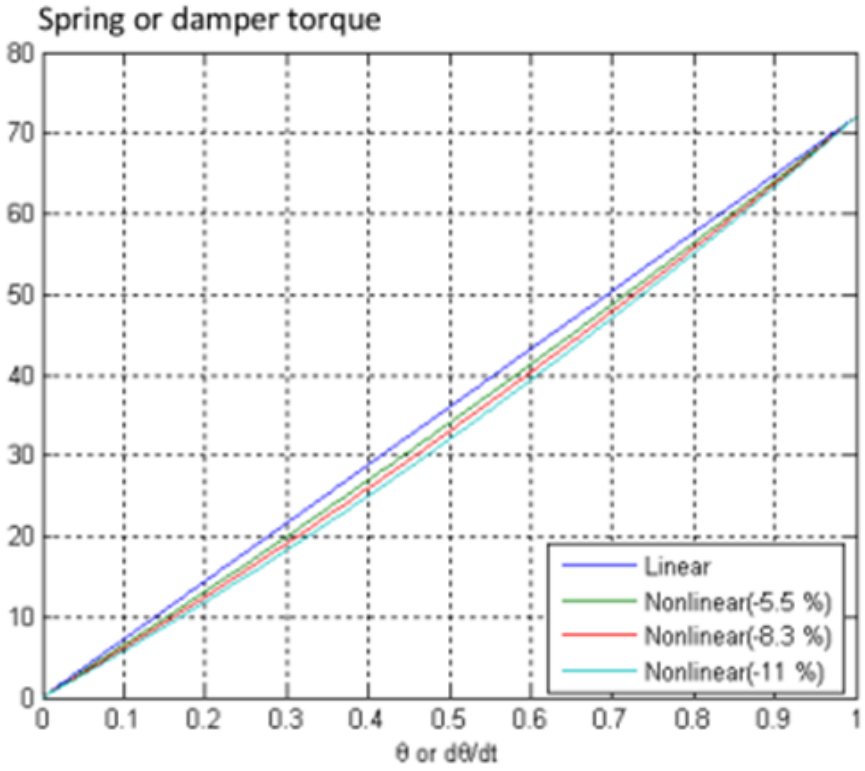


Fig.2 Closing mechanism characteristics (negative deviation)

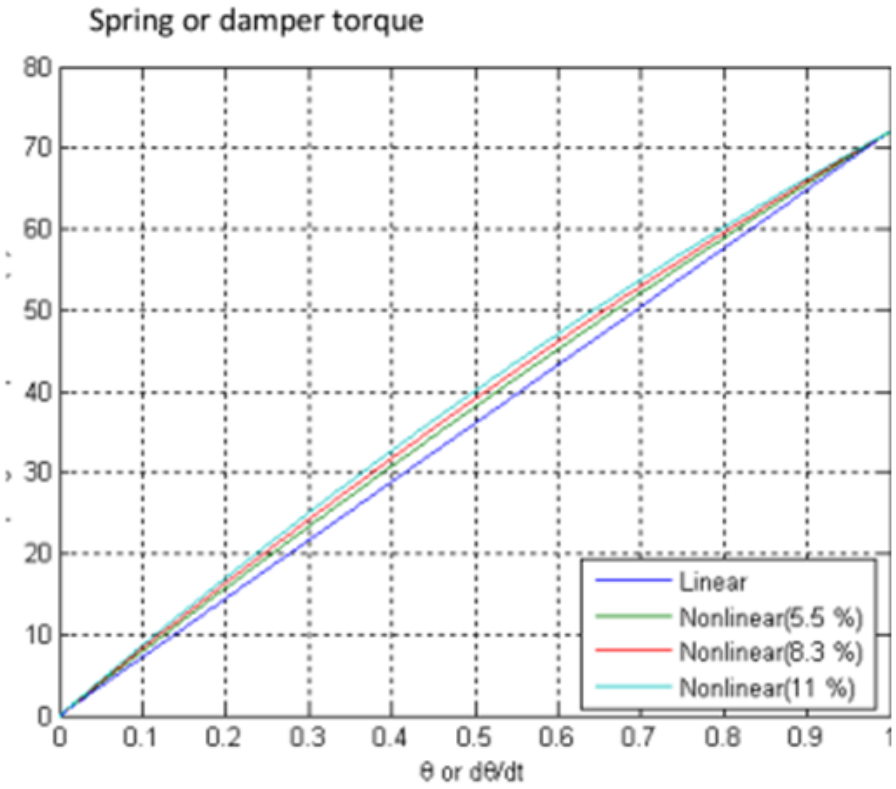


Fig.3 Closing mechanism characteristics (positive deviation)

The six nonlinearity levels correspond to the maximum deviation of the linear characteristics of the torsional closing elements as follows:

Level 1: - 5.5 % (maximum deviation).
Level 2: - 8.3 % (maximum deviation).
Level 3: - 11.0 % (maximum deviation).
Level 4: 5.5 % (maximum deviation).
Level 5: 8.3 % (maximum deviation).
Level 6: 11.0 % (maximum deviation).

The static torque applied to the closing mechanism, T is related to the mechanism deflection and/or velocity, q through the fitted second-order polynomial model:

$$T = a_0 q^2 + a_1 q + a_2 \quad (2)$$

The parameters of the nonlinear model of Eq.2 depend on the deviation level from linear characteristics. They are given in Table 1.

Table 1. Parameters of the nonlinear characteristics in Eq.2

Deviation level (%)	a_0	a_1	a_2
-5.5	8	64	0
-8.3	12	60	0
-11.0	16	56	0
5.5	-8	80	0
8.3	-12	84	0
11.0	-16	88	0

To simplify the analysis it is assumed that the elastic and damping characteristics of the closing mechanism are defined by the same equation (Eq.2). Therefore, the stiffness of the closing mechanism is given from Eq.2 by:

$$k = dT/dq = 2a_0\theta + a_1 \quad (3)$$

Where q is replaced by the door motion θ.

The damping coefficient of the closing mechanism using Eq.2 is:

$$c = dT/d\theta' = 2a_0\theta' + a_1 \quad (4)$$

Now, combining Eqs.1, 3 and 4 provides the differential equation of the door during its dynamic motion as:

$$J_o\theta'' + 2a_0\theta'^2 + a_1\theta' + 2a_0\theta^2 + a_1\theta = 0 \quad (5)$$

Eq.5 is a second-order nonlinear homogeneous differential equation describing the dynamic motion of the door as excited by the initial conditions.

3 DOOR DYNAMIC RESPONSE

The dynamic response of the automatic closing door of an 18 kgm^2 mass moment of inertia to an initial displacement θ (0) can be obtained by solving the door differential equation (Eq. 5). This is can be done by using any numerical technique such as Runge-Kutta 4 technique [16].

This requires transferring the second-order differential equation of Eq.5 to a set of first-order differential equations using the state variables. This constructs the state model of the system as follows [17]:

State variables:

$$x_1 = \theta$$
$$x_2 = \theta' = x_1'$$

Using the state variables and Eq.5, the state model of the dynamic system under study is:

$$x_1' = x_2$$
$$x_2' = -(2a_0/J_o)x_2^2 - (a_1/J_o)x_2 - (2a_0/J_o)x_1^2 - (a_1/J_o)x_1 \quad (6)$$

MATLAB is used to apply the Runge-Kutta 4 technique to solve Eq.6 for the initial conditions $x_1(0)$ and $x_2(0)$ [18,19]. A MATLAB code is written to solve Eq.6 for the boundary conditions:

$$[x_1(0) \;\; x_2(0)]^T = [1 \;\; 0]^T$$

The code output for different nonlinearity levels is given in Figures 4 and 5.

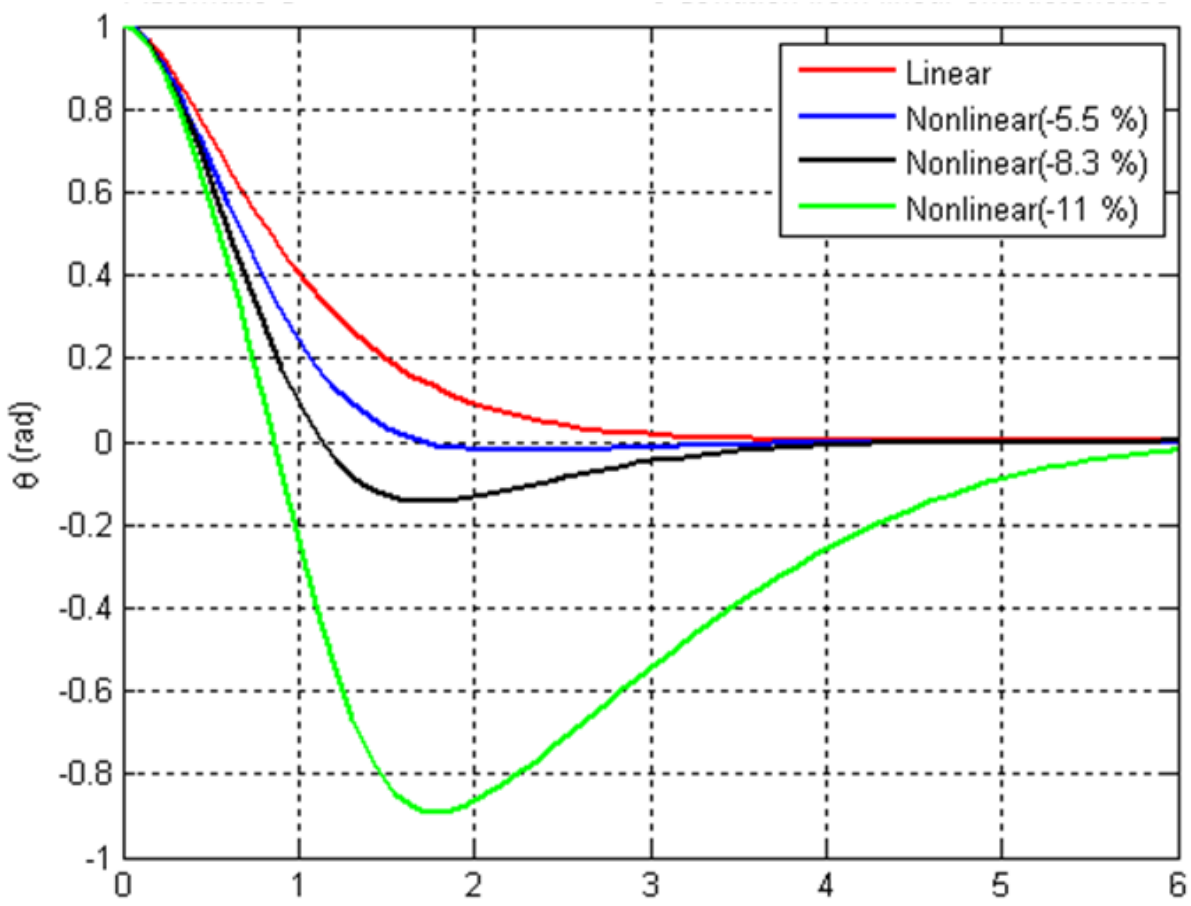


Fig.4 Door response with nonlinear negative deviation.

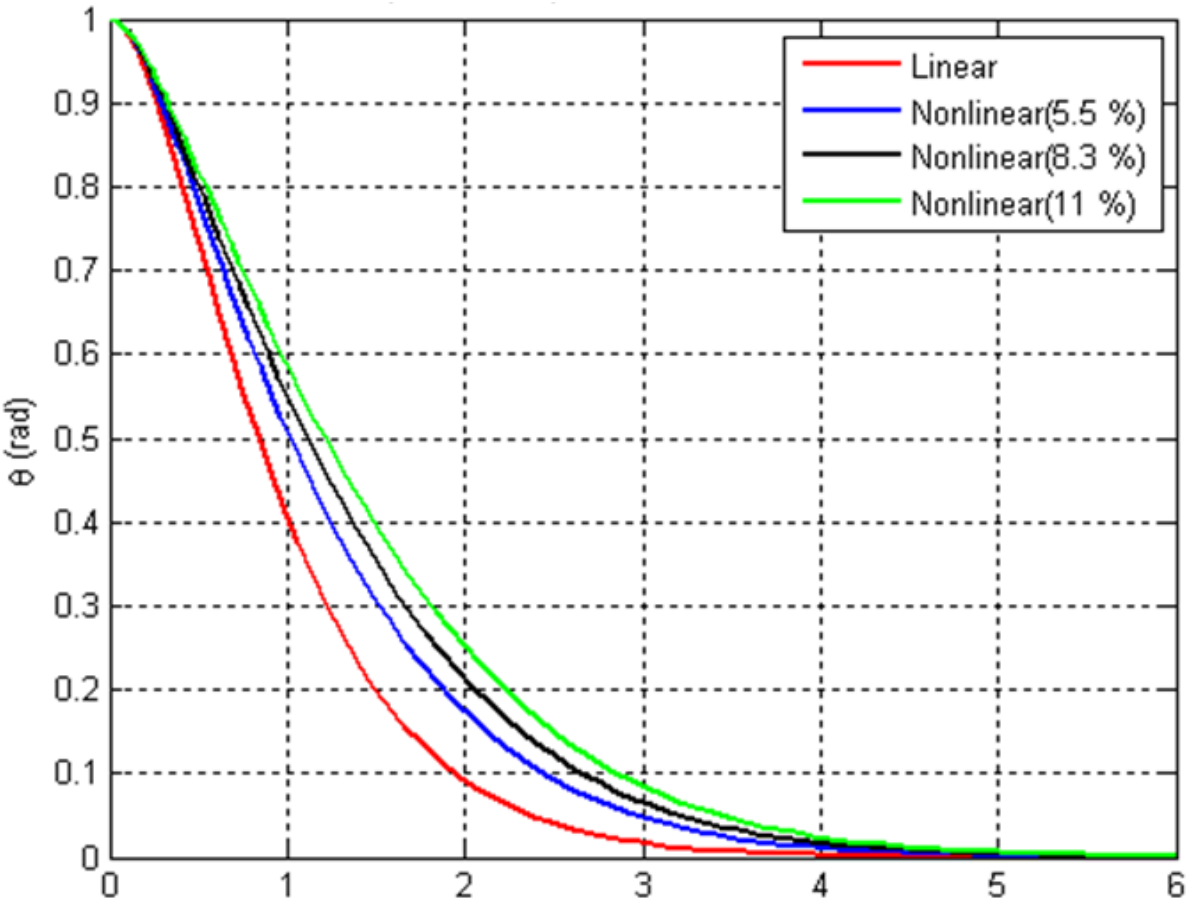


Fig.5 Door response with nonlinear positive deviation.

There is a remarkable deviation in the door response from that of a door closing mechanism with linear characteristics. This deviation is much bigger with negative deviation-nonlinear characteristics. Some of the specifications of the nonlinear door closing system based on the door time response an initial displacement motion are listed in Table 2 as extracted from Figures 4 and 5.

Table 2: Specifications of the nonlinear door closing system.

Linearity level (%)	Maximum response deviation from linear (%)	Minimum motion (rad)	Settling time (s)
0 (linear)	0	0	2.58
5.5	52.4	0	3.55
8.3	75.6	0	3.58
11.0	100	0	4.20
-5.5	-80	-0.023	2.50
-8.3	-160	-0.148	3.51
-11.0	-714	-0.840	6.00

4 NONLINEARITY EFFECTS

- For nonlinearity with positive deviation from linear characteristics, the door dynamic system behaves as an overdamped single degree of freedom system.
- For nonlinearity with negative deviation from linear characteristics, the door dynamic system behaves as an underdamped single degree of freedom system. Oscillation appears around the static equilibrium position (closing position).
- The minimum motion of the door decreases as the maximum negative deviation from linear characteristics increases.
- With maximum deviation from linear characteristics less than -8.3 %, the response deviation from linear characteristics response becomes slow and oscillating.

5 CONCLUSION

- An automatic door with nonlinear characteristics was studied in this work..
- Both positive and negative deviations from linear closing mechanism characteristics were considered.
- Nonlinear characteristics with positive deviation resulted in door time response similar to that of free overdamped single degree of freedom vibrating systems.
- Nonlinear characteristics with positive deviation resulted in door time response similar to that of free overdamped single degree of freedom vibrating systems.
- Nonlinear characteristics with negative deviation resulted in door time response similar to that of free underdamped single degree of freedom vibrating systems.
- Maximum door time response deviation from linear characteristics response changed from 52 to 100 % with positive deviation from linear characteristics, and from -80 to -4 % with negative deviations.
- Minimum door motion in the negative direction reached -0.84 rad for the -11.0 % maximum negative deviation.
- The speed of response was measured by the settling time corresponding to ± 2 % of the steady state response (closing position of the door).
- In general, the settling time increased with increased nonlinearity of the closing mechanism characteristics.

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L'implication des populations riveraines condition essentielle à la gestion durable de la Réserve de Biosphère de la Comoé (RBC)

[Local populations involvement, an essential condition for a sustainable management of the comoe biosphere reserve (CBR)]

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ABSTRACT: This study attempts to show that not involving local population around the Comoé biosphere reserve could very seriously hinder a sustainable management of this socio-ecological space. Now, the recorded results show well that local population are involved in the management of the biosphere reserve through adequate zoning strategies, the setting up of village associations and the role they play, microprojets and local initiatives such as local radio (radio Bouroutou). Indeed, knowing and respecting the three zones (core area, buffer zone and transition zone) as defined by the zoning, significantly contribute to the protection, the sustainable management of the biodiversity and to the development of the local community through the construction of a sustainable development at their level. Likewise, income creating microprojects, which are defined as indispensable activities to the involvement of local populations and chosen consensually by them, constitute some conditionality for an effective participation of those populations in the sustainable management of the Comoé biosphere reserve. The setting up of village associations and local management committee and the role they play are favourable instruments to consolidating experience and to reinforcing permanent dialog between stakeholders. Local population could play a key role if sufficiently prepared, motivated for a better involvement in managing this natural heritage.

KEYWORDS: Biosphere reserve, stakeholders, identification, roles, Comoé.

RESUME: Cette étude essaie de démontrer que la non implication des populations riveraines de l'espace de la réserve de biosphère de la Comoé pourrait constituer un frein voire, un blocage à la gestion durable de cet espace socio-écologique. Or, les résultats enregistrés démontrent bien que les populations riveraines de la réserve sont impliquées dans la gestion de celle-ci à travers des stratégies adaptées du zonage, de la création et du rôle des associations villageoises, des microprojets de développement et des initiatives locales telles que la radio de proximité (radio Bouroutou). En effet, la connaissance et le respect des trois zones définies par le zonage (aire centrale, zone tampon et zone de transition) contribuent d'une manière significative à la protection, à la gestion durable de la diversité biologique et à l'épanouissement des populations locales par la construction d'un développement local durable. De même, les microprojets, générateurs de revenus définis comme activités indispensables à la participation des populations locales et choisis par consensus par et pour elles-mêmes, constituent une certaine conditionnalité de l'implication effective de celles-ci à la gestion durable de l'espace de la réserve de

biosphère de la Comoé. La création et les rôles joués par les associations villageoises et le Comité de gestion locale sont des instruments favorables à la consolidation des acquis et au renforcement du dialogue permanent entre les acteurs parties prenantes parmi lesquels les populations locales pourraient jouer un rôle stratégique moteur si elles sont suffisamment préparées, motivées pour être davantage impliquées dans la gestion de ce patrimoine naturel.

MOTS-CLEFS: Réserve de biosphère, acteurs, identification, rôles, Comoé, Côte d'Ivoire.

1 INTRODUCTION

La conservation des aires protégées est souvent mise en jeu lorsque les populations qui vivent à leurs alentours estiment qu'elles ne bénéficient pas de leur conservation. Ce sentiment s'amplifie lorsqu'elles subissent des répressions en voulant exploiter les ressources biologiques et minières ; d'où les problèmes anthropiques essentiellement auxquels sont confrontées toutes les autres aires protégées en Côte d'Ivoire (DUPUY et N'GUESSAN, 1991[1]). Les RB vont au delà du concept classique de protection, elles encouragent une approche spatiale et conceptuelle plus large. Les RB visent à concilier la conservation, la recherche et le développement local car la prise en charge des projets de développement n'est pas toujours aisée dans les aires protégées et les objectifs de conservation ne sont pas atteints par la seule gestion et actions de conservation. Le concept de RB entend donc proposer des stratégies multiples de gestion durable des aires protégées. Dans le cas particulier de la Réserve de Biosphère de la Comoé (RBC), les populations riveraines sont confrontées à une pauvreté grandissante liée à ses terres environnantes devenues incultes et impropres à l'agriculture, l'exploitation de l'anacardier dévoreuse de l'espace utilisable pour les cultures vivrières et les conditions bioclimatiques qui rapprochent, de plus en plus, l'espace Comoé des zones semi-arides. Les populations riveraines éprouvent cependant, le sentiment à lier leur subsistance en l'exploitation des ressources de la RBC qui leur est malheureusement interdite. Cette étude veut contribuer à la gestion durable de la RBC en proposant des stratégies adéquates, selon la Stratégie de Séville, pour l'implication des populations riveraines dans sa gestion.

RECHERCHES ANTERIEURES

Nommée « Parc de la région nord » en 1926 à sa création, par la suite « Réserve de faune de Bouna » puis « Parc national », la réserve de biosphère de la Comoé a connu une gestion qui ne relevait que de l'autorité des seuls conservateurs, sans l'implication des populations locales. En effet, jusqu'à la fin du 20eme siècle, l'approche de la conservation était sanctuariste et les activités humaines étaient considérées comme destructrices de la nature et incompatibles avec la protection des espaces (SIEGE, 2001[2]) d'où l'idée de la défense des éléments du milieu naturel contre les dynamiques anthropiques jugées négatives (RODARY *et al.*, 2003[3]). La mise en défens des espaces naturels à des fins de conservation est de ce fait un acte dont l'essence échappe à la compréhension des populations riveraines et celles-ci se voient expropriées de "leur bien" (VOOREN et MEIJERINK, 1995[4]). Cette approche dirigiste de la conservation a favorisé le développement des rapports conflictuels entre conservateurs et populations et s'est soldée souvent par des échecs.

2 MÉTHODOLOGIE

2.1 SITE D'ÉTUDE

La RBC est située dans le Nord-Est de la Côte d'Ivoire entre les latitudes 8°30' et 9°40' Nord et les longitudes 3°10' et 4°20' Ouest. Elle est depuis 1983 une RB mais était avant cette date le Parc National de la Comoé avec une superficie de 1 150 000ha qui a été officiellement créé en 1968 par le décret 68 - 94 du 08 février 1968 avec la fusion de la Réserve de Faune de Bouna et la Forêt Classée de Kong. Ce parc qui s'étend actuellement sur 1 149 150 ha, s'est vu débiter, à la suite du déclassement en 1977, par décret n° 77–116 du 25 février 1877, d'une superficie de 850 ha au profit de Téhini.

La RBC fait partir du réseau ivoirien d'aires protégées qui compte quatorze parcs nationaux et réserves dont huit parcs nationaux, cinq réserves partielles, un réserve naturelle intégrale. Cet ensemble d'aires protégées couvre une superficie globale de plus de 2 100 000 ha (6,5% du territoire). La gestion des aires protégées en Côte d'Ivoire, notamment de la RBC, est exclusivement assurée par l'Office Ivoirien des Parcs et Réserves (OIPR) qui a été créé par le décret n° 2002-359 du 24

juillet en application de la loi d'orientation n° 2002-102 du 11 février 2002 sur les PNR. L'OIPR est placé sous tutelle administrative du Ministère en charge de l'Environnement et du Développement Durable. Selon le découpage administratif de 2011 de la Côte d'Ivoire, elle appartient à la région du Bounkani. Cependant, la périphérie est constiutuée de cinq Sous-préfectures reparties dans 3 régions. Ce sont : **i**) dans la région du « Bounkani », les Sous-préfectures de Téhini et Bouna au nord et à l'est, la Sous-préfecture de Nassian au sud et au sud-est ; **ii**) dans la région du « Tchologo », la Sous-préfecture de Kong à l'ouest et au nord-ouest ; **iii**) dans la région du « Hambol », la Sous-préfecture de Dabakala au sud-ouest (figure 1).Son potentiel biologique est de : 710 espèces d'oiseaux, 232 espèces de mammifères dont 26 endémiques du bloc forestier guinéen, 134 espèces de reptiles (LAUGINIE, 2007[5]) et plus de 3864 espèces végétales (AKE ASSI, 2004[6]). Cette importante diversité biologique a favorisé son inscription sur la liste des RB en 1982 et sur celle du Patrimoine Mondial de l'UNESCO en 1983. Ce statut lui confère une protection stricte et une conservation durable, au plan international.

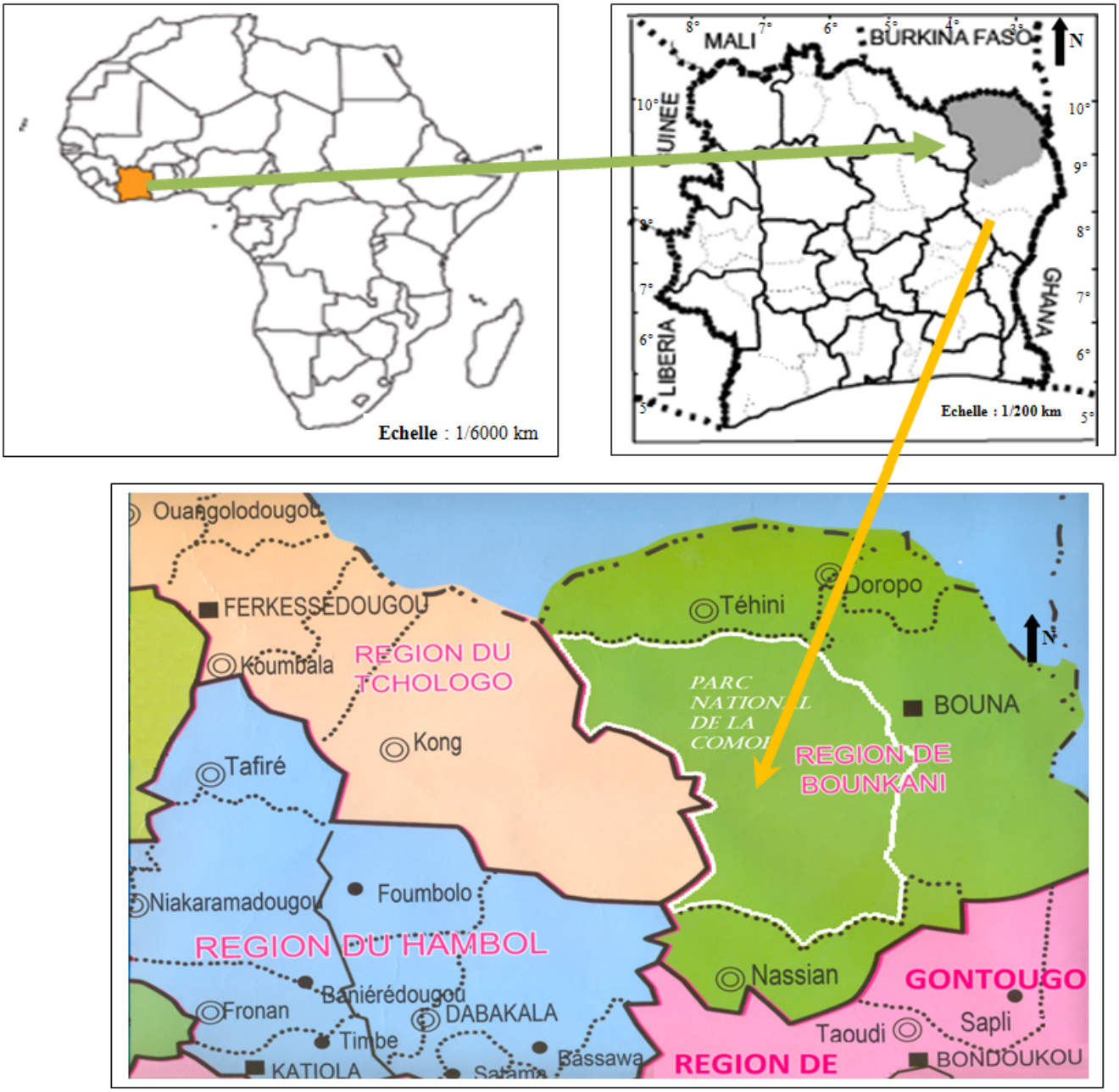


Figure 1 : Localisation du Parc National de la Comoé.

2.2 MATÉRIELS

Les matériels utilisés sont essentiellement constitués de fiches d'enquête et guides d'entretien qui sont un moyen essentiel de récolte de données de proximité. Les fiches d'enquête sont des : **i**) fiches d'enquêtes et de questionnaire du projet pilote agroforestier Comoé ; **ii**) fiches d'enquêtes "commerçants" ; **iii**) fiches d'enquêtes "pêcheurs" et **iv**) fiches d'enquêtes "agriculteurs". Concernant les guides d'entretien, ils ont visé les personnalités impliquées directement ou indirectement dans la conservation de la RBC. Toutes ces fiches et guides d'entretien permettent d'étudier les différentes corporations sociales essentielles utilisant les différents de la diversité biologiques et leur impact sur la conservation de la RBC.

2.3 MÉTHODES

2.3.1 METHODE D'OBSERVATION DIRECTE DU SYSTEME SPATIAL DE LA RESERVE

La méthode d'observation du système spatial RBC s'appuie sur la méthode MAB qui s'articule autour d'une référence institutionnelle principale : la Stratégie de Séville (SS).

2.3.2 TECHNIQUES DE COLLECTE D'INFORMATION SUR LE TERRAIN

Actuellement, en matière d'enquête, la formalisation mathématique est généralement de mise dans les sciences sociales. Mais, cette opération n'est pas un passage obligé pour tous les cas. Pour ce qui concerne nos unités de sondage et d'observation, nous avions à choisir entre trois types d'enquête : **i**) une enquête exhaustive ; **ii**) une enquête par sondage et **iii**) une enquête partielle.

Un sondage ''raisonné'' a été effectué. Il est axé sur une enquête partielle pour des raisons de temps et de moyens. L'enquête partielle est une enquête sur un sous-ensemble limité en nombre qui représente en réalité des structures. D'où sa dimension surtout qualitative, qui permet de rendre compte de l'essentiel de l'opinion de la population concernée. On utilise souvent ce type d'enquête partielle lorsque la taille ne détermine pas le comportement et la population considérée, homogène. C'est donc le fait d'avoir adapté l'enquête aux objectifs et exigences de l'étude que notre sondage, baptisé ''partiel raisonné'', nous épargne la formalisation mathématique. Ce qui conduit, dans la même logique, à ne pas non plus recourir à la notion de généralisation statistique des résultats. Puisque ce qui nous intéresse dans le cadre de nos enquêtes, c'est surtout la richesse de l'information.

2.3.3 CHOIX DES UNITES D'OBSERVATION ET DES SITES D'ENQUETE

Dans la présente étude, nous avions plutôt affaire à des groupes stratégiques, en raison de l'influence de leur opinion sur l'ensemble de la population. Ces différents groupes stratégiques, identifiés comme échantillons de travail, sont les suivants : les scientifiques, les gestionnaires du parc, les autorités administratives, les ONG, les coopératives, les associations locales (jeunes, femmes, etc.), les populations locales de statuts divers (autorités coutumières, notables, personnes âgées, jeunes, hommes, femmes), les structures administratives et coutumières, les populations riveraines des partenaires essentielles dans l'approche MAB.

Quant aux sites d'enquête, ils ont été choisis suivant les quatre critères suivants : **i**) appartenance à la subdivision administrative (sous préfectures) et à la subdivision militaire ; **ii**) nature des problèmes spécifiques tels que les pratiques de chasse et de la situation du village par rapport à la RBC ; **iii**) niveau de collaboration avec l'administration de la RBC. On s'intéresse aux villages manifestant une volonté de collaboration et ayant des relations avec le secteur OIPR ; **iv**) diversité ethnique du groupe culturel dominant et le groupe ethnique réclamant la paternité du village. En fonction donc des critères susmentionnés, un échantillon de 16 villages riverains de la RBC a été retenu (tableaux 1 et 2). Puis le choix des villages et des ménages a été fait par tirage simple.

2.3.4 ENTRETIENS AVEC LES GROUPES CIBLES

L'enquête s'est déroulée à l'aide d'entretiens semi-directifs. Ils se sont effectués à l'aide de guides d'entretien et sont articulés autour des quatre thématiques suivantes : occupation de l'espace et impacts sur les écosystèmes, impact des activités de prélèvement sur les écosystèmes, sociétés locales et écosystèmes, contraintes de la gestion de la biodiversité dans la RBC.

2.3.5 TRAITEMENT ET ANALYSE DES DONNEES COLLECTEES

Les données recueillies ont été traitées à l'aide de l'outil informatique suivant trois phases : **i**) une phase pré-informatique au cours de laquelle nous avons codifié manuellement les réponses fournies aux questions ; **ii**) une phase de saisie informatique au cours de laquelle nous avons configuré une maquette de saisie à l'aide des logiciels Excel ; **iii**) une phase de tabulation des données et de croisements des tableaux.

Tableau 1 : Structures administratives et coutumières rencontrées.

Structures	Objectifs visés
Préfecture de Bondoukou Préfecture de Nassian Sous-préfecture de Téhini Sous-préfecture de Bondoukou Sous-préfecture de Nassian Sous-préfecture de Kong Sous-préfecture de Dabakala Commandement zone Bouna Commandement Zone Téhini	- Rendre une visite de courtoisie et demande de facilitation des contacts dans le cadre de la mission - Apprécier le regard des administrateurs sur les problèmes relatifs à la gestion de la RBC - Apprécier leurs motivations par rapport à une éventuelle collaboration
Direction Départementale de l'Agriculture de Bondoukou ANADER de Bondoukou	Collecter des informations sur: - l'économie à l'échelle locale - les projets de développement rural en cours ayant une incidence directe ou indirecte sur la RBC - le degré d'implication des populations dans la réalisation de ces projets - les difficultés liées à l'encadrement des paysans de la zone - les opportunités à saisir ou potentialités à valoriser dans le cadre d'un éventuel projet d'aménagement de la RBC
Secteur OIPR de Nassian	- Identifier les problèmes de gestion de la RBC zone par zone - Mesurer la motivation des agents par rapport à leurs missions - Apprécier les relations entre les populations et les agents
PNDDR Bondoukou	- Connaître les attributions et les champs d'action de la structure - Connaître le programme DDR de la zone - Apprécier l'incidence de ce programme sur la conservation de la RBC - Apprécier la place accordée à la RBC dans le programme DDR
Roi des Koulango à Bouna Chef de la communauté lobi à Nassian	- Comprendre la structuration sociopolitique des deux communautés - Apprécier le sentiment des autorités traditionnelles sur les questions de gestion durable de la RBC (braconnage, relations avec l'OIPR, activités des populations riveraines, etc.)

Source : GAUZE T. M. 2008

Tableau 2 : Liste de quelques villages choisis pour l'enquête

Sous-préfecture	Noms des villages	Nombre de ménages	Population totale	Groupes ethniques	Echantillon	Observation
TEHINI	Bawé	46	391	Dioula	9	
	Ouango-koro	52	362	Lobi	11	Ex zone sous contrôle FAFN
	Biguilaye 1	113	479	Koulango	23	
KONG	Kafolo-bac	214	1 907	Dioula	23	
	Koniéré	95	474	Dioula	19	Ex zone sous contrôle FAFN
	Gorowi	45	342	Koulango	9	
DABAKALA	Toupé	18	106	Djimini	4	Ex zone sous contrôle FAFN
	Wendéné	112	601	Djimini	22	
BOUNA	Sayé	34	228	Koulango	7	Ex zone sous contrôle FAFN
	Yalo	32	220	Koulango	6	Ex zone sous contrôle FAFN
	Bania	45	369	Koulango	9	Ex zone de confiance
NASSIAN	Kakpin	138	616	Koulango	28	
	Gansé 2	180	790	Koulango	36	Zones sous contrôle gouvernemental
	Lambira	167	751	Koulango	33	
	Sandé-Anvéyo	142	695	Koulango	29	
	Dedi	131	451	Koulango	26	

Source : GAUZE T. M. 200

3 RÉSULTATS STRATÉGIQUES

3.1 IDENTIFICATION DES COMMUNAUTÉS RIVERAINES

Autour de la RBC, treize (13) groupes ethniques ont été répertoriés et répartis dans les différentes localités, dont les plus importants sont les Lobi, les Koulango, les Dioula (Malinké), les Djimini, les Lorhon et les Komono. Les Lobi, avec 49,6% des localités, représentent le groupe ethnique majoritaire. Les activités économiques développées autour de la RBC, relèvent presqu'exclusivement des secteurs primaire et tertiaire. Plusieurs paramètres justifient l'implication des populations riveraines dans la gestion de la RBC. Il s'agit entre autres du zonage, de la création des associations villageoises et des actions qu'elles mènent, des microprojets de développement.

3.2 STRATÉGIE DE COMMUNICATION D'INFORMATION

L'objectif relatif à la stratégie de communication et d'informations a été réalisé avec la création d'une radio de proximité à la RBC (**Planche 1)**. En effet, installée dans le Département de Nassian, cette radio de proximité a été créée dans le cadre du projet UNESCO–MAB, projet d'appui pour le renforcement des capacités de gestion de la RBC initié par le réseau Africain du MAB (AfriMAB), de 2005 à 2008, en Afrique de l'Ouest. La radio appelée radio « Boutourou » est un atout majeur pour la conservation de la RBC d'autant qu'elle permet de diffuser des messages en langues locales, plus accessibles, aux populations riveraines, facilitant ainsi la communication entre les populations et les gestionnaires. L'aménagement d'un local pour abriter l'émetteur et d'un bâtiment pour l'installation de la radio locale en est un autre acquis. La mise en onde de la radio "Boutourou" est effective depuis 2007 et émet sur la fréquence 104.3 FM sur un rayon de plus de 60 km.

Elle comprend deux organes : le Conseil de Gestion et la Direction dans lesquels exerce un personnel de qualité motivé à la tâche, composé d'un Directeur (le Chef Secteur), d'un Président du Conseil de Gestion (le Président de l'Association des Villages riverains à la RBC) et d'animateurs choisis au sein des riverains émettant en langues locales (Lobi et Koulango) de 8 heures à 20 heures.

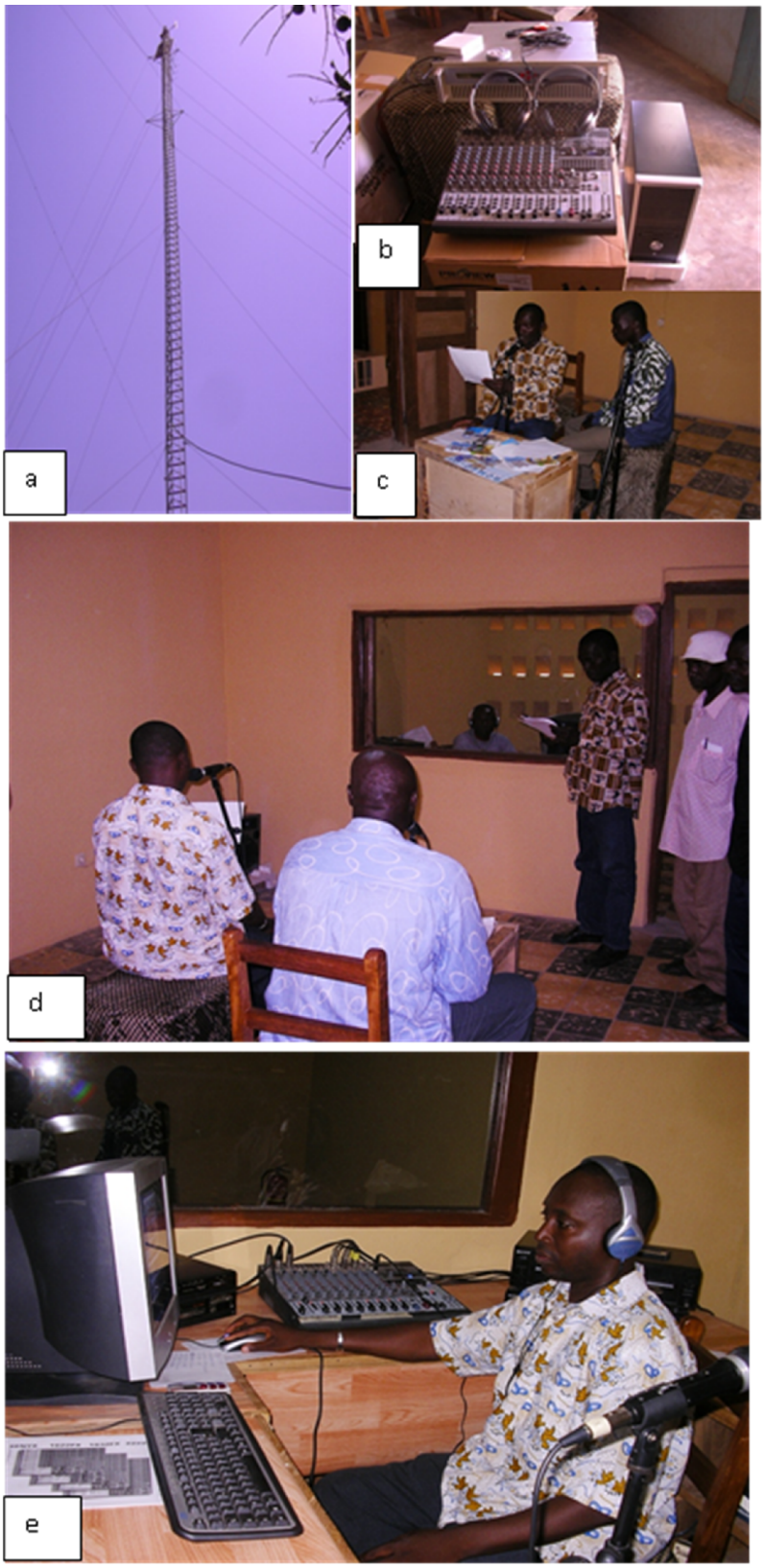


Planche 1 : Radio communautaire Boutourou pour la vulgarisation des activités de gestion de la Réserve de Biosphère de la Comoé. a : Antenne émettrice, b : matériel technique, c et d : animateurs lors d'une émission, e : cabine technique informatisée.

Comme mission, la radio Boutourou contribue à une gestion rationnelle et durable de la RBC par l'information, la sensibilisation à la lutte contre le braconnage, contre les feux de brousse, contre la transhumance, l'éducation des populations et contre tous les effets néfastes à la conservation. En plus, la radio se veut aussi d'informer, de former et de divertir les populations en vue de leur participation effective au développement dans les secteurs de l'agriculture, de la santé, de l'éducation, de la culture, etc. Ainsi, la radio diffuse plusieurs programmes : portant notamment sur la connaissance de l'environnement et de l'utilité de la RBC.

Vu son impact perceptible et croissant sur le développement de l'Espace Comoé, la radio a suscité un intérêt chez des Partenaires au développement tels que l'IUCN et la Banque Mondiale qui ont étendu son rayon d'émission à plus de 100 km de la RBC, et qui en font un suivi périodique pour son bon fonctionnement. Cette radio communautaire est un maillon important dans le processus de sensibilisation des populations contre les actions illégales dans la réserve et la sauvegarde du bien.

3.3 LE ZONAGE

Cette approche inclut un système de zonage spécial : une aire centrale légalement protégée qui vise à conserver les principaux écosystèmes où l'on n'y autorise que des perturbations humaines minimales (ex. pour l'inventaire et le suivi des espèces) comme l'indique la figure 2. L'aire centrale est entourée par une zone tampon appelée zone de gestion qui aide à protéger cette aire centrale et qui peut affecter un niveau supérieur d'exploitation humaine et des manipulations expérimentales à des fins de recherches scientifiques et de développement. Une zone de transition ou zone de développement qui visera à entourer les deux précédentes. C'est là que l'on développe la coopération avec les populations locales et des pratiques soutenables en matière de gestion des ressources. Le zonage actuel de la RBC, redéfini dans le cadre de cette étude, se présente en trois zones qui sont :

- **Une aire centrale** strictement réservée à la conservation et à la protection. Cette zone incompatible aux activités humaines, hormis la recherche scientifique et le tourisme écologique est sous la juridiction directe de l'OIPR ;

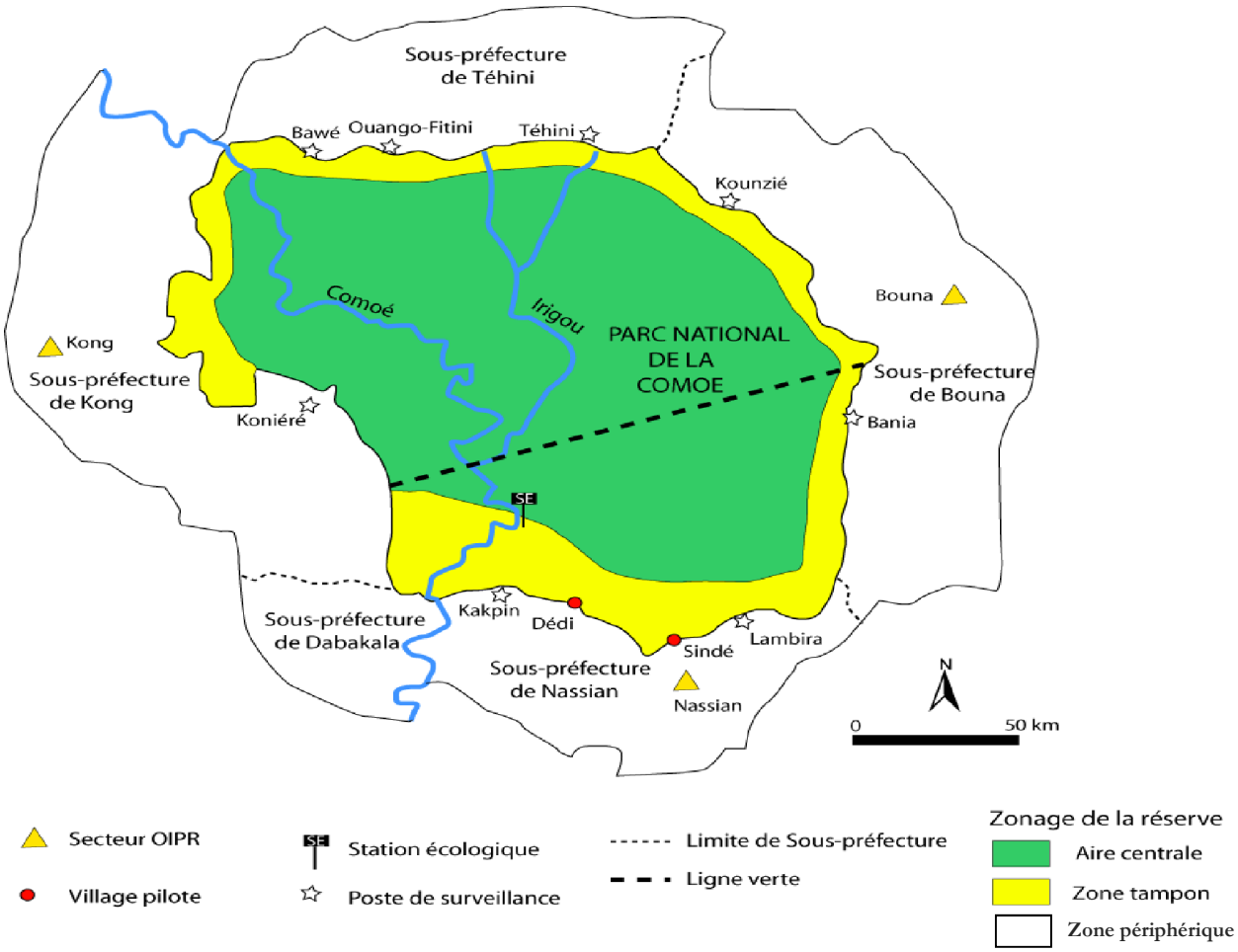


Figure 2: Zonage actuel de la RBC proposé par le Projet MAB.

Source : Projet UNESCO/MAB-UNEP/GEF ; complétée par TAHOUX T M 2012

- **Une zone tampon ou** zone de cogestion : c'est la zone de contact et de dialogue entre les gestionnaires (OIPR), les scientifiques (CRE et autres structures) et les communautés locales riveraines intervenant dans les activités expérimentales et la gestion de cet espace.
- **Une zone de transition** ou zone de coopération avec les populations locales dans laquelle les pratiques durables d'utilisation de la biodiversité sont autorisées. Les critères de délimitation de cette zone large de 30 km en moyenne, obéissent à une combinaison de critères déterminés par le découpage des collectivités locales et des aires d'influence ethnique et culturelle des villages riverains.

Au total, l'approche novatrice que nous avons adoptée et expérimentée dans la présente étude mérite d'être promue. En effet, la redéfinition du zonage de la RBC est un élément essentiel du processus de sa gestion durable. Par ce moyen, on définit les différents niveaux d'utilisation et d'intervention des différents acteurs et partenaires en fonction des différentes responsabilités, permettant ainsi, une ouverture salutaire pour la pérennisation des mécanismes de gestion de la diversité biologique de la RBC.

3.4 CREATION ET ROLES DES ASSOCIATIONS VILLAGEOISES

Pour répondre aux contraintes de la gestion efficiente de la RBC, les populations locales se sont organisées en associations appelées Associations Villageoises de Conservation et de Développement (AVCD). Ces dernières sont en activités et se sont fédérées au sein d'une faitière. Le responsable de la faitière a également sous sa tutelle, la présidence du Conseil de Gestion de la radio locale créée par le projet UNESCO/MAB pour faciliter la communication et la sensibilisation au sein de l'espace Comoé. Les AVCD œuvrent pour l'information, la sensibilisation, l'éducation environnementale et à la mise en œuvre de la convention sur la gestion des terroirs (Figure 4). L'organisation des acteurs notamment les pêcheurs avec un chronogramme définissant les moments et les périodes de pêche, constitue l'un des résultats satisfaisants de cette étude.



Figure 4 : Rencontre avec les populations riveraines de la RBC.

3.5 ONG LOCALES

A la RBC, les ONG locales de Nassian ont été recensées en 2010, dans le cadre du projet PARC-CI. L'ONG DEPRERENAF aide à la mobilisation des populations locales autour des objectifs de conservation et de gestion durable de la RBC. Ces actions consistent à organiser des réunions d'information et de sensibilisation dans les villages centres, auxquelles sont conviés les villages environnants, sur l'intérêt de participer à la conservation de la RBC. Les ONG « Sauvons le Parc National de la Comoé » et « Mon Parc National de la Comoé ».ont des objectifs cadrent avec ceux des institutions qui se préoccupent de la conservation de la RBC. Un appui technique leur a été apporté pour la formation et la formalisation de leurs organisations. Cette démarche des parties prenantes à la gestion du bien participe d'une meilleure implication des leaders d'opinion pour sa conservation. La mobilisation des ONG locales participe à une plus grande campagne d'information et de sensibilisation dans les villages centres de toute la zone périphérique. Ainsi, trois conventions de partenariat avec les radios de proximité (Bouna, Dabakala et Nassian) ont été établies.

Les ONG jouent un rôle déterminant pour la conservation de la RBC. La gestion des feux de brousse par exemple se fait régulièrement avec le concours de deux ONG locales DEPRENAF et SOS Comoé, à travers une convention de collaboration soutenue financièrement par le projet PARC-CI de la Banque Mondiale. Après la phase de négociation en 2010 et la finalisation du cadre de collaboration, un contrat de formation dans vingt-deux villages limitrophes à la RBC a été confié à l'ONG LUCOFEBROU pour initier une dizaine de jeunes à la prévention des feux de brousse. Dans le cadre de la lutte contre le

braconnage, deux ONG locales (DEPRERENAF et SOS Comoé) ont été créées pour protéger les ressources naturelles et fauniques. L'action de ces ONG est suivie de près par l'OIPR qui leur apporte également son appui.

3.6 MICROPROJETS DE DÉVELOPPEMENT

3.6.1 PROJETS PILOTES DEMONSTRATIFS D'AGROFORESTERIE POUR LES COMMUNAUTES LOCALES

Des résultats importants obtenus de l'agroforesterie (Figure 5) sont : **i**) communautés riveraines sensibilisées et formées aux techniques agroforestières et associatives (GVC) ; **ii**) systèmes agroforestiers inventoriés ; **iii**) techniques agroforestières à haut rendement identifiées ; **iv**) biomasse des ligneux évaluée ; **v**) taux de matière organique du sol amélioré ; **vi**) productivité du sol et rendements des cultures améliorés ; **vii**) rendements des cultures de l'anacarde améliorés ; **viii**) karité reboisé ; **ix**) bois d'énergie et graines de karité disponibles ; **x**) associations culturales à hauts rendements identifiées et **xi**) niveau de vie des populations riveraines amélioré. Il faut rappeler qu'il existe un volet apicole associé à cette activité (Figure 6). En effet, sur une prévision de 15 ruches, 12 ont été effectivement confectionnées. Six ruches - piège en contre-plaqué ont été placées dont 3 au Sud - Est et 3 au Nord - Est du village de Lambira. Parmi ces ruches, 3 ont été colonisées par des abeilles. Au total sur le site du projet, on dénombre 9 ruches placées et dont les récoltes se font au cours du mois de décembre pour la petite récolte. La grande récolte est quant à elle prévue pour les mois de mai et juin.



Figure 5 : Projet pilote d'agroforesterie de Lambira, sites avec anacarde planté en association avec l'igname



Figure 6 : Volet apicole du projet agroforestier de Lambira, ruche colonisée par les abeilles

3.6.2 PROJET PILOTE D'AULACODICULTURE A SINDE-ANVEYO

L'aulacode (*Tryonomys swinderianus*) est un gibier très prisé dans le pays et dans la sous-région. Son élevage a intégré la construction de l'animalerie, l'aménagement de l'aire fourragère (banque fourragère) composée de légumineuses (*Leucaena leucocephala*), d'herbacées (*Panicum maximun* ou *Pennisetum purpereum*) et de cultures agricoles variées. Pour se faire, une équipe de 21 coopérateurs (très mobilisés) a été constituée. Les coopérateurs s'attellent à suivre la conduite de l'alimentation composée d'un mélange de paille (*Panicum maximum*) et/ou d'herbe à éléphant (*Pennisetum purpureum*) dans les proportions 85% par animal de fourrage vert et 15% de complément alimentaire. Ils veillent également à la santé des aulacodes élevés en captivité, l'entretien de l'aulacoderie, le séchage des herbes récoltées et la propreté des matériels utilisés. Un suivi régulier des opérations aulacodicoles est effectué par la mise en place d'un calendrier de gestion de l'élevage contrôlé par le secrétaire adjoint chargé du suivi des travaux sur le terrain et le président du groupement de base.

3.6.3 PROJET PILOTE D'AULACODICULTURE A SINDE-ANVEYO

L'aulacode (*Tryonomys swinderianus*), comme l'indique la figure 7, est un gibier très prisé dans le pays et dans la sous-région. Son élevage a intégré la construction de l'animalerie, l'aménagement de l'aire fourragère (banque fourragère) composée de légumineuses (*Leucaena leucocephala*), d'herbacées (*Panicum maximun* ou *Pennisetum purpereum*) et de cultures agricoles variées. Pour se faire, une équipe de 21 coopérateurs (très mobilisés) a été constituée. Les coopérateurs s'attellent à suivre la conduite de l'alimentation composée d'un mélange de paille (*Panicum maximum*) et/ou d'herbe à éléphant (*Pennisetum purpureum*) dans les proportions 85% par animal de fourrage vert et 15% de complément alimentaire. Ils veillent également à la santé des aulacodes élevés en captivité, l'entretien de l'aulacoderie, le séchage des herbes récoltées et la propreté des matériels utilisés. Un suivi régulier des opérations aulacodicoles est effectué par la mise en place d'un calendrier de gestion de l'élevage contrôlé par le secrétaire adjoint chargé du suivi des travaux sur le terrain et le président du groupement de base.



Figure 7 : Mise en place de l'aulacodière à Sindé-Anvéyo

3.6.4 APPUI AUX INITIATIVES ET AU DEVELOPPEMENT LOCAL

Pour appuyer le développement local, des initiatives ont été prises. Elles ont consisté à faire l'inventaire des besoins des populations riveraines en infrastructures sociales de base. Par ordre d'importance, quatre types d'équipement ont apparu de façon récurrente dans les doléances des populations riveraines rencontrées. II s'agit de : (**i**) la construction de centres de santé (maternité et dispensaire) ; (**ii**) la construction d'écoles primaires ; (**iii**) l'amélioration des systèmes hydrauliques villageois en place ; (**iv**) la construction d'un barrage hydro agricole pour palier les aléas climatiques (sécheresse et pénurie d'eau).

Pour la réalisation de ce type de projet il faut: **i**) une participation à concurrence de 8 à 10% pourrait être demandée aux populations qui le souhaitent. Les capacités de mobilisation des fonds des populations, le plus souvent à travers les GVC, l'autorisent ; **ii**) un cahier de charges paraphé par le chef de village et les autorités sous-préfectorales définira les actions de protection de la RBC auxquelles s'engagent les populations contractantes et **iii**) dans l'optique d'une pérennisation de la mémoire de ce contrat et dans la mesure du possible, les équipements financés, dans leur désignation, devront porter le nom de a RBC.

Dans le cadre de la conservation pour le développement, il convient de donner une formation opérationnelle aux communautés locales en vue de renforcer leur capacité de conservation de la RBC.

4 DISCUSSION

4.1 STRATEGIE DE COMMUNICATION, D'INFORMATION ET DE PUBLICATION

Une radio de proximité, nommée « Radio Boutourou », a été créée au sein de la RBC dans le cadre de la stratégie de communication, d'information et de publication. Cette activité est prévue au point 2 de l'objectif III.3 de la SS qui est « Promouvoir la mise en place de systèmes de communication pour diffuser l'information sur les Réserves de biosphère et sur les expériences de terrain ». C'est une importance avancée dans la sensibilisation et la formation des populations riveraines dans un cadre concerté. L'importance des radios communautaires et des centres de connexion Internet dans six RB d'Afrique de l'Ouest a été évoquée par AMADOU (2008[7]). Les émissions radios constitueront des espaces de discussion et de concertation pour le grand public sur la conservation et la gestion du Parc National de Taï et des autres AP de l'espace Comoé (GOH, 2005[8]).

4.2 ZONAGE

La RBC avait fait l'objet d'une superposition de zonage, le zonage écologique ayant été modifié par le zonage politico-militaire lié à la crise. Le flux des acteurs avait compliqué le fonctionnement de l'espace Comoé. Cette étude sur la RBC a permis de donner une meilleure vision sur la réserve au plan socioéconomique et social selon le zonage réalisé. C'est dans ce cadre qu'on peut inscrire l'adoption de la SS et du Cadre statuaire du RMRB par la Conférence générale de l'UNESCO en 1995 qui a réaffirmé le rôle des RB pour concilier conservation et développement des populations. Le point 5 de l'article 4 du cadre statutaire du RMRB rappelle la mission d'une RB qui se résume en trois fonctions à travers un zonage approprié. Le point 12 de l'objectif IV.1 de la SS, souligne cette assertion : « Lorsque c'est nécessaire pour préserver la zone centrale, redéfinir les zones tampon et de transition selon les critères de développement durable ». La nécessité d'une redéfinition du zonage de la RBC avait d'autant nécessaire que l'une des raisons de l'échec relatif de l'approche participative dans les projets de gestion des ressources naturelles résulte d'une gestion inadéquate et sectorielle des questions foncières et des règles d'accès entre les aires de conservation et les aires de production des populations rurales (BINOT et DAOU, 2007[9]).

L'élaboration de règles collectives d'accès et de gestion des ressources dans une réserve de biosphère, le partage du territoire en aire(s) centrale(s), zone(s) tampon(s) et aire(s) de transition (le zonage) devraient ainsi être le résultat de la négociation entre les acteurs des modalités d'accès et d'usages des ressources et des milieux. Les enjeux de la concertation dans une réserve de biosphère seraient alors d'accroître le respect des règles collectives et de diminuer les coûts de contrôle, la mise en place de manière conjointe par l'autorité de gestion et des acteurs de règles de gestion, de partage des coûts et des bénéfices de programmes ou projets (BEURET, 2006[10]). Les dispositifs de la concertation dans une réserve de biosphère devraient permettre à ceux qui veulent conserver les ressources et à ceux qui en vivent de trouver des compromis et de se donner un avenir, une perspective commune, autour d'un objectif de développement durable (BOUAMRANE 2006[11]).

4.3 CREATION ET ROLES DES ASSOCIATIONS VILLAGEOISES ET ONG

La gestion de la biodiversité est, avant tout, une affaire de connaissance et de pratiques locales, c'est pourquoi on ne peut ignorer les communautés (regroupées au sein des Association Villageoises pour la Conservation et le Développement (AVCD)) qui vivent dans leur territoire. La participation communautaire implique aussi bien au niveau décisionnel qu'au niveau consultatif en référence à SOME (1984[12]) qui évoque le partage du pouvoir entre tous les groupes et la possibilité concrète pour tous les groupes d'influencer la décision collective qu'est le choix des groupes sociaux. L'approche fondée sur la participation communautaire poursuit donc un double objectif de renforcer la situation des groupes vulnérables et améliorer en particulier leur accès aux services sociaux essentiels et de pérenniser les intérêts de développement, par une répartition consensuelle et équilibrée des rôles, charges et responsabilités entre tous les acteurs au niveau local (ETTE *et al.*, 1998[13] ; CRE, 2006[14]). Ailleurs dans d'autres pays africains, des associations villageoises vont jusqu'à soutenir le financement des investissements et des charges récurrentes à la conservation des PNR comme le stipule la SS en ses points 9, 19 et 22 de l'objectif IV.2, qui indiquent bien de « mobiliser des fonds privés en faveur des RB auprès des entreprises, des ONG et des Fondations ». C'est le cas de la création de la Commission Foncière (COFO) au Niger et de l'Association Villageoise de Gestion des Réserves de Faune (AVIGREF) de la Pendjari au Bénin (AMADOU, 2008[15]).

4.4 MICROPROJETS DE DÉVELOPPEMENT

Les activités définies dans les microprojets émanent d'un consensus. Elles sont identifiées et proposées par les populations elles-mêmes en tant que solution alternative pour lutter contre la pauvreté dans l'espace Comoé, tout en contribuant à la préservation de la RBC. Au point 6 de l'objectif III.2 de la SS, il est demandé d'« Utiliser la RB pour développer des indicateurs de durabilité, pour chacune des activités de production menées à l'intérieur de la zone tampon et de l'aire de transition ». C'est donc la preuve de l'exécution d'un volet stratégique de la SS et ainsi, de la CDB. Les objectifs de ces microprojets sont décrits comme suivent : **i**) l'agroforesterie qui vise à accroître la productivité des sols par la maîtrise et l'utilisation de différentes espèces végétales sur la même parcelle. La maîtrise des systèmes agroforestiers permettra aux communautés locales d'accroître leurs productions agricoles. D'ailleurs, les pratiques agroforestières ont été annoncées comme un moyen qui pourrait offrir des perspectives intéressantes contre l'extension de l'agriculture itinérante par MALDAGUE (2004[16]) ; **ii**) l'aulacodiculture vise à réduire le braconnage dans la RBC en facilitant l'accès à la viande tandis que l'apiculture fournit le miel, un aliment assez recherché sur le marché ; **iii**) la radio locale représente un outil appréciable non seulement pour véhiculer des informations, mais aussi pour sensibiliser les communautés.

5 EDUCATION, SENSIBILISATION ET FORMATION A L'ENVIRONNEMENT ET AU DEVELOPPEMENT DURABLE

L'éducation à l'environnement doit permettre aux populations riveraines concernées de mieux comprendre leur milieu naturel proche afin qu'elles en reconnaissent la valeur et le respectent. Cette sensibilisation aux richesses de l'environnement vise à la conservation de la diversité biologique et des ressources. L'éducation au développement durable lie, quant à elle, cet environnement à l'activité de l'homme. Il s'agit d'enseigner la façon dont nos modes de vie (production, consommation, transport) sont en relation directe avec les dynamiques environnementales d'une part, mais également avec les valeurs culturelles et sociales des sociétés locales et de toutes les sociétés humaines dans le cadre de la mondialisation des échanges. L'objectif est de sensibiliser les acteurs à des comportements qui s'orientent vers une utilisation durable des espaces et des ressources naturelles (DELDICQUE, 2007[17]).

6 CONCLUSION

Les résultats obtenus montrent que de nombreuses méthodes stratégiques ont contribué à l'implication des populations riveraines dans la gestion de la RBC. Il s'agit de la stratégie de communication d'information et de publication, celles du zonage, de la création et rôles des associations villageoises, des microprojets de développement et des initiatives locales.

Ainsi, dans la dynamique de l'épanouissement des populations locales de la RBC, la connaissance et le respect des 3 zones définies par le zonage (l'aire centrale, zone de conservation des ressources naturelles ; la zone tampon, lieu de rencontre des acteurs, de dialogue, d'expérimentation et d'échange ; l'aire de transition, zone de développement local) contribue d'une manière très significative à la protection, à la gestion durable de la diversité biologique et au développement local. L'espoir est donc grand, avec le zonage actuel de la RBC réalisé au cours de cette étude, surtout après la crise qu'a connue le pays tout entier, pour une gestion participative qui pourra garantir une gestion durable des ressources naturelles et un développement durable autour de la réserve car le redémarrage économique de l'espace Comoé voire de la région du Nord-Est en dépend.

De même, les microprojets définis comme activités à mener par les populations locales sont issus par consensus entre elles-mêmes et les gestionnaires de la RBC. Cette approche participative a permis de mieux impliquer tous les acteurs, notamment les acteurs locaux, dans la gestion et la protection de la RB. Les microprojets d'agroforesterie et d'aulacodiculture se sont révélés comme sources de revenu local permettant ainsi de lutter contre la pauvreté dans l'espace Comoé tout en épargnant la Réserve des agressions anthropiques. Une des résultantes de cette approche a été la répartition et l'organisation des acteurs notamment les pêcheurs avec un chronogramme définissant les moments et les périodes de pêche. Les projets relais doivent aussi couvrir les modes d'écoulement des produits (transport, conservation et commercialisation). La conduite de ces microprojets par les populations riveraines organisées en associations villageoises et la mise en place des ONG pourraient contribuer efficacement au renforcement des relations entre les communautés locales.

Face aux résultats encourageants obtenus avec l'application partielle de la SS, son application plus complète pourrait renforcer la gestion durable de la RBC.

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Impact de la Mecreka dans la vie socio-économique et culturelle des agents du Centre de Recherche en Sciences Naturelles (CRSN/Lwiro), RD Congo

[Impact of Mecreka in life socio-economic and cultural of agents of the Centre de Recherches en Sciences Naturelles (CRSN/Lwiro), DR Congo]

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ABSTRACT: We have carried out this study in order to establish the impact of MECRE-KAVUMU in CRSN/LWIRO agent's life who, as other agents in DRC are unable to keep out their daily needs because of the thinness of their salary. Thus, they are obliged to search for other survival means and above all look for debts. The presence of MECREKA is welcome by everybody and seems to be a solution to this problem.

KEYWORDS: Impact, Mecreka, CRSN, Saving, credit, State.

RESUME: Nous avons effectué cette étude pour déterminer l'impact de la MECRE-KAVUMU dans la vie des agents du CRSN/LWIRO qui, comme tous les autres agents de l'Etat congolais, sont incapables de couvrir leurs besoins quotidiens à la suite de la maigreur de leur salaire. Ainsi, ils sont obligés de recourir à d'autres sources de financement et principalement l'endettement. La présence de la Mecreka parait alors comme une solution à ce problème.

MOTS-CLEFS: Impact, Mecreka, CRSN, Épargne, crédit, l'Etat.

1 INTRODUCTION

A l'instar de tous les agents et fonctionnaires de l'Etat congolais, la maigreur et le manque de pouvoir d'achat des salaires que le gouvernement congolais paie aux agents du CRSN/LWIRO ne leur permettent pas de couvrir même les 3/4 de leurs besoins quotidiens ; ce qui les renvoie à un besoin perpétuel de financement et l'incapacité d'épargner.

Cherchant à tout prix à couvrir le vide déjà créé par cette modicité, ces travailleurs de l'Etat congolais doivent absolument recourir à d'autres moyens pour survivre, et principalement l'endettement chez les particuliers et cela aux taux d'intérêt jamais vu ailleurs.

Ce qui empire cette situation, c'est l'absence d'une source de crédit fiable. Les quelques individus capables de réserver quelque chose après leur consommation grâce aux recettes accidentelles pratiquent la thésaurisation, alors que le dépôt en banques et/ou coopératives leur faciliterait l'accès au crédit.

Lorsqu'il doit épargner, l'homme qui ne peut compter que sur sa rémunération mensuelle le fait ordinairement dans des conditions particulièrement défavorables, car la seule garantie qu'il peut offrir à un préteur éventuel est le fait qu'il a un emploi et qu'il touche une rémunération. Il peut tomber malade, être renvoyé ou transféré, de sorte qu'il présente un mauvais risque et qu'il doit payer, sur le prêt qui lui est accordé, un taux d'intérêt fixé en conséquence(1).

En effet, en RDC, en 1974, l'Etat congolais avait jugé bon d'amener les congolais à la culture d'épargne, à la banque bien entendu, et institué, par ordonnance présidentielle, une retenue obligatoire de X montant sur la rémunération brute du personnel de carrière des services publics de l'Etat, montant à verser à la Caisse d'Épargne du Congo(CADECO), institution publique et entièrement sous la gestion de l'Etat (Ordonnance n°74/315 du 05 Décembre 1974).Malheureusement, l'inflation battant son plein, les épargnes des salariés se sont effritées…cet établissement public a connu de sérieuses difficultés et n'était plus en même de restituer les avoirs des citoyens qu'il détenait.

Cette situation a eu un impact négatif sur les épargnants salariés, à tel point qu'ils ne sont plus encouragés aujourd'hui ni à effectuer des dépôts en banque, ni à faire transiter leur salaire par banque(2).

Bien d'autres situations malheureuses de ce genre renchérissent ce dégout (Tontine, BARAKA PRESSE, …)

A côté de toutes ces contraintes combien lamentables, le manque d'information sur les principes et mouvements coopératifs (ils n'arrivent pas en effet à établir une distinction entre les emprunts productifs et improductifs et entre les emprunts à long terme et à court terme) vient pérenniser la misère dans laquelle croupissent ces agents.

La présence de la MECREKA parait alors comme une autre source de financement, et donc un salut à leur misère de longtemps.

A cet effet, nous pensons que :

- La célébration de la journée internationale des coopératives permettrait aux participants d'acquérir de l'information sur les mouvements et les principes coopératifs ainsi que les avantages qu'ils offrent ;
- La connaissance des avantages du mouvement coopératif encouragerait les citoyens et les agents du CRSN en particulier à adhérer dans ces dits mouvements ;
- L'adhésion massive aux coopératives permettrait aux citoyens et en particulier aux agents du CRSN de (d') :
    - Épargner ;
    - Accéder facilement aux crédits pour l'investissement ;
    - Éviter les endettements et crédits aux taux d'intérêts forfaitaires.

L'objectif de ce travail est de déterminer l'impact de la MECREKA dans la vie socio-économique et culturelle des agents du CRSN/LWIRO, et les susciter à adhérer massivement dans les coopératives, source de financement au taux d'intérêt supposé raisonnable.

2 METHODOLOGIE

Nous avons effectué cette étude en deux phases :

1° ***L'exposé*** **:** Grace à la documentation, nous avons constitué une brève littérature sur les mouvements coopératifs et nous l'avons exposé auprès de 52 participants dont 47 hommes et 5 femmes. Il a porté sur la définition des concepts clés, les attentes des populations et le rôle de l'Etat dans le développement des coopératives. Ledit exposé a été sanctionné par une petite vérification de l'acquis sur la journée.

2° ***L'enquête*** : Nous avons effectué notre enquête auprès des agents du CRSN membres de la MECREKA. Pour tirer l'échantillon, nous nous sommes servis de la formule de SPIELGER (1982) selon laquelle l'échantillon d'une population à étudier est égal à la racine carrée de la population totale. A la date du 30/10/2012, 362 agents du CRSN sont membres de la MECREKA. La MECREKA n'ayant pas classé ces agents par catégorie, nous nous sommes servis des proportions à partir de l'effectif total d'agents du CRSN.

Tableau. 1 : Effectif du CRSN/catégorie /sexe

Catégorie du personnel	**Nombre**			**Pourcentage**
	Homme	**Femme**	**Total**	
Personnel scientifique et technique				
- Directeur. de recherche	1	-	1	0,1
- Maitre de recherche	1	-	1	0,1
- Chargé de recherche	3	-	3	0,4
- Attaché de recherche	21	-	21	2,7
- Ass. de 2ème mandat	10	1	11	1,4
- Ass. de 1er mandat	67	4	71	9
- Directeur technique	2	-	2	0,3
- Technicien de recherche qualifié	1	1	2	0,3
- Technicien de recherche de maitrise.	1	-	1	0,1
- Technicien de recherche	31	10	41	5,2
Sous-total	138	16	154	19,6
Personnel administratif				
- Directeur chef de service	3	-	3	0,4
- Directeur	4	1	5	0,6
- Chef de Division	19	1	20	2,5
- Chef de Bureau	39	3	42	5,4
- Attaché de Bureau. 1er	203	16	219	27,9
- Attaché de Bureau. 2ème	55	9	64	8,2
- Agent de Bureau. 1er	99	40	139	17,7
- Agent de Bureau.2ème	51	7	58	7,4
- Agent Auxiliaire. 1er	72	7	79	10,0
- Agent Auxiliaire.2ème	1	1	2	0,3
Sous-total	546	85	631	80,4
TOTAL	**684**	**101**	**785**	**100**

Source : Service des Ressources Humaines du CRSN/LWIRO

Le tableau 1 reprend le personnel du CRSN par catégorie et par sexe, jusqu'en Octobre 2012. Il montre que le personnel administratif du CRSN est 4 fois plus grand que le personnel scientifique et technique. La part essentielle de ce premier se situe entre les Attachés de Bureau de première classe et les agents de Bureau de première classe.

Tirage de l'échantillon :
Population totale : 362
L'échantillon est donc : $\sqrt{362}$ = 19,026297= 19 personnes

Tableau 2 : Échantillon par catégorie et par sexe

Catégorie	Nombre		Total	Pourcentage
	Homme	Femme		
Personnel scientifique et technique	4	-	4	19,6
Personnel administratif	12	3	15	80,4
Total	16	3	19	
Total	84,2	15,8		100

Le tableau 2 représente l'échantillon par catégorie et par sexe. Chacun des enquêtés était appelé à répondre à un questionnaire écrit.

Étant à la fois agent au CRSN et membre de la MECREKA, l'observation participative et l'entretien libre nous ont aidés à récolter des informations supplémentaires et vérifier quelques affirmations qui sembleraient douteuses.

Après l'enquête, nous sommes passés au dépouillement et les résultats étaient un à un repris dans des tableaux synthétiques.

3 RESULTATS ET DISCUSSION

INFORMATION CONTENUE ET TIREE DE L'EXPOSE

Après l'exposé et l'analyse de la vérification de l'acquis sur la journée (petite évaluation à l'issu de la journée), les éléments suivants sont ressortis :

1. Une coopérative est un groupement des personnes qui se fixent des objectifs et des stratégies pour les atteindre, en vue de leur propre promotion.

Coopérer, c'est réussir autrement(3).

Cette définition est très proche de celle proposée par la loi N° 002/2002 du 2 Février 2002, selon laquelle : « sont considérées comme coopératives d'épargne et de crédit ; tout groupement de personnes doté de la personnalité juridique, qui poursuivent principalement un objectif social à travers les services rendus à leurs membres(4)».

2. L'épargne est une accumulation des fonds que les coopératives et/ou institutions financières récupèrent en dépôt pour les mettre à la disposition des citoyens sollicitant des crédits ; lesquels fonds seront ultérieurement utilisés. Trois notions en découlent :

- Qui épargne prospecte sa promotion socio-économique future ;
- Qui épargne ouvre la porte d'accès au crédit ;
- Épargner c'est rendre disponible du crédit à ses concitoyens par le truchement d'une institution financière (bien entendu que ces concitoyens accéderont au crédit avec un taux d'intérêt raisonnable et éviteront ainsi les endettements incontrôlés). L'épargne a donc une connotation sociale.

3. Un crédit est un bien que l'on reçoit en terme de dette et consenti sous quelques conditions liées aux modalités de remboursement.

4. Les coopératives, sous toutes les formes, visent la promotion socio-économique et culturelle de leurs membres et rien que ça.

5. La sous-information des populations sur les mouvements coopératifs est avant tout et surtout une responsabilité de l'Etat qui devait intégrer cet enseignement dans le système éducatif national.

RESULTATS D'ENQUETE PROPREMENT DITE

1. Les modalités d'adhésion à la MECREKA

a. La motivation de l'adhésion :

Tableau 3 : Motivation de l'adhésion à la MECRE

Motivation	Scores	Pourcentages
Un collègue de service	3	15,8
L'idée d'épargne	8	42,1
L'accès facile au crédit	8	42,1
Total	19	100

Il ressort du tableau n° 3 que pour adhérer à la MECREKA, les agents du CRSN sont motivés par deux éléments principaux : l'accès facile au crédit (42,1%) et l'idée de l'épargne (42,1). Ceux qui sont poussés par leurs collègues de service représentent 15,8%.

D'éminents auteurs corroborent l'opinion selon laquelle, ce qui intéresse le paysan au début, c'est la conservation de son argent plutôt que sa fructification(5).

Les agents du CRSN quant à eux, sont surtout motivés par l'accès facile au crédit, compte tenu de leur situation d'endettement et le besoin excessif de financement, causés par le manque de l'épargne.

Cette dernière motivation, si elle n'est pas totalement subordonnée à l'une des incitations précédentes ; elle reste cependant une adhésion aveugle et prestigieuse.

b. Les conditions de l'adhésion :

Chez tous les membres de la MECRE, les conditions d'adhésion sont :

- La manifestation de la volonté à travers une demande d'adhésion adressée au gérant ;
- Le paiement des frais d'adhésion selon la catégorie choisie ;
- La présentation de l'identité complète ;
- Le dépôt de quatre photos passe port
- Le dépôt d'au moins un dollar (1$) dès l'ouverture du compte comme épargne de départ.

D'une manière générale, l'adhésion au sein de la MECREKA est volontaire et tient compte des principes coopératifs universellement reconnus.

2. L'accès au crédit

a. Les agents du CRSN ayant déjà accédé au crédit :

Tableau 4 : Réception des prêts de la MECRE

Opinions	Scores	Pourcentages
Oui	17	89,5
Non	2	10,5
Total	19	100

Comme l'indique le tableau 4, 17 personnes sur 19, soit 89,5% ont déjà reçu un prêt de la MECRE : 16 mariés et 1 célibataire. Seuls deux n'en ont pas encore reçu.

Ces premiers doivent de cette façon boucher différents vides (besoins) que leurs salaires mensuels n'ont pas pu couvrir.

Les deux qui n'en n'ont pas encore reçu sont des célibataires n'ayant généralement pas une lourde charge et ne représentent que 10,5%. Quant aux célibataires débiteurs de la MECREKA, ceux-ci usent de ce crédit pour s'organiser, c-à-d acheter une parcelle et y construire, préparer et organiser le mariage, etc.

b. Fréquence de prêts accordés aux agents du CRSN

Tableau 5 : Fréquence de réception de crédit

Réponses	Fréquences	Pourcentages
Une fois	8	47,1
Deux fois	9	52,9
Total	17	100

A la lumière du tableau 5, nombreux sont ceux qui ont déjà décroché le prêt plus d'une fois (52,9), les autres ne sont qu'à leur premier tour (47,1%).

La MECREKA aide les agents du CRSN à éviter les différentes contorsions liées à l'accès au crédit et contourner les différends qui surgiraient au cours du remboursement des crédits tel que convenu entre les agents et /ou entre les agents et certains particuliers.

La MECREKA promeut donc aussi d'une façon indirecte la cohésion sociale à travers les prêts qu'elle accorde à ses membres.

c. *Les plus grands demandeurs des crédits parmi les agents du CRSN*

Tableau 6 : Les demandeurs de crédit

Grades	Scores	Pourcentages
Directeurs	1	5 ,26
CD	2	10,53
CB et AT	2	10 ,53
ATB_1 et ASS.	8	42,10
ATB_2 et TR	4	21,05
AGB (Tous)	2	10,53
Total	19	100

Le tableau 6 montre les demandes de crédit et se présentent comme suit : les ATB1 et ASS occupent la première place (42,10%) ; les ATB_2 et TR la deuxième (21,05) ; les CD, CB, AT et les AGB la troisième (10,53%) et enfin les directeurs (5,26%).

Les finances du CRSN précisent que ;

- Les grands demandeurs sont les ATB_1 suivis des ATB_2 et les Assistants. Cela s'explique parce que le plus grand personnel du CRSN est compris entre les AGB_2 et les ATB_1 dans l'administration ; dans la recherche les Assistants (de premier mandant et de deuxième mandant) sont majoritaires.
- Ceux qui demandent moins les crédits sont les TR et les ATR pour la simple raison qu'ils représentent la plus petite proportion de l'ensemble du personnel.
- Les MR ainsi que les DR n'en sont pas demandeurs, cela parce qu'ils sont non seulement le mieux payés par rapport à tous les autres agents, mais aussi ils ont plusieurs sources de revenus (notamment l'enseignement dans les institutions universitaires et les consultances).

d. Les exigences pour accéder à un crédit MECREKA sont entre autre :

- Être membre de la MECRE
- L'avis de l'employeur
- Déposer les frais d'étude du dossier
- Déposer une épargne caution de 10% du montant sollicité
- Que le remboursement du principal restant ajouté de ses intérêts ne dépasse pas au maximum les 2/3 du salaire de l'agent.
- Retirer le prêt avec son conjoint pour les mariés

L'avis de l'employeur est en effet indispensable parce que les salariés présentent généralement plusieurs possibilités fâcheuses (tomber malade, être renvoyé, affectation maladroite des fonds, etc.) alors qu'ils doivent payer par échéances le prêt auquel sont ajoutés les intérêts. L'employeur s'engage ainsi à payer la dette au cas où l'agent serait dans une situation ne lui permettant plus d'honorer ses engagements.

Les frais d'étude du dossier couvrent différents contacts dans le processus d'octroi du crédit.

L'épargne caution qui revêt un caractère obligatoire assure la continuité des services de la maison aux autres membres.

Pour ce qui est du remboursement ne dépassant pas les 2/3 du salaire de l'agent, il est compris que l'agent doit continuer à survivre malgré le paiement de son crédit.

Quant au retrait conditionné par la présence du (de la) conjoint(e), on constate en fait que c'est l'agent qui sollicite le crédit, mais on le donne à toute la famille.

Il a été remarqué que certains membres sollicitent le crédit sans l'implication de leurs familles et dilapident cet argent en dehors de leurs foyers. Cette condition prévient même les malentendus éventuels qui pourraient surgir d'une part entre le débiteur et sa famille ; et d'autre part entre le débiteur et son créancier la MECREKA.

e. Réception des explications fiables sur les conditions d'accès au crédit.

Tableau n°7 : Avis sur la réception des explications fiables dans le processus d'accès au crédit

Avis	Scores	Pourcentages
Satisfaction	5	26,3
Non satisfaction	14	73,7
Total	19	100

Au vu du tableau 7, l'on constate que la plupart des agents ayant reçu le prêt (73,7) se disent qu'ils ne sont pas satisfaits des explications qu'ils reçoivent. Seulement 26,3% signalent leur satisfaction.

Les coopératives sont des organisations où les membres exercent d'un pouvoir démocratique et participent activement à l'établissement des politiques et à la prise de décisions.

La boulimie de financement dont les agents du CRSN sont victimes ne leur permet pas cependant de jouir de cette démocratie. Ils ne posent pas en effet suffisamment de questions lors de la conclusion du contrat de prêt, de peur qu'ils n'en soient privés.

Notons que les agents de crédit de la MECREKA se disent toujours disposés à fournir les explications possibles et répondre à toutes les questions éventuelles.

3. Affectation du prêt par les agents du CRSN

Tableau n° 8 : Affectation du prêt par les agents du CRSN/LWIRO

Affectation	Score	Pourcentage
Paiement des frais scolaires et/ou académiques	4	21,1
Achat d'un ordinateur	1	5,2
Satisfaction des besoins primaires	4	21,1
Achat d'une parcelle	2	10,5
Construction d'une maison	3	15,8
Organisation du mariage	2	10,5
Paiement des dettes	3	15,8
Total	19	100

Grace aux crédits que la MECREKA accorde à ses membres, les agents du CRSN satisfassent primordialement 6 types de besoins tel que repris dans le tableau 8, notamment :

- Le paiement des frais scolaires et académiques (21,1%) ;
- La satisfaction des besoins primaires (21,1%).

Ces besoins sont notamment la nutrition, les vêtements et les soins médicaux.

Notons cependant que certains en profitent pour se livrer, d'une part aux vétilles (choses de peu d'importance, qui ne méritent aucun intérêt) et principalement l'ivresse notoire et la polygamie ; et d'autre part aux dépenses somptuaires.

- La construction/réhabilitation du logis (15,8) ;
- Le paiement des dettes antérieures (15,8) ;
- Construction d'une maison (10,5%) ;
- L'achat d'une parcelle (10,5%) ;
- Achat de l'ordinateur (5,2%)

Les coopératives jouent un rôle très important dans la réduction de la pauvreté et contribuent à la mise en œuvre du programme de l'OIT en faveur du travail décent. Elles ont un rôle d'émancipation en permettant aux couches les plus pauvres de la population de participer aux progrès économiques. Elles offrent des possibilités d'emploi à ceux qui ont des compétences, mais peu ou pas de capital et assurent protection en organisant l'assistance mutuelle au sein des communautés

La résolution 127 de la conférence générale de l'Organisation Internationale du Travail , convoquée à Genève par le conseil d'administration du Bureau International du Travail , le 1er Juin 1966, portant Recommandation concernant le rôle des coopératives dans le développement économique et social des pays en voie de développement stipule que :

- L'établissement et la croissance des coopératives devraient être considérés comme un des facteurs importants du développement économique, social et culturel, ainsi que de la promotion humaine, dans les pays en voie de développement.
- En particulier, les coopératives devraient être établies et développées comme un moyen :

  a) D'améliorer la situation économique, sociale et culturelle des personnes ayant des ressources et possibilités limitées, ainsi que d'encourager leur esprit d'initiative ;
  b) D'augmenter les ressources individuelles et le capital national par l'encouragement de l'épargne, la suppression de l'usure et l'utilisation judicieuse du crédit ;
  c) D'apporter à l'économie un plus grand élément de contrôle démocratique des activités économiques et de répartition équitable des excédents ;
  d) D'accroitre le revenu national et les recettes revenant de l'exploitation, et d'augmenter les possibilités d'emploi des travailleurs, par une exploitation plus complète des ressources, grâce, par exemple, à l'application de système de reforme agraire et de colonisation intérieure tendant à rendre productives de nouvelles régions, et au développement d'industries modernes, de préférence disséminées, pour la transformation sur place des matières premières ;
  e) D'améliorer les conditions sociales et de compléter les services sociaux dans des domaines tels que le logement et, le cas échéant, la santé, l'éducation et les communications ;
  f) D'aider et élever le niveau des connaissances générales et techniques de leurs membres(6).

Déo KATULANYA (*Communication personnelle, 2010*) qui dirige aussi une mutuelle d'épargne et de crédit affirme que les coopératives d'épargne et de crédit sont une alternative pour les personnes non éligibles aux services des banques, notamment dans les milieux ruraux où les banques sont inexistantes. En plus, les coopératives ont la capacité de prêter de faibles montants dont les petits commerçants parfois besoin mais que les banques ne peuvent pas leur donner. Le travail des coopératives est donc complémentaire à celui des banques(7).

4. Propositions pour la satisfaction effective des membres

Tableau n°9 : Proposition pour la pleine satisfaction des agents du CRSN membres de la MECREKA

Proposition	Score	Pourcentage
Révision à la baisse du taux d'intérêt	13	68,4
Cessation d'exiger une caution, sinon la bloquer	5	26,3
Accession au prêt le jour même de l'introduction de la demande	1	5,3
Total	19	100

Les agents du CRSN pensent que la révision à la baisse du taux d'intérêt (68,4%) leur permettait pleine satisfaction (Cfr Tableau 9). A cela s'ajoute la non exigence d'une caution lors du consentement du crédit (26,3%) et l'accès au crédit le jour même de l'introduction de la demande (5,3%)

5. souhait de demeurer membre de la MECREKA

Tableau n°10 : souhait de demeurer membre de la MECREKA

Réponses	Scores	Pourcentages
Oui	17	89,5
Non	2	10,5
Total	19	100

Comme nous pouvons le constater à travers le tableau 10, la majorité des agents du CRSN (89,5%) préfèrent demeurer membres de la MECRE, et ceux qui ne le souhaitent pas ne représentent que 10,5%.

La MECREKA est non seulement un dépôt crédible d'argent, mais aussi une source de financement précise.

6. *conditions pour demeurer membres de la MECREKA*

Tableau n°11: conditions pour demeurer membres de la MECRE

Conditions	Scores	Pourcentages
Revoir à la baisse le taux d'intérêt	14	73,68
Accorder de l'intérêt aux débiteurs dont une caution de 10% est toujours exigé	17	89,47
Prolonger de l'échéance	12	63,15

Parce que la question était largement ouverte ; chacune des réponses pouvait être retenue par tous les enquêtés ; il n'est donc pas question de chercher la somme des scores ou de pourcentages. Le tableau 11 dénote trois conditions posées par les agents du CRSN pour demeurer (sans beaucoup envier d'autres IMF) membres de la MECREKA :

- Revoir à la baisse le taux d'intérêt (14/19, soit 73,7%) ;
- Accorder de l'intérêt aux débiteurs dont une caution de 10% est toujours exigée (17/19, soit 89,5%
- Prolonger de l'échéance (12/19, soit 63,2%)

En effet, ces agents estiment que les membres débiteurs de la MECREKA sont nombreux, de sorte que la révision à la baisse du taux d'intérêt ne peut pas compromettre le développement et/ou le fonctionnement harmonieux de la coopérative.

A ce qui concerne la caution toujours exigée, l'épargne caution est en fait une obligation prévue, non seulement par la politique de la MECREKA, mais aussi de la Banque Centrale du Congo qui la prévoit à 20%. L'épargne caution ne peut être placée à un quelconque taux d'intérêt, parce que le propriétaire peut y accéder à tout moment, à condition qu'il ait apuré son crédit.

En plus, tout membre est appelé à contribuer au capital de la coopérative sous forme d'épargne, sans lequel aucun service de prêt ne serait possible. On comprend donc que l'exigence de l'épargne caution est une règle sans exception, parce que les membres sollicitent généralement le crédit lorsque leurs comptes sont presque vides.

Quant à l'accès au crédit le même jour de l'introduction de la demande, ceci est impossible parce que le dossier doit connaitre une étude minutieuse pour que l'agent de crédit se rende compte que le demandeur est éligible au montant sollicité, et qu'il a un avis favorable de son employeur pour les salariés. Dans une coopérative, l'accès au crédit est et reste un processus.

4 CONCLUSION ET SUGGESTIONS

Comme toute coopérative, la MECREKA joue tant soit peu un rôle de promotion sociale et culturelle dans la vie des agents du CRSN ; en permettant à leurs familles d'accéder à l'éducation, à l'habitat, aux soins médicaux, etc.

On ne peut vraiment pas parler d'un impact directement économique, du fait que les agents du CRSN reçoivent un crédit à la consommation, différent du crédit à la production accordé aux commerçants.

Il sied de signaler cependant qu'il est difficile que la MECREKA résolve le problème monumental de l'endettement dont sont victimes ces agents tant que le gouvernement n'aura pas payé un salaire décent à l'ensemble de ses agents. Il s'ajoute aussi que le taux d'intérêt leur exigé est très élevé si on tient d'une part compte de leur revenu mensuel, d'autre part de la mission même des coopératives.

Cela implique que les agents du CRSN en particulier et les fonctionnaires de l'Etat congolais en général tricheront, quoi qu'on fasse, et iront travailler ailleurs pour tenter de trouver de quoi vivre pendant la deuxième quinzaine du mois suivant le paiement. Les recettes de l'Etat sont donc, dans ce cas en danger.

En résumé, au Sud-Kivu, comme dans la plupart de provinces de la RDC, les revenus les plus faibles sont observés non seulement chez les actifs du secteur informel (agricole et non agricole), mais également dans l'administration publique. Or, les employés de l'administration publique sont parmi les actifs les plus instruits (11 années d'étude réussie). Cette faible rémunération pourrait alors avoir des impacts sur la qualité des services publics(8).

L'Etat congolais doit donc à temps revenir à ses responsabilités sans quoi ses attentes vis-à-vis de ses agents et fonctionnaires ne seront pas effectives.

Le paiement en banque, s'il ne reste qu'un racontar, permettrait à ces agents en besoin perpétuel de financement d'accéder aux crédits suffisants, aux taux d'intérêt raisonnables et à longue échéance.

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Euclidean distance and HAC methods coupled to FT-MIR spectroscopy as chemometric tool for the authentication of the virgin olive oil

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ABSTRACT: Therapeutic efficiency of virgin olive oil components, like antioxidants, has been proved. Moreover, the adulteration of virgin olive oil by the refined olive oil is a known fraudulent practice in non formal markets in some developing countries. In Morocco, there is a need of non expensive and fast tool to quantify the adulteration of virgin olive oil by the refined one. That is why we used a coupling between Fourier transform middle infrared spectroscopy, as a non expensive analysis technique, and Euclidean distance and hierarchical ascending cluster methods.
Virgin olive oil was extracted from ''Picholine'' cultivar olives in Tadla Azilal area, in Morocco. Fourier transform middle infrared spectroscopic parameters of prepared mixtures of virgin and refined olive oils have been used to determine the adulteration. The result of the Euclidean Distance concerning such an adulterated virgin olive oil has allowed the quantification of the adulteration percentage. The results of the hierarchical ascending cluster could provide a fast classification of virgin oil oils. Thanks to its rapidity and relatively low cost, coupling between middle infrared spectroscopy and chemometric methods would be an efficient tool to ensure authentication and traceability of virgin olive oil.

KEYWORDS: Virgin olive oil, adulteration, authentication, FT-MIRS, Chemometrics.

1 INTRODUCTION

Virgin olive oil (VOO), known for its health properties as a Mediterranean food is still interesting by its scientific and dietetic communities. It contents antioxidant substances that the therapeutic efficiency has been proved [1], [2], [3], [4], [5],

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[6], [7], [8], [9]. Moreover, the adulteration of olive oil by the used olive oil is a known fraudulent practice in non formal markets is some developing countries. This adulteration is made in order a material benefit without respecting the security of the consumers. Many works have been carried out until now are, namely, to find markers of adulteration in blends of extra virgin olive oil with refined olive oil (ROO). These anterior studies have contributed to increase the knowledge about this problematique of the adulteration. Several physical and chemical methods are used to detect and quantify the adulteration in virgin olive oil [10], [11], [12], [13], [14], [15], [16]. Moreover chemometric methods are used to solve the problematique of the adulteration. In fact, to discriminate French virgin olive oils (VOOs) that are registered as designations of origin (RDOS) and thanks to chemometrics, Ollivier D. and al. have in 2006 [17] used sensory and chromatography characteristics like fatty acid and triacylglycerol compositions. In 2011, using to the hierarchical ascendant clustering analysis (HAC), derivative FTIR spectroscopy have allowed De Luca M. and al. [18] the classification of Moroccan VOOs. A recent work of El bir M. and al. has used a coupling between gas chromatography and chemometric methods (PCA, K-Means and HAC) for automatic classification of Moroccan virgin olive based on its fatty acids and sterols contents [19]. In Morocco, there is a need of non expensive and fast tool for the quality control and the detection and the quantification of the adulteration of the virgin olive oil by refined oil. That is why the present work has aimed to contribute to the control of the quality of the VOO adulterated by refined oil (ROO) in some informal markets.

2 MATERIALS AND METHODS

Olives from the Moroccan Picholine cultivar were collected in the "Tadla-Azilal" Moroccan area in December 2012. The olives have been submitted to mechanical press in the laboratory to assure the extraction of virgin olive oil samples. The virgin olive oil extracted has been stored at 10°C. Fourier Transform Middle Infrared (FT-MIR) spectroscopic parameters of 17 prepared "VOO+ROO" mixtures (table 1) were explored to predict adulteration. These 17 prepared adulterated samples were analyzed by using a Brücker Vector 22 ATR Diamond FT-MIR spectrometer. However, the FT-MIR spectroscopy could not allow the discrimination between the 17 adulterated samples.

So, we have used the Euclidean distance method to remedy this problem. The square of Euclidian distance “d” between a spectrum of unknown sample and a "VOO+ROO" mixture spectrum is given by the following equation (1):

$$d^2 = \sum \left(Ab_{i(unknownsam\ ple)} - Ab_{i(knownsampl\ e)} \right)^2 \qquad (1)$$

Where $Ab_{i(unknownsample)}$ and $Ab_{i(knownsample)}$ are the absorbency corresponding to the wave number $1/\lambda_i$ for the unknown sample and for the known one, respectively. (i) is raising from 1 to 1764. Table 2 illustrates a type of a table for the FT-MIR data base of the 17 samples.

Table 1. Weight and percentage of adulteration for the 17 "VOO+ROO" mixtures

Mixture number	1	2	3	4	5	6	7	8
VOO (g)	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004
"VOO + ROO" (g)	4.9004	4.9238	4.9492	4.9734	5.0042	5.0310	5.0534	5.0760
Adulteration (% w/w)	0.00	0.48	0.99	1.47	2.07	2.60	3.03	3.46

Mixture number	9	10	11	12	13	14	15	16	17
VOO (g)	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004	4.9004
"VOO + ROO" (g)	5.1074	5.1334	5.1604	5.1860	5.2098	5.2414	5.2662	5.3000	5.3302
Adulteration (% w/w)	4.05	4.54	5.04	5.51	5.94	6.51	6.95	7.54	8.06

Table 2. Type of a table for the FT-MIR spectroscopic data base of 17 "VOO+ROO" mixtures

Column 1	Column 2	Column 3	.	.	Column 17	Column 18	Column 19 (unknown sample)
A	B (0% w/w)	C (0.48% w/w)	.	.	Q (7.54% w/w)	R (8.06% w/w)	S (% to determine)
1/λ (cm^{-1})			.	.			.
1/λ =3999	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.

Finally, we applied the Euclidean distance method to predict 10 samples of VOO, eventually adulterated by ROO, collected in the informal markets in the Moroccan Tadla Azilal area.

In order to enrich the results of the Euclidean Distance method we have applied the HAC method on the Fourier Transform Middle Infrared spectroscopic data extracting from the 17 ‘‘VOO+ROO’’ mixture spectra of the virgin olive oil adulterated by the refined olive oil.

3 RESULTS

3.1 EUCLIDEAN DISTANCE

The FT-MIR spectra of the "VOO+ROO" mixtures present the same bands that one can detect by MIR spectroscopy. The type of the spectrum of these 17 spectra is given in the figure 1. The adulteration of VOO by a low quantity of ROO is not easy to be detected. In fact, the figure 2 shows that it is difficult to distinguish between the 17 "VOO+ROO" mixtures. So, it was necessary to couple the FT-MIR spectroscopy with the Euclidean distance method. We checked the equation (1) of Euclidean distance method by testing it using the sample which corresponds to the column number 6. As it is observed in column 6 (G) in table 3, Euclidean distance is equal to zero, so it means that the adulteration percentage of this testing sample would be 2.6%. The result of the predicted Euclidean Distance concerning the 10 adulterated VOO by ROO samples collected in the informal markets is reported in the table 4.

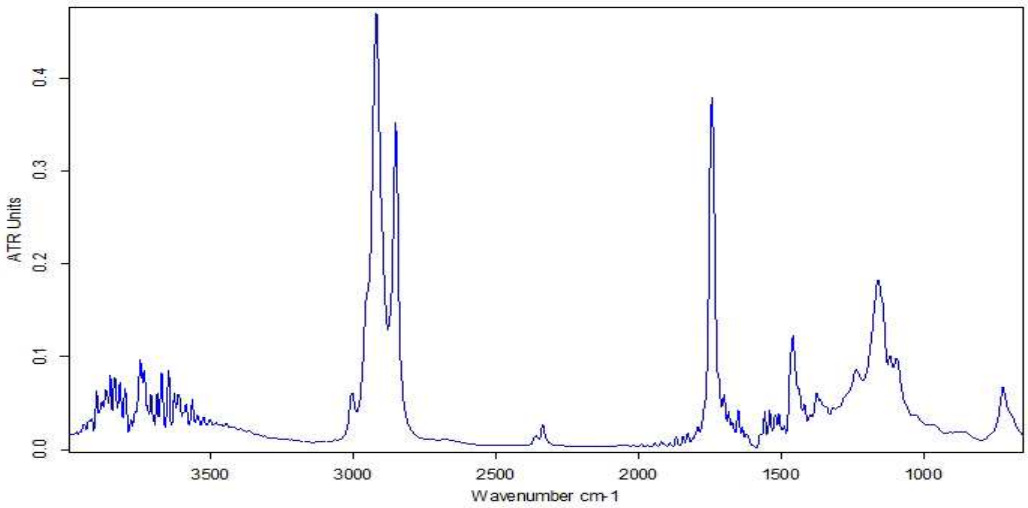


Fig.1. FT-MIR spectrum of virgin olive oil adulterated by refined oil

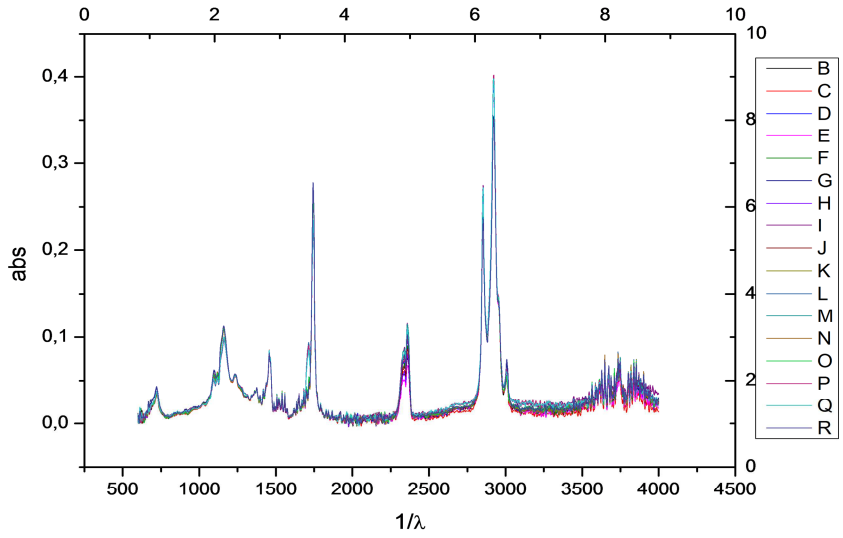


Fig. 2. FT-MIR spectra of the 17 prepared "VOO+ROO" mixtures

Table 3. Euclidean Distance (ED) between testing sample spectrum and each one of 17 FT-MIR mixtures spectra

	1	2	3	4	5	6	7	8	9	10
A	B	C	D	E	F	G	H	I	J	K
d	0.2002	0.2634	0.1927	0.2111	0.2009	0	0.1949	0.3094	0.1874	0.2143

11	12	13	14	15	16	17
L	M	N	O	P	Q	R
0.3526	0.2456	0.2374	0.2231	0.3238	0.3246	0.1443

Table 4. Predicted Euclidean distance between each one of the 10 collected adulterated VOO sample spectrum and each one of 17 FT-MIR mixtures spectra.

Real adulteration percentage (% w/w)	HT1	HT2	HT3	HT4	HT5	HT6	HT7	HT8	HT9	HT10
H1 (0.00)	0.1433	0.1261	0.1312	0.2209	0.0967	0.0944	0.2303	0.1417	0.2809	0.1312
H2 (0.48)	0.0159	0.2333	0.1604	0.2923	0.2131	0.0897	0.3471	0.1760	0.3504	0.2383
H3 (0.99)	0.1660	0.0839	0.1150	0.1954	0.0864	0.0897	0.1980	0.1500	0.2504	0.1073
H4 (1.47)	0.1241	0.2292	0.1777	0.2707	0.1883	0.1252	0.3159	0.1011	0.3362	0.2175
H5 (2.07)	0.1518	0.1263	0.1283	0.2127	0.0978	0.1010	0.2184	0.1390	0.2734	0.1327
H6 (2.60)	0.2527	0.2216	0.2323	0.2688	0.2007	0.2122	0.2524	0.1095	0.3214	0.1595
H7 (3.03)	0.1822	0.1521	0.1295	0.1706	0.1094	0.1368	0.2163	0.1351	0.2410	0.1546
H8 (3.46)	0.3683	0.1877	0.2586	0.2126	0.2006	0.3046	0.0665	0.3142	0.2266	0.2106
H9 (4.05)	0.1877	0.1144	0.1295	0.1809	0.0519	0.1301	0.1890	0.1395	0.2418	0.1177
H10 (4.54)	0.2077	0.0900	0.1502	0.2028	0.0757	0.1475	0.1738	0.1820	0.2549	0.0810
H11 (5.04)	0.3672	0.2468	0.2253	0.1281	0.2651	0.3174	0.2449	0.3461	0.0851	0.2829
H12 (5.51)	0.2523	0.0413	0.1618	0.1889	0.1071	0.1872	0.1413	0.2313	0.2245	0.1167
H13 (5.94)	0.2329	0.0816	0.1638	0.2052	0.0716	0.1710	0.1600	0.2134	0.2504	0.1127
H14 (6.51)	0.2353	0.0785	0.1408	0.1596	0.0873	0.1709	0.1447	0.2004	0.2065	0.1127
H15 (6.95)	0.3422	0.2348	0.2018	0.0731	0.2445	0.2943	0.2324	0.3133	0.0221	0.2656
H16 (7.54)	0.3461	0.2106	0.1960	0.1107	0.2298	0.2923	0.1990	0.3185	0.0741	0.2478
H17 (8.06)	0.3056	0.2049	0.2568	0.2816	0.2158	0.2524	0.2107	0.2082	0.3164	0.1380
Predicted adulteration percentage	**0.48**	**5.51**	**0.99**	**6.95**	**4.05**	**0.48**	**3.46**	**1.47**	**6.95**	**4.54**

3.2 HIERARCHICAL ASCENDING CLUSTER (HAC)

We have, also, preceded to the hierarchical ascending cluster (HAC) method and the result is given by the dendrogram in the following figure 3.

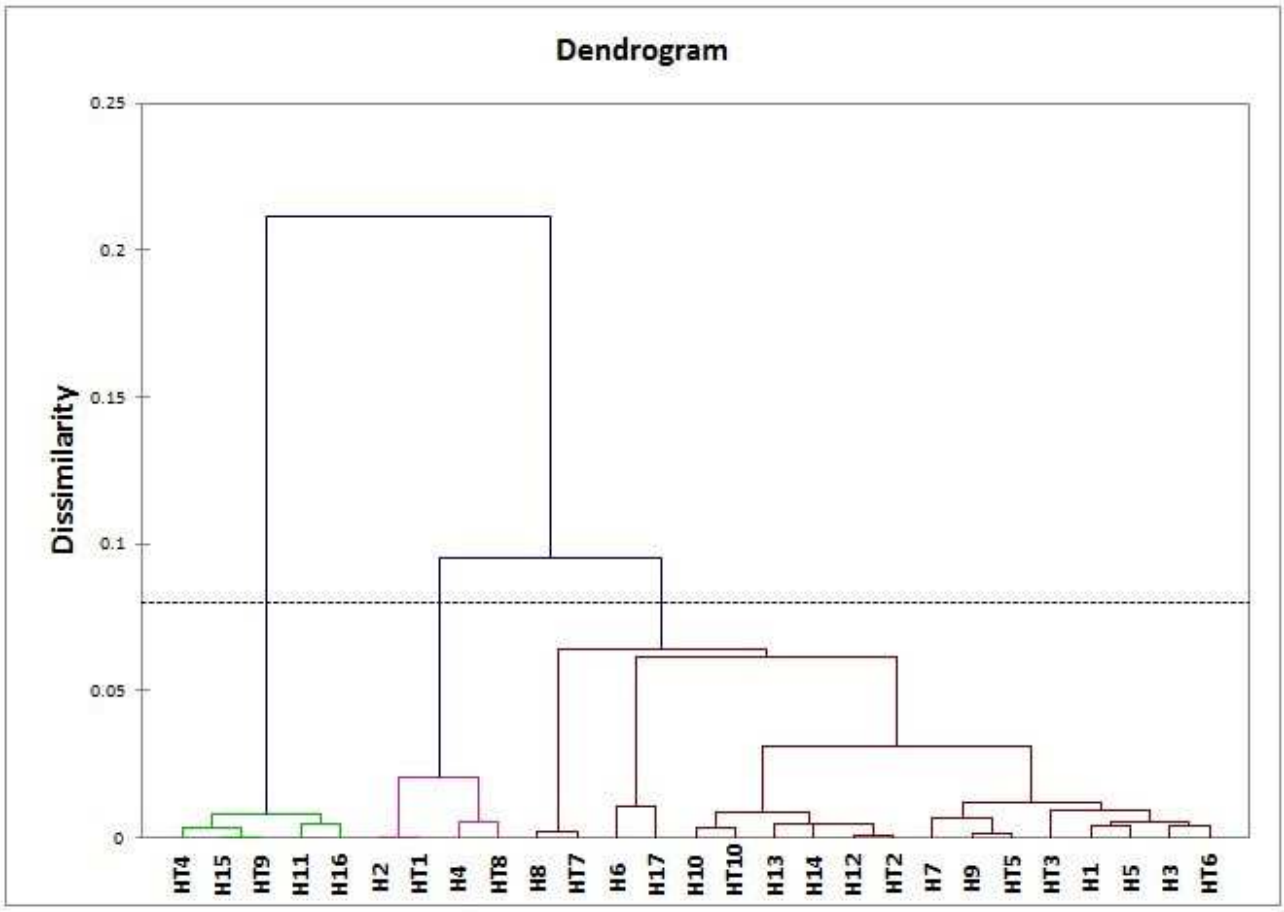


Fig.3. Classification dendrogram by the HAC method

4 DISCUSSION

It was important to try to determine adulteration degree by a rapid and simple tool that is coupling between FT-MIR spectroscopy and chemometrics. As it is shown in figure 2, it has been actually difficult to discriminate between the 17 FT-MIR spectra of the prepared adulterated virgin olive oil ("VOO+ROO"). In fact, these 17 spectra present the same olive oil characteristic bands. The two intense bands at 2924 and 2853 cm^{-1} are attributed respectively to the asymmetric and symmetric vibrations of the pulled CH_2 group. Another band having medium intensity at 2953 cm^{-1} is due to the asymmetric stretching vibration of the CH_3 group. At the low frequency region, only the bending vibration of CH_2 is observable. The bands at 1458 and 1232 cm^{-1} are due to vibrations of shear deformation out of the plane. The band which appears at 724 cm^{-1} is representative of the deformation vibrations of swinging and corresponds to the fact that the latter is the most apparent in the unsaturated fatty acids into saturated fatty acids.

The =CH mode vibration corresponds to a band of low intensity is observed around 3008 cm^{-1}. In contrast, one can observe an intense band at about 970 cm^{-1}. It is due to the bending vibration of the =C-H group. The Mode C=O vibration appears around 1750 cm^{-1}. The C-O mode vibration which appears at 1150 cm^{-1} is due to the stretching vibration of C-O group of esters. The band line to 2350 cm^{-1} is related to the conditions of the spectra registration.

FT-MIR spectroscopy coupled to Euclidian distance method has finally allowed recognizing that an testing sample which was adulterated VOO by ROO, arbitrarily chosen as the one corresponding to the column 7 (2.6%).

The Euclidean distance (ED) is a statistical method used for the classification in the field of information processing (image processing, data mining and chemometrics), More studies have been done using this Euclidian distance method as discriminative parameter for classification of sud-Paris waters. The same approach and others have been to represent data objects by their similarity or dissimilarity with respect to other objects, The Euclidean distance and incremental linkage methods used by A.G. Cruz et al. [20] in the pre-processing to elaborate the Hierarchical Cluster Analysis in chemometric techniques to discriminate low-fat and full-fat yogurts.

Elbir and al. have recently applied algorithms (PCA, K-Means an HAC) for discrimination between virgin olive oils on the basis of their contents in terms of fatty acids and sterols [19]. Also, classification algorithms like LDA (linear discriminant analysis), CART, and Treenet and SVM (support vector machines) have been carried out by A.S. Melissa [21] so that he PCCM method performed well for different tests over large sets of classification experiments. These last authors have established discriminating PCCM classifier that provides a quick visualization tool to diagnose complex classification problems. Many techniques used in soil Vis–NIR sensing are based on the measurement of the similarity or distance between samples [22]. The authors evaluated the following distance metrics: Euclidean (ED), Mahalanobis (MD), spectral angle mapper (SAM), surface difference spectrum (SDS), spectral information divergence (SID), principal component distance (PC-M), optimized PC distance (oPC-M), locally linear embedding distance (LLE-M) and σ-locally linear embedding (σLLE-M) [22]. The experimental results of these last authors showed that the Vis–NIR similarity measures reflecting better the soil compositional similarity are those corresponding to the oPC-M, LLE-M and σLLE-M methods. The United States and Canada currently use exposure-based metrics to protect vegetation from O_3 [23]. Using 5 years (1999 to 2003) of commeasured O_3, meteorology and growth response, the two countries have developed exposure-based regression models that predict Populus tremuloides growth change within the context of North American ambient air quality. These models comprised growing season fourth-highest daily maximum 8-h average O_3 concentration, growing degree days, and wind speed.

So, in the present work, to discriminate between the 17 FTIR spectra of the adulterated virgin olive oil, a coupling between the MIR spectroscopy and the method of Euclidian distance was an efficient, rapid, less expensive and determining for routine analyses, particularly for the olive oil quality control.

Finally, such results of the present work are very important as a first level in the control of the quality of the olive oil, thanks to its optimizing in terms of time, exactitude and price.

The results of the HAC were found corresponding to those of the Euclidean distance method. Overall, the Euclidean distance between the FT-MIR spectrum of each of the 10 samples (HT1 to HT10) coming from the informal market and that of a spectrum FT-MIR coming from a 'VOO + ROO' mixture, is minimal (hatched values in Table 4) when the two spectra are those of samples that are close neighbors on the HAC dendrogram (Figure 3). In fact, only the HT6 sample coming from the informal market is the exception of this observation since it is not a neighbor of the H2 mixture sample on the HAC dendrogram.

5 CONCLUSION

Adulteration of virgin olive oil by adding a very small quantity of refined olive oil is difficult to be detected. Coupling between Middle infrared spectroscopy and Euclidian distance method contributes to the detection and the prediction of this adulteration. Thanks to its rapidity and relatively low cost, coupling between FT-MIRS and Euclidean distance and Hierarchical Ascending Cluster methods would be an efficient chemometric tool to ensure authentication and traceability of virgin olive oil, foods, medicines or other products.

In order to control the quality of the olive oil at the industrial laboratory and the research one, such a coupling may be a reference chose of rapid and less expensive tool.

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Spatial resource allocation: multi task, multi competences case

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ABSTRACT: In this paper we consider a problem of spatial allocation of agents "Technicians" with multi competences, for maintenance of distributed equipment requiring multi skills tasks. The objective is to ensure optimal partitioning of resource allocation taking into account the multi competences constraints and resources displacement. The approach to the problem is performed using the techniques of cellular automata and Voronoi diagrams. We first consider a simplified case of seven equipments and tree technicians with two competences. An algorithm is proposer for the considered case, and a simulation is presented. The technician displacement is not treated in this paper. A generalization to *m* equipments *p* technicians and n competences is proposed.

KEYWORDS: Cellular Automata, Voronoi diagram, industrial, maintenance, modelling, process.

1 INTRODUCTION

The maintenance department by putting in good operating conditions production equipments and preventing failures is, conspicuously, influencing on companies productivity. The human factor appears to be the best asset to carry out any project. Its impact on the functioning of the company now seems indisputable. Optimizing the use of human resources becomes an aspect of performance that manufacturers are rediscovering and trying to master to exploit these resources. Such recognition has led to the emergence of a new model of management called the competence [1].

Each activity is associated with required competences. Solving assignment problem, will, therefore, lead to find the right resource and the best time to carry out the activity. The assignment of tasks and the organization of the activity of human resources of the maintenance service allow the service to improve considerably its efficiency.

Many studies have focused on the problems of human resource allocation taking into account the competences. Some consider the difference between the qualification levels of the operators as a factor that directly impact the operational performance. Authors, in other studies, have shown that the real duration of a task varies linearly according to the rate of competence [2] or according to the productivity [3] of the resource. [4] assume that the execution time of a task varies by a certain pre-set percentage according to the level of expertise on the resource. The integration of competences in the formulation of the problems of assignment aroused the interest of many researchers. Various approaches and methods of resolution were proposed. We plan, within the framework of this work, to enrich this base by putting forward the impact of the joint introduction of competences and partitioning problem for optimal resource allocation on the performance of an organization. The formulation and the approach of resolution of the problem of assignment which we propose in the following section, is a generalization of previous works of [5].

The aim of this paper is to develop a general approach of optimization and visual simulation by cellular automata based on the integration of spatio-temporal factors in a resources allocations problem (Location of equipment's and facilities, technician displacements) We study the particular case of a manufacturing company consisting of several equipments and facilities, geographically distributed, subject to wide kinds of maintenance interventions requiring different competences. We are particularly interested in the process of assigning interventions of preventive maintenance tasks. Consider a set of

equipment spread over a space and a set of technicians with competences. Maintenance technicians must perform different types of interventions. These maintenance activities are beings managed by allocating tasks to the most appropriate resource available and the closest spatially.

2 PROBLEM STATEMENT

The model must take into account various constraints: tasks duration, significant displacement time between the equipment and facilities of the site, optimal scenarios of intervention tasks, precedence between tasks of the same entity and competence required to each task. We have to consider, also, unplanned interventions due to corrective maintenance. The number of interventions that can be processed simultaneously depends on the technician's skills level and on their competences. The response time is conditioned by the choice of the resource and its proximity to the equipment or installation. However, all technicians must be engaged in a uniform manner, to avoid work overload and optimize transport and travel.

SYSTEM MODEL:

We consider:

- A set of equipments noted $\mathbf{E}$ with M elements. We assume that each equipment with index j for $1 \le j \le M$ requires intervention with *k* competences $1 \le k \le I$ where I is the total number of different competences required for all equipment. We note $\mathbf{E}_j^k$ the equipment index j and requiring k competence;
- A set of technicians noted $\mathbf{T}$ compound P technician. We assume that each technician with index i technician, for $1 \le i \le P$ has *n* qualifications with $1 \le n \le Q$ where Q is the total number of different skills of all technicians. We note $\mathbf{T}_i^n$ the technician index i with n competences.

Also we assume that each equipment $\mathbf{E}_j^k$ requires preventive" interventions. For each equipment $\mathbf{E}_j^k$, each intervention k should be performed after T_k^I (Mean Time Between Failures) and it lasts T_k^R (Mean Time To Repair).

We consider the following problem : How to allocate technician's to the different maintenance tasks taking into account required skill, technicians competences and their spatial positions in order to reach optimal performance as : less equipment downtime, Better use of in-shop maintenance personnel , less technician displacement ... etc ...

We will formulate this problem as a cellular automaton dynamical system. Cellular Automata [6] and Voronoi diagram [7] will be the basic tools to be implemented in the present approach. The use of evolutionary methods in spatial optimization problems such as the ones outlined here is called for by their complexity and nonlinearity. Additionally, a particular characteristic of these problems is the relation between local interactions and global system behaviour. We recall the Cellular Automata and Voronoi diagram definitions and properties.

2.1 CELLULAR AUTOMATA

Cellular automata date back to von Neumann. Their fundamental importance was demonstrated by Wolfram (2002). They have been used as a background for modelling a great diversity of natural, as well as social and economic systems. Also, numerous applications have been presented for the spatial analysis.

Definition: *A cellular automaton is a quadruple* $\mathbf{A} = (\mathbf{L}, \mathbf{S}, N, f)$ *where:*

- $\mathbf{L}$ *is a lattice defined by a regular grid of cells denoted by* $C_{i_1 i_2 \cdots i_d}$ *, on a* d *dimensional domain* Ω*,*
- $\mathbf{S}$ *a finite set of states given as a commutative ring in which modular arithmetic will be used,*
- N *a neighbourhood of the cell* c *,*
- f *a set of local transition rules which update the state of cell* c *. It can be given by a transition function :*

$$f : \begin{array}{ccc} \mathbf{S}^{N(c)} & \rightarrow & \mathbf{S} \\ s_t(N(c)) & \rightarrow & s_{t+1}(c) \end{array}$$

2.2 VORONOI DIAGRAM ADAPTED TO LATTICE

Consider a lattice $\mathbf{L}$ of $p \times q$ cells and a set of cells

$$\mathbf{C} = \{C_{ij} \in \mathbf{L}, (i, j) \in \Delta\}$$

Where $\Delta = \{(i, j) : 1 \le i \le p'; 1 \le j \le q'\}$ and $p, q \in N$

Definition: *we define:*

- *The Voronoi cell* $V(C_{ij})$ *of* C_{ij} *as the subset of* $\mathbf{L}$ *defined by:*

$$V(C_{ij}) = \{C \in \mathbf{C} : d(C, C_{ij}) \le d(C, C_{lk}) \text{for all } (i, j) \ne (l, k); \text{and } (l, k) \in \Delta\}$$

Where $d(C, C_{ij})$ *is a distance from* C *to* C_{ij}.
And the Voronoi diagram of $\mathbf{C}$ *is the set* $Vor(\mathbf{C}) = \bigcup_{(i,j)\in\Delta} V(C_{ij})$

- *The cells* $C_{ij}, (i, j) \in \Delta$ *are called seed (site, or generator) the Voronoi cell.*

Remark:

The Voronoi cell of seed C_{ij} *is the region of all Cellular Automaton cells closer to that seed than to any other. We will use this property to approach our problem.*

We recall some important properties of Voronoi diagram that we will use in our approach.

Proposition*:*

- *The intersection of two Voronoi cells is either empty or an edge*
- *The intersection of three Voronoi cell is either empty or a Cellular Automata cell called Voronoi vertex*
- *A Voronoi cell is convex.*

2.3 CONCEPTUAL FRAMEWORK

To simplify the notations and present clearly our work, a hypothetical problem is considered in order to illustrate, without loss of generality, we assume that $M = Q = 2$. At the end of the paper we give the algorithm in the case Where M and / or Q is greater than 2

In this case we get T_k^I and T_k^R for $k = 1.2$. These times are in general random, and in the case they may be deterministic and T_k^I decreasing, T_k^R is growing according to "age" or "running time" of the equipment. We do not consider the random case in the present work but it will be considered in future work.

To apply the cellular automata approach to the resource allocation problem, we start by defining the corresponding cellular automaton $\mathbf{A} = (\mathbf{L}, \mathbf{S}, N, f)$.

The lattice $\mathbf{L}$ corresponds to a grid of an bidimensional space $(d = 2)$ such as : $\mathbf{L} = \left\{ c_{ij} \;/\; \begin{matrix} 1 \le i \le N \\ 1 \le j \le M \end{matrix} \right\}$ where $N \times M$ represents the total number of cells $\mathbf{L}$. We assume that our domain is bounded.

$\mathbf{S}$ a finite set of states of cells. A cell is either empty, contains equipment operational or equipment down or an assigned for maintenance or available, busy or assigned technician:

Equipments are indexed in a set $\mathbf{M}$, $i = \{1, ..., E\}$ and technicians in a set $\mathbf{P} = \{1, \cdots, p\}$.

The equipment, noted $\mathbf{E}_j^k$ for $k = 1, 2$, can be Operational or Down. In the case it fails it may need the Intervention 1 or 2 or Both 1 and 2 and if any technician is available he can be assigned. So we can assign to each equipment a state values:

$$\theta(\mathbf{E}_j^k)=\begin{cases}3 & \text{equipment } \mathbf{E}_j^k \text{ operational}\\ -1 & \text{need intervention 1}\\ -0.5 & \text{is assigned for intervention 1}\\ -2 & \text{need intervention 2}\\ -1.5 & \text{is assigned for intervention 2}\\ -3 & \text{need intervention 1 and 2}\\ -2.5 & \text{is assigned for intervention 1 and 2}\\ -2.1 & \text{need intervention 1 and 2 and assigned 1}\\ -2.2 & \text{need intervention 1 and 2 and assigned 2}\end{cases}$$

Each equipment $\mathbf{E}_j^k$ need intervention after running time (Mean Time Between Failures) T_k^I. The intervention lasts (Mean Time To Repair) T_k^R .

The technician, noted T_i^n for $n=1,2$, has a state $\varphi(.)$ defined by:

$$\varphi(T_i^n)=\begin{cases}4 & \text{if the technician } T_i^n \text{ is available and have two competencies 1 and 2}\\ -4 & \text{if } T_i^n \text{ is assigned to an equipment for intervention requring both comptencies 1 and 2}\\ 3.1 & \text{if the technician } T_i^n \text{ is available and have competency 1}\\ 3.2 & \text{if the technician } T_i^n \text{ is available and have competency 2}\\ -3.1 & \text{if the technician } T_i^n \text{ is assigned to an equipment requiring competency 1}\\ -3.2 & \text{if the technician } T_i^n \text{ is assigned to an equipement requiring competency 2}\end{cases}$$

Then the state space is given by: $\mathbf{S}=\{3,-1,-0.5,-2,-1.5,-3,-2.5,-2.1,-2.2,4,-4,3.1,3.2,-3.1,-3.2\}$ where the state of each cell is:

- $e(c_{ij})=0$ if the cell is empty.
- $e(c_{ij})=3$, if the cell is occupied by an operational equipment ;
- $e(c_{ij})=-1$ if the cell is occupied by a down equipment requiring competence 1;
- $e(c_{ij})=-0.5$ if the cell is occupied by an assigned down equipment for intervention with competence 1 ;
- $e(c_{ij})=-2$ if the cell is occupied by a down equipment requiring competence 2;
- $e(c_{ij})=-1.5$, if the cell is occupied by an assigned down equipment for intervention with competence 2;
- $e(c_{ij})=-3$ if the cell is occupied by a down equipment requiring both competence 1 and 2;
- $e(c_{ij})=-2.5$ if the cell is occupied by an assigned down equipment for intervention with both competence 1 and 2;
- $e(c_{ij})=-2.1$ if the cell is occupied by an assigned down equipment for intervention with competence 1;
- $e(c_{ij})=-2.2$, if the cell is occupied by a down equipment requiring competence 2;
- $e(c_{ij})=4$ if the cell is occupied by an technician not available ;
- $e(c_{ij})=-4$ if the cell is occupied by an technician available with two competences 1 and 2 ;
- $e(c_{ij})=3.1$ if the cell is occupied a technician available with competence 1 ;
- $e(c_{ij})=3.2$ if the cell is occupied by a technician available with competence 2 ;
- $e(c_{ij})=-3.1$, if the cell is occupied by an assigned technician to 1 ;
- $e(c_{ij})=-3.2$ if the cell is occupied by an assigned technician to 2;

- Neighbourhood: We consider the Von Neumann or the Moore neighbourhoods which are characterized by a radius r and defined by: $N(c)=\{c'\in \mathbf{L} \mid \|c'-c\|_i \le r\}$ where $\|c\|_i, i=1,\infty$ indicates the sum and the maximum respectively, of the absolute value of the components of cell c.
- Transition rules: The evolution of the state of each cell c_{ij}, depends on its state and those of its neighbourhood and the technicians displacement. It is summarized as follow:

$e_t(c_{ij}) \rightarrow e_{t+1}(c_{ij})$

if $e_{t_i}(c_{ij})=0$ then:

$$e_{t_{i+1}}(c_{ij})=\begin{cases} 4 \text{ or } 3.1 \text{ or } 3.2 & \text{if occupaied by, respectively, an available technician with 1 and 2, or 1 or 2} \\ -4 \text{ or } -3.1 \text{ or } -3.2 & \text{if occupaied by, respectively, an assigned technician for 1 and 2, for 1 or for 2} \\ 0 & \text{otherwise} \end{cases}$$

if $e_{t_i}(c_{ij})=3$ then :

$$e_{t_{i+1}}(c_{ij})=\begin{cases} 3 \text{ if the equipement operational} & \\ -1 \text{ or } -2 \text{ or } -3 & \text{if the equipement requires 1 or 2 or (1 and 2)} \\ 0 & \text{if the equipment is removed} \end{cases}$$

if $e_{t_i}(c_{ij})=-3$ then

$$e_{t_{i+1}}(c_{ij})=\begin{cases} -2.5 \text{ or } -0.5 \text{ or } -2.5 & \text{if assigned respectively for (1 and 2) or 1 or 2} \\ -3 & \text{if not assigned} \\ 0 & \text{if the equipment is removed} \end{cases}$$

if $e_{t_i}(c_{ij})=-1 \text{ or } -2$ then

$$e_{t_{i+1}}(c_{ij})=\begin{cases} -0.5 \text{ or } -1.5 & \text{if assigned} \\ -1 \text{ or } -2 & \text{if not assigned} \end{cases}$$

if $e_{t_i}(c_{ij})=-1.5(\text{ or } -2.5 \text{ or } -0.5)$ then :

$$e_{t_{i+1}}(c_{ij})=\begin{cases} 4 & \text{Equipement fixed} \\ -1,5 & \text{Si } c_{ij} \text{ Equipement not yet fixed} \end{cases}$$

if $e_{t_i}(c_{ij})=-2.1 \text{ or } -2.2$ then :

$$e_{t_{i+1}}(c_{ij})=\begin{cases} -2.5 & \text{if assigned for 1 and 2} \\ -2.1 \text{ or } -2.2 & \text{if no new assignment ?} \\ -2 \text{ or } -1 & \text{1 fixed and need 2 or 2 fixed and need 1} \end{cases}$$

if $e_{t_i}(c_{ij})=4 \text{ or } 3.1 \text{ or } 3.2$ then :

$$e_{t_{i+1}}(c_{ij})=\begin{cases} 4 & \text{technician still available} \\ -4 \text{ or } -3.1 \text{ or } -3.2 & \text{if the technician is assigned to 1 and 2 or to 1 or to 2} \end{cases}$$

if $e_{t_i}(c_{ij}) = -4 \text{ or } -3.1 \text{ or } -3.2$ then :

$$e_{t_{i+1}}(c_{ij}) = \begin{cases} -4 \text{ or } -3.1 \text{ or } -3.2 & \text{technician still repairing} \\ 4 \text{ or } 3.1 \text{ or } 3.2 & \text{finished fixing the equipment and become available?} \\ 0 & \text{the technician left the cell} \end{cases}$$

3 PROBLEM APPROACH

The problem consists in keeping all (or maximum) equipments operational. In case where some interventions of technicians are required, the problem is to perform them with an optimal way: minimal cost, energy, displacements.... etc;

3.1 RESOURCE ALLOCATION PROBLEM

As we have assumed that each equipment may require both interventions with competences 1 and 2 then we consider two cases: The case where these two interventions are independent and the case where these interventions are prioritized (eg 1 before 2 if the machine requires both at the same time).

1- Case where Interventions are independents.

Algorithm:

- We divide all the down equipments into three subsets $\mathbf{E}_1$, $\mathbf{E}_2$ and $\mathbf{E}_{12}$ equipment requiring respectively the intervention with skill 1, skill 2 and the both 1 and 2 at the same time.

Note that $\mathbf{E} = \mathbf{E}_1 \cup \mathbf{E}_2 \cup \mathbf{E}_{12} \cup \{\text{operationa l equipments}\}$.

- We divide all technicians **available** in three subsets $\mathbf{T}_1$, $\mathbf{T}_2$ and $\mathbf{T}_{12}$ technicians with the competences respectively 1, 2 and both 1 and 2.

Note that $\mathbf{T} = \mathbf{T}_1 \cup \mathbf{T}_2 \cup \mathbf{T}_{12} \cup \{\text{Technicians assigned}\}$.

Remark *Priority is given to equipments requiring a highest number of skills in our case both 1 and 2.*

- We consider a first Voronoi diagrams relatively to $\mathbf{E}_{12}$. In the case there's only one technician available with the required competences in each Voronoi cell, we assign it.

Otherwise, if heir's more than one technician we consider a second Voronoi diagram $\mathbf{T}_{12}$. The intersection between the two diagrams is either empty, in that case no assignment can be performed or contain a technician then this one is assigned.

- We eliminate the assigned equipments and technicians and go back to 1.

Note $\mathbf{E}(no)_{12}$ and $\mathbf{T}(no)_{12}$ respectively all equipments and technicians not assigned.

- As it was assumed that interventions are independent, equipments and technicians assigned for both 1 and 2 are removed we consider then the sets $\mathbf{E}_1 \cup \mathbf{E}(no)_{12}$ and $\mathbf{T}_1 \cup \mathbf{T}(no)_{12}$. We go back to 1 by replacing the sets $\mathbf{E}_{12}$ and $\mathbf{T}_{12}$ by $\mathbf{E}_1 \cup \mathbf{E}(no)_{12}$ and $\mathbf{T}_1 \cup \mathbf{T}(no)_{12}$, respectively;

2- In case interventions are prioritized We do the same thing for interventions with skills 2.

Generalization n> 2 :

$i = j = n$ Do while there is down equipments and not assigned : Draw Voronoi diagram for down equipments necessitating the skills j; If in the Voronoi cell, of seed (site, or generator) $\mathbf{E}_j$, there is only one technician having competences j assign it;

If there is more than one technician do: Draw Voronoi diagram for available technicians; Assign technician $\mathbf{T}_j$ to equipment $\mathbf{E}_j$ if they are in the intersection of the two Voronoi cells with seed (site, or generator) $\mathbf{E}_j$ and $\mathbf{T}_j$ respectively. $j = j - 1$

Remark 1) *Given the properties of the Voronoi diagram, we have two extreme cases:*

- *A down equipment (respectively an available technician) is midway between two available technicians (respectively two equipments down);*
- *A down equipment (respectively an available Technician) is at a scabies distance of three available technicians (respectively three down equipment);*
- *In those cases the rules of priority are to be specified. In this work we consider the following rules: The technician who is in the EAST takes priority and if there's more than one the one in the NORTH. This rule allows us to take in account all extreme cases considered above.*
- *If the interventions are prioritized we change the order in the algorithm (eg, interventions 2 before 1).*

3.2 PROBLEM OF TECHNICIAN'S DISPLACEMENTS

For the displacement of the technicians we consider the approach proposed by Ouardouz et al. [5] which we will remind the principle.

Displacement rules: Respect to the Voronoi diagram, the following traffic rules are adopted:

- If two technicians cross in perpendicular directions: the rule of the priority to the right will be adopted.
- If two technicians target the same empty cell with opposite directions, we perform, for at least one of them, a $\pi/2$ rotation to the right of its direction
- If a technician goes to a cell containing equipment a clockwise rotation of the angle $\pi/2$ is performed

4 SIMULATION AND RESULTS

4.1 INITIAL CONDITIONS

For the simulation we consider the initial conditions represented in fig1 a company layout with:

- 5 down equipments of 7 and 3 available technicians.
- Tree competences Mechanical (1), Electrical (1) and Electromechanical (12)
- T_k^I =3 and T_k^R =2

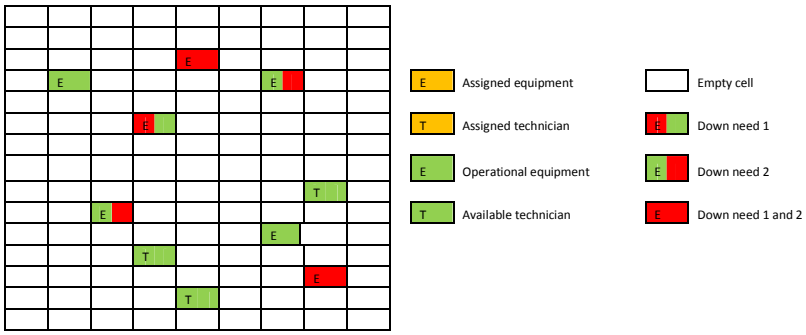


Fig1. : Initial conditions

4.2 SIMULATION

The snapshots of the simulation are represented in fig2.

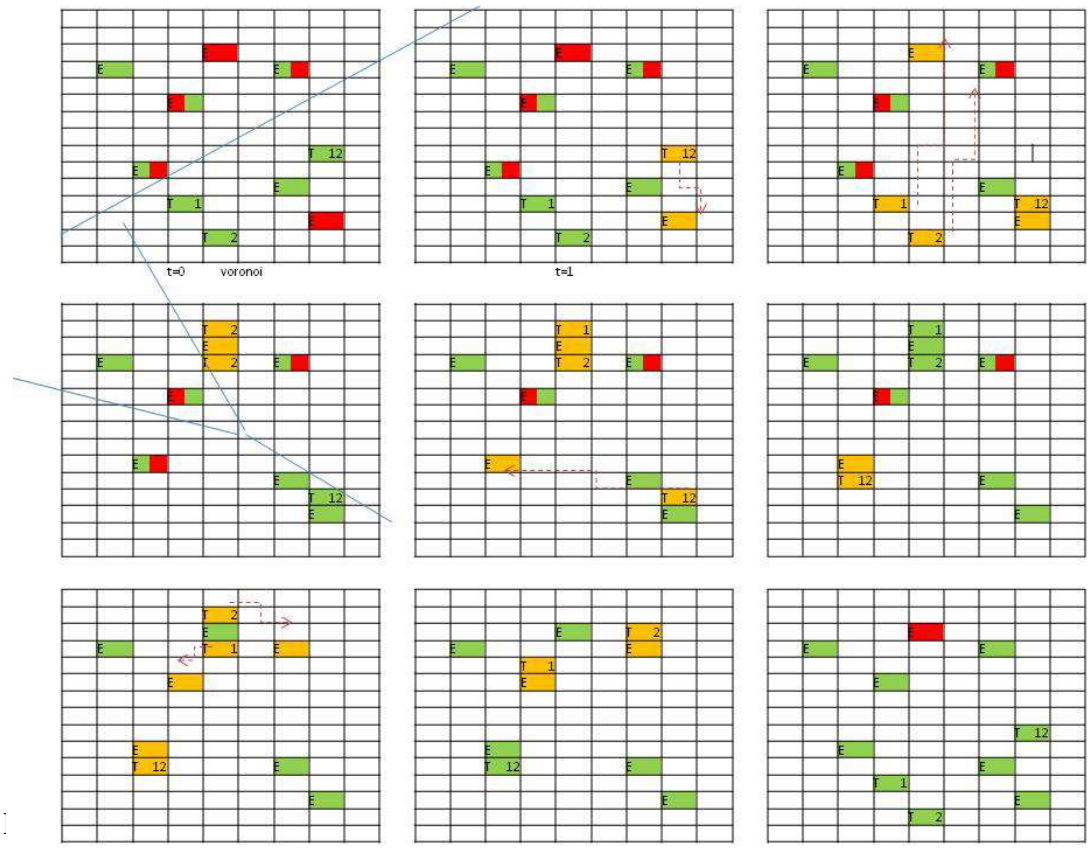


Fig2. : Simulation result

We first draw the Voronoi diagram considering the two down equipments requiring the highest number of competences E red in our case (Grid1 fig2). We assign after that the available technician with both the two competences T12 to the first equipment (Grid2 fig2), and the two technicians with respectively, competence 1 and 2 to the second equipment (Grid3 fig2).

We eliminate the assigned equipments and technicians and we draw a new Voronoi diagram (Grid4 fig2). We continue the algorithm until all down equipment are assigned.

5 CONCLUSION

In this paper, we considered the problem of spatial resource allocation in the multi task and multi competences cases. This work is an extension of the previous work done by Ouardouz et al. [5] who considered only one task and one competence. We propose an approach to the problem based on an algorithm for finding the optimal partition resource allocation. The approach is based on the known Cellular automata and Voronoi diagram techniques.

The contribution of our work is an efficient algorithm that combines multi task and multi resource competences allocation with the underlying spatial information for retrieving the final result.

Our approach is illustrated in the case where the equipments require tree tasks and technicians with two competences. Some simulations are presented.

We have considered in this paper that failure and interventions are deterministic however in practice such situations are random. It will be very interesting to extend this work to random cases. Such problems are under investigation.

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Elaboration d'un logiciel de simulation du nombre de plateaux théoriques dans une colonne de distillation continue

[Development of simulation software of the number of theoretical plates in a continuous distillation column]

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ABSTRACT: In this work we have developed a software for the simulation of the number of theoretical plates in a continuous distillation column, based on the equations of vapor-liquid equilibrium and mass balance in the different sections of the column, by an iterative calculation tray by tray. Using an interactive graphical interface, the software can determine the compositions of the vapor and liquid fractions and temperature on each plate, and the liquid and vapor flow rates in the two sections of the column, it can even represent these balances graphically to determine the number of theoretical stages using the McCabe and Thiele method. The compilation results for the distillation of a binary mixture of benzene - toluene (F = 11.84 Kmol/h; Xf = 0.444, Tm = 91.5 ° C) seems 16 theoretical stages, benzene (most volatile compound) is obtained at the head of the column with vapor molar fraction 98,63% and a bottoms fraction of 35% while the toluene is obtained with 1,37% and 26,31% at the head and bottom of the column, respectively. The graduating temperature prevailing in the column increases upwards of 103.06 ° C (first tray) to 80.86 ° C (16th tray). The results of the number of theoretical stages estimated by our software coincide well with those determined graphically by the McCabe and Thiele method.

KEYWORDS: Distillation, simulation, software, theoretical tray, liquid-vapor.

RESUME: Dans ce travail nous avons mis en évidence un logiciel permettant la simulation du nombre de plateaux théoriques d'une colonne de distillation continue, basée sur des équations d'équilibre liquide-vapeur et de bilan matière dans les différentes sections de la colonne, par un calcul itératif plateau par plateau. A l'aide d'une interface graphique interactive, le logiciel permet de déterminer les compositions des fractions liquides et vapeur et la température sur chaque plateau, ainsi que les débits liquide et vapeur dans les deux sections de la colonne, il permet même de représenter ces équilibres et de déterminer graphiquement le nombre d'étages théoriques à l'aide de la méthode de Mc Cabe et Thièle. Les résultats de compilation pour la distillation d'un mélange binaire benzène – toluène (F=11,84 Kmol/h ; X_f= 0,444 ; T_f=91,5 °C) font paraitre 16 étages théoriques, le benzène (composé le plus volatil) est repéré en tète de colonne avec une fraction molaire vapeur de 98,63% et en bas de colonne à une fraction de 35% tandis que le toluène est obtenu à 1,37% et 26,31% en tète et en bas de

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colonne, respectivement. Le graduent de température, régnant dans la colonne, augmente de bas en haut, de 103,06 °C (premier étage) à 80,86 °C (16eme étage). Les résultats du nombre d'étages théoriques estimés par notre logiciel coïncident bien à ceux déterminés graphiquement par la méthode de Mc Cabe et Thièle.

MOTS-CLEFS: Distillation, simulation, logiciel, plateau théorique, liquide-vapeur.

1 INTRODUCTION

La distillation est un procédé fondamental de séparation en génie chimique, qui permet, en exploitant les différences de volatilité des constituants d'un mélange, la séparation ou le fractionnement de ses constituants en fonction de leur température d'ébullition [1], [2]. La simplicité du procédé et son prix de revient en font une opération de base dans les processus d'obtention de beaucoup de produits chimiques et pétroliers [3],[4].

De nos jours, et avec le développement de l'outil informatique, beaucoup de travaux de recherche se sont penchés vers l'étude et la simulation informatique de beaucoup de phénomènes physiques et chimiques faisant intervenir des équations de transfert de matière et d'équilibres entre phases assez complexes tel est le cas de la distillation [5], [6], [7], [8].

L'objectif de notre travail est la simulation par ordinateur du nombre de plateaux théoriques d'une colonne de séparation par distillation continue, basée sur des équations d'équilibre liquide – vapeur et les bilans de matière, dans les deux sections de la colonne. Au biais d'un calcul progressif, plateau par plateau, compilé par un logiciel informatique conçu à cet effet, permettant ainsi la détermination du nombre de plateaux théoriques nécessaires à la séparation, la température et les fractions molaires liquides et vapeurs des constituants distillés, sur chaque plateau. L'environnement de développement orienté objet « Delphi », qui est un outil très puissant de programmation sous Windows [9], a été utilisé pour l'élaboration de ce logiciel.

2 MODELISATION PAR CALCUL PROGRESSIF PLATEAU PAR PLATEAU

Soit une colonne de distillation en continu, alimentée d'un mélange binaire de débit F de composition connue, le distillat D et le résidu W sont soutirés en tête et en bas de colonne, respectivement, à des proportions préalablement fixées [10].

En supposant que les hypothèses de Lewis sont applicables [11}, le calcul commence à partir du dernier plateau (y_n=x_D), en descendant progressivement le long de la colonne jusqu'au plateau d'alimentation pour la section concentration et en montant à partir du rebouilleur pour la section épuisement (fig 1) .

Pour chaque section on élaborera les bilans de matière et les équations d'équilibre liquide-vapeur [12],[13], afin de simuler le nombre de plateaux théoriques et de déterminer la température et les compositions des produits distillés sur chaque plateau.

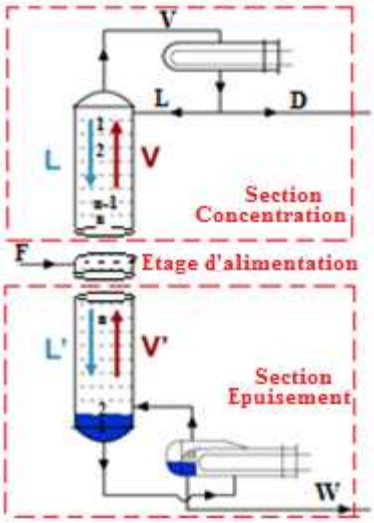


Fig. 1. Schéma descriptif des différentes sections de la colonne de distillation continue

2.1 BILAN MATIÈRE

Le bilan de matière élaboré pour la colonne entière peut être exprimé en fonction des débits entrant et sortant de cette colonne par la relation (1) ci-après :

$$F=D+W \qquad (1)$$

Pour le composé le plus volatile, il s'exprime ainsi:

$$F.x_F = D.x_D + W.x_W \qquad (2)$$

En descendant progressivement plateau par plateau, depuis le condenseur jusqu'au plateau d'alimentation, Les différents bilans dans la section concentration, peuvent être écris:

$$\begin{bmatrix} V.y_n + L.x_n & = & V.y_{n-1} + L.x_{n+1} \\ V.y_{n-1} + L.x_{n-1} & = & V.y_{n-2} + L.x_n \\ \vdots & \vdots & \vdots \\ V.y_{i+1} + L.x_{i+1} & = & V.y_i + L.x_{i+2} \\ V.y_i + L.x_i & = & V.y_{i-1} + L.x_{i+1} \end{bmatrix} \qquad (3)$$

On sommant ces bilans on obtient la fraction vapeur du plateau (i-1) en fonction de celle du liquide du plateau (i) considéré:

$$y_{i-1} = \frac{R}{R+1} \cdot x_i + \frac{1}{R+1} \cdot x_D \qquad (4)$$

De même, en montant progressivement plateau par plateau, du rebouilleur jusqu'au plateau d'alimentation, les bilans dans la section épuisement, s'écrivent:

$$\begin{bmatrix} V.y_1 + W.x_W & = & L'.x_2 \\ V.y_2 + L'.x_2 & = & V.y_1 + L'.x_3 \\ \vdots & \vdots & \vdots \\ V.y_{i+1} + L'.x_{i+1} & = & V.y_i + L'.x_{i+2} \\ V.y_i + L'.x_i & = & V.y_{i-1} + L'.x_{i+1} \end{bmatrix} \qquad (5)$$

On sommant ces bilans on obtient la fraction vapeur du plateau (i) considéré en fonction de celle du liquide du plateau (i+1) :

$$y_i = \frac{R.D+F}{D.(R+1)} \cdot x_{i+1} + \frac{W}{D.(R+1)} \cdot x_W \qquad (6)$$

2.2 EQUATIONS D'ÉQUILIBRE LIQUIDE-VAPEUR

Sur chaque plateau, les fractions molaires liquides et vapeurs du constituant j sont liées par la relation suivante [14] :

$$y_j = K_j.x_j \qquad (7)$$

Où $K_j = \gamma_j \frac{P°_j}{P} = \frac{P°_j}{P}$ (8) $(\gamma_j = 1$ solution ideale $)$

Les pressions de vapeurs sont déterminées à partir de l'équation d'Antoine, T et P sont respectivement la température en °C et la pression P en mmHg, A B et C sont les constantes de cette équation [14], [15].

$$logP°_j = A - \frac{B}{T_j + C} \qquad (9)$$

2.3 MODÉLISATION DE LA TEMPÉRATURE SUR CHAQUE PLATEAU :

Une température exacte satisfait la relation: $\sum_{j=1}^{n} y_j = 1$ (10)

Posons $f(T) = \sum_{j=1}^{n} y_j$ et remplaçons yj et Kj par leurs valeurs, la relation (10) devient :

$$f(T) = \sum_{j=1}^{n} x_j \,.\, 10^{A-B/(C+T_j)} \qquad (11)$$

La détermination de la température Ti du plateau i pour laquelle f(Ti)=1 revient à résoudre l'équation : f(Ti)-1=0. La racine de cette équation est calculée en utilisant une résolution mathématique basée sur la méthode de la sécante par approximations successives selon l'équation:

$$T_{i+1} = T_i + \frac{1-f(T_i)}{f(T_i)-f(T_{i-1})} \cdot (T_i - T_{i-1}) \qquad (11)$$

L'ordinateur fait un calcul itératif et garde la valeur de la température du plateau considéré pour laquelle : $T_{i+1} - T_i \leq \varepsilon$, (ε étant la précision exigée dans les calculs : $\varepsilon = 10^{-5}$), il incrémente progressivement la température jusqu'à ce que la somme des fractions liquides et vapeurs des composés distillés soient égales respectivement à l'unité, il sauvegarde les résultats du plateaux considérés et passe au plateau suivant. Le calcul est arrêté au moment où le plateau d'alimentation est identifié. La même procédure est appliquée pour la zone épuisement dans laquelle les calculs commencent à partir du premier étage (rebouilleur) en montant progressivement vers le plateau d'alimentation. La figure 2 suivante élucide l'algorithme du programme exécuté.

2.4 ALGORITHME

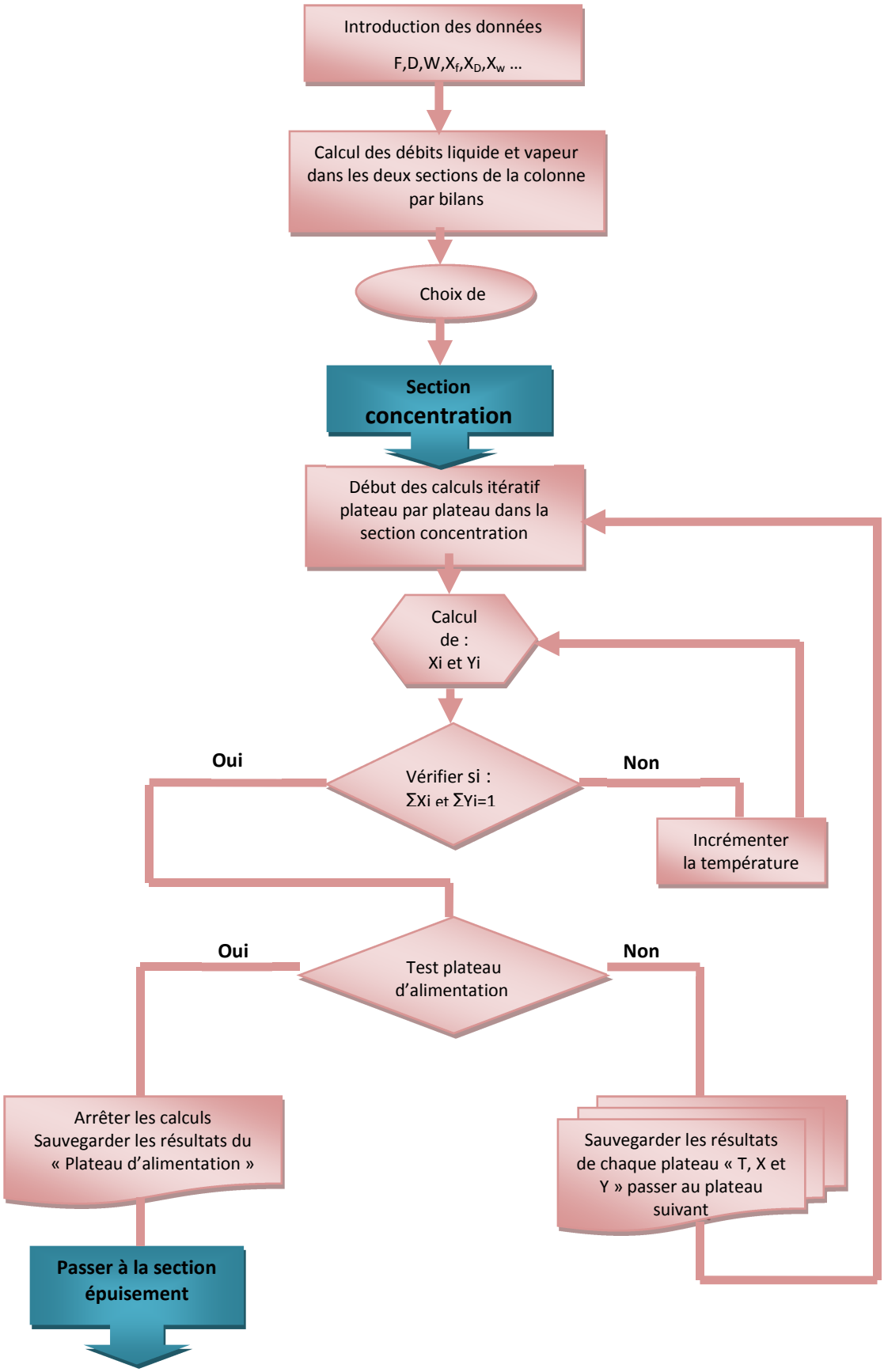


Fig. 2. Algorithme des calculs itératifs pour la zone concentration

3 RÉSULTATS ET DISCUSSION

3.1 DESCRIPTION DU LOGICIEL

Le logiciel de simulation de la distillation « PLATE », mis en évidence dans notre travail, peut être facilement installé sous Windows, à l'aide de son interface graphique interactive, il permet l'estimation du nombre de plateaux théoriques dans une colonne de distillation binaire en continu et de prédire la température et les fractions molaires liquide et vapeur des composés sur chaque plateau. Les principales fiches du logiciel sont :

3.1.1 **LA FICHE « PRINCIPAL MENU »** (fig 3) qui permet l'introduction des données, leur compilation, l'enregistrement et l'accès vers d'autres menus tel que la base de données ou le menu d'aide.

3.1.2 **LA FICHE « COLUMN SECTIONS »** (fig 4) qui permet l'affichage des différentes sections de la colonne et la répartition des fractions liquide-vapeur des constituants sur chaque plateau.

3.1.3 **LA FICHE « MCCABE-THIELE DIAGRAM »** (fig 5) qui permet de représenter graphiquement le diagramme d'équilibre liquide-vapeur Y=f(X) et les droites opératoires par la construction graphique de McCabe et Thièle. Dans cette fiche, l'utilisateur peut exploiter une base de données d'équilibre liquide-vapeur pour une multitude de binaires incorporée au logiciel et de représenter graphiquement ces équilibres en vue de la détermination du nombre d'étages théoriques par la méthode de McCabe et Thièle.

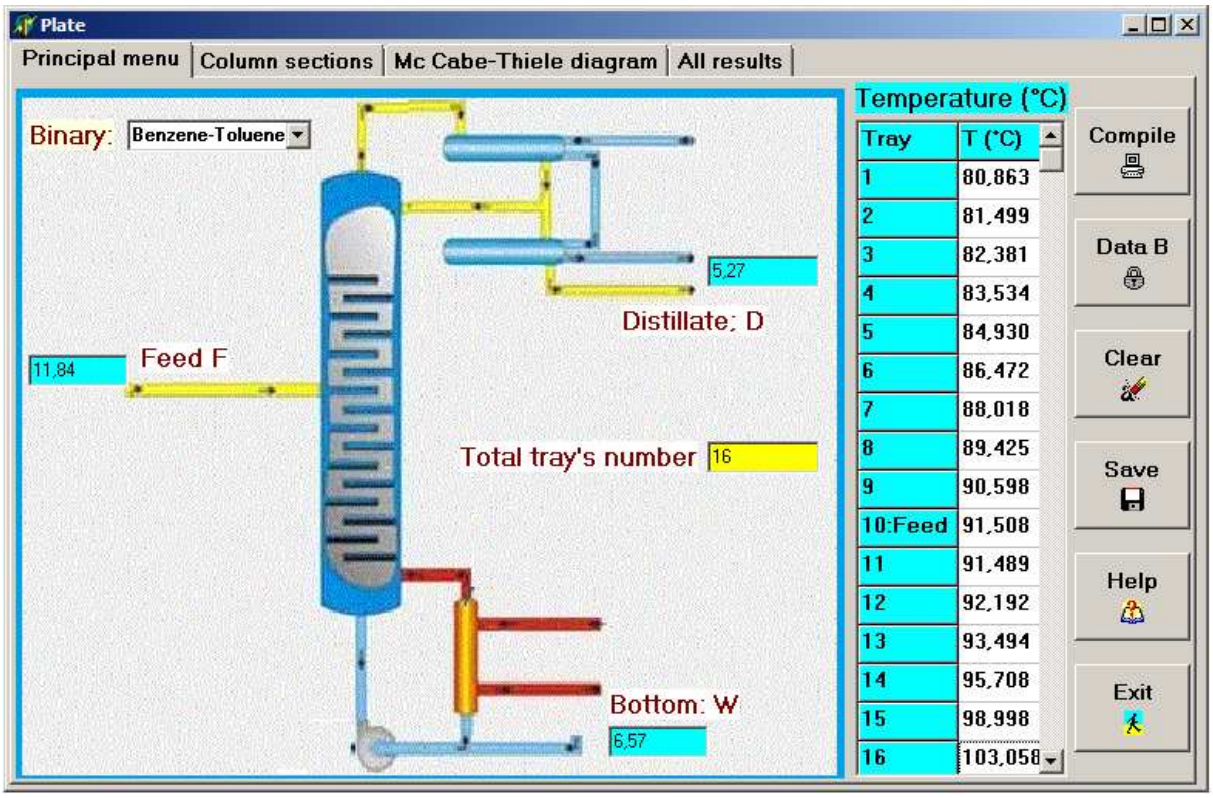


Fig. 3. Menu principal du logiciel

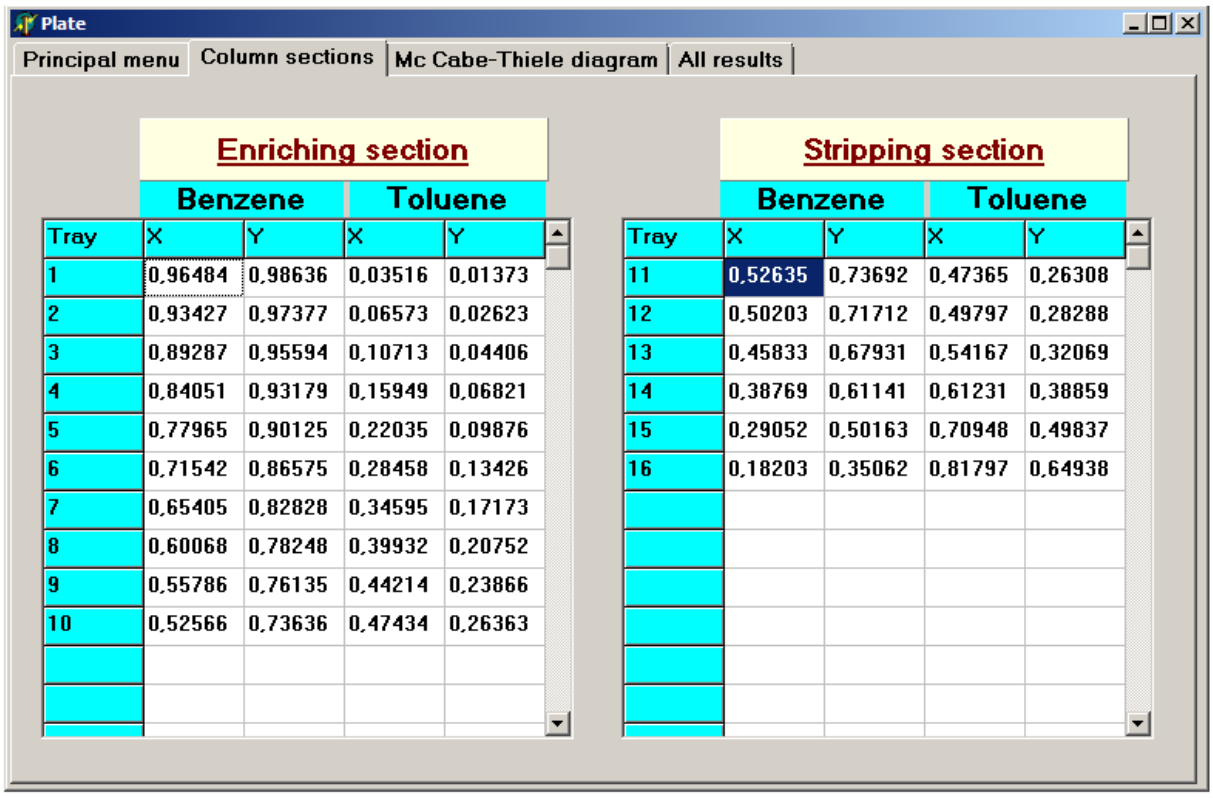


Fig. 4. : Fiche de répartition des compositions liquide-vapeur dans les différentes sections de la colonne

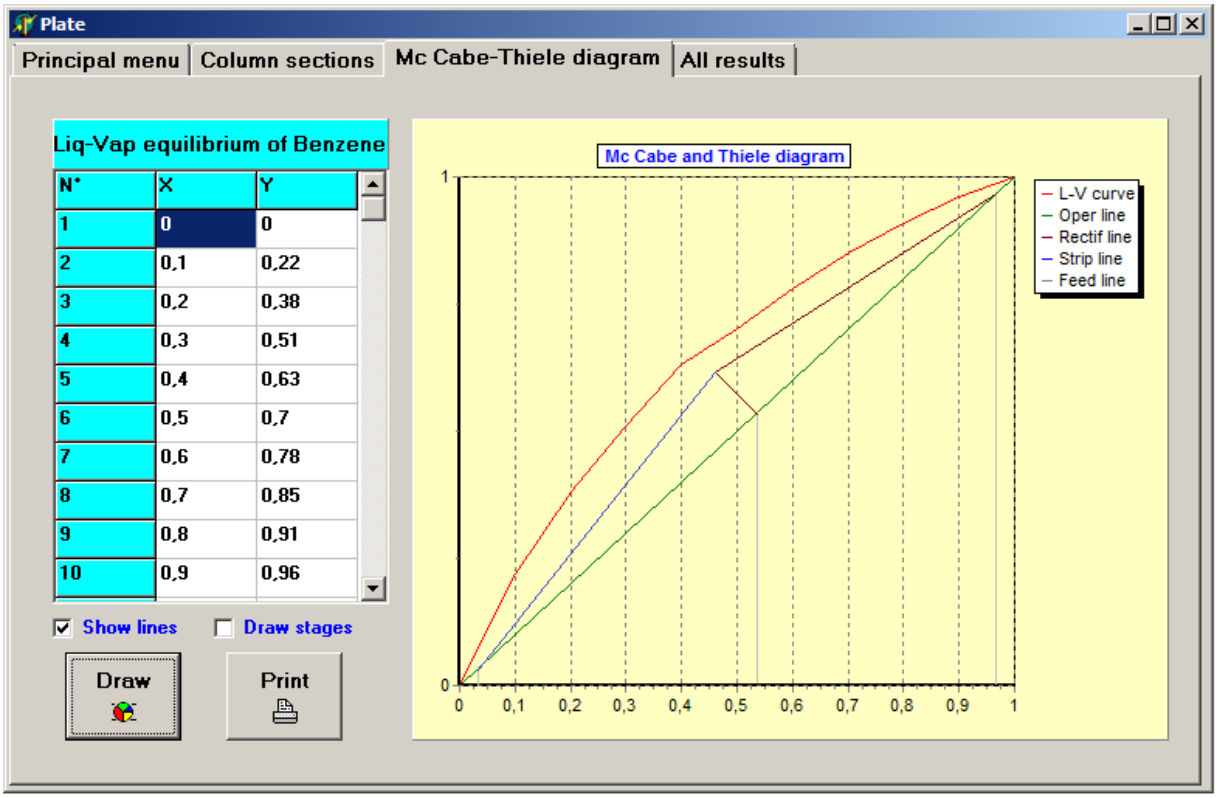


Fig. 5. : Fiche de la représentation graphique de McCabe et Thiele

3.2 VALIDATION DES RÉSULTATS DU LOGICIEL

Afin de tester les résultats de notre logiciel, une compilation de celui-ci a été appliquée à un mélange binaire benzène-toluène, considéré comme solution très proche de l'idéalité [16], [17], le mélange alimente une colonne de distillation, vaporisé à 67,7 % sous une pression de 760 mmHg , les données concernant les débits et les compositions par rapport à la clef volatile (benzène) de l'alimentation ainsi que le distillat et le résidu sont mentionnés dans le tableau 1 ci-dessous :

Tableau 1. Débits et compositions des entités alimentant et sortant de la colonne

	Alimentation : F	**Distillat : D**	**Résidu : W**
Débit (kmol/h)	11,84	5,27	6,57
Fraction molaire Vap	0,54	0,957	0,206
Fraction molaire Liq	0,46	0,043	0,794

Les données d'équilibre et les constantes de l'équation d'Antoine du binaire étudié, mentionnées dans le tableau 2 suivant, ont été pris de la littérature [18], [19] :

Tableau 2. Constantes de l'équation d'Antoine du binaire benzène-toluène

Composé	**Formule**	**A**	**B**	**C**
benzène	C_6H_6	6,90565	1211,033	220,790
toluène	C_7H_8	6,95334	1343,943	219,377

3.3 RÉSULTATS DES CALCULS ITÉRATIFS PLATEAU PAR PLATEAU :

Les calculs itératifs plateau par plateau font paraitre un total de 16 étages (10 à la section de concentration et 6 à la section d'épuisement), ainsi, les résultats indiquent que l'alimentation est effectuée au $6^{ème}$ plateau à partir du rebouilleur, la température, en ce plateau, simulée par notre logiciel est de 91,5 °C . Les débits liquides et vapeurs constituant l'alimentation, calculés par bilan matière, sont repris dans le tableau 3 ci-dessous :

3.3.1 SECTION CONCENTRATION

Le nombre de plateaux théoriques prédit par les calculs itératifs de notre logiciel, dans la section concentration, est de 10 plateaux, la température du premier plateau, à partir de la tète de colonne, est environ 80,86 °C .La fraction molaire vapeur du benzène (composé le plus volatil) est de 98, 63 %, dans ce plateaux, celle du toluène est de 1,37 % , les fractions molaires liquides sont de 96,48 % pour le benzène et 3,52 % pour le toluène.

3.3.2 SECTION CONCENTRATION

Le nombre de plateaux théoriques dans la section concentration, est de 06 plateaux, la température du premier plateau, à partir du rebouilleur, est environ 103,1 °C .La fraction molaire vapeur du benzène (composé le plus volatil) est de 35,06 % dans ce plateaux, celle du toluène est de 64,94 % , les fractions molaires liquides sont de 18,2 % pour le benzène et 81,8 % pour le toluène.

Tableau 3. Tableau récapitulatif des résultats des calculs itératifs plateau par plateau dans les deux sections de la colonne pour le mélange binaire benzène-toluene

Plateau	T (°C)	Composé	Fraction mol. Vapeur	Fraction mol. Liquide
Zone concentration **Débit liquide:** L= 7,378 Kmol/h ; **Débit vapeur**: V= 12,648 Kmol/h				
1	80,863	C_7H_8	0,01373	0,03516
		C_6H_6	0,98626	0,96484
2	81,499	C_7H_8	0,02623	0,06573
		C_6H_6	0,97377	0,93427
3	82,381	C_7H_8	0,04406	0,10713
		C_6H_6	0,95594	0,89287
4	83,534	C_7H_8	0,06821	0,15949
		C_6H_6	0,93179	0,84051
5	84,930	C_7H_8	0,09876	0,22035
		C_6H_6	0,90125	0,77965
6	86,472	C_7H_8	0,13426	0,28458
		C_6H_6	0,86575	0,71542
7	88,018	C_7H_8	0,17173	0,34595
		C_6H_6	0,82828	0,65405
8	89,425	C_7H_8	0,20752	0,39932
		C_6H_6	0,79248	0,60068
9	90,598	C_7H_8	0,23866	0,44214
		C_6H_6	0,76135	0,55786
10	91,508	C_7H_8	0,26363	0,47434
		C_6H_6	0,73636	0,52566
Zone épuisement **Débit liquide:** L'= 18,429 Kmol/h ; **Débit vapeur**: V'= 11,859 Kmol/h				
11	91,489	C_7H_8	0,26308	0,47365
		C_6H_6	0,73692	0,52635
12	92,192	C_7H_8	0,28288	0,49797
		C_6H_6	0,71712	0,50203
13	93,494	C_7H_8	0,32069	0,54167
		C_6H_6	0,67931	0,45833
14	95,708	C_7H_8	0,38859	0,61231
		C_6H_6	0,61141	0,38769
15	98,998	C_7H_8	0,49837	0,70948
		C_6H_6	0,50163	0,29052
16	103,058	C_7H_8	0,64938	0,81797
		C_6H_6	0,35062	0,18203

3.4 COMPARAISON DU RÉSULTATS À CEUX DE LA MÉTHODE DE MC CABE ET THIELE

La méthode de McCabe et Thièle est l'une des méthodes empiriques les plus employées pour la simulation du nombre d'étages théoriques pour une distillation binaire [20], [21].Afin de vérifier les résultats compilés par notre logiciel, en ce qui concerne la détermination du nombre d'étages théoriques, nous avons procédé à la détermination graphique de ceux-ci, par la méthode de McCabe et Thièle pour les mêmes données de l'opération de distillation du binaire étudié pour une éventuelle comparaison. Les données d'équilibre liquide vapeur du binaire pour le benzène et le toluène à 760 mmHG ont été relevés de la littérature [19], le tableau 4 suivant renferme les fractions molaires liquides en fonction de celles de la vapeur pour le benzène,

Tableau 4. Y=f(X) du benzène à 760 mmHg

Fraction mol. liquide	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9
Fraction mol. vapeur	0,22	0,38	0,51	0,63	0,7	0,78	0,85	0,91	0,96

3.5 DROITES OPÉRATOIRES

3.5.1 Zone concentration

L'équation de la droite opératoire de concentration est de la forme [22], [23] :

$$y = \frac{R}{R+1} \cdot x + \frac{x_D}{R+1} \qquad (12)$$

En remplaçant R et X_D par leurs valeurs dans l'équation précédente, on obtient :

$$y = 0{,}58 \cdot x + 0{,}399 \qquad (13)$$

3.5.2 ZONE ÉPUISEMENT

L'équation de la droite opératoire dans la zone épuisement est de la forme [22], [23] :

$$y = \frac{R+(1-w).F/D}{R+1-w.F/D} \cdot x - \frac{x_D - x_F.F/D}{R+1-w.F/D} \qquad (14)$$

En remplaçant R et D, F, w, X_F et X_D par leurs valeurs dans l'équation précédente, on obtient :

$$y = 1{,}55 \cdot x - 0{,}113 \qquad (15)$$

3.5.3 DROITE D'ÉTAT THERMIQUE:

L'équation de la droite d'état thermique est donnée par l'équation [22], [23] :

$$y = \frac{w-1}{w} \cdot x + \frac{x_F}{w} \qquad (16)$$

En remplaçant w et g_F par leurs valeurs dans cette équation, on obtient :

$$y = -14 \cdot x + 8{,}1 \qquad (17)$$

3.6 CONSTRUCTION DE MC CABE ET THIELE

La construction graphique de Mc Cabe et Thièle (fig. 6) fait paraitre un total de 17 étage théoriques, 9 dans la zone concentration et 8 dans la zone d'épuisement ce qui coïncide, à un étage près, aux résultats simulés aves notre logiciel. Il est à noter que notre logiciel donne des résultats plus précis étant donné que l'erreur des calculs est évaluée à 10^{-5}, en plus, il calcule les températures et les fractions liquides et vapeurs sur chaque plateau.

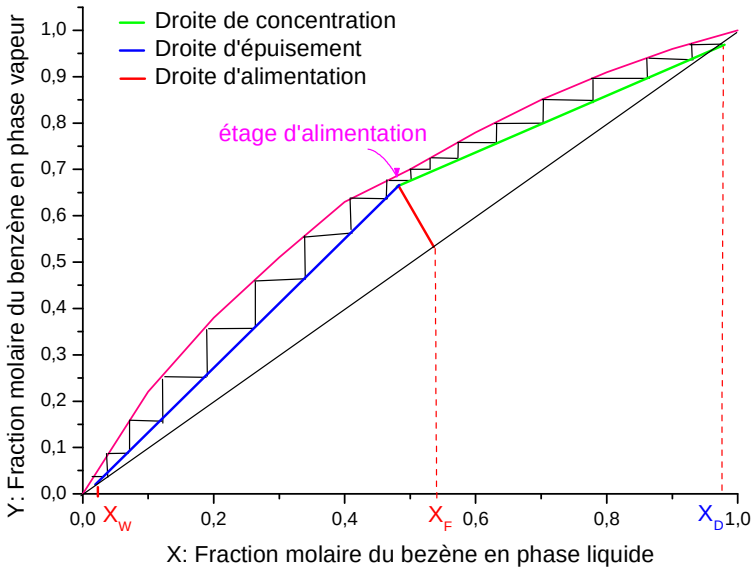


Fig 6. : Représentation graphique de McCabe et Thièle

3 CONCLUSION

Le logiciel mis en évidence dans notre travail, nous a permis, avec succès, la simulation du nombre de plateaux théoriques dans une distillation binaire en continu et de prédire le nombre de plateaux théoriques dans chaque section de la colonne, avec la localisation du plateau auquel est effectuée l'alimentation ainsi que la détermination avec exactitude de la température et les fractions molaires liquides et vapeurs des composés distillés sur chaque plateau.

Les résultats de compilation pour le binaire benzène-toluène à 760 mmHg, pris comme exemple dans notre étude, montrent que la colonne nécessite au total un nombre de 16 étages théoriques pour effectuer cette séparation, l'alimentation doit être au $8^{ème}$ étage, à compter du rebouilleur. Ces résultats coïncident bien à ceux déterminés par la méthode graphique de Mc Cabe et Thièle.

NOMENCLATURE

D: débit molaire de distillat

F: débit molaire de l'alimentation

K_j: coefficient d'équilibre du constituent j

L: débit liquide dans la section concentration

L': débit liquide dans la section épuisement

P: pression totale

$P_j°$: pression de vapeur du constituent j

R: taux de reflux

T: temperature

V: débit vapeur dans la section concentration

V': débit vapeur dans la section épuisement

W: débit molaire de résidu

w : fraction vaporisée de l'alimentation

x_D: fraction molaire de la clef volatile dans le distillat

x_F: fraction molaire de la clef volatile dans l'alimentation

x_i: fraction molaire liquide dans l'étage i

x_W: fraction molaire de la clef volatile dans le résidu

y_i: fraction molaire vapeur dans l'étage i

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Risk of water erosion in coastal watersheds north of Tetuan (Internel Rif, northern Morocco): Evidences from GIS-based spatial approach

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ABSTRACT: In this study we estimate the risk of water erosion in coastal watersheds between M'diq and Fnideq located in northern Morocco, through using a new approach based on spatial cartography. Precisely, the methodology adopted here integrates a Geographic Information System (GIS) with the universal soil loss equation (USLE). The field data includes three major components namely, lithology, degree of slope and vegetation density. Each of these components is represented by a separate layer, in which 1 to 5 value expresses its lateral variability degree. The final map of water-erosion risk is obtained by the sum of superposed indices, separately assigned to three thematic layers (facies, slope and vegetation cover), and multiplied by the percentages of the contribution of each factor to determine the percentage of weighting. . Secondarily, a complementary table translates the cartographic values of each layer as percentage values expressing the impact exerted by the corresponding risk factor throughout the studied area. The risk map is deducted after validation of these weightings on the field by choosing checkpoints distributed throughout the watersheds of the site. This method would allow for the tracking and of course monitoring of water erosion on a larger scale and to better direct the administrations concerned to the priority of installations.

KEYWORDS: Water Erosion, Spatial GIS Approach, Watershed, M'diq and Fnideq, (Rif Region), Morocco.

1 INTRODUCTION

Soil erosion by water is a major cause of land degradation. It is estimated that 1/6 of the world's soils are affected by water erosion [1]. Land degradation induced by water erosion results not only in the loss of fertile soil and in the soil-productivity reduction. It also results in increasing the concentration of suspended sediment in the watercourse, and in carrying material to fill reservoirs. This two-fold physical risk reverberates medium to short-term consequences on the ecosystems equilibrium and on the civil engineering infrastructures

It is well known that the process of water erosion and sedimentation are influenced by biophysical and human factors, occuring at different intensities across the landscape. However, the spatial and temporal scales of processes are still misunderstood, which makes monitoring and evaluation of erosion and deposition a complex and cumbersome task with a considerable uncertainty.

Consequently, there is a need fora deep understanding of the erosion processes and the deposition on ground, in order to analyze their impact on the productivity of soil as well as their impact elsewhere (for example, sedimentation and water quality) [2], [3].

Problems related to water erosion are widespread in the countries of the Mediterranean and North Africa. [4] In Morocco, especially in the Rif region, a reputed still young chain, erosion in general and more particularly water erosion is today the basis of a series of economic and social problems. This is what makes it an important phenomenon in which the study is intensified due to the action of many teams in the world at large. Erosion of plots rate measurements were often

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used and have given successful results for a quantitative estimation [5]-[8]. However, they represent a lengthy and expensive approach because they require monitoring over many years. The punctual measurements of erosion on plots for many years allow us to compare well the risks in various soil conditions, slopes, land use, but not to spatialize risks on the watersheds because they (measurements) isolate the plots and thus eliminate the cumulative effects. Therefore, it appears more interesting to opt for techniques, allowing a quick estimation of erosion, capable of taking into account the temporal and spatial variations across the watershed and can be applied to the entire studied area.

The undertaken study, as part of this work on assessing the rate of erosion, was conducted across three coastal watersheds between M'diq and Fnideq, which are characterized by a quite high pluviometry, its large storm resources, and strong oscillations in the altitude and by the nature of its soil which promotes the development of a high risk of erosion. (and by the nature of the soil more or less favorable to the release of the processes of gullying, hydric erosion and landslides.) The approach adopted in the framework of this work is to develop a mapping method for a rapid, reliable and inexpensive diagnosis, making use of the limited data available for the identification, quantification and spatialization of the erosion in order to deduce the steps of anti-erosion controls

The method is to draw up a map of water erosion on the basis of lithological, topographic and land use indicators. The erosion map is obtained after the superposition of thematic layers, and it is then validated on the ground to determine the contribution percentage of each of the intervening factors in the erosion process to highlight thereafter the most influential factor in the area.

2 PRESENTATION OF THE STUDY AREA

2.1 LOCATION AND GEOLOGICAL SETTING

The study area is located in the northwest of Morocco, at the western north extremity of the Rif chain. It extends from the town of M'diq up to the north of Fnideq. It is limited in the east by the Mediterranean Sea, in the west by the chain of Haouz, in the north by the city of Fnideq and in the south by the city of M'diq. It includes three watersheds: Smir, Negro and Fnideq (Fig.1).



Fig. 1. Landsat image with delimitation of the study area

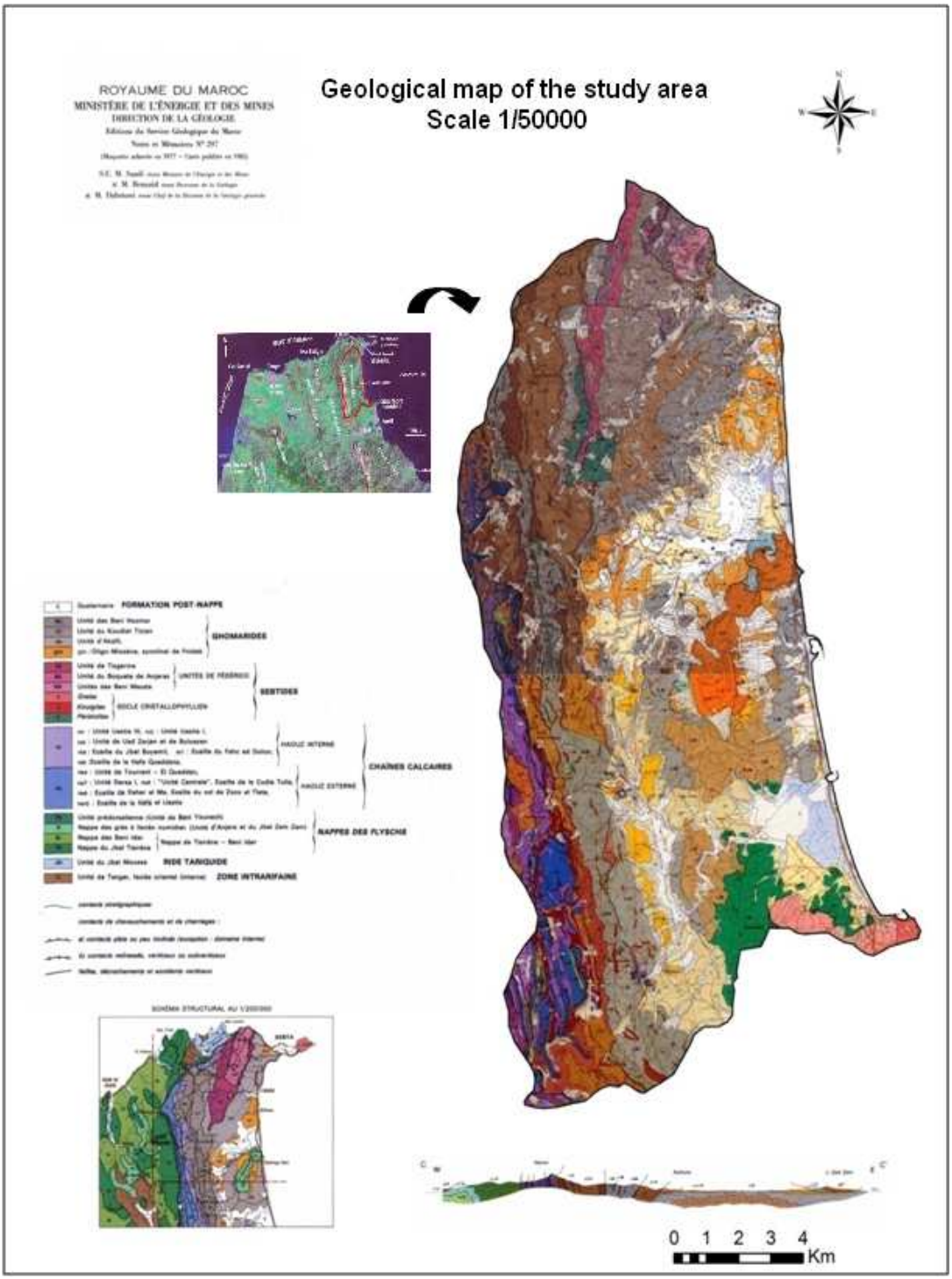


Fig. 2. Geological map of the study area 1/50 000 (from Kornprobst and Durand-Delga 1985). [17]

It belongs to the Rif internal zones and it is composed mainly of three units: *the calcaire chain of Haouz (Dorsale Calcaire)*, the Ghomarides and the Sebtides unites. The Sebtides are metamorphic landson Paleozoic series, diversely assumes a detrital clay, carbonated permo-triasic alpine coverage. The Ghomarides consist mainly of shale and sandstone Paleozoic rocks, but they assume more alpine coverage ranging from Triassic through the middle Burdigalien [9], [10] with quitely diverse carbonate and clastic facies. As its name indicates, The calcaire chain of Haouz, consist of units and / or of no metamorphic series napes essentially carbonated ranging from Triass to Early Miocene [11], [9] (Fig. 2).

2.2 GEOMORPHOLOGY OF THE SITE

Overall, the studied site is part of a chain topographically fragmented enough for structural reasons and which owes its allure to High Mountain for its character which is young and consequently of its relief. [11] Watersheds located between Fnideq M'diq, making object of this study, are limited in the west by the chain of Haouz reliefs, elongated along a north-south axis, and their high points are situated in the massive of Hafat Raouda (641m) in the North, and the massive Hafat Uestia in the South (838m). These high ridges and scales are characterized by many steep cliffs and a karstic morphogenesis. It is these ridges that define our watersheds in the West and thus form their lines divide Many travertineuses terraces with structures in staircases juxtapose these carbonated solid masses. These are the peaks which delimit our basins slopes in the West and form consequently their watersheds. At these ridges join in the Eastern foothills dominated by sandstones-pelitic facies of Paleozoic overcome locally (to the immediate north of the watershed of Smir) by the Numidian massive Jebel Zem Zem which forms only a small mountain little more than 400 m. With the exception of this massive, the most dominant altitudes often remain below 150m.

On the Paleozoic in low altitude are installed recent Quaternary alluvial formations forming the coastal plains of very low altitude developed on paléorias already shaped the Pliocene [12]. The downstream portion consisting of Paleozoic alluvial land and is often crossed by watercourse, the most important form the main Oueds in the region (Oued Smir Oued Negro etc ...). On the Paleozoic and lowland are installed recent Quaternary alluvial formations forming the low-lying coastal plains developed on paléorias which already shaped the Pliocene [12]. The downstream portion, consisting of Paleozoic alluvial land, is often crossed by watercourse of torrential character, the most important of which form the main Oueds in the region (Oued Smir Oued Negro etc ...).

Two coastal plains are distinguished in the study area.. They constitute the downstream termination of the main Oueds of coastline between Fnideq and M'diq, it is the plain of Restinga and Smir. They are bordered by rocky terraces of the ancient and medium quaternary, and they are often flooded during winter due to their low altitude, their proximity to the sea level and the torrential watercourse. [12]

The coastline between Fnideq and M'diq about 24Km long, is dominated by sandy beaches sometimes associated with cobbles/pebbles and gravel beaches. These gravel beaches are characterized by an average slope, a generally narrow width (50 to 150m) and a variable width as they develop downstream plains or river geographic torrential mouths [13].

2.3 CLIMATE

The climate of the study area is sub-humid Mediterranean type. In this sector the average rainfall is 600 mm / year (Fig. 3), which represents the double of the national average. The wet season runs from October to April and the rain is particularly abundant between November and January. The dry season is relatively short, resulting of low to null rainfall between June and September.

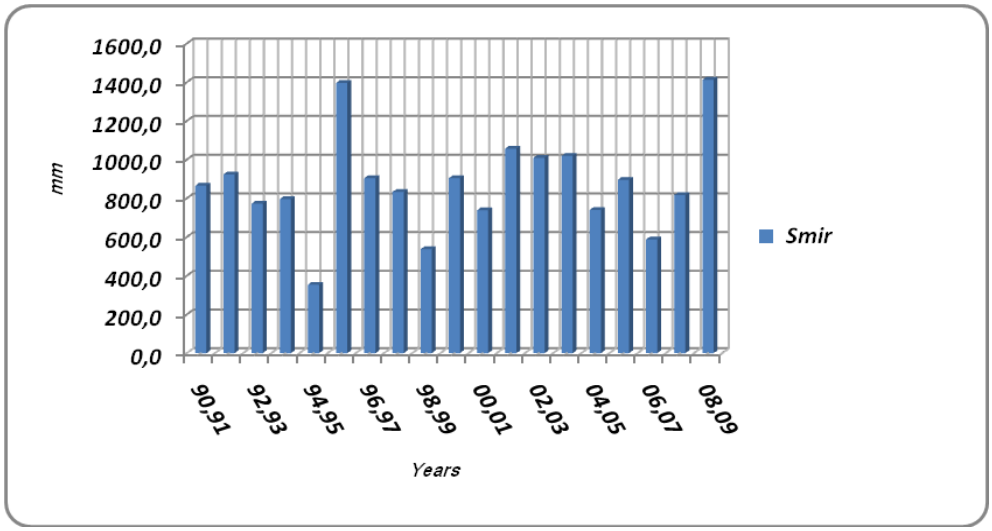


Fig. 3. The variation of the annual average of precipitation Source (Hydraulic Basin Agency of Loukkos)

2.4 VEGETATION

The vegetation of the site is quite varied, like the diversity of habitus. Climatic conditions, the heterogeneous terrain, and the presence of wetlands «lagoon-marsh complex and retaining dam (Smir dam)», located on the Smir River, are the main factors responsible for this diversity.The vegetation is characterized by the presence of a large number of species, about 375 species belonging to 236 genera and 94 families. [14]

Spontaneous species, the most common of which are Thuya, Lentisque and Kermès Chêne, grow on limestone bedrock, the cork oak on siliceous bedrock and oleander along rivers, on the banks of Oueds and the introduced species from reforestation which are mainly the pine and eucalyptus**.**

2.5 HYDROGRAPHIC NETWORK

The Smir Watershed, with an area of about 97 Km^2, is drained by the Smir River which collects water of the four main tributaries: Oued Zarjoune, Oued El Lille, Bayine and Belouazene. Secondary tributaries which we also find are: Kof el Fouki and Kof Essefli. It is essential to note that all watercourses in the watershed of the Smir river originate from sources that appear as resurgence at the contact zone between the limestone ridge and Paleozoic schists ghomarides..

Oued Negro "Aswad" feeds Merja de Negro directly in freshwater. It leads to the sea water collected in the watershed Negro. The watershed of the Oued Negro is bounded on the east by the Mediterranean Sea, in the west by the limestone ridge, south by Jebel ZemZem and to the north by Fnideq watershed, it is drained by a series of tributaries where the principal ones are: Oued Ailiyine, Oued Heddadine and Hofret Zeitoune. It covers an area of about 71 Km^2, with a maximum altitude of 641 m and a minimum of 5 m.

The Fnideq Watershed extends over an area of 35 Km^2, is drained by the Oued Bayssa which collect water of the four major tributaries: Oued Laimouna, Oued sfayh, oued Kahndeq and Oued Assalas (Fig. 4).

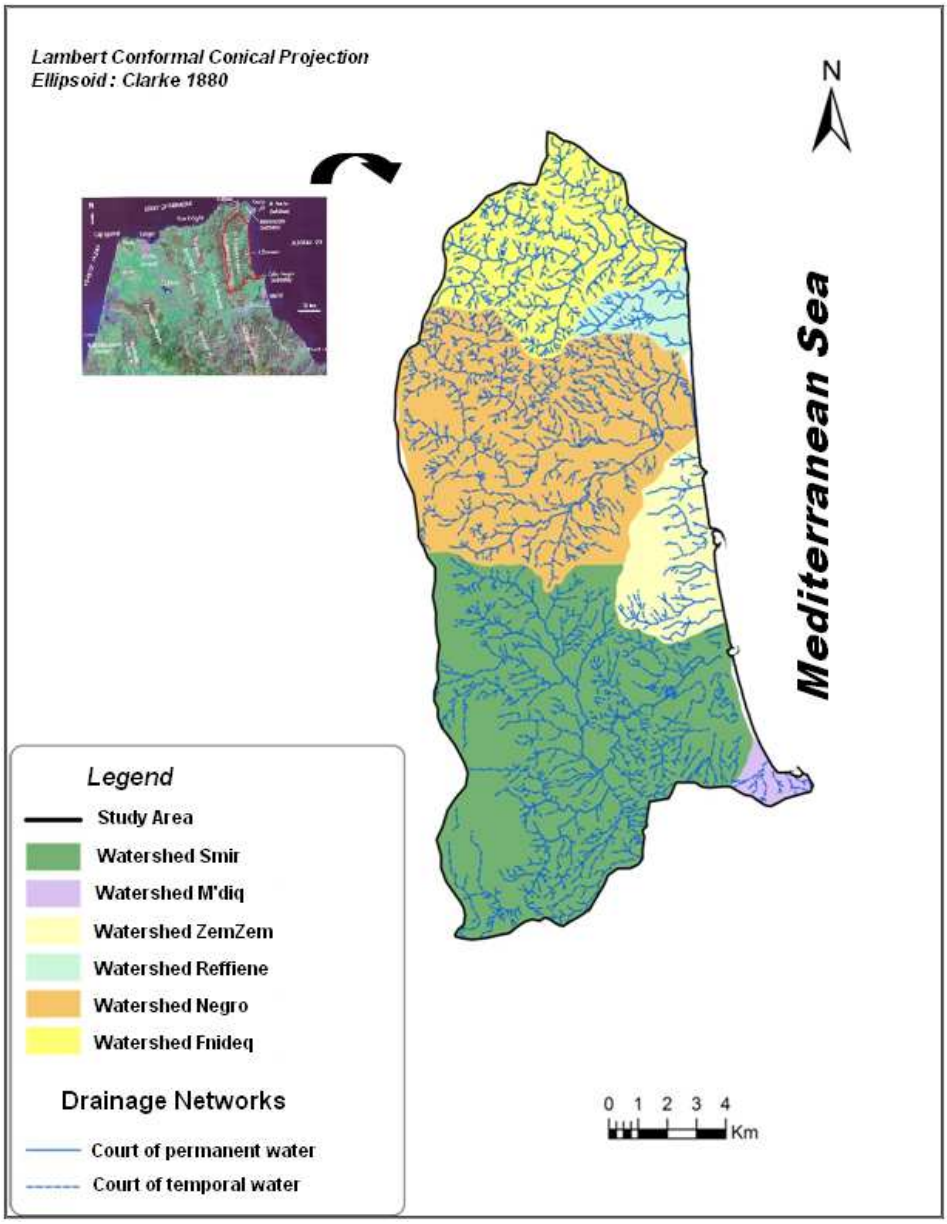


Fig. 4. Map of the hydrographic network of the three watersheds Smir, Negro and Fnideq

3 METHODOLOGY AND PURPOSE OF WORK

The approach adopted in this study is to integrate a Geographic Information System (GIS) to the universal soil loss equation (USLE) [15], which would allow for the monitoring of water erosion in a largest scale. The method used to develop the map of risk is based on the degree of influence of three parameters of the equation [15] namely, slope, lithology and vegetation cover. The application of the erosion model has established the thematic maps for the studied area.

The proposed methodology is applied to three watersheds; Smir, Negro and Fnideq. The erosion model plays a prediction by identifying and evaluating all participants in order to determine parameters of the model, namely the slope, lithology and vegetation cover

The USLE is an acronym for "Universal Soil Loss Equation" [15]. It is the mathematical model most used for evaluating and calculating the loss in soil. It has been tested for many years in North America. The main method is to estimate erosion across parcels in order to intervene and not to exceed the threshold limit for the tolerable erosion rate which vary from 1 to 12t/ha/an [16].

The following equation expresses this model:

$$A = R \times K \times LS \times C \times P$$

Where:

A = Annual soil loss from sheet and rill erosion in tons/acre
R = Rainfall erosivity factor
K = Soil erodibility factor
LS = Slope length and steepness factor
C = Cover and management factor
P = Support practice factor

Due to a lack of data to assess and calculate the parameters of the method (USLE), we approach the study of erosion in our area from another view. Thus, we thought to introduce Geographic Information System software in ArcMap. This latter will allow us at first to produce a database for creating maps, and then to overlay these thematic maps in which the factors intervene directly in the estimation of potential erosion in the three basins (Fig. 5). Another advantage of this method is that it allows developing risk maps of erosion over large areas by minimizing the cost and time of work, something that is not evident with the conventional method (USLE) which is feasible only on land parcel which eliminate the cumulative effect.

The model shows water erosion resulted of rain, which is considered as the main driver of soil loss.

Thus, in an ArcMap environment, the calculation of classes of erosive potential is obtained from the sum of the indices assigned to different classes of parameters which are: lithology, slope and vegetation cover. Each index is multiplied by the contribution (weight) percentage of the corresponding thematic layer (parameters). The result is classified into five equal classes:

$$Pe = (IV \times A) + (IFR \times B) + (C \times IPT)$$

Pe: erosive potential. IFR: Index friability.

IV: Index of vegetation density. IPT: Index degree slope.

A, B and C: Percentage of contribution (weights).

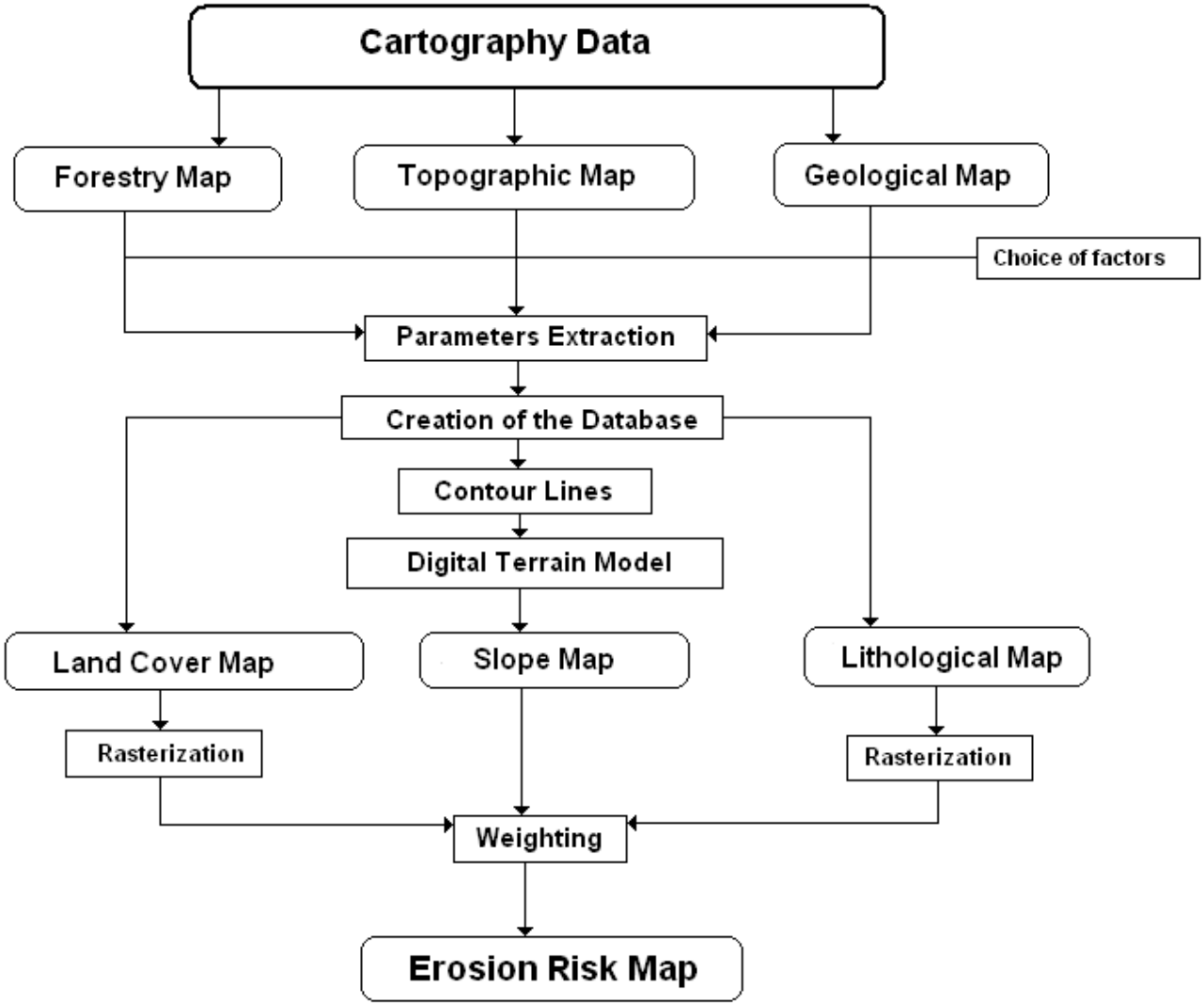


Fig. 5. Scheme showing the different steps of the adopted methodology

3.1 PREPARATION OF MAPS

The slope map (Fig. 6) is obtained by digitalizing contour lines on topographic maps: *Tlat Taghramt, Fnidq M'diq, Port Tanger Méditerranée* (Tangier Mediterranean Port), Dam of Smir 1/25 000th and then treatment with ArcGIS software. The slope derived from this model is classified according to the contribution of slope erosion and this as shown in Table (1).

The vegetal cover Map (Fig. 7) is extracted from the forest map Tétouan NI-30-XIX-4, 1:100,000 (Inventaire Forestier National Deuxième Cycle, 2003). Vegetal communities were classified according to their density, a recommendation made by an official of the "*service des eaux et forêts"*. Table (1) summarizes the different classes of the vegetal cover based on density.

Lithological facies Map (Fig. 8) is synthesized from the geological maps of the Rif (RAS MAZARI-Tétouan and Ceuta, 1/50 000 [16]. The lithofacies were then classified and grouped according to their degrees of friability, we distinguish five classes are then selected (see Table 1).

Table 1. The different classes of land cover, facies and degree of slope and the contribution index.

Classes	Land cover	Facies	Degree of slope	Index
1	Dense Forest > 66%	Limestone	0-5°	**1**
2	Moderately Dense Forest 33% -66%	Sandstone	5-15°	**2**
3	Low Dense Forest 10% - 33%	Schists	15-30°	**3**
4	Mattoral	Flysh	30-35°	**4**
5	Non Wooded Ground	Alluvium	35-90°	**5**

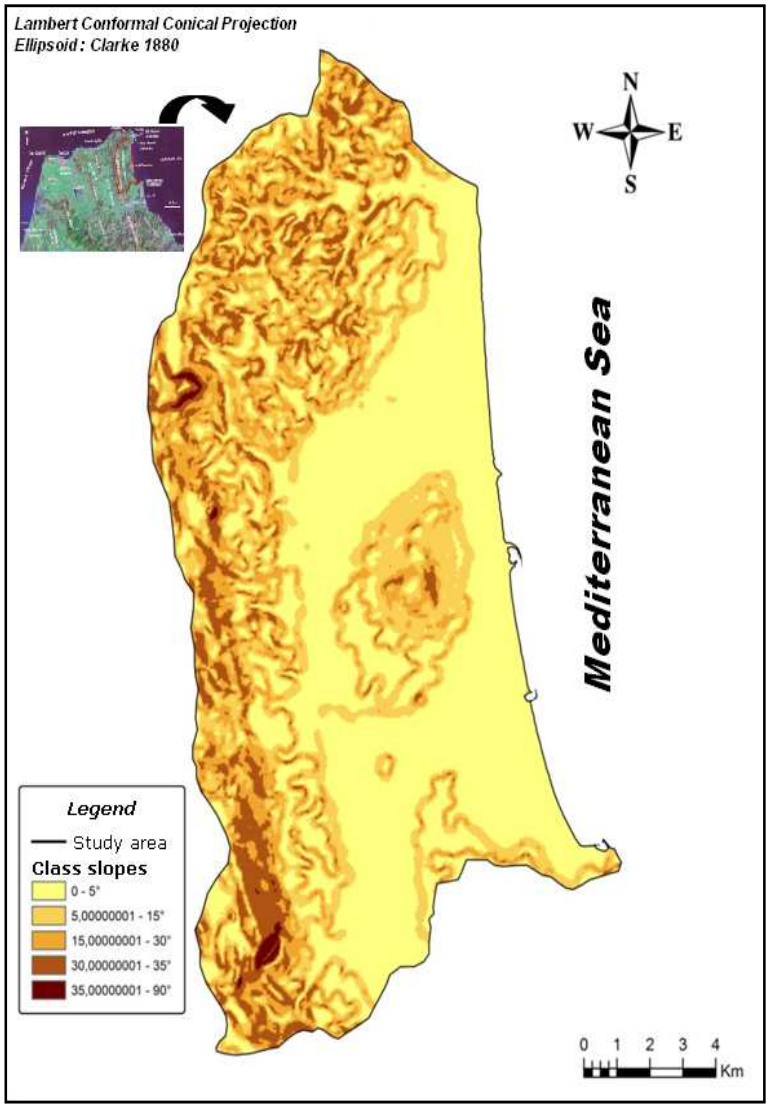


Fig.6. Slope map

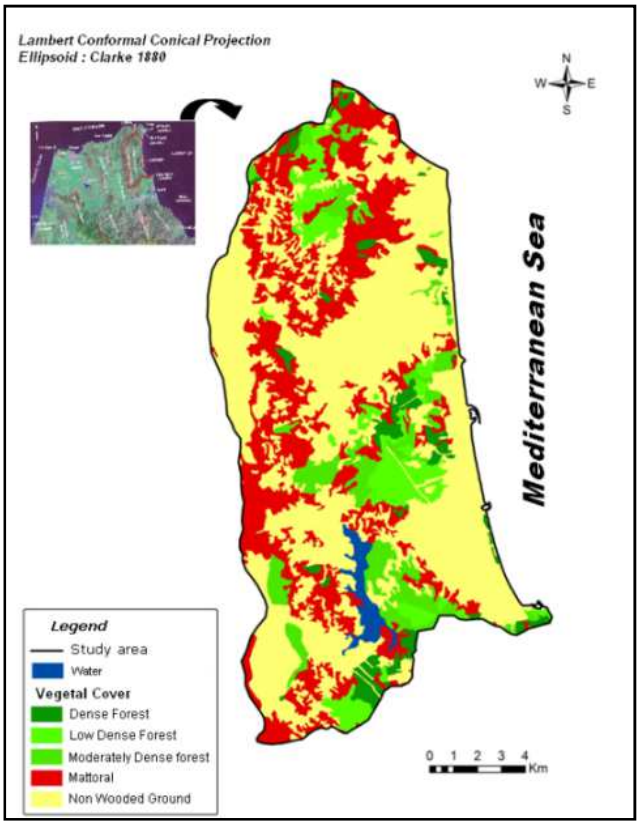


Fig.7. Land cover map

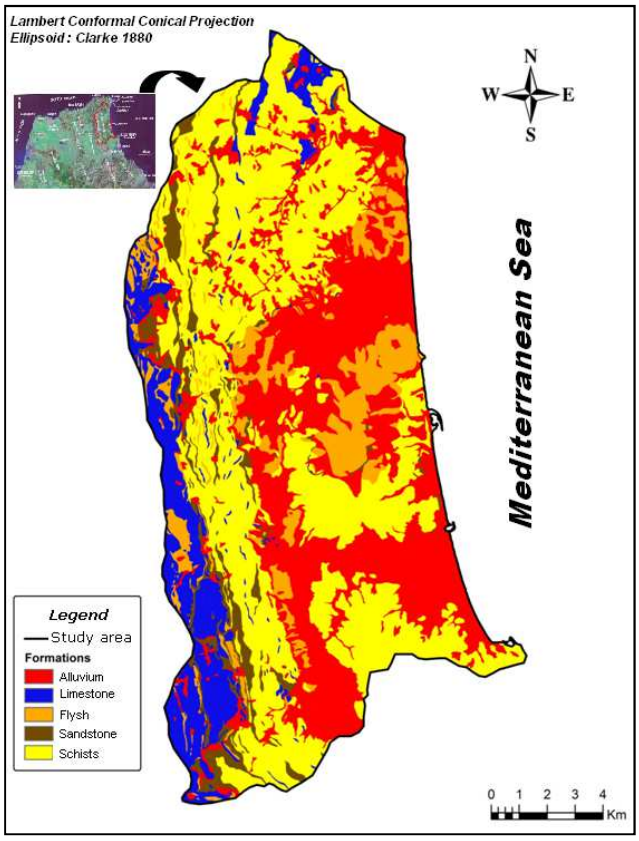


Fig.8. Map of lithologic facies

3.2 ELABORATION OF THE RISK MAP

Having rasterized the three thematic maps of parameters involved in the risk of erodibility, we preceded to the superposition of three layers, namely: the slope map, the vegetal cover map and lithological map in order to use them for mapping weights.

The used model allows to impose percentages of relative weighting on each parameter and to deduce different maps of erosive potential (see Table 2).

Four erosion risk maps were obtained using the sum of weights. It should be noted that only one risk map is selected and this is according to the percentage of validation deduced from observations on the ground (ground truth). This allowed us to identify areas at erosion risk by the percentage weighting assigned to each parameter which is reported in Table (2).

Table 2. Table weighting coefficients or contributions used in the model.

	% Weighting		
Sum of Weighting	**Map of lithologic facies**	**Map of slopes**	**Land cover**
A	50	30	20
B	40	40	20
C	33,3	33,3	33,3
D	25	25	50

- **Obtained Maps and validation of the model on the ground**

The four maps obtained by weighting are shown in Figures 9, 10, 11 and 12 (maps A, B, C, and D).

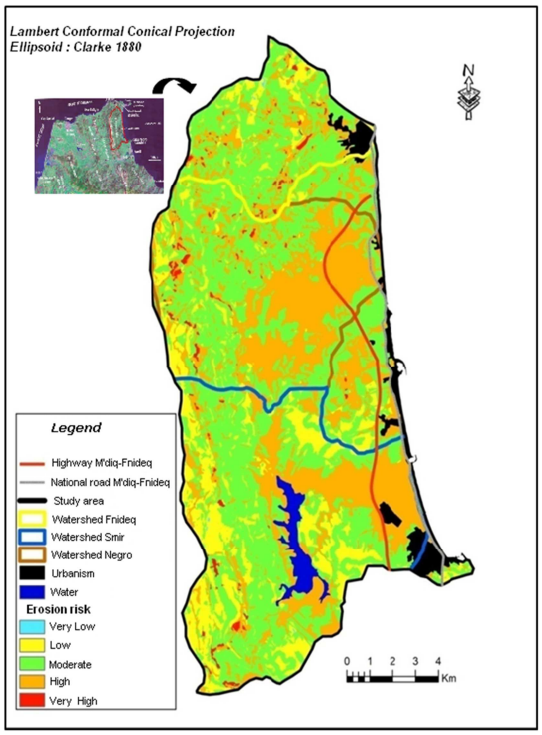


Fig.9. Map A

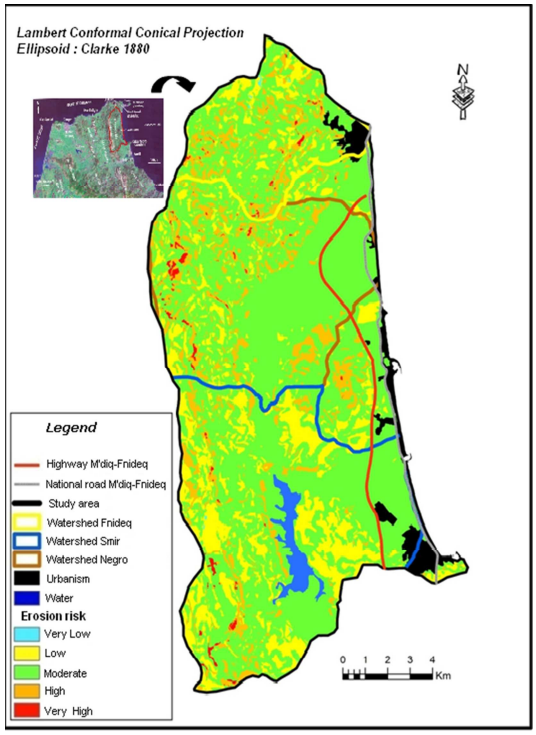


Fig.10. Map B

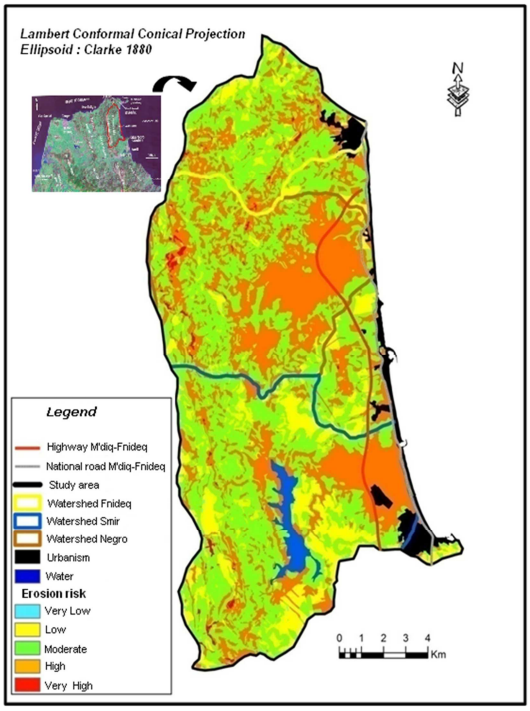


Fig.11. Map C

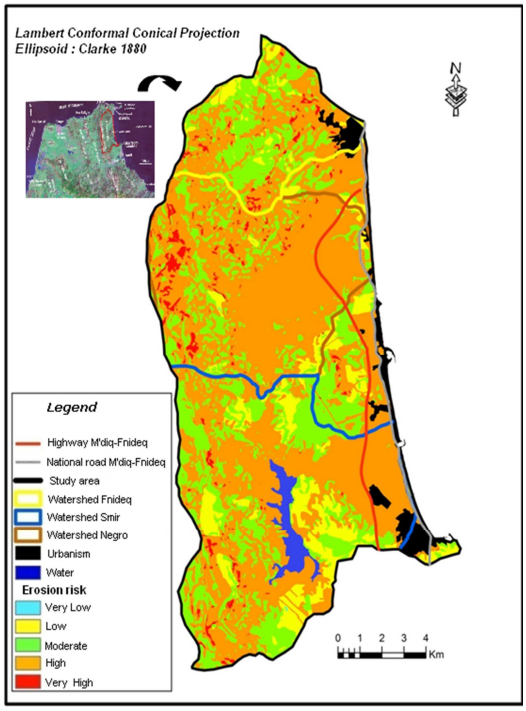


Fig.12. Map D

The rapid spatial analysis of the map generated by the model shows high rates of erosion in areas where there are low slopes with more or less consistent formations.

To ensure the validity of the model, we compared the results with field data. Criteria and forms of erosion considered on the ground are those reported in Table 3. For this purpose, we selected 16 checkpoints which are distributed in each river basin out of a total of 48 checkpoints across three watersheds forming the studied area, and which concern all classes of potential erosion (Fig. 13) (see also Annex 1 Picture 1 and 2). A table of erosion rates based on events of erosion on the ground is then established (see Table 3).

From these field observations, it is possible to calculate the total accuracy of the model and choose the amount of weight (the porch to the reality on the ground or a percentage of the highest validation). Table (4) gives us an idea of the percentage of validation calculated from the following formula:

$$Pt = PCV / PCt$$

Pt: Total accuracy.

PCV: Number of checkpoints valid to confirmation on the field.

PCt: Total number of control points/checkpoints.

For the observation of erosion on the field we developed a table linking the form of erosion to a rate of erosion to assign an index.

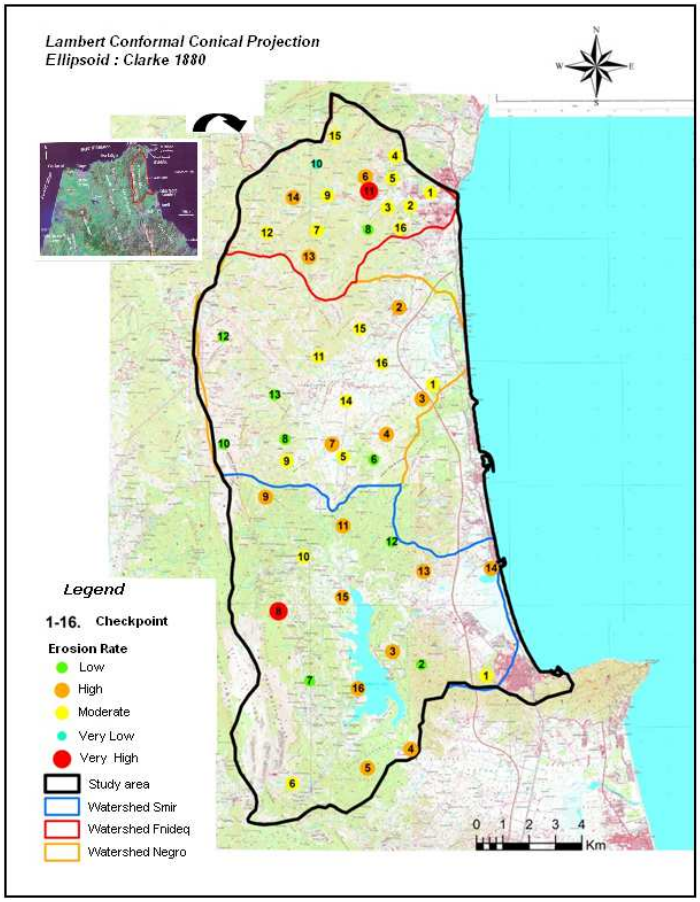


Fig.13. Distribution of checkpoints with their erosion rate in three watersheds of the study area rates.

Table 3. Percentage validation of checkpoints in the three watersheds for each map.

Watershed	Checkpoint	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	% de Validation
Negro	Map A	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	93.75
	Map B	1	0	0	1	1	0	0	0	0	1	0	1	0	1	1	1	50
	Map C	1	1	0	1	1	0	1	0	1	1	1	0	1	1	1	1	75
	Map D	0	1	1	1	0	1	1	0	1	0	1	0	1	0	0	0	50
Smir	Map A	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	93.75
	Map B	1	1	0	0	0	1	1	1	1	0	1	1	1	1	0	0	62.5
	Map C	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	87.5
	Map D	1	1	1	1	0	1	0	1	1	1	1	0	1	1	1	1	81.25
Fnideq	Map A	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	87.5
	Map B	1	1	1	1	1	0	0	1	1	1	1	1	0	1	0	1	75
	Map C	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	0	75
	Map D	0	1	1	0	1	1	0	1	1	0	1	0	1	1	1	0	62.5

1	Validé
0	Non validé

4 RESULTS AND DISCUSSIONS

- Case 1: Sum of weights D:

In this case, the weights are set as follows: 25% for lithology, slope 25% and 50% for the vegetal cover.

The map obtained based on these weighting coefficients is displayed in the Figure 12.

The rapid spatial analysis of the map generated by the model shows strong erosion rates in areas where there are slight slopes with more or less consistent formations. In this case, the percentage of map validation D would be 62.5% for the Fnideq watershed, 81.25% for the Smir watershed and 50% for watershed Negro. The average validation percentage would be then 64.58% (see Table 4).

- Case 2: Sum of the weighting C:

In this case, the weights coefficients are set as follows: 33.3% for the lithology, 33.3% for the slope 33.3% for the vegetation cover.

The obtained map based on these weighting coefficients is displayed in the Figure 11. The average validation coefficient in this case would be 79.16% (see Table 4).

- Case 3: Sum of weights B:

In this case, the weights are set as follows: 40% for the lithology, 40% for the slope 20% for the vegetal cover

The obtained map based on these weighting coefficients is displayed in the Figure 10.

Spatial analysis of the map B generated by the model shows the distributions of classes of low erosive potential to medium with a large percentage in area where there are high slopes with a friable substrate and a low density of vegetation cover. This result is not consistent with the reality on the ground. The average validation percentage in this case is 62.5%. (See Table 4).

- Case 4: Sum of weighting A:

In this case, the weights coefficients are set as follows: 50% for lithology, 30% for slope and 20% for the vegetal cover

The obtained map based on these weighting coefficients is displayed in the (Fig. 9).

Analysis of the spatial map generated by the model shows the class distributions of the erosive potential more or less favorable to the first contribution of lithology and slope and then the vegetal cover.

The average percentage of validation in this case is 91.58%. (See Table 3).

5 CONCLUSION

Based on average validation percentages calculated for the entire studied zone in each case weight given to various factors (lithology, slope and vegetal cover), it is clear that it is in the case of the map A where the weights are distributed in this way: 50% for the lithology, 30% for slope and 20% for vegetal cover where the coefficient of average validation is the strongest, which is 91.58%. Therefore, it should be noted that this is the map A (Fig. 14) that would be chosen as representative model of the risk of erosion of the entire watersheds of our studied area. In Morocco, especially in the Rif region, the water erosion is today the basis of a series of economic and social problems. This kind of map should already be taken into account in the institutions in charge of regional planning. It is an essential tool for decision which should be consulted during the implementation of works, the management of agricultural land etc... And especially that our country is currently undertaking a fairly significant economic development in many areas.

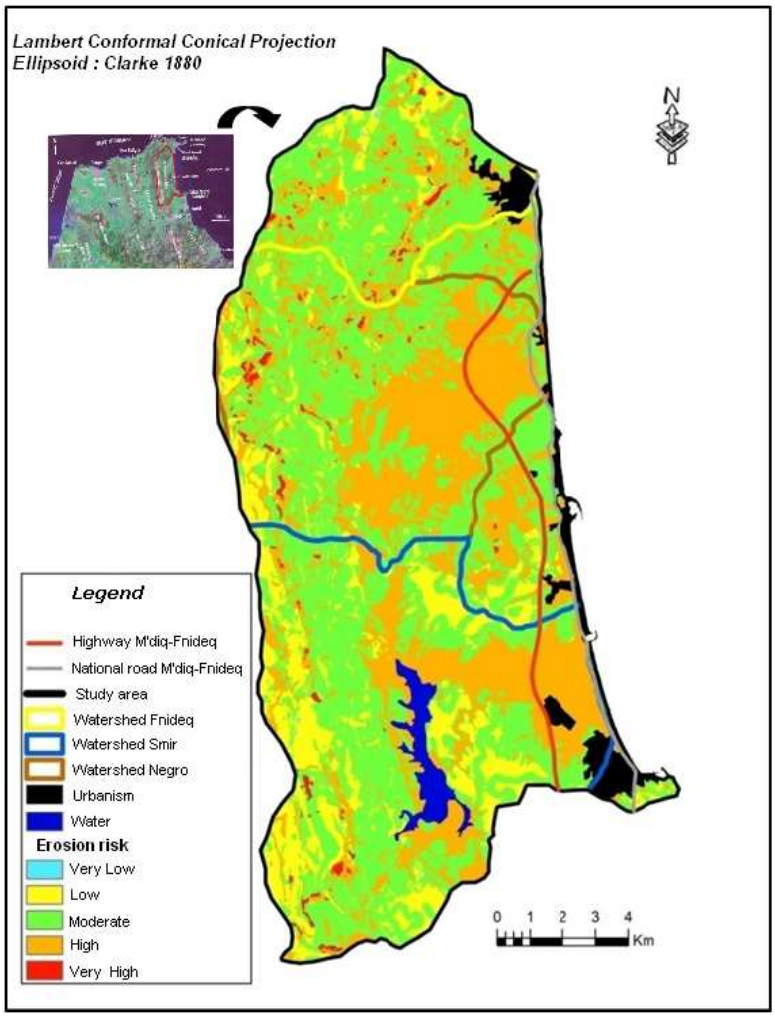


Fig. 14: Map of the risk of erosion obtained with a weighting coefficient A.

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ANNEX 1

Picture Planche



Picture 1 : vegetation density at the location of the checkpoint 1 in the Negro watershed .



Picture 2 : Gully at the location of the checkpoint 2 in the Fnideq watershed indicating a relatively stronger erosion than the previous case in the Negro watershed.

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Contribution de la géophysique à l'étude structurale et à l'identification des aquifères de fissures dans le Département de Dabakala (Centre-Nord Côte d'Ivoire)

[Contribution of geophysics in structural study and in identification of fissured aquifers in the department of Dabakala (North Central of Côte d'Ivoire)]

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ABSTRACT: The groundwater's exploitation located in the bedrock is one way indicated to provide water to population. Indeed, the aquifers of the fissured base constitute excellent water tanks. This article aims to determine the sites favorable to the establishment of drillings to good flows in the department of Dabakala. The methodological approach used is the combination of various geophysics methods and remote sensing. A card of morpho-structural alignments was established. This one highlighted two families of fractures hydraulically active of N70° and N120° direction. The electrical prospecting made it possible to strengthen the knowledge of the geological structure of underground for the water provision of 16 localities.

KEYWORDS: Fissured aquifer, Electrical prospecting, Basement, Remote sensing, Drilling, Dabakala, Ivory Coast.

RÉSUMÉ: L'exploitation des eaux souterraines en zone de socle est l'une des voies indiquées pour l'approvisionnement en eau des populations. En effet, les aquifères du socle fissuré constituent d'excellents réservoirs d'eau. L'objectif de ce travail est de déterminer les sites favorables à l'implantation de forages à bon débits dans le département de Dabakala. L'approche méthodologique utilisée est la combinaison des méthodes géophysiques et de télédétection. Une carte des alignements

morpho-structuraux a été établie. Celle-ci a mis en évidence deux familles de fractures hydrauliquement actives d'orientation N70° et N120°. La prospection électrique a permis de renforcer la connaissance de la structure géologique du sous-sol pour l'approvisionnement en eau de 16 localités.

MOTS-CLEFS: aquifère de fissure, prospection électrique, socle, télédétection, forage, Dabakala, Côte d'Ivoire

1 INTRODUCTION

Le département de Dabakala connaît des difficultés d'accessibilité aux ressources en eau souterraine. En effet les ouvrages hydrauliques sont peu nombreux avec des débits généralement faibles. Les besoins en eau de cette région sont importants et nécessitent la réalisation de nombreux forages. Le déficit en eau des populations est estimé à 54 448 m^3/jour). La connaissance du réseau de fractures constituant les principaux axes d'écoulements souterrains, il est fondamental pour la recherche des eaux souterraines [17], [34], [12], [33]. Ce travail a nécessité l'usage de méthodes de télédétection et de géophysique pour la prospection des eaux souterraines du département. L'usage des techniques de télédétection constitue une approche fiable dans la détection et la cartographie des réseaux de fractures. La géophysique en général et la prospection électrique en particulier, viennent en complément des études par imagerie satellitaire. En effet, elle permet de déterminer avec une meilleure précision le positionnement de la discontinuité tectonique et de localiser les zones d'intérêt hydrogéologique. L'objectif est de cartographier les réseaux de fractures en vue d'un meilleur approvisionnement des populations en eau potable.

2 CONTEXTE GEOGRAPHIQUE ET GEOLOGIQUE DU DEPARTEMENT DE DABAKALA

Le département de Dabakala est situé au Centre-Nord de la Côte d'Ivoire. Il est compris entre les longitudes 4° et 5° W et les latitudes 8° et 9° N (Fig. 1). Du nord au sud, la végétation passe de la savane arborée à la savane boisée. Elle est sévèrement dégradée par les feux de brousse des saisons sèches, occasionnés par les activités champêtres et/ou de chasses. La zone d'étude est à cheval entre les bassins versants du N'Zi et du Kinkéné (affluent du Comoé). La pluviométrie moyenne annuelle sur la chronique de 1951 à 2000 est de 1200 mm [15]. Le relief est monotone avec des altitudes variant de 100 à 650 m.

Le sous-sol est constitué de roches cristallines (granites et granodiorite), métamorphiques (migmatites) et de roches volcano-sédimentaires (métasédiments, métavulcanites et schistes) (Fig. 1). Parmi les granites, on distingue les granites à biotites, les leucogranites, les granites hyperalcalins (type sarala) et les granites porphyroïdes. La zone de Dabakala est à cheval sur trois sillons : Katiola à l'Ouest, Bouaké au Sud et Téhini à l'Est. Cette région a été le siège de trois déformations majeures senestres d'orientation NS pour les deux premières et WNW-ESE pour la dernière [7], [8]. On enregistre aussi localement la présence de zones de cisaillement senestres orientée WNW-ESE et dextre de direction NE-SW.

Au plan hydrogéologique, on distingue les réservoirs d'altérites, de fissures et de failles comme partout en zone de socle de Côte d'Ivoire [32], [1], [5]. Les aquifères des altérites sont superficiels et proviennent de l'altération de la roche-mère compacte ou fracturées. Les aquifères de fissures ou de fractures sont plus profonds. Ils sont mis en place à la faveur d'évènements tectoniques et sont constitués de fractures ouvertes et interconnectées dans lesquelles l'eau circule et s'emmagasine. La présence d'un aquifère de socle est donc subordonnée à l'existence d'une fissuration et/ou d'une altération. Autrement dit l'emmagasinement d'eau n'est possible que si les roches ont été soumises à des transformations postérieures à leurs genèses qui sont d'ordre météorique ou tectonique [17].

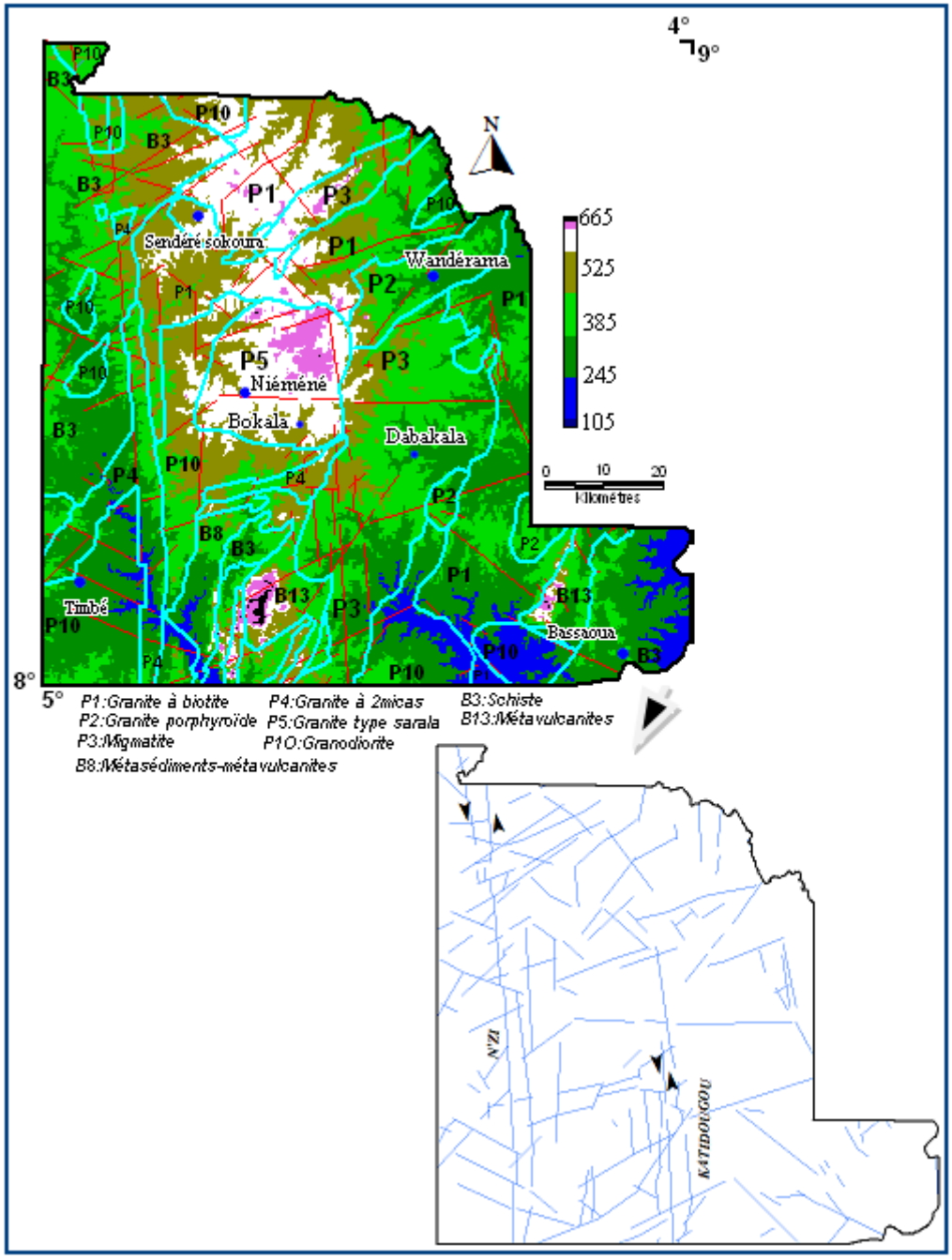


Fig. 1 Contours géologiques superposé au MNA de Dabakala.

3 MATERIELS ET METHODES

3.1 MATERIELS ET DONNEES

Pour cette étude, la scène (196 ; 54) d'une image satellite Landsat-7 ETM+, acquise le 29 janvier 2002 a été utilisé. De plus, des cartes topographique, géologique et aéromagnétique, toutes à l'échelle 1/200 000 ont été traitées. Enfin, des fiches techniques de forages comportant des informations relatives aux niveaux statiques de l'eau, aux débits air-lift, aux profondeurs de forage, aux arrivées d'eau, etc.ont été exploitées. Ces fiches ont été fournies par la Direction Territoriale de l'Hydraulique (DTH) de Bouaké.

Le matériel d'acquisition des données géophysiques utilisé est constitué d'un résistivimètre de type Syscal junior avec ses accessoires (des bobines de raccordement, les électrodes, un hectomètre, des masses, une boussole, un GPS, etc.). Celui de traitement des données se compose de logiciels de cartographie (Mapinfo Professional 7.5), de traitement d'images (Envi 4.1) et de traitement géophysique (Ipi2win, Qwseln).

3.2 METHODOLOGIE

L'approvisionnement en eau potable (AEP) nécessite des cartes structurales de grandes précisions. Les familles de discontinuités se définissent par leur orientation, leur ouverture, leur persistance, leur densité ainsi que par leur origine géologique [26]. L'étude de la fracturation est essentielle et consiste à la compréhension du fonctionnement hydrogéologique des aquifères discontinus.

3.2.1 CARTOGRAPHIE DES DISCONTINUITES PAR AEROMAGNETISME

Elle est élaborée à partir des cartes aéromagnétiques et des images satellitaires ETM+. Le traitement et l'interprétation des données aéromagnétiques permet de mettre en évidence des discontinuités susceptibles de constituer des guides pour les prospections hydrogéologiques [22], [30]. L'extraction des discontinuités (fissures, failles) sur les cartes aéromagnétiques est basée sur la répartition des anomalies magnétiques. Il faut tenir compte des différentes signatures des structures magnétiques comme les failles et les zones de contacts. Les failles se manifestent par un mouvement latéral (déplacement latéral de l'axe d'allongement des anomalies magnétiques) et un mouvement vertical (gradient important au-dessus du plan de faille. Les contacts géologiques se manifestent par un changement de comportement du champ magnétique qui passe d'un état perturbé à un état calme ou vice-versa. Ils sont généralement indiqués par le gradient plus ou moins fort des lignes de contour [9]. Le couplage des cartes aéromagnétique, géologique et topographique permet de mettre en évidence certaines discontinuités. Le tracé des fractures a été réalisé de façon manuelle.

3.2.2 CARTOGRAPHIE DES STRUCTURES LINEAMENTAIRES PAR TELEDETECTION

De nombreuses études hydrogéologiques [27], [3], [28], [16], [18], [11], [13], [34], [14] ont démontré la nécessité d'utiliser les images satellitaires pour cartographier les fractures d'origine tectonique. Les techniques de rehaussement mises en œuvre dont l'ACP et le filtrage spatial ont largement fait leur preuve en région tropicale humide [23]. Cela a consisté à séparer au maximum les informations afin d'obtenir un canal spécifiques aux hautes fréquences. Le filtrage spatial utilisé est de type directionnel (Sobel 7 × 7). Cette dernière approche a eu pour objectif de mieux distinguer les linéaments. Le relevé des linéaments structuraux se fait manuellement.

Les linéaments et les éléments structuraux cartographiés sont par la suite validés par les connaissances de terrain, les cartes photo-géologiques et géologiques existantes. Les travaux de différents auteurs [29], [19], [20], [8] ont été utilisés pour confronter les résultats obtenus. Au cours de la phase de validation, les linéaments ayant une origine autre que tectonique sont supprimés. Il s'agit des routes, pistes, lignes de transport d'énergie, etc. Les linéaments retenus ont donc une valeur de fracturation.

3.2.3 STRATEGIE DE PROSPECTION

La télédétection et la géophysique (méthode de résistivité électrique) apportent une contribution précieuse dans la localisation des zones d'altération, des failles, des dysharmonies, qui sont autant de zones favorables à la présence d'eau dans les roches. L'étude prospective comporte deux volets d'investigations. Le premier est composé de l'examen géomorphologique et de la mise en œuvre des méthodes électriques (traîné et sondage électriques) sur le terrain. Le second repose sur le choix de sites d'implantation de forages.

Les méthodes géophysiques mesurent les paramètres physiques du sous-sol à partir de la surface. Celle des résistivités électriques consiste à injecter un courant continu dans le sol à l'aide d'électrodes A et B et à mesurer la différence de potentiel entre deux autres électrodes M et N compris entre A et B. Les levés par traîné électriques permettent une investigation latérale en vue de déterminer les discontinuités dans le socle, tandis que les sondages électriques permettent de mieux appréhender la succession des couches de terrains [4], [16]. Dans le cadre de cette étude, les traînés électriques ont été effectués selon le dispositif gradient rectangle avec les caractéristiques géométriques suivantes : AB = 500m et 300m, MN = 20 m et quelques fois le dispositif Schlumberger (AB = 200 ; MN = 20). Le pas de mesure est de 10 m. Les sondages électriques ont été effectués selon le dispositif Schlumberger, au droit des anomalies de résistivité apparente déterminées

par traîné électrique. Les données acquises avec ces deux techniques permettent de construire des profils de résistivité et des sondages électriques.

4 RESULTATS

4.1 ANALYSE DES DISCONTINUITES MAGNETIQUES

La cartographie des failles et fractures basée sur leur signature magnétique à permis de disposer d'une carte qui est une représentation des discontinuités magnétiques (Fig. 2). La rosace directionnelle associée à cette carte est également illustrée par le schéma 2. Seule la famille de fractures N00-10 dépasse les 10% en fréquence. Après suivent les familles N170-180 et N80-110.

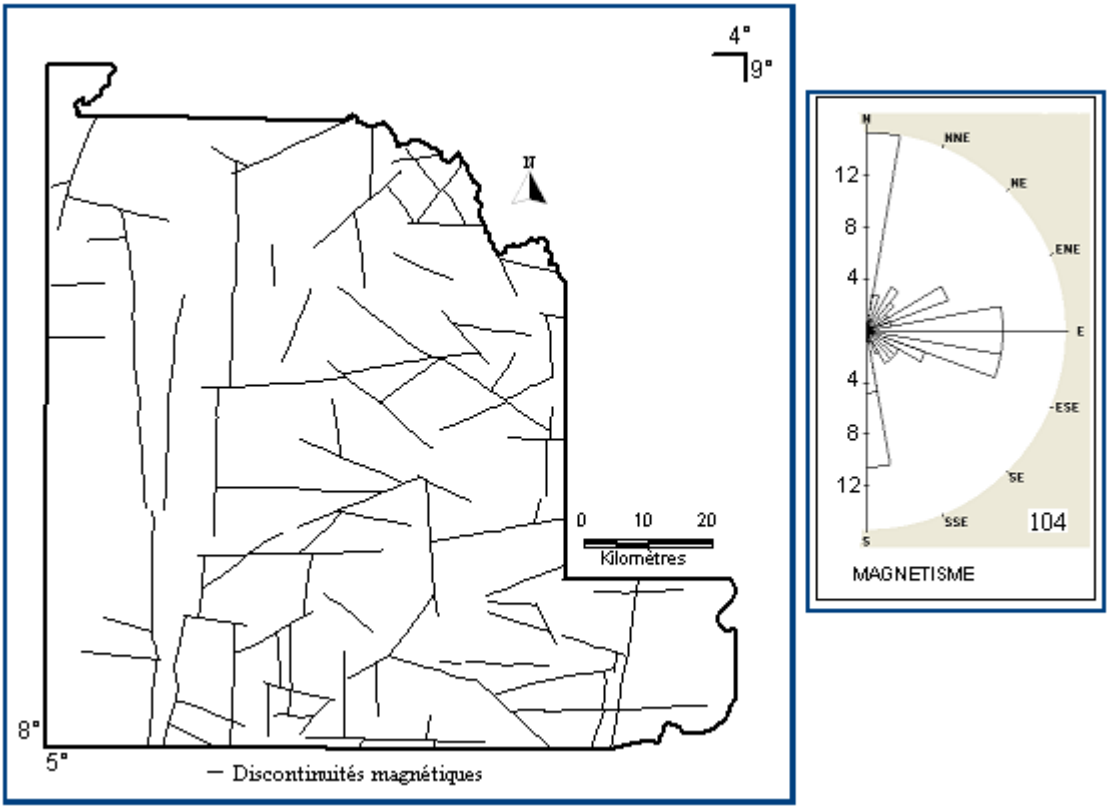


Fig. 2. Carte des discontinuités magnétiques de Dabakala et rosace directionnelle

4.2 ANALYSE DES LINEAMENTS

La méthodologie appliquée pour le traitement des images satellitaires a permis de cartographier les linéaments majeurs de Dabakala (Fig. 3). L'analyse du réseau linéamentaire indique que la classe NS constitue la direction majeure. Les directions secondaires sont N110°-120 et N170-180 (Fig. 4).

4.3 ANALYSE COMPARATIVE ENTRE LA CARTE DE LINEAMENTS ET DE DONNEES DE GEOLOGIE STRUCTURALE

La superposition de la fracturation issue de la télédétection et celle de la carte géologique met en évidence une certaine concordance des fractures identifiées. En effet, les linéaments issus de l'imagerie satellitaire sont souvent plus ou moins superposés aux éléments structuraux du terrain ou encore sont dans le prolongement de ces derniers (Fig. 3). De nombreuses fractures jusque-là inconnues dans la base de données de cette région ont pu être mises en évidence. Les fractures célèbres comme les cisaillements NS du N'Zi et de Katidougou ont été identifiées. Cependant certaines structures géologiques n'ont pas pu être identifiées sur les images satellitaires.

Les rosaces directionnelles des cartes de fracturation et celle obtenue par télédétection sont illustrées à la figure 4. Sur ces rosaces, on observe d'une manière générale que la fracturation est presque homogène. En effet, en dehors de la famille de fractures NS (N170-180, N00-10), aucune famille de fractures ne dépasse 10 % en fréquence. Les fractures cartographiées par télédétection ont été confirmées par les données de terrain (Fig. 4). Cette différence observée au niveau de ces rosaces s'explique comme nous l'avons souligné, par la taille du support étudié. En effet, les images satellites couvrent de vastes surfaces géographiques comparativement aux investigations de terrain.

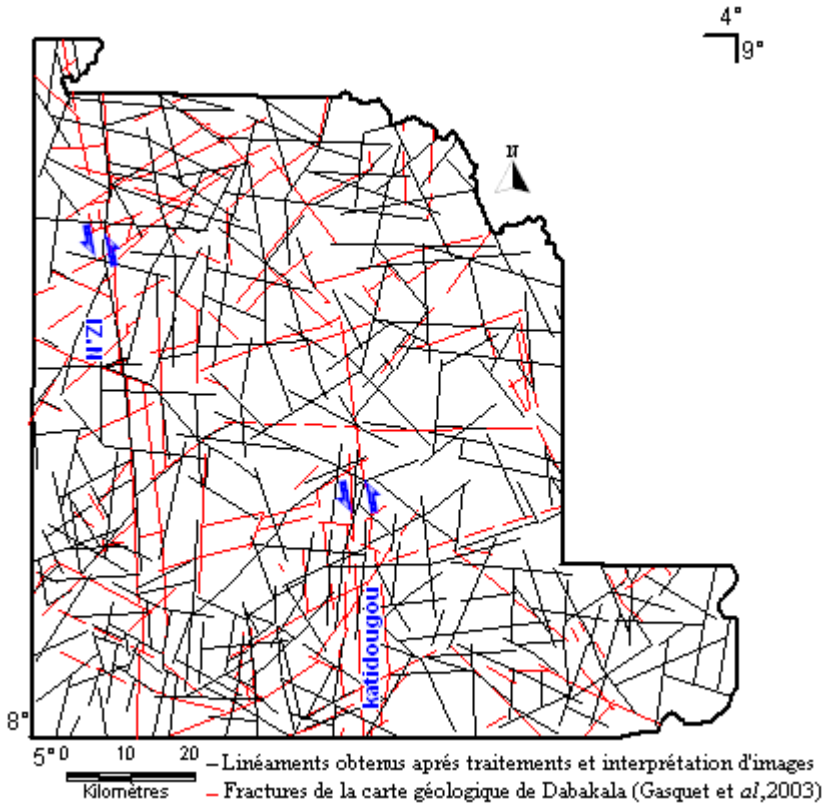


Fig. 3. Comparaison de la carte de linéaments interprétés de la zone test à celle des études antérieures.

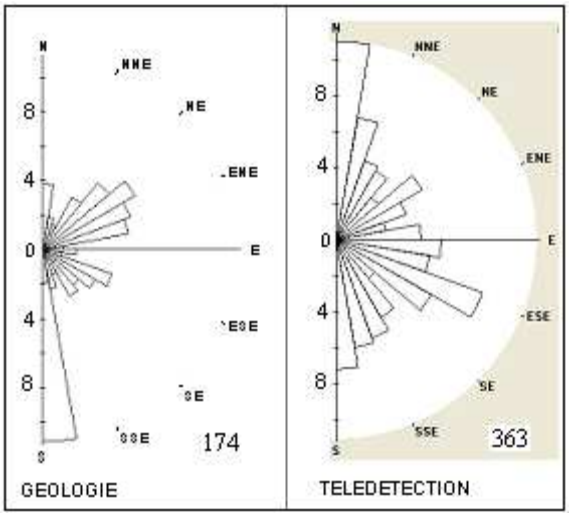


Fig. 4. Comparaison des rosaces des différents supports

La figure 5 met en évidence la relation existant entre la nature lithologique des formations et le réseau de fractures cartographiés par télédétection. Les linéaments d'orientation NNE-SSW pourraient être interprétés comme des anomalies

d'origine structurale ou lithologique. En effet, ces orientations s'apparentent à celle de la foliation et de la linéation minérale subverticale relevées dans les zones de contact (NNE-SSW et NNW-SSW) suivant les grandes directions de déformation.

Il ressort des analyses que malgré les quelques différences, les résultats de cette étude correspondent à des structures déjà existantes. Ces structures ont été identifiées avec une meilleure précision. Notons que l'orientation préférentielle NS mise en évidence sur les différents supports correspond aussi à celle des fractures d'origine géologiques. La confrontation des résultats à celles des données existantes a permis de faire un lien géologique entre les différents éléments et de faciliter leur interprétation :

- certains linéaments cartographiés ont été identifiés et reconnus sur le terrain comme étant des discontinuités tectoniques (failles ou des fractures);
- les linéaments majeurs sont liés à des failles mises en place dans les profondeurs et associés aux grands mouvements tectoniques à l'échelle régionale [10].
- Les linéaments mineurs sont liés à des phénomènes géologiques locaux (mise en place d'intrusions rocheuses, déformations et plissements locaux).

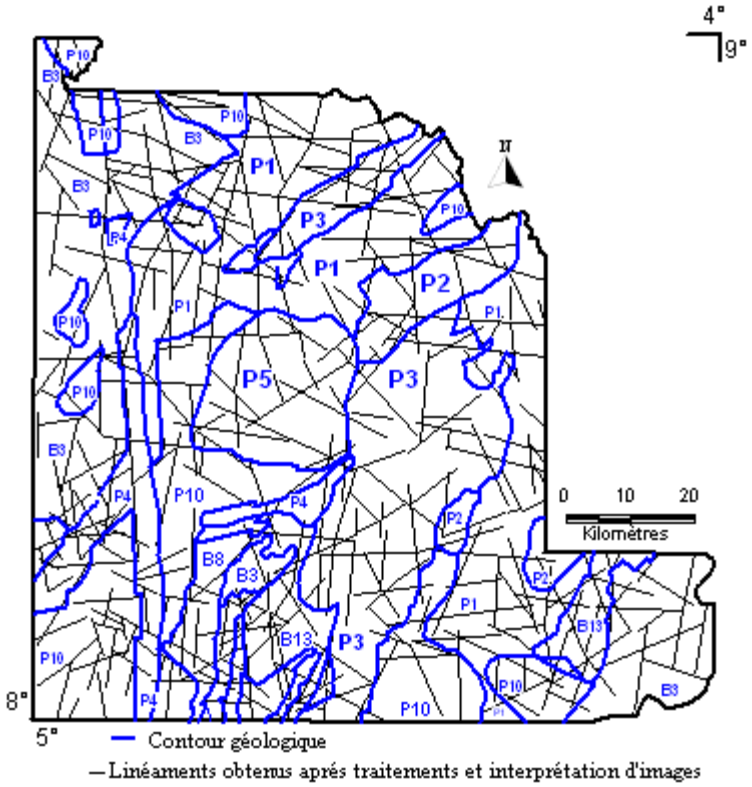


Fig. 5. Comparaison de la carte de linéaments et de la carte géologique de Dabakala.

P1. Granite à biotite ; P2. Granite porphyroïde ;P3. Migmatite ; P4. Granite à micas ; P5. Granite type Sarala ; P10. Granodiorite ; B3. Schistes ; B8. Métasédiments-métavulcanites ; B13. Métavulcanite

4.4 SYNTHESE DE L'ANALYSE STRUCTURALE

La synthèse des travaux et de l'étude structurale effectuée par [8] dans le département de Dabakala indiquent que la fracturation affecte les terrains sur plusieurs kilomètres et les linéaments repérés s'organisent selon les orientations NS et N 90 (Fig. 6). Cette fracturation est à mettre en relation avec la tectonique régionale. Par ailleurs, les réseaux de fractures N 70° et N 110° déjà repérés par [6] affectent les granites à biotite et les schistes. Ces fractures sont peu représentées dans la zone au niveau régional mais prépondérante à l'échelle locale.

L'usage des données issues des images satellitaires et aéromagnétiques dans la prospection hydrogéologique a donné des résultats probants malgré les limites de ces méthodes (difficulté de détection des linéaments sous les fortes épaisseurs d'altération et les fractures non injectées de roches à susceptibilité magnétique élevée [24]. La confrontation des deux supports a permis d'élaborer un schéma structural précis (Fig. 7).

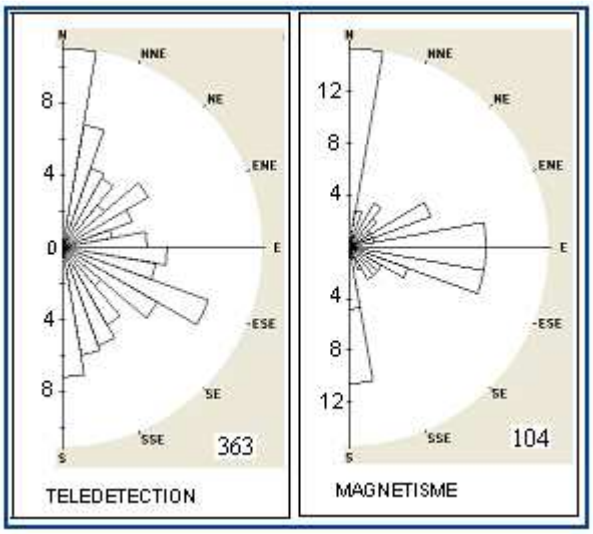


Fig. 6. Rosaces issues des différents traitements

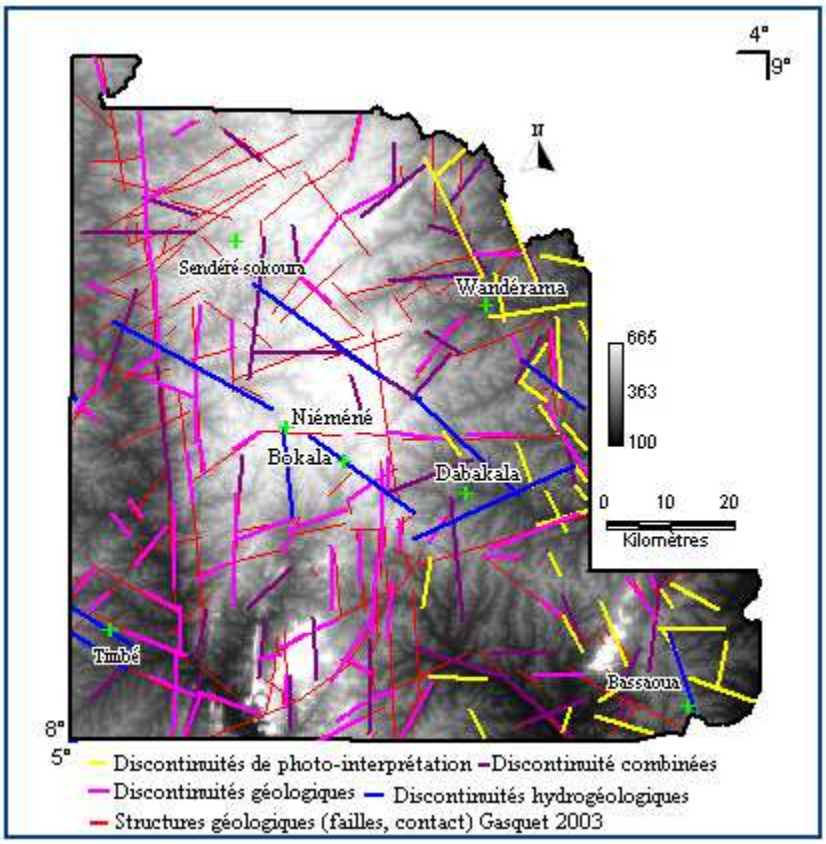


Fig. 7. Schéma structural combiné sur fond MNT du département de Dabakala.

Les linéaments satellitaires et les discontinuités magnétiques ont été comparées aux données de la carte géologique, de photo-interprétation et de forages. Les linéaments identifiés à la fois par télédetection et aéromagnétisme sont en couleur

violet. Les accidents confirmées par un tracé géologique (faille ou contact), par une discontinuité de photo-interprétation ou par forages sont soulignés respectivement par les couleurs rose, jaune et bleue.

Cette carte de la figure 7 met en évidence l'importance régionale des orientations méridionales NS. Plusieurs discontinuités magnétiques de même orientation, parfois soulignées par la télédétection sont ainsi mises en évidences dans la partie ouest de la zone d'étude, au niveau d'un couloir de 30 à 50 km de large. Cette déformation transpressive post-archéenne est le résultat d'un aplatissementet d'un cisaillement [8]. Elle a affecté le socle cristallin de Dabakala qui présente de nombreux témoins de cette déformation. La fracturation E-W, correspondant à des décrochements dextres reste mal représentée dans la zone étudiée.

La direction NE-SW confirmées par la géologie marque l'influence de l'orogenèse éburnéenne. Cette deuxième direction est bien visible à l'ouest et au Nord-ouest de la zone d'étude.

La direction NW-SE, visible au Sud de Dabakala est signalée à la fois par les deux méthodes et confirmée par la géologie. Cette direction serait due à des fractures profondes.

4.5 RESULTATS DES CAMPAGNES GEOPHYSIQUES

4.5.1 RESULTATS DE LA METHODE GEOMORPHOLOGIE ET GEOPHYSIQUE

Traîné électrique et sondage électrique ont été réalisés à Kassembélé (Azimut : 140°, AB=200 m, MN=20 m). Le profil de la figure 8 permet l'investigation d'une profondeur de 25 m en moyenne. Il montre une première zone de 0 à 30 m caractérisée par une anomalie de type "U" (649 Ω.m). Entre les abscisses 90 et 170 m, la seconde zone représente un substratum très fracturé. Elle est caractérisée par des résistivités oscillant entre 500 et 1220 Ω.m et des anomalies "V" et "U".

Pour vérifier la succession verticale de terrain et connaître l'intérêt hydrogéologique des discontinuités, des sondages électriques ont été implantés à l'aplomb des anomalies, au niveau des stations x= 20 m, x= 100 m et x=130 m du profil (Fig. 8).

La figure 9 regroupe l'inversion des trois sondages réalisés sur le site de Kassembélé. Trois couches géo-électriques sont mises en évidence par les différents sondages :

- un terrain superficiel correspondant à de la latérite contenant des teneurs en sables et argiles variables (334-7204 Ω.m). Les variations de teneurs sont bien développées sur SE2;
- un terrain conducteur (14,6-272 Ω.m) correspondant à une formation de type altération argileuse dont l'épaisseur varie de 6 à 25 m ;
- un terrain très résistant (26650-46083 Ω.m) correspondant au socle granitique sain relativement fissuré.

On note la présence, sur SE3 d'un terrain (96Ω.m, 12 m d'épaisseur environ) entre l'altération et le socle sain correspondant au socle fissuré altéré. Cette hypothèse est confirmée par le forage réalisé en SE3. L'interprétation des sondages électriques montrent que la côte du toit du substratum est constante (environ 10 m). Le forage réalisé au niveau de SE3 a fourni un débit de 5 m^3/h et a mis en évidence une épaisseur d'altération de 9 m. Le sondage SE3 a permis une bonne estimation de l'épaisseur d'altérites, cependant la limite horizon fissuré et socle sain n'est pas évaluée avec précision.

La mise en œuvre de cette méthode a permis l'implantation de 9 forages dont 4 sont positifs soit un pourcentage de succès de 44,44 % (Tab. 1).

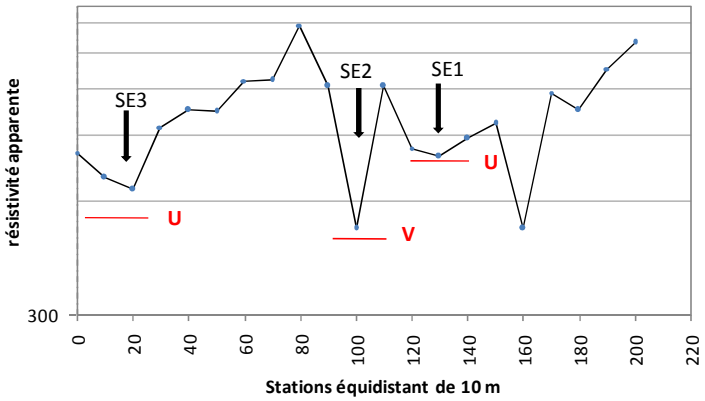


Fig. 8. Profil de traîné électrique de Kassembélé.

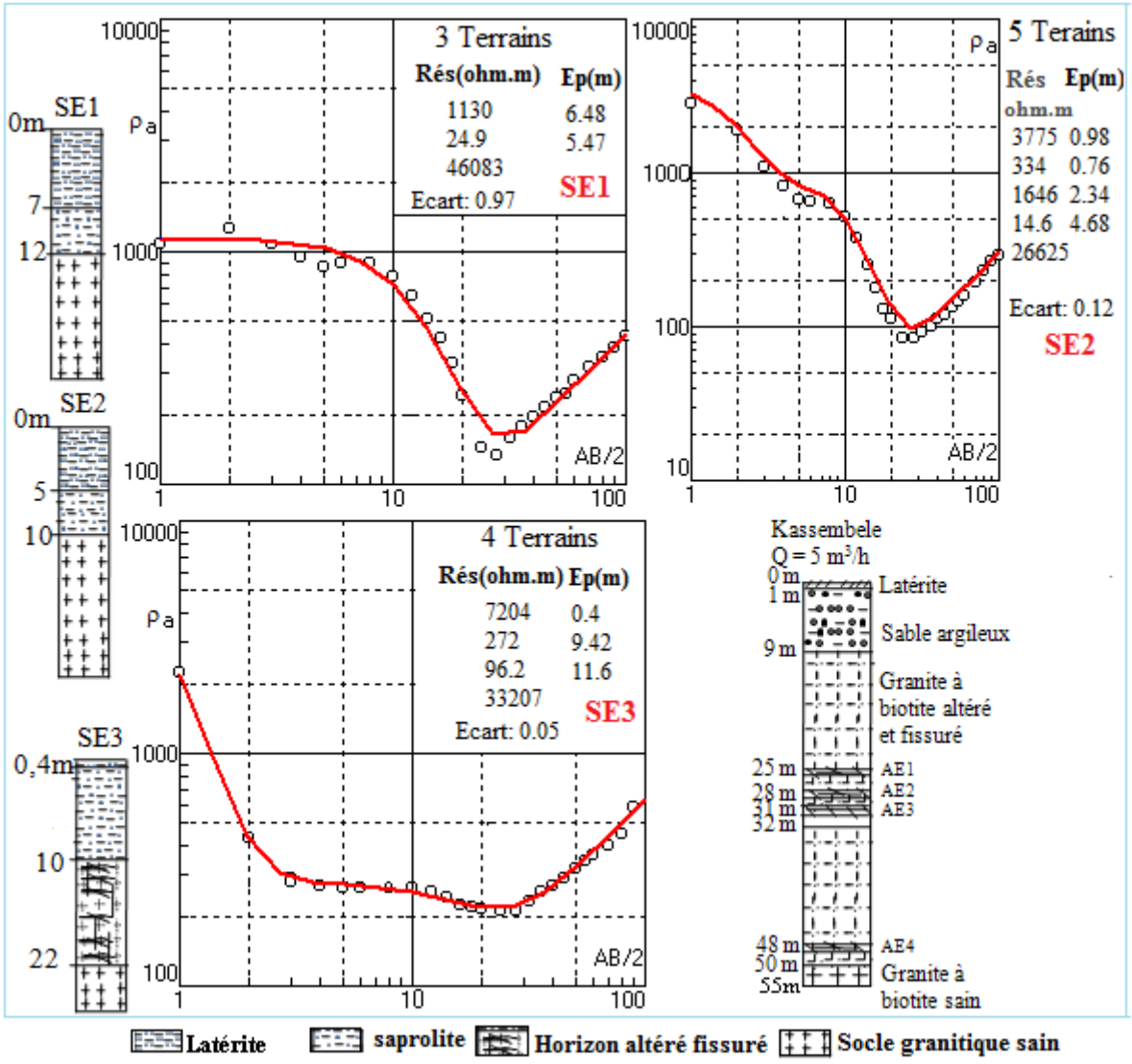


Fig. 9. Interprétation géologique des sondages électriques et coupe lithologique à Kassembélé

Tableau 1. Résultats de la première phase de prospection

Localité	Altitude	Lithologie selon carte géologique	1ère AE/ fracture	Q (m3/h)	Ep altérite (m)
Niéméné 1	376	Leucogranite peraluminuex	53	0	29
Niéméné 2	370	Leucogranite peraluminuex	82	0	4,13
Niéméné 3	380	Leucogranite peraluminuex	48,5	0	23,9
Tindikan sofana	376	Leucogranite peraluminuex	44	1	31
Kassemblé	370	Granite à biotite homogène	25	5	9
Kafigué 2	260	Granite à biotite homogène		0	9,32
Karpélé sokoro 1	344	Leucogranite peraluminuex		0	15
Kafiné noumoussou		Migmatite granitique	52	0,5	32
Koffissiokaha	216	Granodiorite	17	4,2	13

4.5.2 RESULTATS DE LA METHODE TELEDTECTION ET GEOPHYSIQUE

Cette méthode a été mise en œuvre dans 15 localités du département de Dabakala. Les études préliminaires ont permis d'avoir une carte linéamentaire de la localité de Bokala Napiandougou (Fig. 10). Les linéaments sont orientés préférentiellement selon deux directions : N20-30° et N100-120°.

Le profil du traîné électrique présente une courbe irrégulière et montre des pics où la chute de résistivité est importante attestant de la présence d'un corps conducteur qui peut être interprété comme un aquifère (Fig. 11). Le linéament 13°N est aussi souligné par un pic de type "U". Sur la courbe, les pics correspondent à deux types d'anomalies. Une anomalie de type " U " (x = 30 m) et de type " H " (x ϵ [100; 110] et x ϵ [140; 150]).

Pour vérifier la succession verticale de terrain et connaître l'intérêt hydrogéologique des discontinuités, des sondages électriques ont été implantés à l'aplomb de ces anomalies, au niveau des points x= 30 m et x=110 m du profil (Fig. 12).

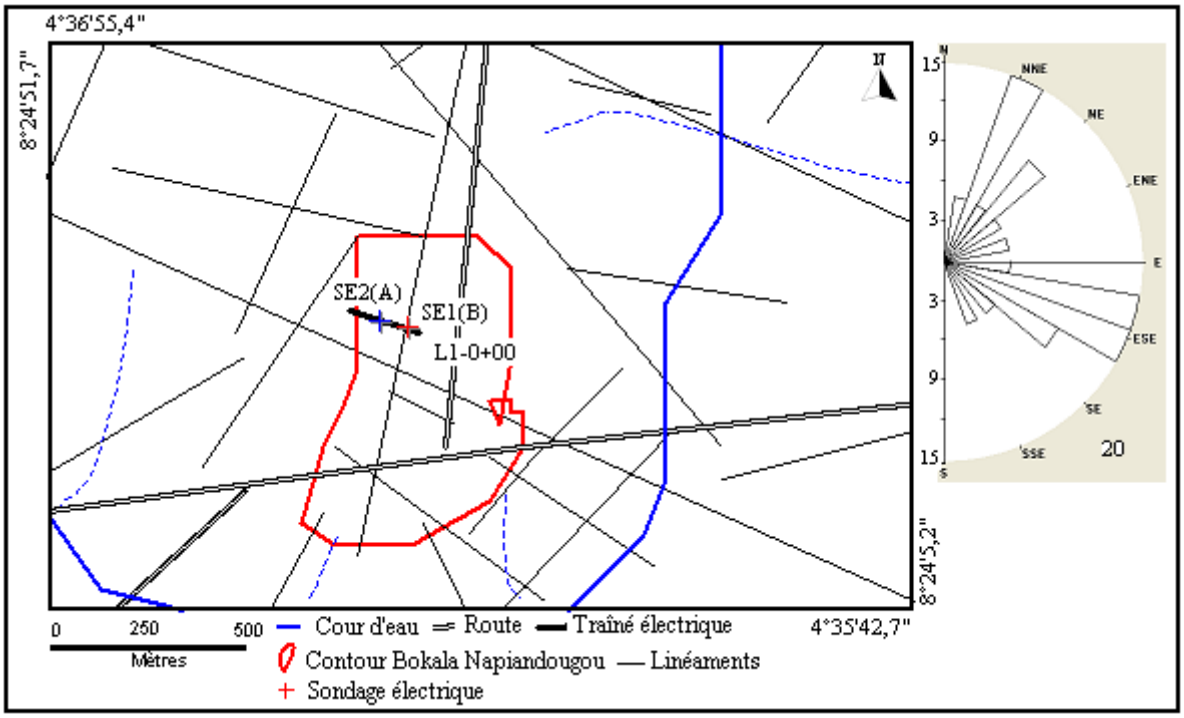


Fig. 10. Carte linéamentaire de la localité de Bokala-Napiondougou

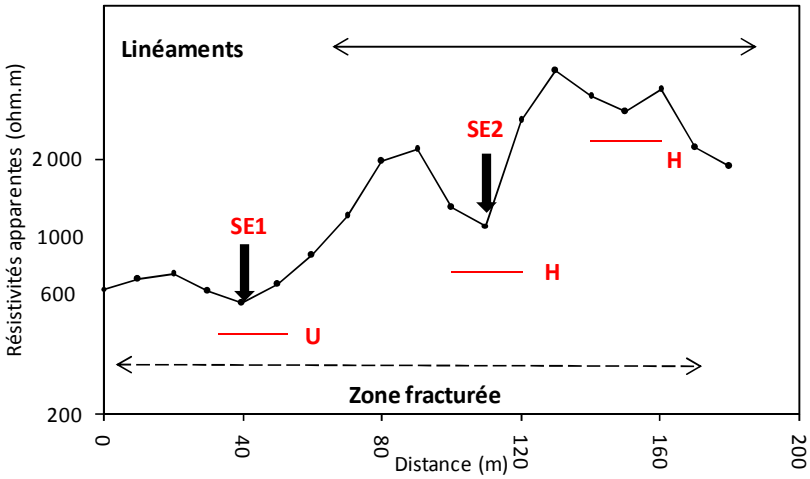


Fig. 11. Signatures du linéament N13° de Bokala-Napiondougou par le traîné

La figure 12 regroupe l'inversion des deux sondages réalisés sur le site de Bokala Napiondougou. Trois couches géoélectriques sont mises en évidence par les différents sondages :

- un terrain superficiel correspondant à l'argile latéritique (107-117 Ω.m) dont l'épaisseur varie de 0,5 à 1m ;
- un terrain conducteur (20-122 Ω.m) correspondant à l'horizon argilo-sableux dont l'épaisseur varie de 6 à 25 m ;
- un terrain très résistant (13695-36433 Ω.m) correspondant au socle granitique sain relativement fissuré.

On note la présence, sur SE2 d'un terrain intermédiaire (9190 Ω.m, 29 m d'épaisseur environ) entre les argiles sableuses et le socle sain correspondant au socle fissuré. Cette interprétation est confirmée par le forage réalisé au niveau de SE2.

L'interprétation des sondages électriques montrent donc une variabilité de la côte du toit du substratum qui passe de 25,7 m sur SE2 à 8 m sur SE1. Le forage réalisé au niveau de SE2 a permis d'obtenir un débit de 1 m^3/h. L'épaisseur d'altération sur ce forage est de 23 m. Il existe donc une bonne corrélation entre le sondage SE2 et le forage.

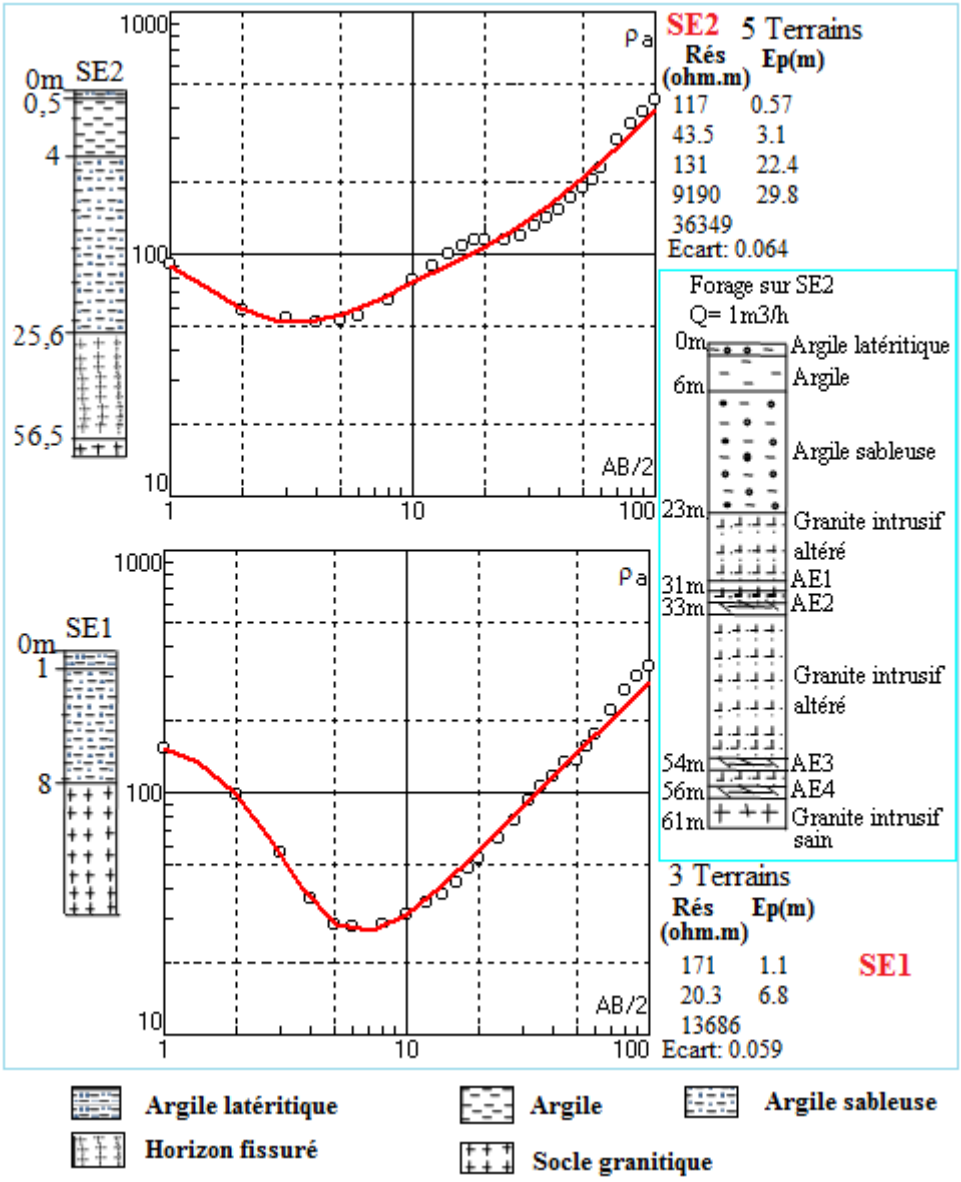


Fig. 12. Interprétation géologique des sondages électriques et coupe lithologique de Bokala-Napiondougou

Cette approche a permis l'implantation de 17 sondages mécaniques dont 12 positifs soit un pourcentage de succès de 70,59 % (Tab. 2). Il y a une nette amélioration du taux de réussite des forages. Sur l'ensemble des 26 forages réalisés dans le département de Dabakala, 16 sont déclarés positifs et 10 négatifs, soit un taux de succès de 61,53 %.

Tableau 2. Résultat de la deuxième phase de prospection

Localité	Altitude	Lithologie selon carte géologique	1ère AE/ fracture	Q (m3/h)	Ep altérite
Tetindougou	267	Granite à biotite homogène	23,5	1,5	20
Diedana 1	242	Granite à biotite homogène		0	4
Diedana 2	238	Granite à biotite homogène		0	4
Bokala	352	leucogranite peralumineux	31	1	23
Niéméné	376	leucogranite peralumineux	75	3,6	29
Karpélé sokoro 2	341	leucogranite peralumineux		0	4
Yaossedougou	297	Granite porphyrique	48	1	40
Karpélé	315	Granodiorite	35	1	33
Finessedougou	291	Granodiorite	22,5	0,5	9
Kawolo sobara	318	Granodiorite	63	2,5	38
Lissolo sobara	181	Métasédiment, métavulcanites	53	3	43
Namahounoudougou	255	Métasédiment, métavulcanites	50	6	42
Kogbéra	287	Métasédiment, métavulcanites	27	3	24
Kafondougou 1	291	Migmatite granitique		0	21
Kafondougou 2	280	Migmatite granitique	35	0	28
Diarradougou	268	Migmatite post-birrimiennes	60	2,5	11
Darala	266	Migmatite post-birrimiennes	59	1,5	33

Du point de vue lithologique, il apparait que les granites et principalement les leucogranites peralumineux présentent un taux élevé d'échec, du fait du remplissage ou colmatage de la fissuration. Ce taux d'échec particulièrement élevé dans la sous-préfecture de Boniérédougou a affecté le taux de succès global de l'ensemble de la zone d'étude (Fig. 13). L'épaisseur moyenne des altérites est de 22 m. Les plus grandes et les plus faibles sont enregistrées respectivement dans les sous-préfectures de Bassawa (42 m à Namahounoudougou) et de Foumbolo (4 m à KarpéléSokoro). Les débits importants se rencontrent sur des épaisseurs d'altération allant de 40 à 50 m, surtout sur substratum schisteux.

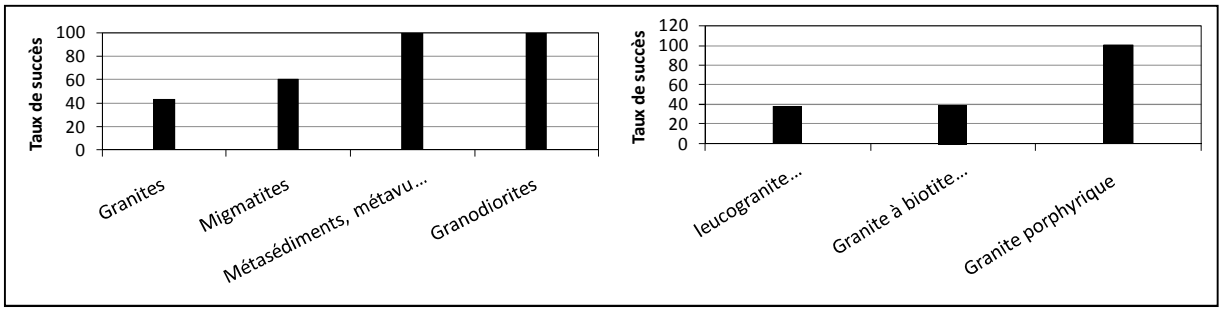


Fig. 13 Taux de succès en fonction des formations géologiques.

L'étude de l'influence de la proximité des forages avec la fracturation montre que les forages implantés au voisinage de plusieurs fractures présentent un taux de succès plus élevé (87,5%) que les autres (Fig. 14). Les forages implantés à partir des anomalies géophysiques ont prouvés l'utilité de la méthode dans la mesure où des résultats importants ont pu être obtenus. Lorsque les anomalies géophysiques mises en évidence sont d'origine tectonique, elles peuvent être potentiellement très productives (Tab. 3).

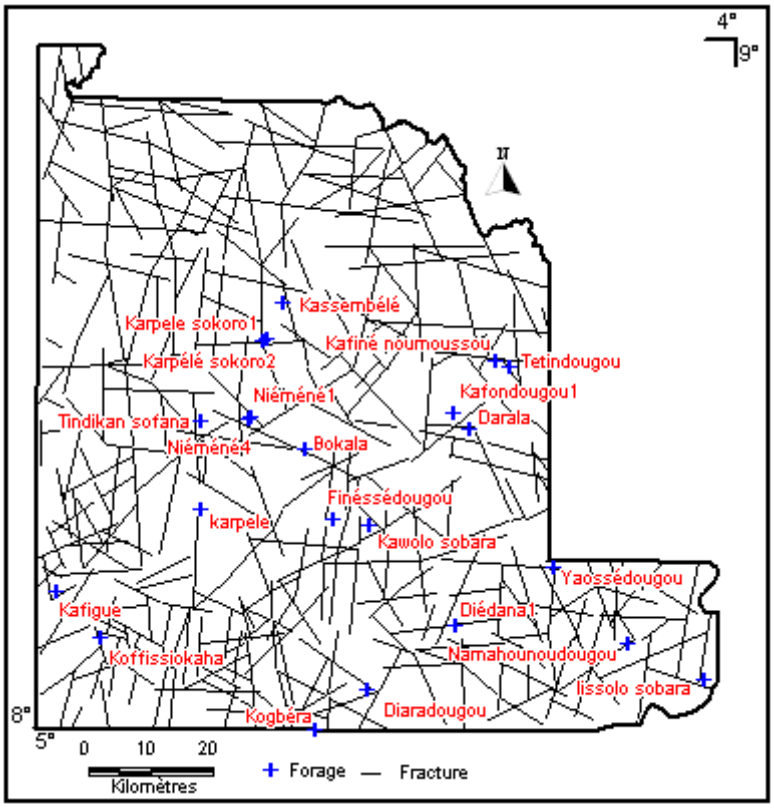


Fig. 14 Positionnement des forages sur le schéma structural

Tableau 3. Taux de succès en fonction du positionnement des forages

Type de forage	Effectif	Forages positifs	Forages négatifs	Taux de succès (%)	Débits moyens (m3/h)
Forages implantés sur une fracture	7	3	4	42,85	1,15
Forages implantés sur plusieurs fractures	8	7	1	87,5	2,67
Forages implantés hors fracture (anomalies géophysiques)	11	6	5	54,54	2,6

5 DISCUSSION

Le schéma structural du département de Dabakala est le résultat de l'interprétation de carte aéromagnétique et d'images satellitaires. Ces structures géologiques donnent un aperçu de la fracturation du milieu souterrain. Il est possible que certaines d'entre elles, identifiées dans les études antérieures [19], [29], [8]) ne soient pas identifiées ici. Cela pourrait être attribué à la compétence de l'opérateur selon [25]; [17]. L'architecture du réseau de fractures est fortement tributaire du support d'étude et de l'expérience de l'opérateur. Il peut se poser aussi le problème de l'échelle à laquelle ces linéaments sont observés; ceci entraîne souvent une mauvaise interprétation des images. Malgré ces limites, des études antérieures ont montrées l'utilité de telles cartes pour la prospection hydrogéologique [22], [24]. La méthode géomorphologie et géophysique a permis d'avoir un taux de succès moyen imputable à l'existence de fractures stériles ou colmatées. Le couplage des données de télédétection et de géophysique (traîné et sondage électrique) a permis d'améliorer le taux de succès des forages sans pour autant perdre de vue les risques d'échec car la répartition des ressources sont aléatoires dans certains contextes géologiques [21]. En plus, l'obligation d'implanter des points d'eau à proximité immédiate des villages, en marge des zones favorables, introduit parfois une incertitude que l'on est tenté de lever. Ce qui confère à la géophysique une importance primordiale. Le taux de succès cache quelque fois des disparités locales dues à certains paramètres comme la lithologie et la fracturation. La prospection par traîné et sondage électrique montre que le sous-sol étudiés est constitué de nombreuses structures assimilables à la fracturation. Toutefois les sondages électriques ne sont pas bien adaptés pour étudier certaines structures et il faut considérer les interprétations proposées dans ce cas comme des hypothèses de travail

[31]. Le profil de traîné électrique peut être trop réduit pour identifier correctement les structures et trop peu pénétrant pour les caractériser [2]. De plus, dans les conditions géologiques (matériaux d'altération argilo-sableux notamment) comme c'est le cas ici, la résistivité électrique n'est pas un indicateur univoque de la ressource en eaux souterraines. En effet, les variations de résistivité peuvent être interprétées comme des variations de la teneur en eau mais aussi de la teneur en argiles des horizons du sous-sol [17], [31]).

6 CONCLUSION

Au terme de cette étude nous retenons que le schéma structural combiné a mis en évidence de nombreuses structures orientées suivant une direction méridionale régionale NS (N170-180 et N00-10°), des structures de direction N20-30° associé à des zones de contact, des décrochements N80-90° et enfin des fractures profondes N110-130°. L'investigation géophysique a permis d'identifier des structures et à définir les caractéristiques des aquifères (épaisseurs d'altération, profondeur de l'horizon fissuré). Dans ce département, malgré les quelques échecs rencontrés, la méthodologie adoptée a permis de fournir de l'eau pour l'approvisionnement de 16 localités.

Nous comptons approfondir les études géophysiques et étendre les différentes méthodes sur l'ensemble de la zone d'étude.

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Design of A Compact, Low-Profile, Elliptical Patch UWB Antenna and Performance Analysis in Vicinity of Human Layered Tissue Model for Wireless Body Area Network (WBAN) Applications

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ABSTRACT: A compact, low-profile, coplanar waveguide fed elliptical patch UWB antenna is proposed in this paper, and then imposed on human body environment for Wireless Body Area Network (WBAN) applications. A comparison of performance of the designed antenna is done in free space and modeled layered human body tissue phantom in terms of reflection coefficient, radiation pattern and voltage standing wave ratio (VSWR). The antenna is designed in such a way that it can give good performance over free space as well as over modeled human tissue phantom without any prerequisite. The antenna provides a wide usable fractional bandwidth of more than 143% (2.39-14.43 GHz) with substrate permittivity ε_r =3.38 which is a RO4000® series high frequency circuit material. A human body model having three layers (skin, fat and muscle) is developed to investigate the characteristics and performance of the antenna and also the impact of human body layers on the designed antenna. The entire observation over modeled human tissue phantom is carried out at six different frequencies: 3 GHz, 5 GHz, 7 GHz, 9 GHz, 11 GHz and 13 GHz.

KEYWORDS: Healthcare Monitor, Wireless Body Area Networks (WBAN), Coplanar waveguide, Elliptical Patch Antenna, Ultra-Wideband (UWB), Human tissue.

1 INTRODUCTION

Over the past few years the body-worn antenna and body-centric communication systems has received much attention for applications such as healthcare monitoring, sports and fitness, gaming, lifestyle and entertainment, military health. These applications have included WBAN, a highly localized wireless network [1], [2]. Body area networks (BAN) are a natural progression from the personal area network (PAN). This network enables wearable computer devices to interact with each other and exchange digital information using the electrical conductivity of the human body as a data network [3], [4]. With the recent development of wireless communication technology, many researchers pay great attention to the study of Wireless Body Area Networks (WBAN). A number of frequency bands have been assigned for WBAN systems, such as medical implant communication system (MICS: 400 MHz) band, the Industrial Scientific Medical (ISM: 2.45 GHz and 5.8 GHz) band and the Ultra Wide band (UWB: 3.1-10.6 GHz) [1].

Ultra-Wideband (UWB) technology has emerged as an attractive solution for WBAN as it offers some benefits such as transmitting signals with an inherent noise-like behavior (due to low EIRP level), reduced probability of detection and intercept, robustness against multipath, and potentially high data rates over short distances. In February, 2002, the Federal Communications Commission (FCC) amended the part 15 rules and releases the UWB standards [7]. UWB technology defined by IEEE 802.15.6 TG- 6 [12], covers a huge Bandwidth of 7.5 GHz (from 3.1 GHz to 10.6 GHz) for communication. One of the main advantages of UWB technology is low power emission density (-41.3 dBm/MHz). UWB technology possesses a feature of variable data rate from few Kbps to Mbps. This features opened a new possibilities for potential application of UWB technology for WBAN, thus, ensuring low interference with other neighboring wireless devices [7].

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Designing a body-worn antenna for body-centric communications would have to face several issues and challenges. The antenna needs to fulfill numerous desirable requirements, like small size, high radiation efficiency, occupy entire UWB frequency spectrum, better on-body propagation, and optimized characteristics in time and frequency domain [6]. The human body is complex structure comprised of several layers like skin, fat, muscle etc. These body layers have different dielectric constant, conductivity and thickness and acts as a non-uniform medium for RF wave propagation. Therefore depending upon the frequency of operation and most importantly presence of human body, which leads to high losses such as power absorption, destruction in antenna radiation pattern, shift in resonance frequency, reduced efficiency, and variations in feed- point impedance. One of the important challenges in antenna design is to occupy the entire UWB frequency spectrum (from 3.1 GHz to10.6 GHz) with better radiation efficiency, which is successfully met by the work of this paper.

In this paper, a novel, compact, low-profile, coplanar waveguide fed elliptical patch UWB antenna is designed which is flat and its planar structure allows it to be comfortably worn. And then, antenna's performance is examined in free space and in indirect contact to layered human body phantom. This phenomenon is achieved by creating three significant layers of human body which includes skin, fat and muscle. Originality of this work is, all the time the antenna occupies UWB frequency spectrum for planar structure irrespective of off or on body environment. All human phantom calculations and other specifications are done using same manner as in [8]. This paper also compares the performance and characteristics of the designed antenna at free space and on body area. Performance analysis over human phantom is carried out at six different frequencies: 3 GHz, 5 GHz, 7 GHz, 9 GHz, 11 GHz and 13 GHz. The structures are designed and analyzed using CST Microwave Studio software package.

2 SUBSTRATE MATERIAL SELECTION

The permittivity of a material is usually given relative to that of free space which is known as relative permittivity or dielectric constant; ε_r. Dielectric constant of the antenna substrate has a significant role in the antenna designing. Different substrates having different dielectric constants affect the antenna performance in various ways. The substrate selected for the designed elliptical patch UWB antenna is RO4000® series high frequency circuit material of Rogers Corporation with ε_r = 3.38. Selection of substrate material for designing the antenna is unique for this paper. Properties of substrate material include high tensile strength, high resistance to stretching, rigid, non flammable, durability, low temperature coefficient, outstanding electrical property [9]. The patch and ground planes are made of copper threads which are perfect electrical conductors (PEC).

3 ANTENNA DESIGN AND IMPLEMENTATION

The designed elliptical patch UWB antenna operates from the frequency of 2.39 GHz to 14.43 GHz. The disc of the antenna is fed by a 50 ohm Microstrip feed line with a width of 4.21 mm. A conductive ground plane with a length of 21 mm is placed on the same side of the disc and the feed on the substrate. The feed gap between the metal strip and the ground plane is 0.695 mm and the gap between the disc and the ground plane is set to 1 mm. The radiating patch and ground plane are made of copper tape with the thickness of 0.7 mm. However, the major and minor radius of the elliptical shape radiating patch are 15 mm and 10 mm respectively, substrate dimension is 35 x 45 x 2 mm3 and the each ground plane dimension is 14.7 x 21 x 0.7 mm3. In addition, there is a elliptical shape slot on the upper hemisphere of radiating patch, the major and minor radius of the elliptical slot are 5 mm and 3 mm respectively. Overall thickness of the antenna is 2.7 mm. Hence, the total dimension of the antenna is quite small. Commercial electromagnetic simulation package CST Microwave Studio was used for design & simulation purposes.

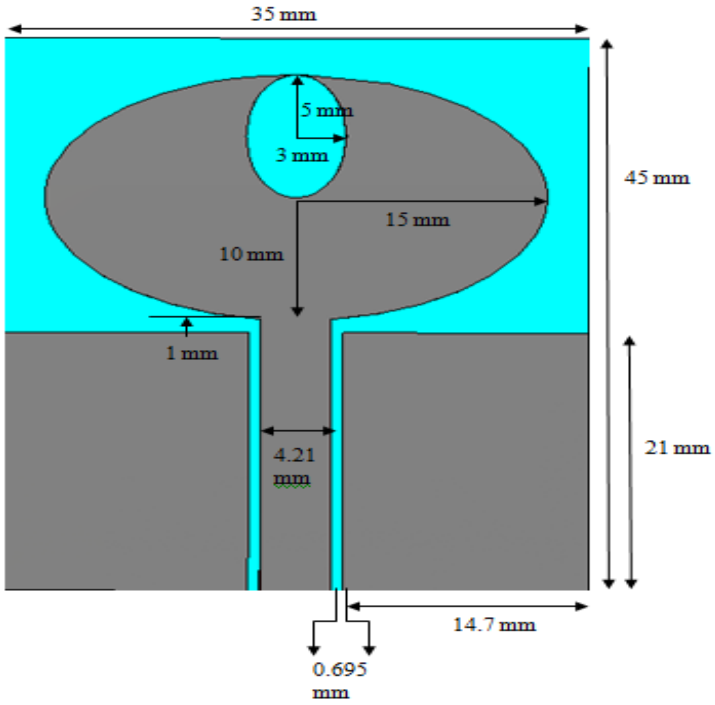


Fig. 1. Top view of designed Elliptical Patch UWB Antenna

Table 1. Measurements of Elliptical Patch UWB Antenna

Parameters	Dimensions (mm)	Material
Substrate:		
Length	45	RO4000® series circuit material
Width	35	(ε_r = 3.38 and tan δ= 0.0025)
Thickness	2	
Elliptical Patch:		
Major Radius	15	Copper
Minor Radius	10	
Thickness	0.7	
Ground Plane (each):		
Length	21	Copper
Width	14.7	
Thickness	0.7	
Elliptical Slot:		
Major Radius	5	-
Minor Radius	3	
Thickness	0.7	
Feed Line:		
Length	22	Copper
Width	4.21	
Thickness	0.7	

4 LAYERED HUMAN TISSUE MODELLING AND ANTENNA IMPLEMENTATION

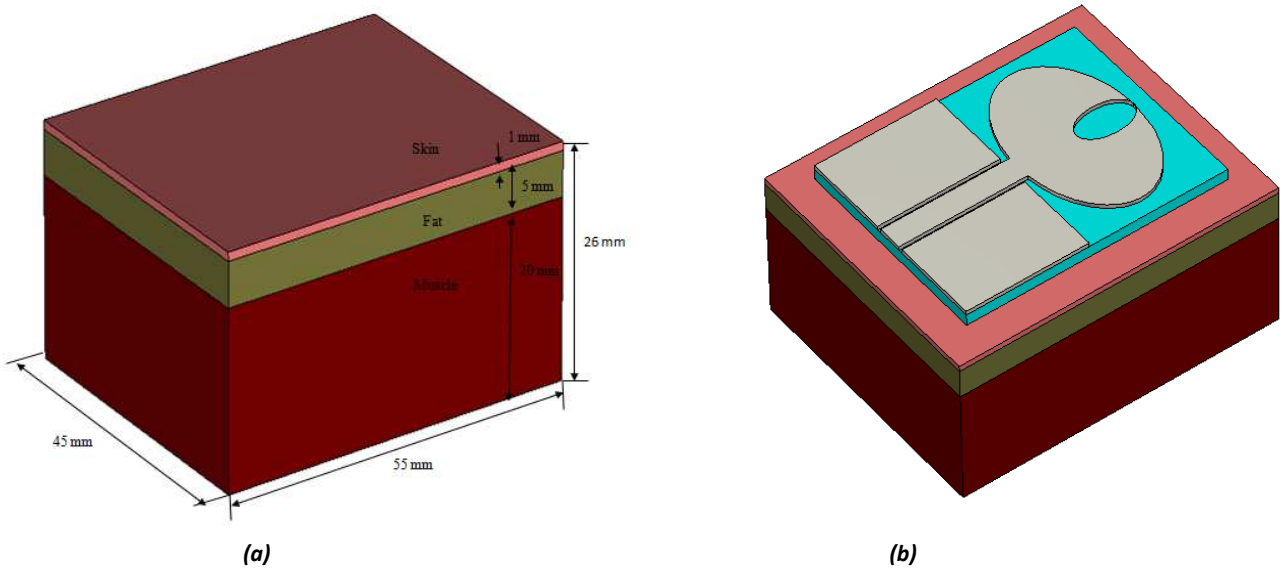


Fig. 2. (a) Layered Human Phantom and (b) UWB Antenna Implemented on Human Phantom

The dimension of modeled layered human body tissue is 45 mm x 55 mm x 26 mm. It comprised of three different tissues namely skin (dry), fat and muscle. This layered model can quite well represent most of the body regions, since the fat has similar properties to the bone tissue, and the electrical parameters of the muscle and many inner organs are alike [8]. Fig. 2(a) presents the modeled layered human phantom and 2(b) presents the implemented UWB antenna on Human Phantom. There is a gap of 0.7 mm between the designed UWB antenna and human phantom. Commercial electromagnetic simulation package CST Microwave Studio was used for design & simulation purposes. Table 2 shows the electrical dispersion of layered human body tissue model for UWB frequencies which is obtained by [11].

Table 2. Layered Human Phantom Material Properties

Tissue name	Frequency [GHz]	Conductivity [S/m]	Relative permittivity, εr	Loss tangent, tan δ
Skin (Dry)	3	1.7406	37.45	0.27848
	5	3.0608	35.774	0.3076
	7	4.8175	34.084	0.36296
	9	6.8949	32.25	0.42701
	11	9.1658	30.310	0.49412
	13	11.514	28.342	0.56176
Fat	3	0.13004	5.2239	0.14916
	5	0.24222	5.0291	0.17315
	7	0.37353	4.8476	0.19787
	9	0.5138	4.6804	0.21926
	11	0.65669	4.5278	0.23701
	13	0.79829	4.3896	0.25146
Muscle	3	2.1421	52.058	0.24655
	5	4.0448	49.54	0.29353
	7	6.4607	46.865	0.35401
	9	9.1923	44.126	0.41607
	11	12.083	41.419	0.47672
	13	15.016	38.814	0.53495

5 SIMULATION RESULTS

The performance of modeled UWB antenna was measured over free space and over modeled layered human phantom.

5.1 PERFORMANCE ANALYSIS OF ELLIPTICAL PATCH UWB ANTENNA OVER FREE SPACE

5.1.1 REFLECTION COEFFICIENT (S_{11})

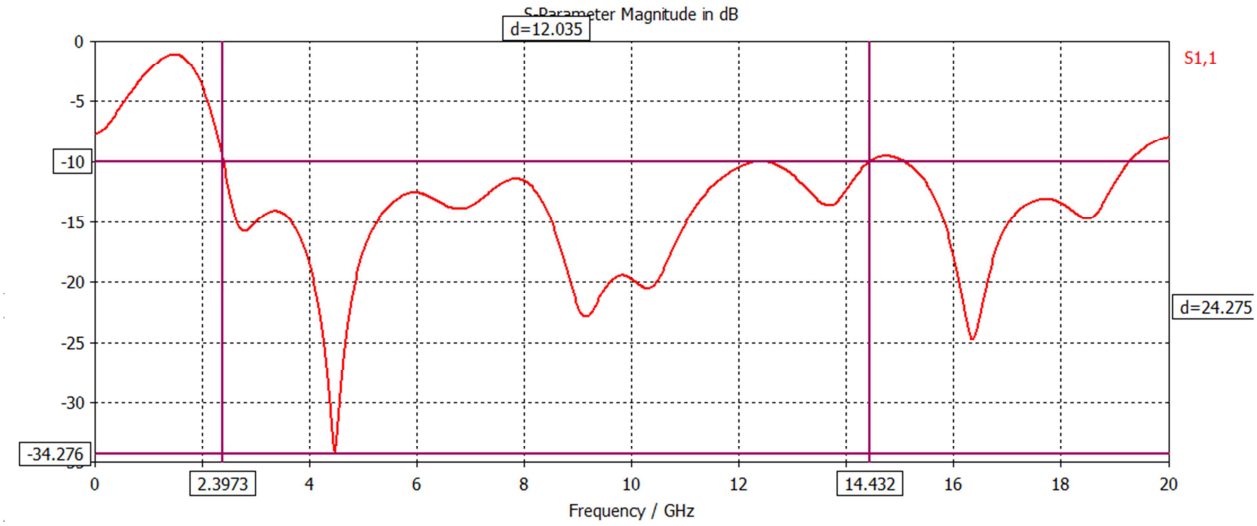


Fig. 3. Simulated S_{11} of proposed UWB antenna over free space

The S-parameter plot of the elliptical patch UWB antenna in Fig. 3 shows that a wide bandwidth of almost 12 GHz starting from 2.39 GHz to 14.43 GHz has been achieved for S_{11}< -10 dB with 3 significant resonances. It has got a good impedance matching with all over its occupied bandwidth.

5.1.2 RADIATION PATTERN

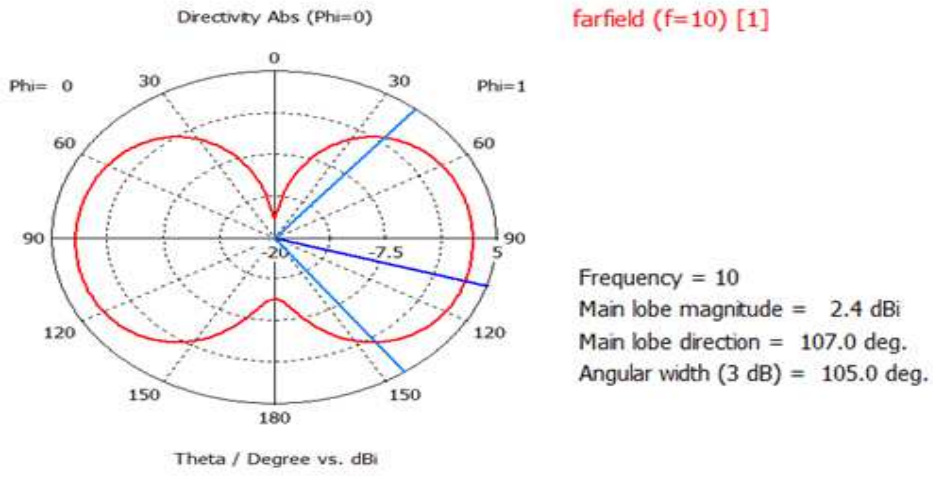


Fig. 4. Radiation Pattern of E- Plane of proposed UWB antenna over free space

For attaining the E- plane radiation pattern as shown in Fig. 4, phi (ϕ) has been set to 0 for all values of theta (θ). The power is radiated mostly in the left and right hemisphere; the power is directed towards 107 degree with main lobe magnitude of 2.4 dBi. 3 dB angular beamwidth (i.e., HPBW) is 105 deg. Omni directional radiation pattern is observed.

5.1.3 3D Radiation Pattern, Directivity, Gain and Efficiency

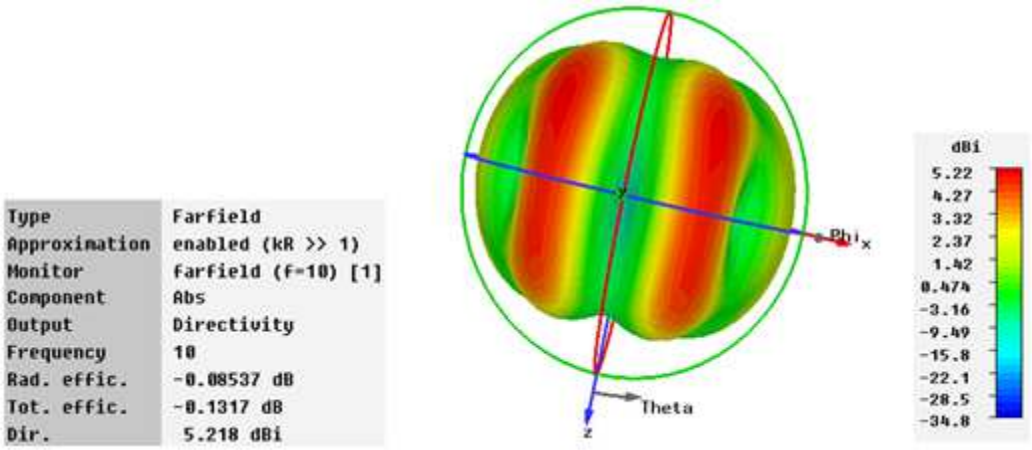


Fig. 5. 3D Radiation pattern of proposed UWB antenna over free space

The simulated result of Omni directional radiation pattern over free space is shown in 3D in Fig. 5. The result shows the directivity of 5.218 dBi of the proposed UWB antenna over free space. Gain and total efficiency of the antenna are measured 5.132 dB and 0.9701 respectively. Total efficiency is calculated in linear scale.

Table 3. Radiation characteristics of proposed UWB Antenna

Parameters	Simulation Results
Directivity (dBi)	5.218
Gain (dB)	5.132
Total Efficiency	0.9701

5.1.4 Voltage Standing Wave Ratio (VSWR)

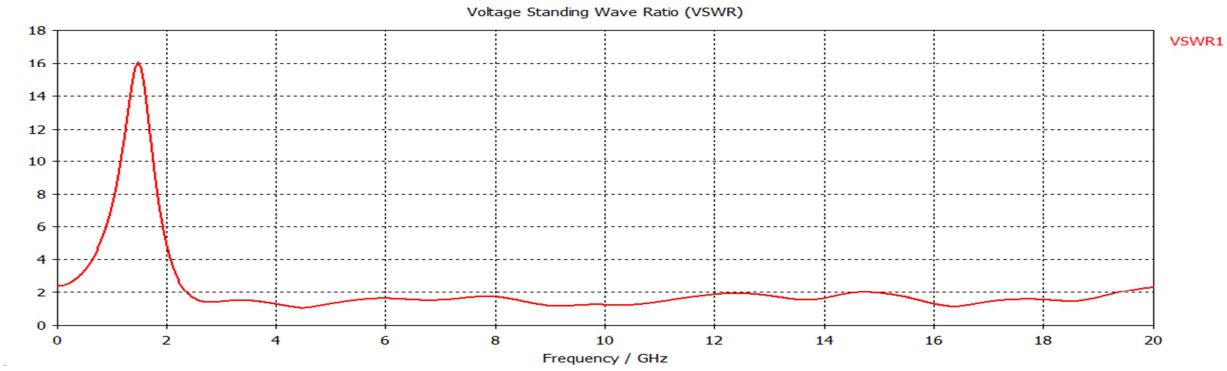


Fig. 6. Simulated VSWR of proposed UWB antenna over free space

The simulated VSWR curve of proposed UWB antenna is shown in Fig. 6. VSWR below 2 is considered well for an antenna [1]. For this designed antenna, VSWR is less than 2 from 2.39-14.43 GHz over free space, which shows a good impedance matching between antenna and transmission line. Thus a very less number of incident waves reflect back to the source.

5.2 PERFORMANCE ANALYSIS OF ELLIPTICAL PATCH UWB ANTENNA OVER MODELED LAYERED HUMAN PHANTOM

5.2.1 REFLECTION COEFFICIENT (S_{11})

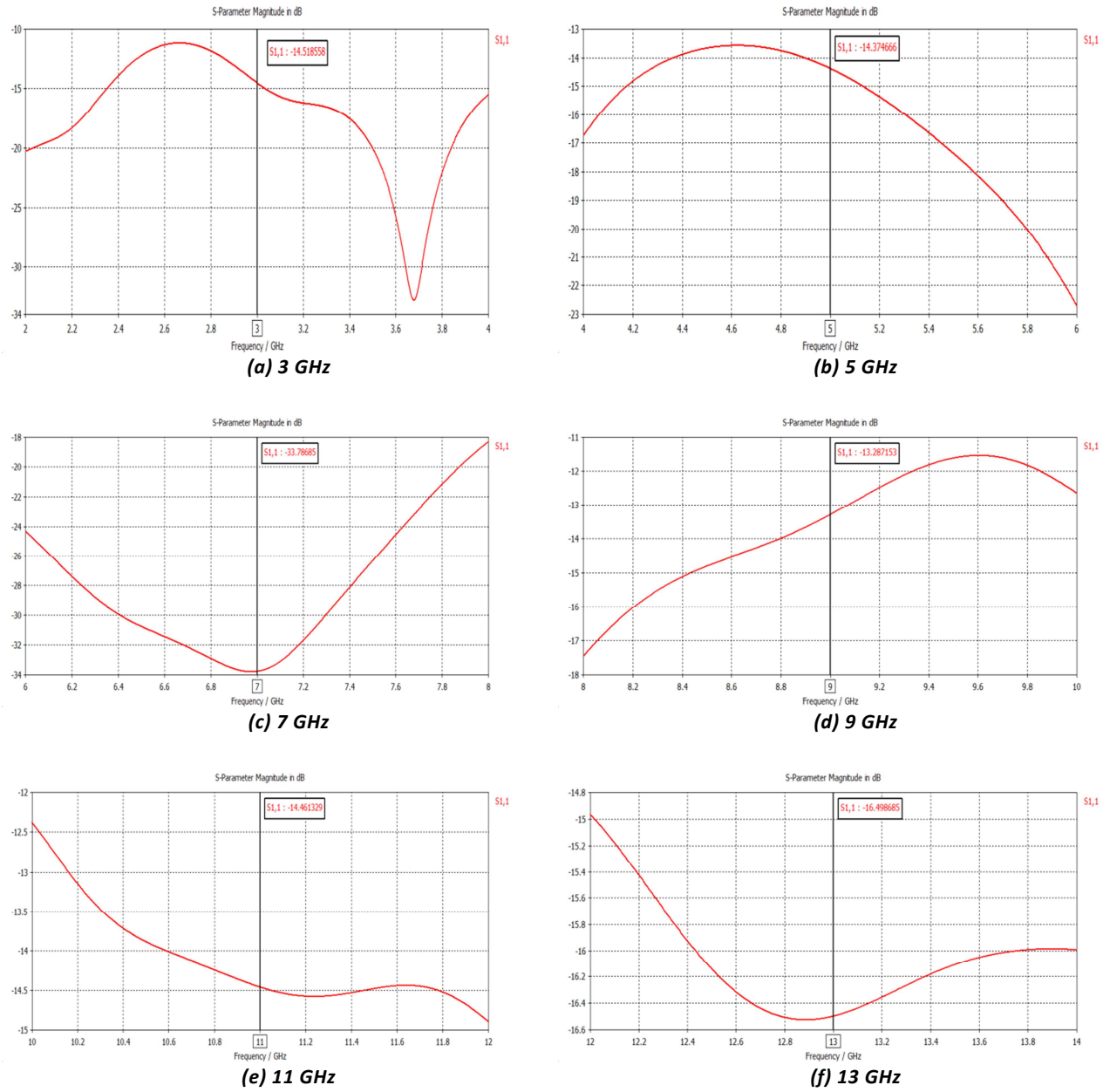


Fig. 7. Simulated S_{11} of proposed UWB antenna over modeled layered human phantom at (a) 3 GHz, (b) 5 GHz, (c) 7 GHz, (d) 9 GHz, (e) 11 GHz and (f) 13 GHz

Fig. 7 illustrates the simulation result of S_{11} of proposed antenna over modeled human phantom at different frequencies. Table 4 summarizes the simulation result of S_{11} at different frequencies. Table 4 shows that all the S-parameters maintain S11< -10 dB, which means antenna has got a good impedance matching with all over its occupied bandwidth.

Table 4. S Parameter of proposed Antenna on Human Phantom at different frequencies

Parameters	Simulation Results					
Frequency (GHz)	3	5	7	9	11	13
S Parameter (dB)	-14.51855	-14.3747	-33.7868	-13.2871	-14.4613	-16.4986

5.2.2 RADIATION PATTERN

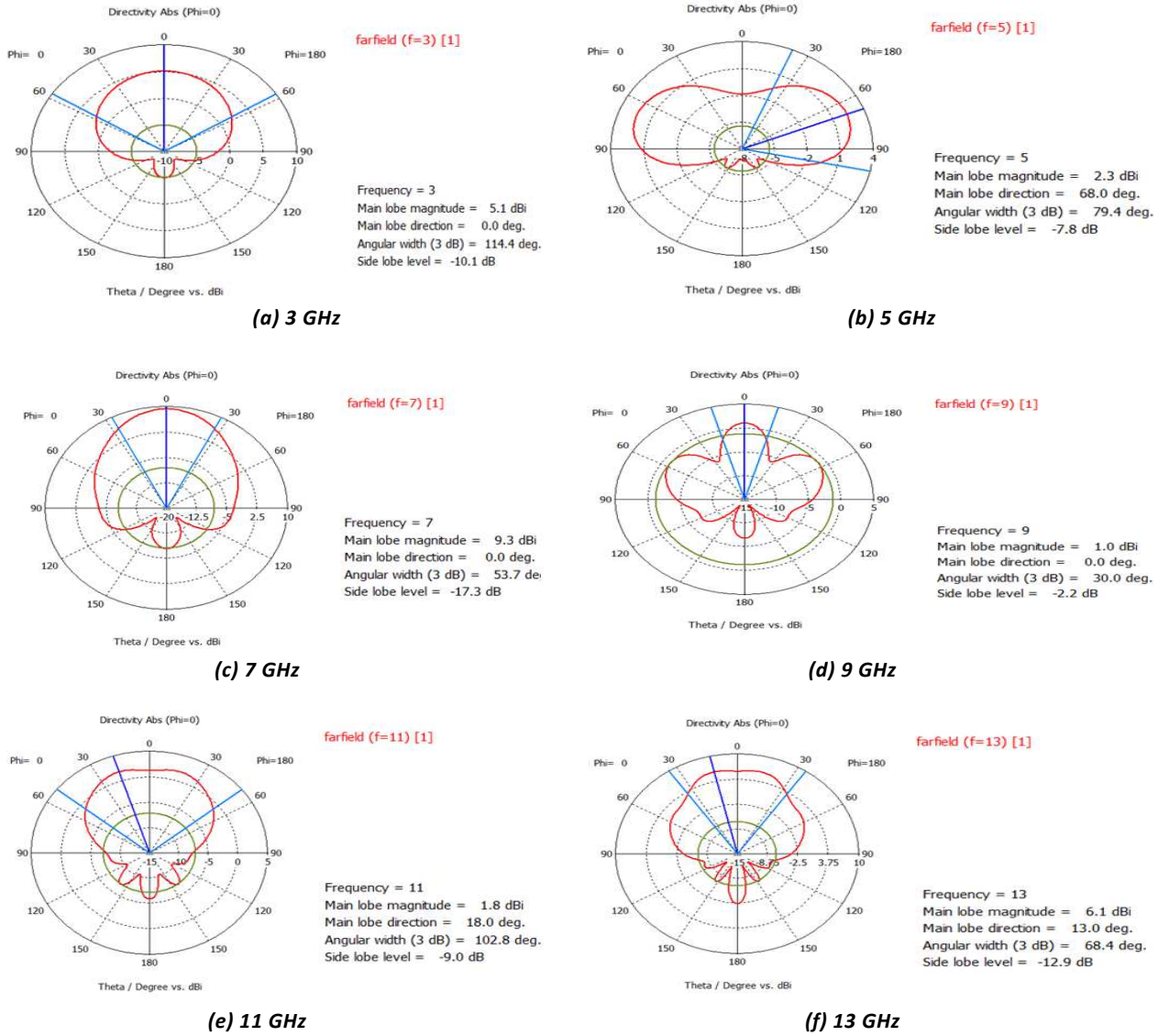


Fig. 8. Radiation pattern of E- plane of proposed UWB antenna over modeled layered human phantom at (a) 3 GHz, (b) 5 GHz, (c) 7 GHz, (d) 9 GHz, (e) 11 GHz and (f) 13 GHz

E- plane radiation patterns of the antenna over human phantom at different frequencies are shown in Fig. 8. Fig. 8 shows that most of the power is radiated in the upper hemisphere at all the observed frequencies. Directional radiation patterns are observed except at 5 GHz. Other parameters are summarized in Table 5.

Table 5. Radiation pattern of proposed Antenna on Human Phantom at different frequencies

Parameters	Simulation Results					
Frequency (GHz)	3	5	7	9	11	13
Main Lobe Magnitude (dBi)	5.1	2.3	9.3	1.0	1.8	6.1
Main Lobe Direction (deg.)	0.0	68.0	0.0	0.0	18.0	13.0
HPBW (deg.)	114.4	79.4	53.7	30.0	102.8	68.4

5.2.3 3D Radiation Pattern, Directivity, Gain and Efficiency

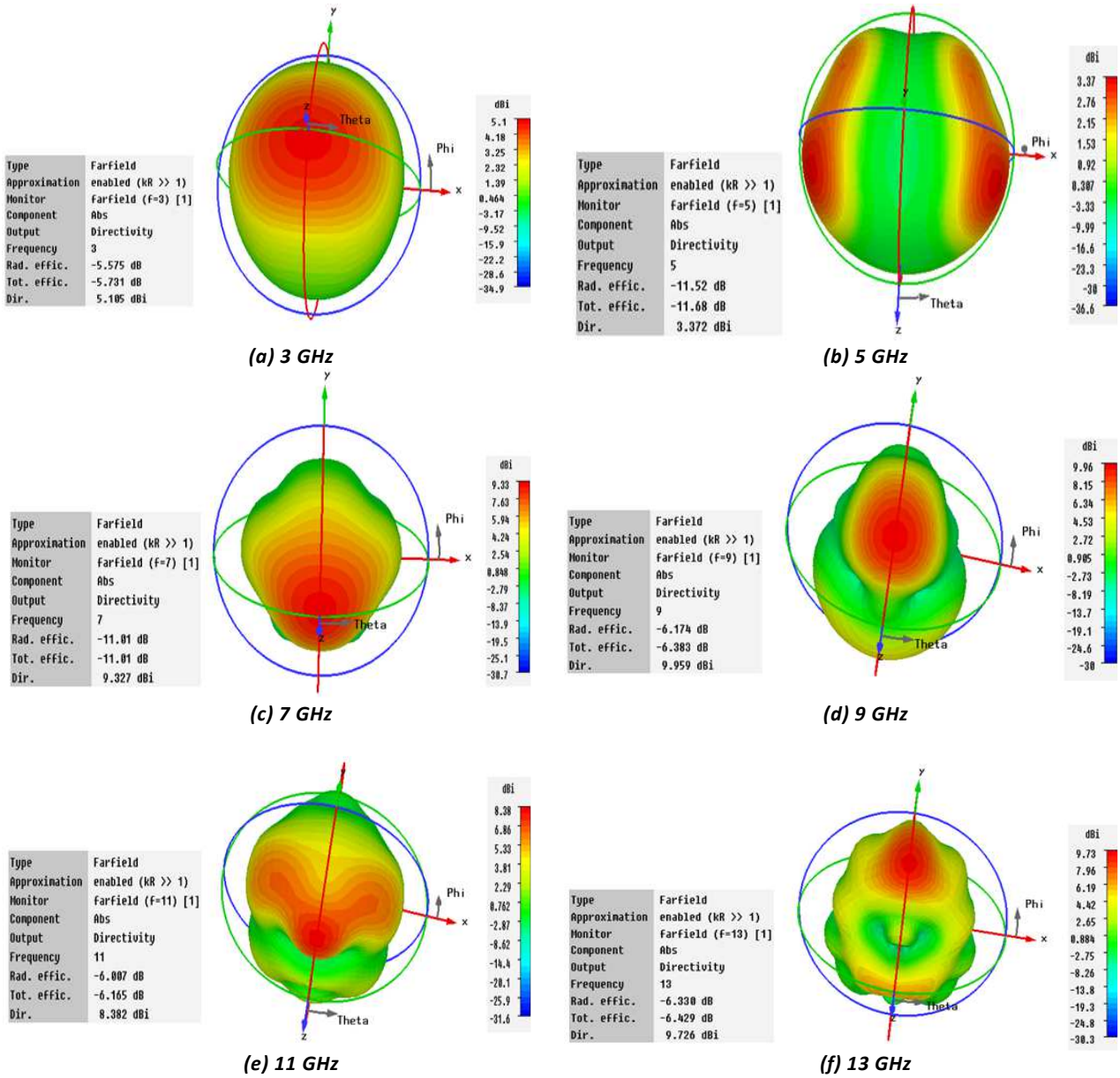


Fig. 9. 3D Radiation pattern of proposed UWB antenna over modeled layered human phantom at (a) 3 GHz, (b) 5 GHz, (c) 7 GHz, (d) 9 GHz, (e) 11 GHz and (f) 13 GHz

The simulated results of 3D radiation pattern of the antenna over human phantom at different frequencies are shown in Fig. 9. The results show the directivity at 3 GHz, 5 GHz, 7 GHz, 9 GHz, 11 GHz and 13 GHz are 5.105 dBi, 3.372 dBi, 9.327 dBi,

9.959 dBi, 8.382 dBi and 9.726 dBi respectively. Gain and total efficiency also have satisfactory results. Results show that the proposed antenna behaves as a directive antenna over the observed frequencies except 5 GHz. And directive antennas are desirable in WBAN as well as in UWB wireless communications. Since, the high value of directivity at a specific angle will lead to minimize power consumption and energy absorption within the body and most importantly minimize the path loss [6].

5.2.4 VOLTAGE STANDING WAVE RATIO (VSWR)

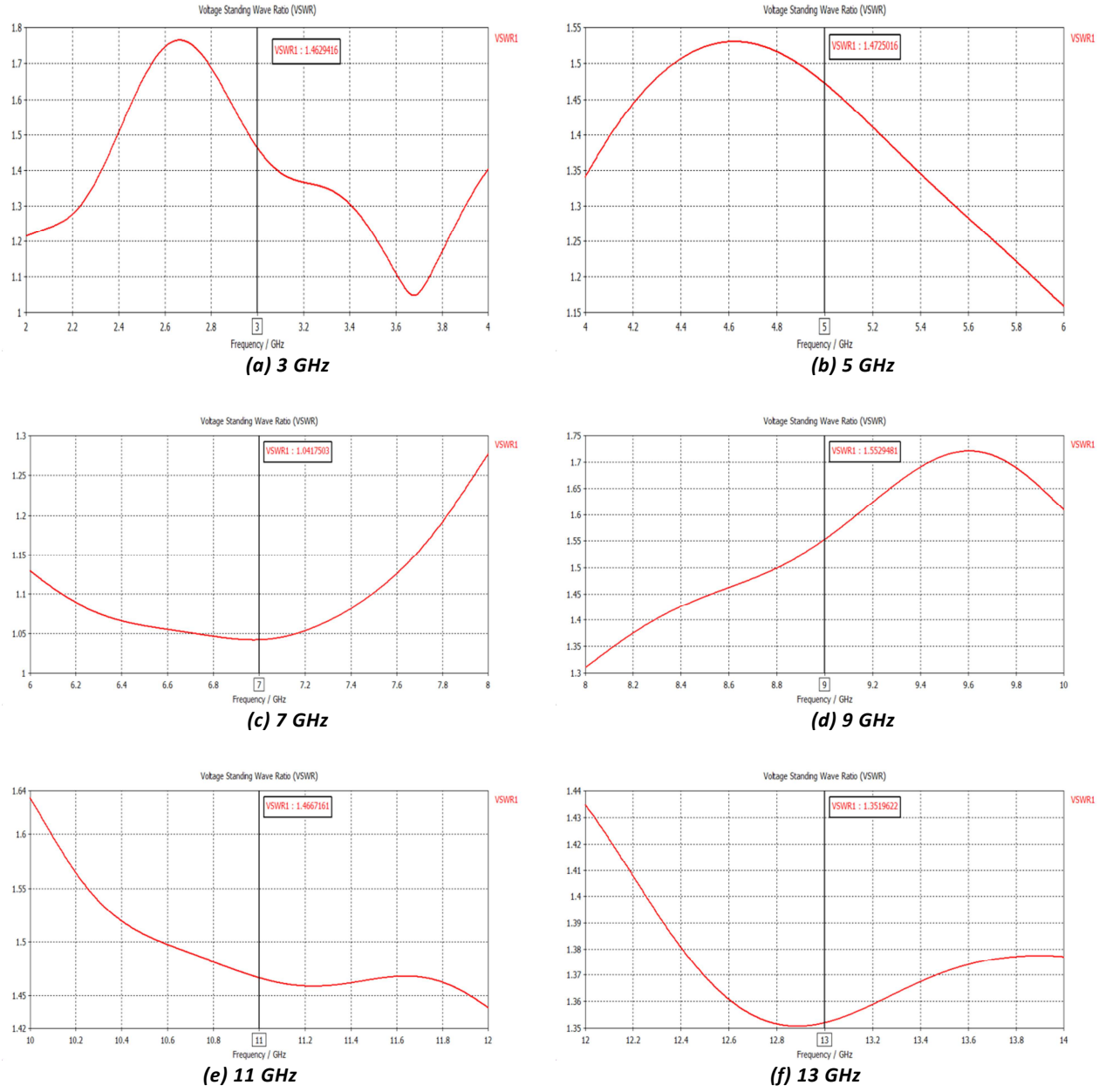


Fig. 10. Simulated VSWR of proposed UWB antenna over modeled layered human phantom at (a) 3 GHz, (b) 5 GHz, (c) 7 GHz, (d) 9 GHz, (e) 11 GHz and (f) 13 GHz

The simulated VSWR curves of proposed UWB antenna over human phantom at different frequencies are shown in Fig. 10. VSWR below 2 is considered well for an antenna [1]. For this designed antenna, VSWR is less than 2 at all the observed frequencies shown in Table 6, which shows a good impedance matching between antenna and transmission line. Thus a very less number of incident waves reflect back to the source.

Table 6. VSWR of proposed Antenna on Human Phantom at different frequencies

Parameters	Simulation Results					
Frequency (GHz)	3	5	7	9	11	13
VSWR	1.462941	1.47250	1.0417503	1.552948	1.4667161	1.3519622

6 COMPARISON OF ANTENNA PERFORMANCE OVER FREE SPACE AND LAYERED HUMAN PHANTOM

The simulated free space antenna parameters are compared here with those at the layered human phantom. To be more specific, the reflection coefficient, radiation pattern, directivity and voltage standing wave ratio for proposed antenna are analyzed to investigate how the performance of the antenna is affected at the body area in comparison to free space. Table 7 illustrates the comparison of antenna performance over free space and layered human phantom.

Table 7. Performance of Antenna over Free Space and Layered Human Phantom

Parameters	Free Space	Layered Human Phantom at Different Frequencies (GHz)					
		3	**5**	**7**	**9**	**11**	**13**
S- Parameter (dB)	-19.741	-14.518	-14.3747	-33.7868	-13.2871	-14.4613	-16.4986
Main Lobe Magnitude (dBi)	2.4	5.1	2.3	9.3	1.0	1.8	6.1
Main Lobe Direction (deg.)	107.0	0.0	68.0	0.0	0.0	18.0	13.0
HPBW (deg.)	105.0	114.4	79.4	53.7	30.0	102.8	68.4
Directivity (dBi)	5.218	5.105	3.372	9.327	9.959	8.382	9.726
VSWR	1.22971	1.46294	1.47250	1.04175	1.55294	1.46671	1.35196

Thorough analysis of the above results indicates that in both free space and layered human phantom antenna performance is satisfactory for WBAN as well as UWB wireless communications. Simulation results show that antenna performance is very good in free space. And in layered human phantom at 7 GHz, all the parameters show a very satisfactory result as a whole. At 7 GHz, VSWR is almost 1; which means there is no reflection of incident wave back to the source. It is also seen from the results that, at higher frequencies proposed antenna becomes more directive which is desirable for WBAN.

7 CONCLUSION

In this endeavor, designing a compact, low- profile, elliptical patch UWB antenna is proposed which has a wide usable fractional bandwidth of more than 143% (2.39-14.43 GHz). The aim of this paper is to observe the performance and characteristics of the proposed antenna in free space and in the indirect contact of layered human body environment for Wireless Body Area Network (WBAN) applications. Three layered (Skin, Fat and Muscle) human phantom is developed to investigate the characteristics and performance of the antenna and also the impact of human body layers on the designed antenna. The designed antenna gives good performance over free space as well as over modeled human tissue phantom throughout the occupied bandwidth. The key finding of this paper lies in the fact that at higher frequencies the radiation pattern of the proposed antenna becomes more directive at layered human phantom than free space which is desirable for WBAN. Reducing the size with increased bandwidth could be the focus towards the further step of this design.

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Morphometric Characterization and Molecular Identification of Different Cattle in Some Selected Regions of Bangladesh

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ABSTRACT: In order to determine the morphometric characterization and molecular identification of cattle in Bangladesh, three districts, i.e., Pabna, Bogra and Jhenidah were selected. In each district, 15 outstanding different crossbred and local dairy female cattle's (cows) blood samples (total 45) and raw data were collected to carry out the study of molecular and morphometric characters respectively. These characters were observed to identify the genetic resources of cattle in the selected regions such as eye color, coat color, horn pattern, age, breed types, conception rate, litter size, milk production, lactation length, heat period and gestation period. The quantity of DNA were found to 198.30±102.40 µg/ml, 193.70±86.34 µg/ml and 196.88± 91.54 µg/ml in Pabna cattle , Jhenidah cattle and Bogra cattle respectively. The purity of DNA was also analyzed and observed 1.80 ± 0.25, 1.84 ±0.15 and 1.64 ±0.22 (OD) in Pabna cattle, Bogra cattle and Jhenidah cattle accordingly. For RAPD experiment, nine primers were randomly tested to evaluate their suitability for amplification of the DNA sequences among these two were matched and found polymorphic, BMC-1222(CCTGAGTGTTCCTCCTGAGT) and OPB-07(GGTGACGCAG). By studying the different molecular and morphometric data it was found that the Pabna cattle possess better genetic resource rather than two other districts like Bogra and Jhenidah. The RAPD profile of PCR amplification in this study can be a useful tool for detecting molecular diversity and genetic variation. Thus, these data give an accession or set of accessions and also helpful for germplasm conservation and improvement program of cattle in our country.

KEYWORDS: Cattle, crossbred, morphometric, livestock, marker.

1 INTRODUCTION

The livestock sector in Bangladesh is one of the major components of agricultural output (crops, livestock, fisheries and forestry) which plays a significant role in national economy, gross domestic product (GDP) and foreign exchange earnings [1]. Bangladesh possesses about 24.5 million cattle, which is about 1.79% of the world and 5.47% of Asian cattle population [2]. The total ruminant livestock population of Bangladesh is composed of 24.0 million cattle among them 34.4 million goats, 0.83 million buffalos and 1.14 million sheep [3].The local as well as improved varieties of cattle breeds are also available in Bangladesh. The classification of the indigenous cattle varieties is primarily based on some morphological and physiological attributes such as body size, horn shape and size, coat color and hump size and their geographical distribution. But there is a little documentation of these varieties on behalf of its diverse resources. However, the usefulness of phenotypic traits to study the genetic variation between populations is very limited [4]. Cattle genetic resources are one of the main tools for cattle variety development. The qualitative and quantitative improvement of these cattle mainly relies on the available gene pool and its manipulation. A number of DNA based marker system are now available for genetic evaluation, classification, characterization and data documentation. Molecular markers based on DNA sequence are more reliable in this regard such as RAPD, RFLP, and AFLP etc. The RAPD marker, generated by the polymerase chain reaction (PCR) is widely used since 1990's to assess intra-specific genetic variation at nuclear level [5], [6]. Therefore, molecular markers can aid estimating the genetic variability of species, breeds and populations, as well as decision related to selection of breeds/ populations to be conserved

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[7]. In the absence of proper genetic identification, the risk of loss of surviving genetic diversity is high. Unlike morphological traits, molecular markers which are assumed to be neutral to the selection forces are appropriate in the study of genetic relationship between breeds [8]. Classification using molecular markers provides a large unbiased basis for the estimates of average breed similarities and differences. Thus, the techniques for the analysis of the genetic variability are an essential ingredient for the programs of rational conservation and improvement, since they must be based on the combination of the phenotypic and genetic data [9]. Therefore, the current research work has been undertaken to determine the morphometric traits, molecular identification & variation and the genetic status of cattle in the selected regions of Bangladesh that would be helpful for their future improvement and conservation program.

2 MATERIAL AND METHODS

The research was conducted in the Biotechnology Laboratory under Animal Production & Research Division of Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka, Bangladesh. This experiment has two parts: A) Morphometric Study & B) Molecular study.

2.1 LOCATION OF THE STUDY AREA

Three regions namely Pabna, Bogra and Jhenidah were selected for morphometric and molecular studies. A total number of 45 outstanding different crossbred and local dairy female cattle blood samples were collected in order to carry out the experiment, beside this phenotypic traits of those cattle also noted. Out of the 45 cattle blood samples 15 from Pabna, 15 from Bogra and 15 from Jhenidah were considered.

2.2 COLLECTION OF DATA (MORPHOMETRIC STUDY)

The information's of productive and reproductive performances of each cow was collected by face to face interviewing the farmers by frequent visit and examination of the cow. For evaluation, following traits of cattle were considered: eye color, coat color, horn pattern, age, breed types, conception rate, heat period, litter size, milk production, lactation length and gestation period. The conception rates (CR) are calculated by dividing the number of cows confirmed pregnant (PR) from those breeding by the total number of cows inseminated [10].

2.3 COLLECTION OF BLOOD SAMPLES (MOLECULAR STUDY)

A total of 45 blood samples were collected from three different selected regions. At least 10ml of fresh blood sample was collected from each of the animal aseptically by puncturing jugular vein in EDTA containing Vacutainer and kept on ice. Subsequently the blood samples were transported to the laboratory and stored at –20°C until the study start.

DNA was isolated with small modification of the protocol of Roe et al. 1996 [11]. Briefly, 500ul blood samples were added with Standard Saline Citrate (SSC) Buffer (400 µl, 800 µl and 1000 µl) and centrifuged (13,000 rpm for 5 minutes) three times and supernatant was discarded every time. After that added 375µl of 0.2 M Sodium acetate solution and vortex thoroughly. Then 25µl of 10% SDS and 5µl Proteinase-K were mixed and incubated at 55°C for 1 hour. Then 20µl PCIA solution was added and mixed and centrifuged at 13,000 rpm for 5 minutes. After removing aqueous layer to new micro centrifuge tube, 1000µl of 100% ethanol was mixed and then centrifuged at 13,000 rpm for 4 minutes and supernatant was discarded. Then 180µl of TE buffer (10:1) was mixed and incubated at 55°C for 10 minutes. After mixing 20µl of 2 M sodium acetate and centrifuged at 13,000 rpm for 4 minutes, the supernatant was discarded. Then 1000µl of 70% ethanol was added and centrifuged again at 13,000 rpm for 4 minutes. After discarding the supernatant the pellets were dried in DNA concentrator by 15 minutes and then 150µl TE buffer (10:1) was added. After proper mixing with TE buffer samples were incubated overnight at 55°C. At the end of incubation, samples were vortex properly and Store at -20^{0}C for further study.

The isolated DNA sample was evaluated both qualitatively and quantitatively. Confirmation of isolated DNA can be done by comparing sample DNA with the standard DNA on 1% agarose gel electrophoresis staining with ethidium bromide or by estimating the absorbance of DNA by spectrophotometer at 260 nm. Both the methods were carried out in this study. Quantification by UV-spectrophotometer, 2ml of deionized sterile water and 2µl of extracted DNA samples were taken in a cuvette and mixed properly. Then cuvette was settled at spectrophotometer and observations were taken at 260nm and 280nm absorption angle. Double stranded DNA is calculated by using the following formula [12]:

$$\text{Concentration of DNA} = \text{Absorbance} \times \frac{\text{Volume of distilled water (µl)}}{\text{Amount of DNA (µl)}} \times \text{Conversion factor (0.05)} \times 1000$$

2.4 PRIMER SELECTION

Nine primers were randomly tested to evaluate their suitability for amplification of the DNA sequences; of them two were matched and found polymorphic primers were evaluated based on intensity of bands, consistency within individual, presence of smearing, and potential for population discrimination.

Table 1. Randomly matched primer

Primer Code	Primer sequence 5′-3′	GC content %
B MC- 1222	CCTGAGTGTTCCTCCTGT	55
OPB - 07	GGTGACGCAG	70

2.5 PCR AMPLIFICATION BY RAPD MARKERS

The amplification conditions were based on Williams et al. (1990) [6], with some modifications. PCR reactions were performed on each DNA sample in a 25µl reaction mix containing 2.5µl of 10X Ampli PCR buffer, 1µl of 100 µm primer, 4.0µl of 2.5mM dNTPs, 5 unit (0.2µl) of Ampli Taq DNA polymerase , 1.25µl of 50mM Mgcl2 and 4µl template DNA and suitable amount of sterile de-ionized water. PCR thermo cycler conditions were: 3 minutes preheated at 94°C, followed by 30 cycles of 1minute denaturation at 94°C, 1 minute annealing at 38°C and elongation or extension of the primer at 72°C for 2 minutes. After the last cycle, a final step of 10 minutes incubation at 72°C was done. After completion of cycling program, reactions were held at 4°C.

2.6 AGAROSE GEL ELECTROPHORESIS

PCR products from each sample were separated by running 2% agarose gel containing 12µl ethidium bromide in 1X TAE buffer at 80V, 300mA and 300W for 2 hrs. 1x Gel loading dye (3µl) was added to the PCR products and loaded in the wells. A molecular weight markers DNA (100 bp ladder DNA) were also loaded on either side of the gel. DNA bands were observer under UV light on a UV trans-illuminator and photographed by a camera.

2.7 DATA OF RAPD

RAPD were scored according to the presence or absence of polymorphic DNA fragments. The scores obtained using the primers in the RAPD analysis were then combined to create a single data matrix. The proper data were then taken for analyzing the similarity & variation determination.

2.8 STATISTICAL ANALYSIS

Results were expressed as mean ± SD (Standard deviation of mean). ANOVA single factor was followed by Duncan's multiple ranges for multiple comparison tests. The statistical program used was Microsoft Office Excel 2007 and its add-in DSAASTAT (Andera Onofri, Dipartimento di scienze Agrarie Ambientali, Borgo xx Giugno, 7406121 Perugia, Italy). $P< 0.05$ was considered statistically significant.

3 RESULTS

Morrphometric traits of 45 female cattle (15 from Pabna, 15 from Jhenidah and 15 from Bogra) were studied basically on body appearance, breed types, coat color, eye color, horn pattern and hump content. It was observed that all the selected cattle in Bogra and Pabna districts were found crossbred. On the other hand, in the Jhenidah district half of selected cattle were belongs to crossbred and the rest half were local type (Figure 1). Breed types varies on geographic area, different environmental factors and available source of natural feed.



Pabna crossbred *Bogra crossbred* *Jhenidah local*

Fig. 1. Different types of cattle: Crossbred cattle of Pabna & Bogra and Local cattle of Jhenidah

Table 2. Analysis of some morphometric characteristics

Region	Coat color variation of cattle					Breed types	
	Black	Red	Black- red	Black-white	White	Cross	Local
Bogra cattle	7	-	-	8	-	15	-
Pabna cattle	4	**2**	**3**	6	-	15	-
Jhenidah cattle	6	**3**	-	2	4	7	8

Table 3. Analysis of some morphometric characteristics

Region	Eye color		Horn pattern			Hump	
	Black	Ash	Small	Medium	Large	No	Yes
Bogra cattle	15	-	6	6	3	15	-
Pabna cattle	15	-	3	8	4	15	-
Jhenidah cattle	14	1	8	4	3	13	2

Table 4. Analysis of some productive and some reproductive characters

Region	Milk production (liters/day)	Lactation length (day)	Conception rate%	Litter size	Heat period (days)	Gestation period (days)
Bogra cattle	8.7 ± 0.98^{b}	290 ± 9.43^{a}	75 ± 0.14^{a}	1.3 ± 0.38^{b}	22.8 ± 0.9^{a}	285.5 ± 0.4^{a}
Pabna	14.6 ± 1.34^{a}	284 ± 8.50^{a}	80 ± 0.41^{a}	3.3 ± 0.84^{a}	23.5 ± 0.5^{a}	285.5 ± 0.4^{a}
Jhenidah	3.1 ± 0.58^{c}	275 ± 6.41^{b}	70 ± 0.52^{b}	2.5 ± 0.68^{ab}	18.9 ± 0.7^{b}	280.3 ± 0.2^{b}

Result are expressed as mean ± SD (Standard deviation), n= 15 sample of each region. Values in the same row with different superscripts (a,b,c) are significantly different at $p< 0.05$. ANOVA single factor followed by Duncan's multiple ranges for multiple comparison tests.

Table 5. Determination of DNA concentration and DNA purity of selected three regions

Region	DNA concentration (µg/ml)	DNA purity (A_{260}/A_{280})
Bogra cattle	196.88 ± 91.54^{a}	1.80 ± 0.25^{b}
Pabna cattle	198.30 ± 120.40^{a}	1.84 ± 0.15^{ab}
Jhenidah Cattle	193.70 ± 86.34^{b}	1.64 ± 0.22^{b}

Result are expressed as mean ± SD (Standard deviation), n= 15 sample of each region. Values in the same row with different superscripts (a,b,c) are significantly different at p< 0.05. ANOVA single factor followed by Duncan's multiple ranges for multiple comparison tests.

RAPD PRIMER SCREENING

Nine primers were randomly screened for DNA polymorphism. Out of them two primers OPB-07 and BMC-1222 were responded to polymorphic DNA. With the analysis of OPB-07 primer, sizes of different polymorphic DNA are obtained by comparing with the marker DNA at different stage.

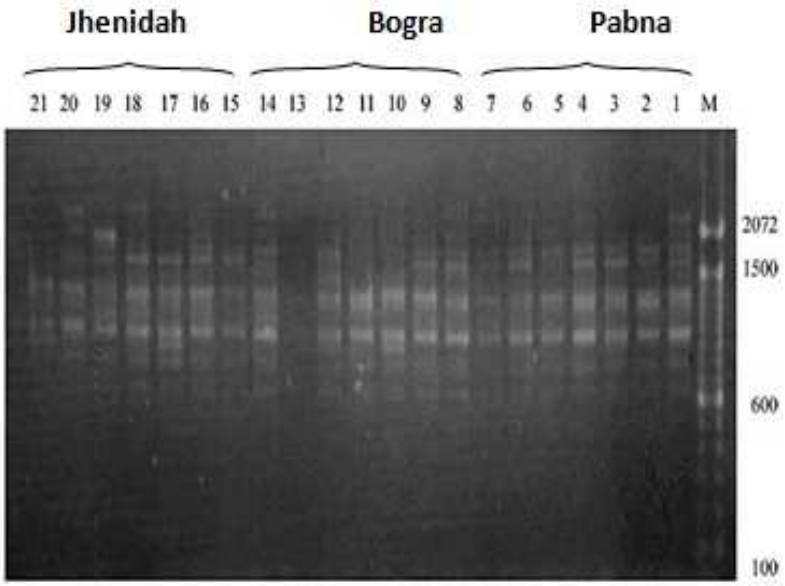


Fig. 2. RAPD banding pattern (primer OPB-07) of the cattle DNA sample ; 1-7 for Pabna, 8-14 for Bogra and 15-21 for Jhenidah

4 DISCUSSION

Local cattle are generally making cross to a foreign cattle (New Zealand or Australian cattle of good heredity) and produce a native crossbred cattle. Therefore, its productivity (eg. milk, meat etc) is generally high then local cattle and they are also susceptible to disease resistant and environmental issue. Coat color of selected cattle in Bogra region was mainly black and black-white in color. Pabna crossbred cattle were also black and black- white in color; but red and black cattle were also observed. On the other hand, selected local and crossbred cattle in Jhenidah were found black, red, black-white and white in color (Table 2). All of the cattle eye color was found black except only one cattle was found ash color in Jhenidah region. Horn pattern of cattle were found small, medium and large in size both of the selected region. The cows are generally not containing hump but only two cows were found to contain medium size of hump within the local breed types in Jhenidah region. The coat color of the variety is red or grey or a mixture of both (table 2). Al-Amin et al. (2007) [13], studied on North Bengal Grey (NBG) cattle of Bogra district and observed that the coat color of these animals is deep grey to white. The observed coat color was similar to the present study.

The Pabna cows are good in size and possess better milking ability [13], the average milk production of Pabna cattle was found 14.6±5.34lit/day that is better than the other two regions; Bogra for 8.7±2.58 and Jhenidah for 3.1± 1.58 lit/day respectively (Table 3). Similar result was also observed by Udo et al. (1990) [14], who reported that Pabna crossbred cattle gives 30% more milk than Pabna local cattle. Some small to big dairy milk factories are established around Pabna district. The average lactation lengths of the selected cattle were 290±9.43, 284±13.50 and 208±43.41 days for Bogra, Pabna and Jhenidah areas respectively (table 4). Auldist et al. (2007) [15], analyzed the effects of varying lactation length on milk production capacity of cows and found the intervals of 12 to 24 month. Al-Amin et al. (2007) [13], found the lactation length of 219 days for Bogra local cattle that did not agreed with crossbred cattle. However, Bag et al. (2010) [16], observed that the

maximum and minimum lactation length of RCC cattle was 295 days and 137 days respectively, that result is more or less similar to the present studied areas.

Conception rate of Bogra, Pabna and Jehnidah cattle region were analyzed, where Jehnidah cattle were found higher conception rate (1.9±1.10) comparatively than Bogra cattle (1.2±0.42) and Pabna cattle (1.2±0.41) (table 4). Inadequate proper nutrition prior to calving, results in cows being thin at calving which delays the onset of estrual activity post-calving. This delay in onset of cycling activity will affect the percent of cows available to be bred during the breeding season, thus reducing overall conception rates. Conception rates of lactating cows decreased sharply when maximum air temperature on day after insemination exceeded 30° C [17].

The litter size is the number of offspring produced at one birth by a viviparous animal. Viviparous animal are those whose embryo development occurred inside the body of the mother, eventually leading to live birth, as opposed to laying eggs. The litter size of cattle found 1.3±0.38, 3.3±0.84 and 2.5±0.68 Bogra cattle, Pabna cattle and Jhenidah cattle respectively. Heat period and gestation period recorded higher in Bogra and Pabna district cattle. These heat period figures were 22.8±0.9 and 23.5±0.5 in Bogra and Pabna district cattle accordingly, and the gestation period were the same of these two districts, these figures were 285.5±0.4. In 2003, Talukder [18], revealed that the gestation period was 279.58±1.85 days in BAU dairy farm. Another research work conducted by Khan et al. (2000) [19], and they observed the period of gestation in rural conditions was 282 days and in farm conditions was 281 days. Azizunnesa also [20], found the mean gestation length was 273.08±7.48 days in farm condition in crossbred cows. The standard gestation period of cows is 285±5 days [21].

For molecular study DNA was extracted from the blood samples by small modification of the protocol of Roe et al. 1996 [11]. The average concentration of DNA samples (µg/ml) of three variable regions of cattle were 198.30±102.40 for Pabna, 193.70±86.34 for Jhenidah and 196.88±91.54 for Bogra, (table 5) .The average quantity of DNA for Pabna region was higher than that of others two regions of DNA sample.

The avarege purity of extracted DNA in Pabna Cattle, Bogra Cattle and Jhenidah Cattle were 1.84 ± 0.15, 1.80±0.25 and 1.64 ±0.22 respectively (Table 5). For pure double-stranded DNA, Sambrook et al. 1989 [22], established that the ratio A260/ A280 should be within 1.8 to 1.9.

5 CONCLUSION

In conclusion that can be drawn from this research work is that the morphometic data obtained in this study might be useful tool in future strategies for cattle breeding. RAPD data would also be useful for detecting genetic diversity & inter-relationship among them, which would be utilized with right protection purposes and also helpful for germplasm conservation from the best genetic resource areas. The present study also finds the molecular technique for quantifying genomic DNA and its purity among the cattle varieties, although it needs for a small work with a greater number of genotypes using greater number of primers for better understanding of the genetic variability of the cattle verities in the country.

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Epidémiologie de la schistosomiase et des géohelminthiases dans l'Arrondissement de Kékem (Ouest- Cameroun)

[Epidemiology of schistosomiasis and soil-transmitted helminthiasis in the sub-division of Kékem (West-Cameroon)]

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ABSTRACT: Urinary schistosomiasis and geohelminths are endemic in Cameroon and continues to pose public health challenges especially in inhabitants of rural areas. This study was conducted in an attempt to re-assess the epidemiological data (prevalence and intensity of infection) of the prevalence of urinary schistosomiasis and geohelminths among school children in Kekem, local government areas,West- Cameroon. The study was carry out in 4 schools and, in each of the selected schools, stool and urine samples were collected from 180 school children. Single Kato-Katz technique was employed to determine presence of geohelminth; urine filtration technique was employed to determine presence of *Schistosoma haematobium* eggs in urine. An overall prevalence of 1.7% for urinary schistosomiasis was observed among the 180 children examined. No significant difference in prevalence was observed between school, sex and across age group examined ($p>0.05$). The prevalence rates of urinary schistosomiasis in each school were 6.5% in Kekem 44; 2% in Mbafamand 0% in Mboebo and Plateau B. This shows that there is a significant decrease, due to previous treatments which took place in this area. This provided the positive intervention of the schistosomiasis control. An overall prevalence rates of Soil Transmitted Helminths were 17.8% for *Ascaris lumbricoïdes,* 17.2% for *Trichuristrichiura*and1.7% for *Necator americanus*. For each parasite, no significant difference in prevalence was observed between school, sex and across age group.

KEYWORDS: Epidemiology, *Schistosoma haematobium*, soil-transmitted helminthes, Kekem, Cameroon.

RESUME: La schistosomiase urinaire et les géohelminthiases sont endémiques au Cameroun et continuent de poser de sérieux problèmes de santé, ceci surtout chez les populations des zones rurales. Cette étude a été menée dans le but d'actualiser les données épidémiologiques (prévalence et charge parasitaire) de la schistosomiase urinaire et des géohelminthiases dans l'Arrondissement de Kékem, Ouest-Cameroun. L'enquête a concerné 180 élèves échantillonnés dans 4 écoles. Les méthodes utilisées comprenaient des prélèvements et analyses de selles par la méthode de Kato-Katz et des

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urines par la méthode de filtration. Trois sujets sur 180 ont éliminé les œufs de *Schistosoma haematobium*, soit une prévalence globale de 1,7%. Les différences de prévalences et de charges parasitaires entre les écoles, les sexes et les tranches d'âges ne sont pas significatives (p>0.05). La prévalence en fonction des écoles est de 6,5% à l'Ecole publique Kékem 44, 2% à l'Ecole publique de Mbafam et 0% à l'Ecole publique de Mboebo et Plateau B. Ceci montre un déclin significatif de la bilharziose dans ce foyer, dû aux traitements antérieurs qui ont eu lieu, d'où l'impact positif des interventions de lutte par le programme national de lutte contre la schistosomiase et les helminthiases intestinales. Quant aux géohelminthiases, les résultats obtenus indiquent une faible prévalence et une infection légère (17,2% et 1529opg pour *Ascaris lumbricoides*, 17,8% et 101opg pour *Trichirus trichiura*, 1,7% et 38opg pour *Necator americanus*). Pour chacun de ces géohelminthes, il n'y a pas de différence significative entre les écoles, sexes et les âges.

MOTS-CLEFS: Epidémiologie, *Schistosoma haematobium*, Géohelminthes, Kékem, Cameroun.

1 INTRODUCTION

La schistosomiase et les géohelminthiases sont des parasitoses endémiques en Afrique Sub-Saharienne ; elles y constituent un important problème de santé publique et sont responsables de 200.000 décès par an [1]. Le Cameroun comprend une série de zones bioclimatiques allant de la forêt équatoriale à la savane sahélienne, favorisant le développement de nombreuses parasitoses humaines parmi lesquelles les bilharzioses urinaire et intestinale [2]. Plus de 5 millions (33%) de la population est exposée aux risques d'infestation et actuellement, 2 millions de personnes soit 13 % sont parasitées [3]. Les foyers de bilharziose sont très inégalement distribués sur le territoire camerounais [4]. Ainsi, il est mentionné que les plus grands foyers de bilharziose urinaire due à *Schistosoma haematobium* Bilharz, 1952*)* se trouvent dans les régions de l'Extrême-Nord, du Nord et de l'Adamaoua [5].Mais quelques foyers sont observés dans les régions du Littoral (Loum, Penja), du Sud-Ouest (Kumba et Barombi Kotto). L'Ouest Cameroun est très faiblement affecté par cette bilharziose ; la région de Kékem, la Plaine des Mbos [6] ainsi que Magba (observation personnelle) sont les seuls secteurs infestés. Kékem se distingue des autres foyers de bilharziose urinaire par le fait que *S. haematobium* y sévit seul [7]. Les premières études sur la bilharziose dans ce foyer ont été faites par Blancheteau et Picot [6]. Ces auteurs avaient investigué sur un échantillon constitué de 1010 élèves et ont obtenu une prévalence globale de 9,7%. Same Ekobo [7] a mené par la suite une enquête épidémiologique sur 2057 élèves issus de trois écoles : école catholique Bangui Chari II, EP du Plateau et EEC de Petit Nkam. Il y obtient les prévalences respectives : 0,6%, 3,2% et 0,5%. En 2001, une autre enquête épidémiologique est menée sur 970 élèves issus plutôt de huit écoles : EP Moumée, EP Kékem 44, EP Groupe 2 Kékem, EP Plateau A Bangui Chari, EP Plateau B Bangui Chari, EEC Bangui Chari, EP Mbafam et EP Bayon. Les prévalences obtenues sont respectivement 0%, 1,2%, 0%, 3,5%, 6,7%, 0%, 53,3%, 0% et 12,3%.Une nouvelle enquête est menée en 2007 sur 169 élèves fréquentant l'école publique de Mbafam ; la prévalence obtenue est de 30,18%. Mais cette prévalence est passée à 2% en 2008 (Tchuem Tchuenté, communication personnelle).Ceci démontre et atteste le caractère dynamique que l'on attribue aux foyers de schistosomes qui exigent par conséquent des suivis épidémiologiques réguliers pour une meilleure appréciation de leur évolution et une mise à jour des niveaux de transmission.

Les géohelminthiases sont des parasitoses qui touchent 2 milliards d'individus dans le monde [8]. Au Cameroun, les géohelminthiases sont classées parmi les maladies parasitaires importantes [9]. Elles sévissent plus dans la partie Sud du pays [10] et environ 5,6 millions de personnes sont infestées. Les helminthes intestinaux les plus rencontrés sont *Ascaris Lumbricoides* Linné, 1758, *Trichirus Trichiura* Linné, 1771 et *Necator Americanus* Stiles, 1902) [9]. Les géohelminthes, forment des associations parasitaires avec d'autres parasites tels les schistosomes [11].

Face à l'évolution que connaissent plusieurs foyers de *S. haematobium*, compte tenu du fait que Kékem représente le foyer le plus actif dans la région de l'Ouest , compte tenu aussi du fait que les géohelminthiases sont assez répandues au Cameroun et de l'intervention perpétuelle du PNLSHI, il nous a semblé opportun d'investiguer ce foyer de Kékem dans le but de mettre à jour les données épidémiologiques. Plus spécifiquement, nous devons :

- Déterminer la prévalence et la charge parasitaire de la schistosomiase urinaire dans quelques écoles primaires ;
- Déterminer également la prévalence et la charge parasitaire des géohelminthiases ;
- Relever le degré d'infestation entre les écoles, les sexes et les âges.

2 MATERIELS ET METHODE

2.1 PRESENTATION DU SITE D'ETUDE

L'étude a été menée dans l'Arrondissement de Kékem (Figure 1), situé dans le Département du Haut-Nkam. Kékem est un Arrondissement bâti sur la chaîne montagneuse de l'Ouest-Cameroun et ses coordonnées géographiques sont : 5°10' de latitude Nord et 10°30' de longitude Est. Cette agglomération comprend 41000 habitants, Il se trouve entre 300 et 800m d'altitude au Sud de Bafang (Chef- lieu du Département). Elle est reliée à Santchou (plaine de Mbos) et à Nkondjock par des routes bitumées. La commune de Kékem est limitée : au Nord par l'Arrondissement de Bafang, au Sud par l'Arrondissement de Melong, à l'Est par l'Arrondissement de Banwa, à l'Ouest par l'Arrondissement de Santchou, l'Arrondissement de Fokoué et celui de Bandja [12]. Cet Arrondissement est subdivisé en 10 communautés.

2.2 METHODOLOGIE DE COLLECTE DES DONNEES

Les autorités compétentes de la ville d'étude (chefs traditionnels, l'inspecteur d'Arrondissement de l'enseignement primaire et les directeurs d'écoles) ont été contactées un mois avant, dans le but d'obtenir l'autorisation pour notre enquête; puis nous les avons amenés à sensibiliser les élèves ainsi que les parents sur notre travail. Notre choix s'est porté sur les écoles primaires pour les raisons suivantes : les écoliers appartiennent à la tranche d'âge de la population la plus touchée [3], [10] ; les individus de cette tranche d'âge sont moins réticents aux examens de masse ; la possibilité de comparer nos résultats à ceux des travaux antérieurs réalisés pour la plupart dans la population scolaire. L'enquête parasitologique menée dans cet arrondissement a donc été effectuée dans quatre écoles: l'Ecole publique de Kékem « 44 », l'Ecole publique de Mbafam, l'Ecole publique du Plateau groupe B**,** l'Ecole publique de Mboebo. Sur les 181 élèves enregistrés, 180 (100 garçons et 80 filles) dont l'âge varie ont effectivement pris part à l'étude.

2.3 ANALYSE DES ECHANTILLONS D'URINES ET DE SELLES

L'étude a été conduite en mai 2010. Dans chaque école visitée, avant les prélèvements, nous présentions notre autorisation de recherche au responsable et une sensibilisation directe était faite par explication des objectifs de l'étude, des manifestations, des causes, des conséquences et du diagnostic de la maladie aux directeurs, maîtres et élèves. Deux pots de 10mLsont remis aux élèves la veille et les échantillons sont collectés le lendemain. Compte tenu de la distance séparant la zone d'étude et le Centre Schistosomiase et parasitologie de Yaoundé, nos échantillons (selles et urines) ont été conservés sur le terrain à l'aide de l'azodure de sodium [13].Les urines ont été examinées par la méthode standard de filtration. En effet, dix millilitres d'urine homogénéisée sont prélevés à l'aide d'une seringue 10 cc et filtrés. Le filtre est retiré et immédiatement coloré au Lugol puis la recherche des œufs est faite à l'objectif x10 d'un microscope de marque Zeiss. L'analyse des selles s'est faite selon la méthode standard de KATO-KATZ [14] pour rechercher les œufs d'helminthes et/ou des parasites adultes ou larves à partir de leur morphologie.

2.4 ANALYSES STATISTIQUES

Le logiciel SPSS 12.0 for Windows a été utilisé pour analyser les résultats. Nous avons évalué :

La prévalence parasitaire (P) qui est le rapport du nombre d'individus hôtes parasités (p) par le nombre d'individus hôtes examinés (N) exprimé en pourcentage : P = (p / N) x 100. La charge parasitaire (CP) qui est le nombre d'œufs de l'espèce parasitaire i estimé pour un gramme de selles ou pour 10 millilitres d'urines.

Le test de KHI-DEUX (X^2) a été utilisé pour comparer les valeurs de prévalence entre les sexes, les tranches d'âge et les écoles alors que le test K de KRUSKAL-WALLIS a été utilisé pour comparer les moyennes des différentes charges parasitaires entre les groupes suscités. Les tests ont été significatifs pour $p<0,05$.

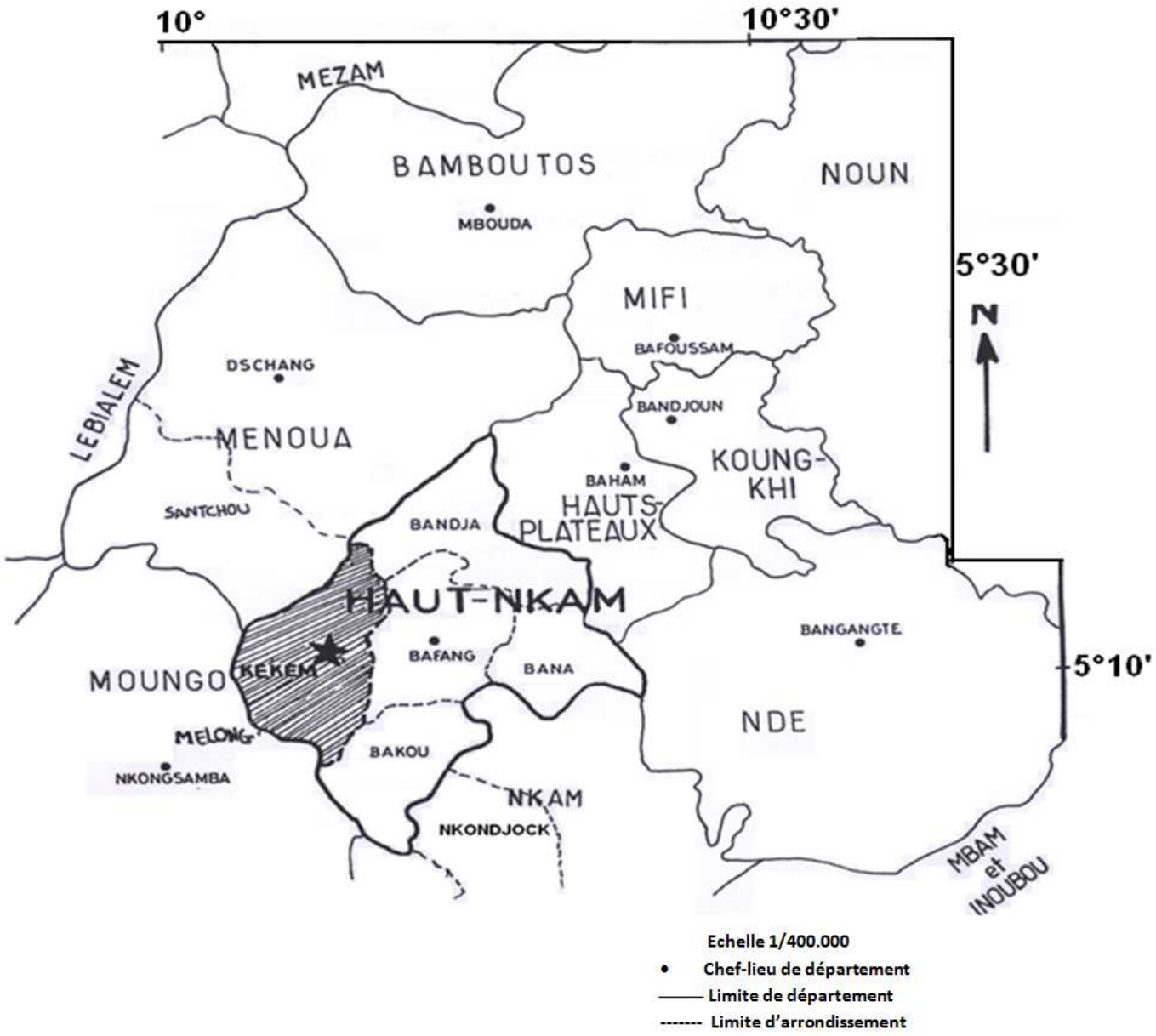


Figure 1: Présentation de Kékem dans la Région de l'Ouest Cameroun (Institut National de Cartographie : Edition 1996)

3 RESULTATS

3.1 EXAMEN DES URINES

Sur les 180 élèves enregistrés et examinés, 3/180 soit une prévalence de 1,7% a éliminé des œufs de *S. haematobium*.

La moyenne géométrique de la charge parasitaire dans notre échantillon est de 2,5 œufs/10 mL d'urines. Le Tableau 1 présente la prévalence de la schistosomiase urinaire par école à Kékem. La prévalence varie de 0,0% à 6,5% entre les quatre écoles prospectées. Cependant, la différence de prévalence observée entre les écoles n'est pas statistiquement significative : (X^2 = 6,04, p > 0,05).

Tableau 1 : Prévalence de la schistosomiase urinaire par école

Ecoles	Nombres d'enfants examinés	Nombres d'enfants positifs	Prévalence d'infestation (%)
E.P. Kékem 44	31	2	6,5
E.P. Mbafam	50	1	2,0
E.P. Plateau B	49	0	0,0
E.P. Mboebo	50	0	0,0
l Moyenne	180	3	1,7

Le tableau 2 présente la prévalence d'infestation des élèves en fonction du sexe. Une prévalence élevée de 2,5% a été enregistrée chez les sujets de sexe masculin alors que celle des filles est plus faible (1,0%). La différence de prévalence entre les deux sexes n'est pas significative (X^2 = 0,579, p > 0,05).

Tableau 2 : Prévalence parasitaire en fonction du sexe

Sexe / Parasite	Masculin			Féminin			Total
	Nb ex	Nb p	%	Nb ex	Nb p	%	
S. haematobium	81	2	2,5	99	1	1,0	3/180 [1,7%]

Nb ex : *nombre d'élèves examinés* ***Nb p :*** *nombre d'élèves parasités*

La Figure 2 montre la prévalence d'infestation à *S. haematobium* en fonction des tranches d'âge. La tranche (7-10) ans a présenté la plus forte prévalence (2,7%), la plus faible prévalence est observée dans la tranche d'âge 15 ans et plus (0,0%).Cependant, l'analyse statistique montre qu'il n'existe pas de différence significative entre les tranches d'âge (X^2 = 0,406, p > 0,05).

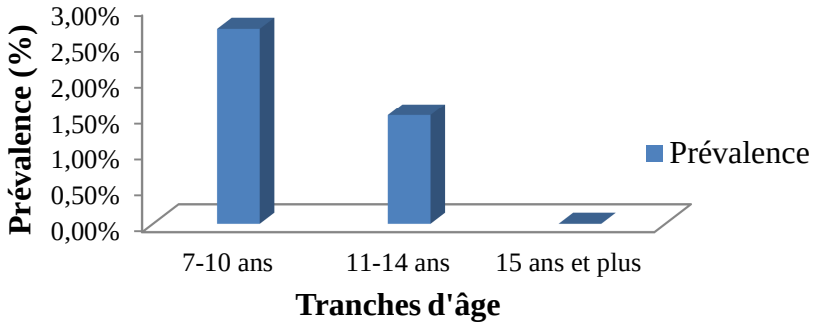


Figure 2 : Prévalence d'infestation à S. haematobium en fonction de l'âge

3.2 EXAMEN DES SELLES

Cent quatre vingt élèves sur les 181 enregistrés ont effectivement été examinés, soit un taux de participation de 99,45%. Sur ces 180 participants, 66 (36,7%) étaient infestés par au moins une espèce de géohelminthes observés: *Ascaris lumbricoides (17,8%)*, *Trichuris trichiura (17,2%)*, et *Necator americanus (1,7%).*Des cas de monoparasitisme (36,7%) et double infestation (5,6%) ont été observés sur ces échantillons examinés. La mono-infestation est marquée chez *A. Lumbricoides* (48,4%) et *T. trichiura* (47,0%), pourtant *N. americanus* (1.7%) est rarement observé. La seule double infestation observée était *A. lumbricoides-T. trichiura* (15,2%). Le Tableau 3 nous donne la diversité des géohelminthes retrouvés dans les selles : *A. lumbricoides*32 (17,8%) et *T. trichiura* 31 (17,2%) sont dominants, tandis que *N. americanus*3 (1,7%) est moins représenté.

Tableau 3 : Prévalence des géohelminthes

Géohelminthes	Prevalence (%)
A. lumbricoides	32 (17,8)
T. trichiura	31 (17,2)
N. americanus	3 (1,7)
Total	66 (100.0)

Il ressort que la prévalence de *A. lumbricoides* chez les garçons (23,8%) est supérieure à celle des filles (13,0%) ; idem pour *T. trichiura* 18,8% chez les garçons et 16,0% chez les filles. Mais cette différence n'est pas significative. Figure 3.

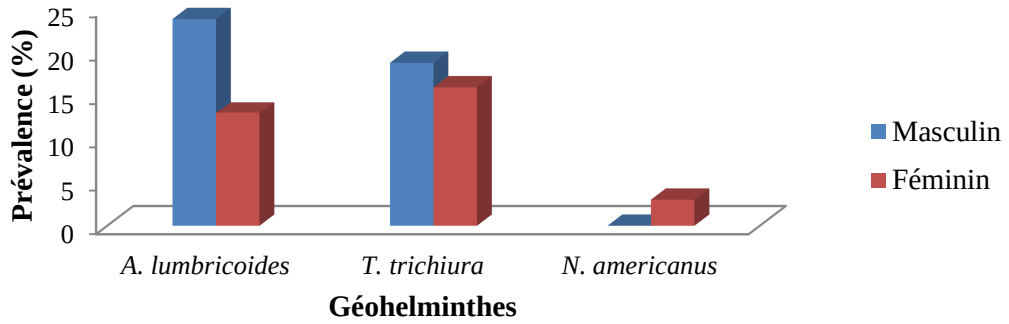


Figure 3 : Prévalence en fonction des sexes

A. lumbricoides se retrouve dans toutes les tranches d'âge, mais dominant dans la tranche 11-14 ans. Quant à *N. americanus*, la tranche d'âge 7-10 ans est celle exclusivement touchée par cette espèce de géohelminthe (8,1%). Cependant, la différence observée entre les tranches d'âge n'est pas significative pour *Ascaris lumbricoides* (X^2 = 3,330 avec ddl = 2 et p > 0,05) et *Trichuris trichiura* (X^2 = 7,006 avec ddl = 2 et p > 0,05). Elle l'est par contre pour *Necator americanus* (X^2 = 11,791 avec ddl = 2 et p = 0,003) (Tableau 4).

Tableau 4 : Prévalence des géohelminthes en fonction des tranches d'âge

Groupe d'âge	Nb examinés	Nb positifs		
		A. lumbricoides	*T. trichiura*	*N. americanus*
7- 10	37	3 (8,1)	2 (5,4)	3 (12,5)
11-14	135	28 (20,7)	29 (21,5)	0 (0,0)
15ans et plus	8	1 (8,1)	0 (0,0)	0 (0,0)
Total	180	32 (17,8)	31 (17,2)	3 (1,7)

Nb = nombre

Dans l'ensemble des sujets examinés, la charge parasitaire variait : de 24 à 35280 opg de selle pour *Ascaris lumbricoides* ; de 24 à1584 opg de selle pour *Trichuris trichiura* et de 24 à 96 opg de selle pour *Necator americanus*.

La variation de la charge parasitaire selon le sexe et l'espèce de géohelminthe est présentée à la Figure 4.Chez les sujets de sexe masculin, elle valait 2342 opg de selle pour *Ascaris lumbricoides*, 82 opg de selle pour *Trichuris trichiura* et 0 opg de selle pour *Necator americanus.* Chez les individus du sexe féminin, elle valait 819 opg de selle pour *Ascaris lumbricoides*, 122 opg de selle pour *Trichuris trichiura* et 38 opg de selle pour *Necator americanus*. La différence observée entre les deux sexes est significative pour *Ascaris lumbricoides* (X^2 = 4,166 avec ddl = 1 et p = 0,041). Cette différence n'est pas significative pour les deux autres espèces parasitaires : *Trichuris trichiura* (X^2 = 0,148 avec ddl = 1 et p > 0,05) et *Necator americanus* (X^2 = 2,427 avec ddl = 1 et p > 0,05).

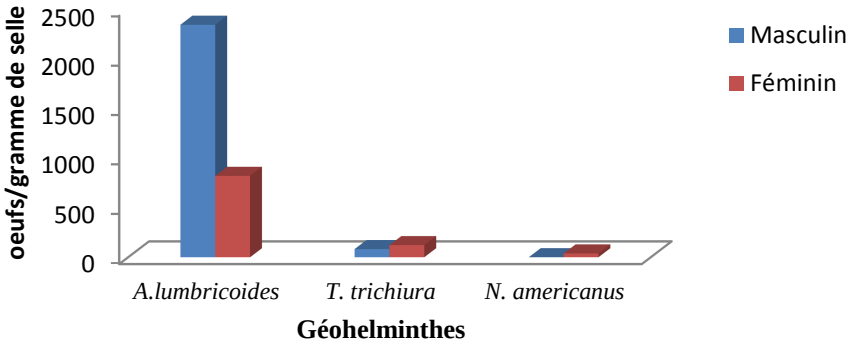


Figure 4 : Variation de la charge parasitaire selon le sexe

4 DISCUSSION

Les résultats de nos travaux confirment la faible endémicité de la bilharziose à *Schistosoma haematobium* dans cette zone. En effet, les prévalences enregistrées sont faibles et situent toutes ces écoles en dessous de 10%. Les prévalences enregistrées sont : 6,5% ; 2% ; 0% ; 0% respectivement dans les écoles publiques de Kékem 44, Mbafam, Mboebo et Plateau B. Les charges ovulaires enregistrées sont également faibles chez S. *haematobium* (2,5 œufs/ 10ml d'urine). Les résultats des études antérieures ont montré que la prévalence n'a pas beaucoup évolué dans ces écoles, sauf pour l'EP de Mbafam.

A l'EP du Plateau, la prévalence est passée de 3,2% à 6,7% en 2001 ([7], Tchuem Tchuenté, communication personnelle) et à 0% dans la présente étude.

A EP de Kékem 44, cette prévalence est passée de 1,2% en 2001 à 6,5% dans la présente étude. Pour ces deux écoles, nous pouvons dire que cette faible évolution serait due au fait que les sujets atteints se sont infestés en dehors de la zone prospectée, bref ils y ont importé la bilharziose.

A EP de Mbafam, une baisse importante de la prévalence de la bilharziose urinaire est notée. Cette prévalence parasitaire est passée de 53,3% en 2001, 30,18% en 2007 pour se stabiliser à 2% en 2008 (Tchuem Tchuenté, communication personnelle) et dans la présente étude à 1.7% Un cas similaire à celui de Mbafam a été observé pour *Schistosoma guineensis* (Pages, 2003) à Edéa par Matike [15] où une régression « spectaculaire » de l'endémicité de la bilharziose a été observée (de plus de 50% en1990 à 0,96% en 2002). Cette diminution de taux d'infestation est fortement liée à la sensibilisation de la population et surtout aux campagnes de traitement de masse au Praziquantel organisées par le PNLSHI (Programme National de Lutte contre la Schistosomiase et les Helminthiases intestinales). De même, l'aménagement de l'espace, l'installation des fontaines publiques et des puits y ont favorisé la diminution du contact homme-eau. La même observation a été faite [16] et s'explique par le fait que l'urbanisation réduit efficacement les points de transmission et la création des points d'eau modernes limitent le contact homme- eau.

Les sujets de sexe féminin présentent une faible prévalence (1%) et les garçons 2,5%.Le facteur sexe influence les niveaux d'infestation (prévalence et charge parasitaire) des bilharzioses. En fait, les garçons sont plus en activité dans l'eau que les filles et par conséquent sont plus parasités qu'elles [11,16]. Des résultats similaires ont été rapportés dans la région de l'Extrême Nord Cameroun où les sujets de sexe féminin ont présenté également une faible prévalence de *S. haematobium*. Les auteurs expliquent cette situation par le fait que les garçons sont plus impliqués dans les travaux champêtres d'une part et pratiquent régulièrement des baignades dans des eaux stagnantes infestées de métacercaires d'autre part [5].Nous n'avons pas noté une différence significative de la prévalence entre les tranches d'âge ; les sujets impliqués dans la présente étude dont l'âge varie entre 7 et18ans auraient la même fréquence de contact avec l'eau. Cette relation reste statistiquement non-significative même si l'on croise l'âge avec la charge parasitaire. Katsha et Watts [17] firent également le même constat dans certains villages du Delta du Nil. La charge parasitaire moyenne observée (2,5 œufs/ 10 ml d'urine) se rapproche de celle de De Clercq [18] à Kinshasa où 36% des sujets avaient des Charges Parasitaires Moyennes inférieures à 100 œufs/10 ml d'urine et traduit selon l'OMS [19] une infection légère.

Parlant des géohelminthiases, leurs prévalences étaient assez élevées par rapport à celle de la bilharziose (17,8% pour *A. lumbricoides*, 17,2% pour *T. trichiura*). Ce résultat pourrait s'expliquer par le fait que l'infestation par les géohelminthes se fait à plusieurs niveaux. L'ascaridiose et la trichocéphalose ont des prévalences presque égales (17,2 et 17,8). Les deux

espèces responsables de ces affections ont la même voie et le même mécanisme de transmission [11]. Pour tous les géohelminthes, il n'y a pas de différence notable entre les deux sexes en termes de prévalence, ce qui signifie que l'infestation par ces parasites est due au non-respect des règles d'hygiène élémentaire. Cependant, lorsqu'on croise le sexe et la charge parasitaire, la différence observée est significative pour *A. lumbricoides* et ne l'est pas pour *T. trichiura* et *N. americanus*. En effet, les garçons ont une charge parasitaire élevée (2342 opg), comparée aux filles (819 opg). Des observations similaires ont été faites à N'Djamena [20] et s'expliquerait par le fait que les filles semblent respecter les règles d'hygiène élémentaire plus que les garçons [5]. Des résultats similaires ont été obtenus en Côte d'Ivoire [21]. Pour certains auteurs, on n'attribue pas cette différence à la susceptibilité des hôtes aux parasites [22]. Ceci s'expliquerait plutôt par une acquisition rapide du parasite par les garçons ; de plus ceux-ci porteraient plus de vers femelles adultes. Quant aux tranches d'âge, il n'y a pas de différence significative pour *A. lumbricoides* et *T. trichiura*, ceci est attribué à leur caractère cosmopolite. Pour ce qui est de *N. americanus*, une différence significative (p=0,037) est notée. Les enfants de la tranche 7-10 ans ont une forte prévalence. Ceci reflète la nature active des enfants de cette tranche d'âge, puisque les jeunes enfants passent plus de temps aux jeux, ce qui les expose au risque d'infection. Nos résultats corroborent ceux de Ratard [10] et Hamit [20].

Le présent travail a révélé l'existence d'un degré de monoparasitisme élevé. Soixante-neuf cas impliquant une seule espèce parasitaire ont été recensés, contre onze cas de polyparasitisme. Ce polyparasitisme observé dans notre étude est un phénomène très récurrent dans les zones d'endémie ; beaucoup d'études l'ont signalé [11], [23]. Nos résultats sont plutôt contraires, ce monoparasitisme élevé par rapport au polyparasitisme est très rare. Une situation similaire a déjà été observée par Sumo [24] qui a obtenu 75% de monoparasitisme, contre 24,2 % à Edéa et 76,3 % contre 23,7% à Eséka. Nos résultats montrent une dominance de la coexistence entre *A. lumbricoides* et *T. trichiura*. Cette observation est un phénomène fréquent [25] et cela corrobore les travaux de Balebata [26]. Elle peut s'expliquer par leur voie de transmission commune, la résistance de leurs œufs aux facteurs environnementaux et la présence dans la poussière, le sol, sur les mains et les crudités [11], [27]. Nous avons relevé dans notre travail un cas de polyparasitisme *S. haematobium* et *N. americanus* ; ceci traduirait le fait que les voies de transmission de ces deux helminthes soient les mêmes (voies transcutanées).

5 CONCLUSION

Les résultats de cette étude montrent la mise en évidence de *Schistosoma haematobium* chez 1,7% des personnes examinées (prévalence faible). Dans les différentes écoles enquêtées, la prévalence n'a pas beaucoup évolué, sauf à Mbafam où nous pouvons dire que la transmission de la bilharziose a considérablement baissé. Ceci s'explique par la construction des fontaines publiques, l'urbanisation et les campagnes de sensibilisation et de distribution du Praziquantel par le PNLSHI. Ainsi, la baisse significative de la prévalence à Mbafam montre que la lutte contre la schistosomiase est un objectif réaliste et que l'élimination de la bilharziose est possible dans certains foyers. Néanmoins, le foyer de schistosomose de Mbafam doit être contrôlé régulièrement pour éviter une éventuelle flambée des schistosomoses. Quant aux géohelminthiases, les résultats obtenus indiquent une faible prévalence et une infection légère. Toutefois, la schistosomiase intestinale semble être absente à Kékem car aucun examen n'a révélé la présence des œufs de *Schistosoma mansoni*. Dans la logique de ce travail, il s'avère nécessaire de mener dans un proche avenir, une enquête sur les hôtes intermédiaires des schistosomes afin d'attribuer effectivement la responsabilité de la transmission.

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Synthesis of some new substituted azetidinonyl and thiazolidinonyl quinazolon-4(3H)-ones as potential non-steroidal anti-inflammatory and analgesic agents

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ABSTRACT: A series of 2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(substituted benzylidene) acetohydrazides (5a-5l) have been synthesized via condensation of 2-(5-(6-Bromo-2-methyl-4-oxaquinazolin-3 (4H)-yl)-4H-1,2,4-triazole-3-ylthio)acetohydrazide (4) with different aromatic aldehydes. Cycloaddition of thioglycolic acid with 5a-5l yielded 2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(substituted benzylidene)-4-oxothiazolidin-3-yl) acetamides (6a-6l) while compound 5a-5l on treatment with chloro-acetylchloride in the presence of triethylamine are converted into 2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro-2-(substituted benzylidene)-4-oxoazetidin-1-yl) acetamides (7a-7l).The structure of all the newly synthesized compounds have been confirmed by elemental analysis and spectral studies (IR, ^{1}H-NMR and mass spectroscopy).Compounds 5a-5l,6a-6l and 7a-7l have been evaluated for their anti-inflammatory and analgesic activity and were compared with the standard drug phenylbutazone. The most active compound of this series is 2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2,6-dichloro benzylidene)-4-oxoazetidin-1-yl) acetamide (7g).

KEYWORDS: Thiazolidinonyl quinazolinone; Azetidinonyl quinazolinone; anti-inflammatory activity; Analgesic activity; acute toxicity.

INTRODUCTION

Quinazolinone nucleus has been gaining prominence due to the fact that its derivatives have been found to possess wide spectrum of activities like anti-becterial[1,2] analgesics[3] , anticonvulsant[4] and anti-inflammatory[5-8]. However, we have also reported substituted quinazolinone[9,10] derivatives as potent anti-inflammatory and analgesic inhibitors. Substitution pattern by different aryl or heteroaryl moieties at 2/3 position [11,12] of quinazolinone nucleus markedly influence anti-inflammatory activities. Moreover, Thiazolidinones[13-15] Azetidinones[16,17] and Triazole[18,20] are other important pharmacodynamic heterocyclic nuclei which when incorporated in different heterocyclic templates have been reported to possess potent anti-inflammatory activity. In the light of the above observation we have synthesized a new series of quinazolinone derivatives by incorporating the Triazole, Thiazolidinone and Azetidinone moieties at 3rd position of the quinazolinone nucleus. All the compounds have been screened for their anti-inflammatory, analgesic and ulcerogenic activities.

CHEMISTRY

The started compound 5-Bromo anthranilic acid has been synthesized according to the method of wheeler (1910). Compound 6-Bromo-2-methyl-4H-benzo [1,3]oxazin-4-one (1) have also been prepared by known method of Bogert et al (1907). Reaction of 5-amino-4H-1,2,4-triazole-3-thiol in dried pyridine with 6-Bromo-2-methyl-4H-benzo[1,3]oxazin-4-one carried out to obtain compound (2), which on reaction with chloro acetyl chloride resulted into 2-(5-(6-Bromo-2-methyl-4-oxaquinazolin-3(4H)-1,2,4-triazole-3-ylthio) acetyl chloride (3). Compound (3) when refluxed with 99% hydrazine hydrate in absolute ethanol yielded 2-(5-(6-Bromo-2-methyl-4-oxaquinazolin-3 (4H)-yl)-4H-1,2,4-triazole-3-ylthio) acetohydrazide (4).

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Compound (5a-5l) have been synthesized by condensation of compound (4) with various aromatic aldehydes in the presence of 2% NaOH solution. Addition of thioglycolic acid in the presence of anhydrous $ZnCl_2$ followed by cyclisation in compounds (5a-5l) introduced the Thizolidinone moiety in these compounds i.e. 2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(Substituted benzylidene)-4-oxothiazolidin-3-yl) acetamides (6a-6l), while compounds 5a-5l when refluxed with chloro acetyl chloride in the presence of triethyl amine resulted into compounds 2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro-2-(Substituted benzylidene)-4-oxoazetidin-1-yl) acetamides (7a-7l).

PHARMACOLOGY

The experiment were performed with albino rats of Charles-Foster strain of either sex, excluding pregnant females, of 60 to 90 days weighing 100 to 120 g. Food (chaw pallet) and water was given to the animals *ad libitum*. The test compounds were dissolved in propylene glycol. Indomethacin and phenylbutazone were used as reference drugs for the comparison of anti-inflammatory, analgesic and ulcerogenic activity.

Anti-inflammatory activity against carrageenan-induced rat's paw oedema

This study was done by following the procedure of Winter et al. [1962]. The rats were divided into three groups (control, drug treated, and standard, drug of six animals each. A freshly prepared suspension of carrageenan (1% in 0.9% saline) 0.05 ml. was injected under the planter aponeurosis of the right hind paw of each rat. Test compounds and standard drug were administered orally to the animals of drug treated groups and the standard drug group, respectively 1h before the carrageen an injection. The paw volume of each rat was measured before 1 and after 3 h of carrageenan treatment with the help of a plethymometer. The percent anti-inflammatory activity was calculated according to the formula given below-

Percentage of inhibition of oedema = $(1-V_t/V_c) \times 100$

Where, V_t and V_c are the mean increase in paw volume of rats of the treated and the control group, respectively. Results obtained were statistically analyzed.

Analgesic activity

Following the method of Berkowitz et al. [1977] performed this activity. This method is based on the property of the test compound to antagonize the phenyl quinone-induced pain syndrome in mice. Groups of five mice were injected intraperitonely with 0.25 ml of a 0.02% solution of phenylquinone in ethanol (5%) 1 h after of oral administration of the test compound. The number of writhes induced in each mouse was counted for 5 min (between 5 and 10 min) after injection of an irritant. The analgesic effect was expressed as percent protection in comparison to control.

% protection = (1-mean no. of writhes in mice of test groups/mean number of writhes in mice of control group) x 100

Ulcerogenic activity

Ulcerogenic liabilities of newly synthesized compounds were checked with method of Verma et al [1981]. Albino rats were fasted for 24 h prior to drug administration. All animals were sacrificed 8 h after drug treatment, and their stomachs and small intestines were microscopically examined to assess the incidence of hyperemia, shedding of epithelium, Petechial and frank hemorrhages and erosion or discrete ulceration with or without perforation. The presence of any one of these criteria was considered to be an evidence of ulcerogenic activity.

Acute Toxicity study

The test compounds were investigated for their acute toxicity (ALD_{50}) in albino mice, according to the method of Smith [1960]. The test compounds were given orally at different dose levels in separate groups of animals. After 24 h of drug administration, percent mortality in each group was observed. ALD_{50} was calculated from the data obtained.

Pharmacological result and discussion

All the newly synthesized compounds were studied for their anti-inflammatory activity against carrageenan-induced oedema. All the compounds were tested at a dose of 50 mg/kg given orally. The results of the study have shown in **table-I, II, & III.** All the compounds of this series **(5a-5l), (6a-6l)** and **(7a-7l)** have shown varying degree of anti-inflammatory activity (10.12-45.76%). The active compounds of this series **6g** and **7g** were found to possess more potent anti-inflammatory activity in the comparison of phenyl butazone. The compound **6g** i.e. which substituted with chloro group at 2,6,-position have shown 40.69% of inhibition of oedema. The compound **5a,** which possessed chloro group at 2^{nd}-position has shown least activity i.e., 10.12%. The compound **(6g)** 2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2-

(2,6-dichloro benzylidene)-4-oxothiazolidin-3-yl) acetamide and **(7g)** 2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio)-N-(3-chloro-2-(2,6-dichloro phenyl)-4-oxoazetidin-1-yl) acetamide, have shown the better anti-inflammatory activity i.e. 40.69 and 45.76% at a dose of 50 mg./kg.p.o. as compared to phenyl butazone, **figure-I** showed the bar diagram of anti-inflammatory activity at three graded doses (25, 50, and 100 mg/kg p.o.) of compounds **6g**, **7g** and phenyl butazone. At all the three dose levels compounds **6g**, **7g** showed more inhibitory activity than that of phenyl butazone.

The newly synthesized compounds of the present series showed analgesic activity varying from 8.35-42.37 %. The active compound of this series **6g** and **7g** were found to possessed better analgesic activity i.e. (38.54 and 42.37 %) at the dose of 50 mg/kg p.o. Considering, potentiality of compound **6g** and **7g**, these were studied in details at three graded doses 25, 50 and 100 mg/kg p.o. The compound **7g** have shown better analgesic activity at all three graded doses of 25, 50 and 100 mg/kg p.o as compared to phenyl butazone **Figure-IV**

Compound **6g** and **7g** were also tested for their ulcerogenic activity and found to be less ulcerogenic liability as compared to phenyl butazone. UD_{50} of compound **6g** is 165.5 mg/kg i.p. and compound **7g** is 195.5 mg/kg i.p. UD_{50} of phenyl butazone is 66.6 mg./kg. i.p.

Approximate lethal dose (ALD_{50}) of all compounds of the present series showed > 1000 mg/kg. p.o. The compound **6g** and **7g** have exhibited > 1400 mg./kg. p.o., it indicates a good safety margin.

EXPERIMENTAL

All reagents and solvents were generally used as received from the commercial supplier. Reactions were routinely performed in oven-dried borosil glassware. The melting points of compounds were determined in open capillaries with the help of thermionic melting point apparatus and were uncorrected. The progress of the reaction is monitored by TLC and product are purified through recrysttalization and purity of the compounds was checked by thin layer chromatography (TLC) performed on silica gel G coated plate of 0.5 mm thickness. The eluent was a mixture of different polar and nonpolar solvents in different proportions, and spots were visualized under iodine chamber. The IR spectra were recorded on Perkin Elmer 881 FTIR spectrophotometer ($\bar{\nu}_{max}$ in cm^{-1}). The ^{1}H-NMR spectra were recorded in $CDCl_3$ and DMSO-d_6 on Brucker DRX-400/300 FTNMR instrument. Mass spectra were determined on JEOL JMS-D-300 instrument.

Elemental and spectral analyses of the compounds were obtained from sophisticated, Analytical Instrumentation Facility Chandigarh, Punjab and CDRI, Lucknow, India.

6-Bromo-2-methyl-4H-benz[1,3]oxazine-4-one (1)

Yield 90%, m.p.176 ºC, IR max/cm-^{1} 2998, 2915, 1685, 1565, 1245,725; ^{1}H-NMR ($CDCl_3$) δ in ppm: 7.90–7.38 (m, 3H, Ar-H), 1.73 (s, 3H, CH_3), Compound 1 (Found: C, 37.84; H, 02.20; N, 16.97; Calc. for : $C_9H_6NO_2Br$,C, 37.99; H, 2.18;N, 16.88 %).

MS: $[M]^+$ at m/z 240.

6-Bromo-3-(5-mercapto-4H-1,2,4-triazole-3-yl)-2-methyl quanazolin-4(3H)-one (2)

To a solution of 5-amino-4H-1,2,4-triazole-3-thiol (0.01 mole) in dried Pyridine (100 ml.) 6-bromo-2-methyl-4H-benzo[d][1,3] oxazin-4-one (0.02 mole) was added. The reaction mixture was refluxed separately for 6-8 hr. Excess of solvent was removed and the residue was neutralized with HCl. The solid separated out, filtered, washed and recrystallized from methanol.

Yield 87%, m.p.216 ºC, IR max/cm-^{1} 3358, 3045, 2920, 1625, 1562, 1485, 735; 1H-NMR

(CDCl3) in ppm: 10.23 (s,1H,SH exchangeable with D_2O), 9.67 (s,1H,NH of triazole ring, exchangeable with D_2O), 7.97-7.42 (m,3H,Ar-H), 1.82 (s,3H,CH_3). Compound **2** (Found: C, 29.25; H, 2.40; N, 20.54; Calc. for : $C_{11}H_8SN_5$ OBr ,C, 39.07; H, 2.38;N, 20.71 %). MS:[M]+ at m/z 338

2-(5-(6-Bromo-2-methyl-4-oxaquinazolin-3(4H)-1,2,4-triazole-3-ylthio) acetyl chloride (3)

6-Bromo-3-(5-mercapto-4H-1,2,4-triazole-3-yl)-2-methyl quinazolin-4(3H)-one (0.01 mole) in dry THF (100 ml.) was added a solution of chloro acetyl chloride (0.02 mole) in dry THF (200 ml.) at OºC drop by drop along with manual stirring for 2hr. The reaction mixture was further stirred for 2-4 hr. on the mechanical stirrer and excess of solvent was distilled off, cooled and poured onto ice. The solid thus obtained, filtered and recrystallized from methanol.

Yield 82%, m.p.225 ºC, IR max/cm-^{1} 3357, 3046, 2932, 1632, 1620, 1553, 1487,732; ^{1}H-NMR ($CDCl_3$) δ in ppm: 9.68 (s, 1H, NH of triazole ring exchangeable with D_2O), 7.91–7.40 (m, 3H, Ar-H), 2.68 (s, 2H, -CH_2CO-), 1.85 (s, 3H, CH_3), Compound 3 (Found: C, 37.84; H, 02.20; N, 16.97; Calc. for : $C_{13}H_9S_5O_2ClBr$,C, 37.99; H, 2.18;N, 16.88 %).

MS: $[M]^+$ at m/z 415.

2-(5-(6-Bromo-2-methyl-4-oxaquinazolin-3 (4H)-yl)-4H-1,2,4-triazole-3-ylthio) acetohydrazide (4)

2-(5-(6-Bromo-2-methyl-4-oxaquionazolin-3(4H)-1,2,4-triazole-3-ylthio) acetyl chloride (0.01 mole) and hydrazine hydrate (99 %) (0.01 mole) in absolute ethanol (50 ml.) was refluxed for 10-12 hr. and the completion of reaction were monitored by TLC. The excess of solvent was distilled off. The reaction mixture was poured onto ice; the product thus obtained was recrystallized by ethanol.

Yield 77%, m.p.234 ºC, IR max/cm-^{1} 3355, 3052, 2924, 1650, 1625, 1555, 1495,1238,743; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 9.64 (s,1H, NH of triazole ring exchangeable with D_2O) 7.92-7.41 (m,3H,Ar-H), 4.45 (s, 2H, $NHNH_2$), 3.12 (hump.1H,CONH exchangeable with D_2O), 2.70 (s,2H,SCH_2CO), 1.90 (s,3H,CH_3).Compound 4 (Found: C, 37.82; H, 02.98; N, 23.96; Calc. for : $C_{13}H_{12}SN_7O_2Br$,C, 38.06; H, 2.95;N, 23.89 %).

MS: $[M]^+$ at m/z 410.

2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2-chloro benzylidene) acetohydrazide (5a)

A mixture of 2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3 (4H)-yl)-4H-1,2,4-triazole-3-ylthio) acetohydrazide (0.01 mole) and 2-chloro benzaldehyde (0.01 mole) in methanol (50 ml.) were refluxed for 7hr, in the presence of few drops of glacial acetic acid. The progress and completion of reaction were checked by TLC. The reaction was distilled off, cooled and then poured into ice water, filtered, washed with water and dried. The solid thus obtained were recrystallized from ethanol.

Yield 72%, m.p.196 ºC, IR max/cm-^{1} 3360, 3050, 2920, 1725, 1710, 1680, 1620,1560,1490,1235,740,710; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.85 (s, 1H, = CH-Ar), 7.92-7.36 (m, 7H, Ar-H), 7.15 (ss, 1H of triazole nucleus exchangeable with D_2O), 3.10 (hump, 1H, CONH exchangeable with D_2O), 2.64 (s, 2H, SCH_2CO), 2.12 (s, 3H, CH_3 attached to quinazolinone ing).Compound 5a (Found: C, 45.27; H, 02.85; N, 18.47; Calc. for : $C_{20}H_{15}SN_7O_2ClBr$,C, 45.09; H, 2.84;N, 18.40 %).

MS: $[M]^+$ at m/z 533.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(4-chloro benzylidene) acetohydrazides (5b)

Yield 67%, m.p.201 ºC, IR max/cm-^{1} 3350,3040,2915,1735,1718,1690,1605,1568,1484,1230,734,705 ; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.82 (s,1H,=CH-Ar), 7.90-7.35 (m, 7H, Ar-H), 7.13 (ss, 1H of triazole nucleus, exchangeable with D_2O),3.07 (hump, 1H, CONH exchangeable with D_2O),2.61 (s, 3H, SCH_2CO), 2.10 (s, 3H, CH_3 attached to quinazolin ring).Compound 5b (Found: C, 45.27; H, 02.85; N, 18.47; Calc. for : $C_{20}H_{15}SN_7O_2ClBr$: C, 45.09; H, 2.84;N, 18.40 %).

MS: $[M]^+$ at m/z 533.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2-bromo benzylidene) acetohydrazides (5c)

Yield 65%, m.p.222 ºC, IR max/cm-^{1} 3354,3040,2922,1740,1715,1695,1612,1565,1480,1225,730,700; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.86 (s,1H,=CH-Ar), 7.95-7.37 (m, 7H, Ar-H), 7.17 (ss, 1H of triazole nucleus, exchangeable with D_2O), 3.12 (hump, 1H, CONH exchangeable with D_2O), 2.66 (s, 3H, SCH_2CO), 2.15 (s, 3H, CH_3 attached to quinazolin ring).Compound 5c (Found: C, 41.78; H, 02.63; N, 17.05; Calc. for : $C_{20}H_{15}SN_7O_2ClBr_2$: C, 41.62; H, 2.62;N, 16.98 %).

MS: $[M]^+$ at m/z 577.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(4-bromo benzylidene) acetohydrazides (5d)

Yield 63%, m.p.242 ºC, IR max/cm-^{1} 3350,3035,2920,1730,1720,1685,1610,1570,1485,1233,730,710 ; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.84 (s,1H,=CH-Ar 7.92-7.38 (m, 7H, Ar-H), 7.15 (ss, 1H of triazole nucleus, exchangeable with D_2O),), 3.08 (hump, 1H, CONH exchangeable with D_2O),2.67 (s, 3H, SCH_2CO), 2.18 (s, 3H, CH_3 attached to quinazolin ring)Compound 5d (Found: C, 41.78; H, 02.63; N, 17.05; Calc. for : $C_{20}H_{15}SN_7O_2ClBr_2$: C, 41.62; H, 2.62;N, 16.98 %).

MS: $[M]^+$ at m/z 577.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2,4-dichloro benzylidene) acetohydrazides (5e)

Yield 60%, m.p.220 ºC, IR max/cm-^{1} 3345,3042,2920,1720,1710,1677,1620,1554,1480,1220,735,710; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.67 (s,1H,=CH-Ar), 7.85-7.15 (m, 6H, Ar-H), 7.10 (ss, 1H of triazole nucleus, exchangeable with D_2O),2.95 (hump, 1H,

CONH exchangeable with D_2O),2.52 (s, 3H, SCH_2CO), 1.98 (s, 3H, CH_3 attached to quinazolin ring).Compound 5e (Found: C, 42.78; H, 02.48; N, 17.21; Calc. for : $C_{20}H_{14}SN_7O_2Cl_2Br$: C, 42.35; H, 2.49;N, 17.28 %).

MS: $[M]^+$ at m/z 567.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2,4-dibromo benzylidene) acetohydrazides (5f)

Yield 55%, m.p.248 ºC, IR max/cm-^{1} 3350,3050,2925,1730,1720,1680,1622,1560,1480,1225,735,710; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.68 (s,1H,=CH-Ar), 7.96-7.22 (m, 6H, Ar-H), 7.08 (ss, 1H of triazole nucleus, exchangeable with D_2O),3.05 (hump, 1H, CONH exchangeable with D_2O), 2.60 (s, 3H, SCH_2CO), 2.04 (s, 3H, CH_3 attached to quinazolin ring).Compound 5f (Found: C, 36.46; H, 02.14; N, 14.88; Calc. for : $C_{20}H_{14}SN_7O_2Br_3$: C, 36.61; H, 2.15;N, 14.94 %).

MS: $[M]^+$ at m/z 656.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2,6-dichloro benzylidene) acetohydrazides (5g)

Yield 65%, m.p.228 ºC, IR max/cm-^{1} 3335,3050,2975,1715,1705,1665,1610,1540,1470,1240,738,700; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.59 (s,1H,=CH-Ar), 7.77-7.11 (m, 6H, Ar-H), 6.95 (ss, 1H of triazole nucleus, exchangeable with D_2O),2.88 (hump, 1H, CONH exchangeable with D_2O),2.43 (s, 3H, SCH_2CO), 1.89 (s, 3H, CH_3 attached to quinazolin ring).Compound 5g (Found: C, 42.18; H, 02.48; N, 17.21; Calc. for : $C_{20}H_{14}SN_7O_2Cl_2Br$: C, 42.35; H, 2.49;N, 17.28 %).

MS: $[M]^+$ at m/z 567.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2,6-dibromo benzylidene) acetohydrazides (5h)

Yield 55%, m.p.252 ºC, IR max/cm-^{1} 3340,3045,2925,1720,1710,1685,1620,1565,1485,1232,740,702 ; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.64 (s,1H,=CH-Ar), 7.90-7.19 (m, 6H, Ar-H), 7.04 (ss, 1H of triazole nucleus, exchangeable with D_2O),3.00 (hump, 1H, CONH exchangeable with D_2O), 2.55 (s, 3H, SCH_2CO), 2.01 (s, 3H, CH_3 attached to quinazolin ring). Compound 5h (Found: C, 36.46; H, 02.14; N, 14.88; Calc. for : $C_{20}H_{14}SN_7O_2Br_3$: C, 36.61; H, 2.15;N, 14.94 %).

MS: $[M]^+$ at m/z 656.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2-methoxy benzylidene) acetohydrazides (5i)

Yield 61%, m.p.197 ºC, IR max/cm-^{1} 3365,3060,2930,1735,1720,1690,1630,1570,1495,1240,750,725; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.88 (s,1H,=CH-Ar), 7.96-7.38 (m, 7H, Ar-H), 7.19 (ss, 1H of triazole nucleus, exchangeable with D_2O),3.13 (hump, 1H, CONH exchangeable with D_2O), 2.74 (s, 3H, SCH_2CO), 2.31 (s, 3H, CH_3 attached to quinazolin ring) .Compound 5i (Found: C, 47.93; H, 3.44; N, 18.63; Calc. for : $C_{21}H_{18}SN_7O_3Br$: C, 47.74; H, 3.43;N, 18.56%).

MS: $[M]^+$ at m/z 528.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(4-methoxy benzylidene) acetohydrazides (5j)

Yield 63%, m.p.188 ºC, IR max/cm-^{1} 3370,3066,2940,1745,1725,1638,1575,1490,1250,745,720; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.80 (s, 1H, = CH-Ar), 7.98-7.41 (m, 7H, Ar-H), 7.24 (ss, 1H of triazole nucleus exchangeable with D_2O), 3.15 (hump, 1H, CONH exchangeable with D_2O), 2.70 (s, 3H, SCH_2CO), 2.36 (s, 3H, CH_3 attached to quinazolinone ing).Compound 5j (Found: C, 47.55; H, 3.42; N, 18.49; Calc. for : $C_{21}H_{18}SN_7O_3Br$: C, 47.74; H, 3.43;N, 18.56%).

MS: $[M]^+$ at m/z 528.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2-methyl benzylidene) acetohydrazides (5k)

Yield 58%, m.p.176 ºC, IR max/cm-^{1} 3375,3070,2950,1750,1735,1645,1580,1495,1260,755,730; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.86 (s,1H,=CH-Ar), 7.98-7.48 (m, 7H, Ar-H), 7.29 (ss, 1H of triazole nucleus, exchangeable with D_2O),3.18 (hump, 1H, CONH exchangeable with D_2O), 2.92 (s, 3H, SCH_2CO), 2.42 (s, 3H, CH_3 attached to quinazolin ring) .Compound 5k (Found: C, 49.43; H, 3.55; N, 19.22; Calc. for : $C_{21}H_{18}SN_7O_2Br$: C, 49.23; H, 3.54;N, 19.14%).

MS: $[M]^+$ at m/z 512.

(E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(4-methyl benzylidene) acetohydrazides (5l)

Yield 56%, m.p.182 ºC, IR max/cm-^{1} 3380,3065,2945,1755,1740,1650,1575,1490,1265,750,730; ^{1}H-NMR ($CDCl_3$) δ in ppm: 8.90 (s,1H,=CH-Ar), 8.02-7.50 (m, 7H, Ar-H), 7.34 (ss, 1H of triazole nucleus, exchangeable with D_2O) 3.23 (hump, 1H, CONH exchangeable with D_2O), 2.88 (s, 3H, SCH_2CO), 2.46 (s, 3H, CH_3 attached to quinazolin ring) .Compound 5l (Found: C, 49.03; H, 3.53; N, 19.02; Calc. for : $C_{21}H_{18}SN_7O_2Br$: C, 49.23; H, 3.54;N, 19.14%).

MS: $[M]^+$ at m/z 512.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2-chloro benzylidene)-4-oxothiazolidin-3-yl) acetamide (6a) :

To a solution of the compound **(5a)** 2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(2-chlorobenzaldehyde) acetohydrazide (0.01 mole) in ethanol (50 ml.), thioglycolic acid (0.02 mole) were added drop wise in presence of anhydrous zine chloride and the reaction mixture were refluxed for 10 hr. The completion of reaction was checked by TLC. The excess of methanol were distilled off. The cooled residual mass were diluted with ice-water, filtered washed with water, dried and recrystallized from methanol.

Yield 55%, m.p.206 ºC, IR max/cm-^{1} 3355, 3050, 2935, 2840, 1745, 1730, 1715,1685,1620,1570,1485,1230,745,715,695; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.90-7.40 (m, 7H, Ar-H), 7.25 (ss, 1H, of triazole nucleus exchangeable with D_2O), 6.75 (s, 1H, -CH-Ar), 3.42 (s, 2H, CH_2 of thiazolidinone ring), 3.15 (hump, 1H, CONH exchangeable with D_2O), 2.70 (s, 2H, S CH_2CO), 2.15 (s, 3H, CH_3 attached to quinazolinone ring). Compound 6a (Found: C, 43.71; H, 02.83; N, 16.10; Calc. for $C_{22}H_{17}N_7O_3S_2BrCl$: C, 43.44; H, 02.82;N, 16.16 %).

MS: $[M]^+$ at m/z 607.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(4-chloro benzylidene)-4-oxothiazolidin-3-yl) acetamide (6b) :

Yield 50%, m.p.211 ºC, IR max/cm-^{1} 3340, 3035, 2930, 2825, 1750, 1725, 1710,1675,1610,1560,1475,1220,735,705,685; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.95-7.45 (m, 7H, Ar-H), 7.30 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.78 (s, 1H, -CH-Ar), 3.48 (d, CH_2 of thiazolidinone), 3.20 (hump, 1H, CONH exchangeable with D_2O),2.80 (s,2H,SCH_2CO), 2.20 (s, 3H, CH_3 attached to quinazolin ring). Compound 6b (Found: C, 43.71; H, 02.83; N, 16.22; Calc. for $C_{22}H_{17}N_7O_3S_2BrCl$: C, 43.54; H, 02.82;N, 16.16 %).

MS: $[M]^+$ at m/z 607.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2-bromo benzylidene)-4-oxothiazolidin-3-yl) acetamide (6c) :

Yield 48%, m.p.217 ºC, IR max/cm-^{1} 3345, 3040, 2935, 2830, 1750, 1730, 1715,1685,1615,1565,1480,1215,740,710,695; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.99-7.40 (m, 7H, Ar-H), 7.35 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.82 (s, 1H, -CH-Ar), 3.55 (d, CH_2 of thiazolidinone), 3.24 (hump, 1H, CONH exchangeable with D_2O),2.84 (s,2H,SCH_2CO), 2.26 (s, 3H, CH_3 attached to quinazolin ring). Compound 6c (Found: C, 40.41; H, 02.62; N, 15.11; Calc. for $C_{22}H_{17}N_7O_3S_2Br_2$: C, 40.57; H, 02.63;N, 15.05 %).

MS: $[M]^+$ at m/z 651.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(4-bromo benzylidene)-4-oxothiazolidin-3-yl) acetamide (6d) :

Yield 45%, m.p.228 ºC, IR max/cm-^{1} 3335, 3035, 2930, 2825, 1750, 1725, 1715,1680,1610,1560,1470,1210,735,710,680; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.92-7.35 (m, 7H, Ar-H), 7.32 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.84 (s, 1H, -CH-Ar), 3.44 (s, CH_2 of thiazolidinone), 3.22 (hump, 1H, CONH exchangeable with D_2O),2.80 (s,2H,SCH_2CO), 2.32 (s, 3H, CH_3 attached to quinazolin ring).Compound 6d (Found: C, 40.41; H, 02.62; N, 15.11; Calc. for $C_{22}H_{17}N_7O_3S_2Br_2$: C, 40.57; H, 02.63;N, 15.05 %).

MS: $[M]^+$ at m/z 651.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2,4-dichloro benzylidene)-4-oxothiazolidin-3-yl) acetamide (6e) :

Yield 49%, m.p.230 ºC, IR max/cm-^{1} 3340, 3030, 2915, 2820, 1745, 1725, 1710,1670,1605,1550,1460,1205,730,705,675; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.85-7.37 (m, 6H, Ar-H), 7.28 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.73 (s, 1H, -CH-Ar), 3.40 (d, CH_2 of thiazolidinone), 3.01 (hump, 1H, CONH exchangeable with D_2O),2.70 (s,2H,SCH_2CO), 2.10 (s, 3H, CH_3 attached to quinazolin ring).Compound 6e (Found: C, 41.36; H, 02.50; N, 15.35; Calc. for $C_{22}H_{16}BrCl_2N_7O_3S_2$: C, 41.20; H, 02.51;N, 15.29 %).

MS: $[M]^+$ at m/z 641.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2,4-dibromo benzylidene)-4-oxothiazolidin-3-yl) acetamide (6f) :

Yield 43%, m.p.258 ºC, IR max/cm-^{1} 3345, 3030, 2915, 2820, 1740, 1725, 1715,1670,1610,1555,1470,1215,740,715,685; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.94-7.41 (m, 6H, Ar-H), 7.14 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.82 (s, 1H, -CH-Ar), 3.48 (d, CH_2 of thiazolidinone), 3.05 (hump, 1H, CONH exchangeable with D_2O),2.78 (s,2H,SCH_2CO), 2.15 (s, 3H, CH_3 attached to quinazolin ring). Compound 6f (Found: C, 36.04; H, 02.22; N, 13.38; Calc. for $C_{22}H_{16}N_7O_3S_2Br_3$: C, 36.18; H, 02.21;N, 13.43 %).

MS: $[M]^+$ at m/z 730.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2,6-dichloro benzylidene)-4-oxothiazolidin-3-yl) acetamide (6g) :

Yield 46%, m.p.238 ºC, IR max/cm-^{1} 3335, 3025, 2905, 2810,1730, 1715,1700,1660,1595,1545,1455,1200,725,705,670; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.75-7.25 (m, 6H, Ar-H), 7.05 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.60 (s, 1H, -CH-Ar), 3.30 (d, CH_2 of thiazolidinone), 3.00 (hump, 1H, CONH exchangeable with D_2O),2.88 (s,2H,SCH_2CO), 2.04 (s, 3H, CH_3 attached to quinazolin ring). Compound 6g (Found: C, 41.36; H, 2.50; N, 15.35; Calc. for $C_{22}H_{16}BrCl_2N_7O_3S_2$: C, 41.20; H, 2.51;N, 15.29 %).

MS: $[M]^+$ at m/z 641.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2,6-dibromo benzylidene)-4-oxothiazolidin-3-yl) acetamide (6h) :

Yield 41%, m.p.248 ºC, IR max/cm-^{1} 3345, 3045, 2920, 2820, 1740, 1725, 1710,1675,1620,1550,1460,1215,740,715,690; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.85-7.35 (m, 6H, Ar-H), 7.15 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.71 (s, 1H, -CH-Ar), 3.41 (d, CH_2 of thiazolidinone), 3.08 (hump, 1H, CONH exchangeable with D_2O),2.96 (s,2H,SCH_2CO), 2.15 (s, 3H, CH_3 attached to quinazolin ring). Compound 6h (Found: C, 36.04; H, 2.22; N, 13.38; Calc. for $C_{22}H_{16}N_7O_3S_2Br_3$: C, 36.18; H, 02.21;N, 13.43 %).

MS: $[M]^+$ at m/z 730.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2-methoxy benzylidene)-4-oxothiazolidin-3-yl) acetamide (6i) :

Yield 48%, m.p.192 ºC, IR max/cm-^{1} 3365, 3065, 2935, 2835, 1750, 1730, 1715,1685,1625,1565,1490,1240,750,720,695; ^{1}H-NMR ($CDCl_3$) δ in ppm:7.90-7.40 (m, 7H, Ar-H), 7.29 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.78 (s, 1H, -CH-Ar), 3.47 (d, CH_2 of thiazolidinone), 3.33 (hump, 1H, CONH exchangeable with D_2O),3.06 (s,2H,SCH_2CO), 2.40 (s, 3H, CH_3 attached to quinazolin ring).Compound 6i (Found: C, 45.67; H, 3.34; N, 16.33; Calc. for $C_{23}H_{20}N_7O_4S_2Br$: C, 45.85; H, 3.35;N, 16.27 %).

MS: $[M]^+$ at m/z 602.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(4-methoxy benzylidene)-4-oxothiazolidin-3-yl) acetamide (6j) :

Yield 45%, m.p.183 ºC, IR max/cm-^{1} 3375, 3070, 2945, 2840, 1765, 1750, 1730,1690,1640,1575,1500,1250,760,730,705; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.95-7.45 (m, 7H, Ar-H), 7.35 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.83 (s, 1H, -CH-Ar), 3.49 (d, CH_2 of thiazolidinone), 3.25 (hump, 1H, CONH exchangeable with D_2O), 3.10 (s,2H,SCH_2CO), 2.50 (s, 3H, CH_3 attached to quinazolin ring).Compound 6j (Found: C, 45.67; H, 3.34; N, 16.33; Calc. for $C_{23}H_{20}N_7O_4S_2Br$: C, 45.85; H, 3.35;N, 16.27 %).

MS: $[M]^+$ at m/z 602.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(2-methyl benzylidene)-4-oxothiazolidin-3-yl) acetamide (6k) :

Yield 40%, m.p.181 ºC, IR max/cm-^{1} 3380, 3075, 2950, 2850, 1770, 1760, 1740,1695,1650,1580,1510,1265,770,735,715; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.99-7.48 (m, 7H, Ar-H), 7.40 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.89 (s, 1H, -CH-Ar), 3.54 (d, CH_2 of thiazolidinone), 3.32 (hump, 1H, CONH exchangeable with D_2O), 3.14 (s,2H,SCH_2CO), 2.54 (s, 3H, CH_3 attached to quinazolin ring).Compound 6k (Found: C, 47.29; H, 3.45; N, 16.68; Calc. for $C_{23}H_{20}N_7O_3S_2Br$: C, 47.10; H, 3.44;N, 16.72 %).

MS: $[M]^+$ at m/z 586.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(4-methyl benzylidene)-4-oxothiazolidin-3-yl) acetamide (6l) :

Yield 42%, m.p.187 ºC, IR max/cm-^{1} 3375, 3070, 2945, 2840, 1765, 1755, 1735,1690,1640,1575,1500,1260,760,730,710; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 8.05-7.55 (m, 7H, Ar-H), 7.46 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.95 (s, 1H, -CH-Ar), 3.62 (d of thiazolidinone), 3.37 (hump, 1H, CONH exchangeable with D_2O), 3.22 (s,2H,SCH_2CO), 2.60 (s, 3H, CH_3 attached to quinazolin ring).Compound 6l (Found: C, 47.29; H, 3.45; N, 16.68; Calc. for $C_{23}H_{20}N_7O_3S_2Br$: C, 47.10; H, 3.44;N, 16.72 %).

MS: $[M]^+$ at m/z 586.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro-2-(2-chloro benzylidene)-4-oxoazetidin-1-yl) acetamide (7a) :

To a solution of the compound **(5a)** 2-(5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio)-N-(2-chloro benzylidene) acetohydrazide (0.01 mole), chloro acetyl chloride were added drop wise with constant stirring in presence of triethyl amine (0.02 mole) at 0-5ºC . The reaction mixture was further refluxed for 8hr. The completion of reaction was checked by TLC and excess of ethanol was distilled off. The resulting residual mass were cooled, poured into ice water, filtered, washed with water, dried and recrystallized from methanol.

Yield 40%, m.p.215 ºC, IR max/cm-^{1} 3360, 3065, 2925, 1745, 1725, 1715, 1685,1625,1565,1490,1225,745,715; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.95-7.32 (m,7H,Ar-H), 7.21 (ss, 1H, of triazole nucleus exchangeable with D_2O), 6.74 (d, 1H, -CH-Ar), 3.92 (d, 1H, -CHCl of Azetidinone ring), 3.08 (hump,1H,CONH exchangeable with D_2O), 2.62 (S, 2H, SCH_2CO), 2.12 (S,3H,CH_3 attached to quinazolinone ring).Compound 7a (Found: C, 43.19; H, 02.62; N, 16.18; Calc. for : $C_{22}H_{16}N_7O_3SBrCl_2$,C, 43.37; H, 02.65;N, 16.09 %).

MS: $[M]^+$ at m/z 609.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro-2-(4-chloro benzylidene)-4-oxoazetidin-1-yl) acet-amide (7b) :

Yield 35%, m.p.221ºC, IR max/cm-^{1} 3360, 3060, 2930, 1735, 1720, 1710,1680,1620,1570,1495,1225,747,718; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.88-7.42 (m, 7H, Ar-H), 7.17 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.78 (d, 1H, CH-Ar), 3.90 (d, 1H, CH-Cl of Azetidinone ring), 3.08 (hump, 1H, CONH exchangeable with D_2O), 2.60 (s, 2H, SCH_2CO), 2.18 (s, 3H, CH_3 attached to quinazolin ring).Compound 7b (Found: C, 43.18; H, 2.64; N, 16.17; Calc. for $C_{22}H_{16}N_7O_3SBrCl_2$: C, 43.37; H, 2.65;N, 16.09 %).

MS: $[M]^+$ at m/z 609.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2-bromo benzylidene)-4-oxoazetidin-1-yl) acet-amide (7c) :

Yield 30%, m.p.213ºC, IR max/cm-^{1} 3355, 3058, 2920, 1743, 1730, 1720,1680,1635,1560,1490,1230,743,710; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.90-7.45 (m, 7H, Ar-H), 7.19 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.70 (d, 1H, CH-Ar), 3.84 (d, 1H, CH-Cl of Azetidinone ring), 3.10 (hump, 1H, CONH exchangeable with D_2O), 2.53 (s, 2H, SCH_2CO), 2.07 (s, 3H, CH_3 attached to quinazolin ring).Compound 7c (Found: C, 40.51; H, 2.48; N, 15.08; Calc. for $C_{22}H_{16}N_7O_3SBr_2Cl$: C, 40.42; H, 2.47;N, 15.00 %).

MS: $[M]^+$ at m/z 654.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(4-bromo benzylidene)-4-oxoazetidin-1-yl) acet-amide (7d) :

Yield 32%, m.p.221ºC, IR max/cm-^{1} 3348, 3050, 2925, 1738, 1730, 1715,1673,1635,1560,1485,1215,748,718; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.85-7.40 (m, 7H, Ar-H), 7.20 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.74 (d, 1H, CH-Ar), 3.88 (d, 1H, CH-Cl of Azetidinone ring), 3.05 (hump, 1H, CONH exchangeable with D_2O), 2.58 (s, 2H, SCH_2CO), 2.14 (s, 3H, CH_3 attached to quinazolin ring).Compound 7d (Found: C, 40.48; H, 2.48; N, 15.09; Calc. for $C_{22}H_{16}N_7O_3SBr_2Cl$: C, 40.42; H, 2.47;N, 15.00 %).

MS: $[M]^+$ at m/z 654.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2,4-dichloro benzylidene)-4-oxoazetidin-1-yl) acet-amide (7e)

Yield 28s%, m.p.237ºC, IR max/cm-^{1} 3365, 3068, 2930, 1740, 17330, 1720,1685,1625,1575,1495,1230,740,720; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.90-7.42 (m, 6H, Ar-H), 7.11 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.62 (d, 1H, CH-Ar), 4.05 (d, 1H, CH-Cl of Azetidinone ring), 2.90 (hump, 1H, CONH exchangeable with D_2O), 2.40 (s, 2H, SCH_2CO), 2.00 (s, 3H, CH_3 attached to quinazolin ring).Compound 7e (Found: C, 41.18; H, 2.31; N, 15.21; Calc. for $C_{22}H_{15}N_7O_3SBrCl_3$: C, 41.05; H, 2.35;N, 15.23 %).

MS: $[M]^+$ at m/z 644.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2,4-dibromo benzylidene)-4-oxoazetidin-1-yl) acet-amide (7f)

Yield 30%, m.p.253ºC, IR max/cm-^{1} 3345, 3055, 2924, 1745, 1725, 1710,1670,1625,1565,1480,1230,745,716; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.80-7.38 (m, 6H, Ar-H), 7.15 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.43 (d, 1H, CH-Ar), 4.00 (d, 1H, CH-Cl of Azetidinone ring), 2.94 (hump, 1H, CONH exchangeable with D_2O), 2.48 (s, 2H, SCH_2CO), 2.04 (s, 3H, CH_3 attached to quinazolin ring).Compound 7f (Found: C, 36.22; H, 2.05; N, 13.30; Calc. for $C_{22}H_{15}N_7O_3SClBr_3$: C, 36.07; H, 2.06;N, 13.38 %).

MS: $[M]^+$ at m/z 733.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2,6-dichloro benzylidene)-4-oxoazetidin-1-yl) acet-amide (7g)

Yield 33%, m.p.234ºC, IR max/cm-^{1} 3372, 3070, 2920, 1745, 1730, 1720,1680,1625,1570,1485,1225,735,712; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.85-7.42 (m, 6H, Ar-H), 7.00 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.50 (d, 1H, CH-Ar), 3.94 (d, 1H, CH-Cl of Azetidinone ring), 3.00 (hump, 1H, CONH exchangeable with D_2O), 2.35 (s, 2H, SCH_2CO), 2.05 (s, 3H, CH_3 attached to quinazolin ring).Compound 7g (Found: C, 41.16; H, 2.33; N, 15.28; Calc. for $C_{22}H_{15}N_7O_3SBrCl_3$: C, 41.05; H, 2.35;N, 15.23 %).

MS: $[M]^+$ at m/z 641.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2,6-dibromo benzylidene)-4-oxoazetidin-1-yl) acet-amide (7h)

Yield 29%, m.p.243ºC, IR max/cm-^{1} 3350, 3060, 2920, 1748, 1725, 1715,1675,1610,1560,1470,1220,750,720; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.77-7.35 (m, 6H, Ar-H), 7.06 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.58 (d, 1H, CH-Ar), 3.98 (d, 1H, CH-Cl of Azetidinone ring), 3.11 (hump, 1H, CONH exchangeable with D_2O), 2.42 (s, 2H, SCH_2CO), 1.98 (s, 3H, CH_3 attached to quinazolin ring).Compound 7h (Found: C, 36.25; H, 2.05; N, 13.29; Calc. for $C_{22}H_{15}N_7O_3SClBr_3$: C, 36.07; H, 2.06;N, 13.38 %).

MS: $[M]^+$ at m/z 733.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2-methoxy benzylidene)-4-oxoazetidin-1-yl) acet-amide (7i)

Yield 26%, m.p.204ºC, IR max/cm-^{1} 3340, 3045, 2960, 1740, 1725, 1715,1680,1605,1570,1460,1225,715,695; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.85-7.42 (m, 7H, Ar-H), 7.20 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.62 (d, 1H, CH-Ar), 3.72 (d, 1H, CH-Cl of Azetidinone ring), 3.40 (hump, 1H, CONH exchangeable with D_2O), 2.50 (s, 2H, SCH_2CO), 2.10 (s, 3H, CH_3 attached to quinazolin ring).Compound 7i (Found: C, 45.80; H, 3.15; N, 16.13; Calc. for $C_{23}H_{19}N_7O_4SClBr$: C, 45.67; H, 3.17;N, 16.21 %).

MS: $[M]^+$ at m/z 605.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(4-methoxy benzylidene)-4-oxoazetidin-1-yl) acet-amide (7j)

Yield 23%, m.p.184ºC, IR max/cm-^{1} 3330, 3040, 2950, 1745, 1725, 1710,1670,1600,1570,1460,1230,720,690; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.90-7.48 (m, 7H, Ar-H), 7.25 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.69 (d, 1H, CH-Ar), 3.76 (d, 1H, CH-Cl of Azetidinone ring), 3.35 (hump, 1H, CONH exchangeable with D_2O), 2.60 (s, 2H, SCH_2CO), 2.22 (s, 3H, CH_3 attached to quinazolin ring).Compound 7j (Found: C, 45.51; H, 3.16; N, 16.13; Calc. for $C_{23}H_{19}N_7O_4SClBr$: C, 45.67; H, 3.17;N, 16.21 %).

MS: $[M]^+$ at m/z 605.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(2-methyl benzylidene)-4-oxoazetidin-1-yl) acet-amide (7k)

Yield 25%, m.p.186ºC, IR max/cm-^{1} 3350, 3040, 2920, 1740, 1730, 1710,1680,1615,1560,1480,1225,740,705; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.95-7.50 (m, 7H, Ar-H), 7.34 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.81 (d, 1H, CH-Ar), 3.70 (d, 1H, CH-Cl of Azetidinone ring), 3.38 (hump, 1H, CONH exchangeable with D_2O), 2.72 (s, 2H, SCH_2CO), 2.35 (s, 3H, CH_3 attached to quinazolin ring).

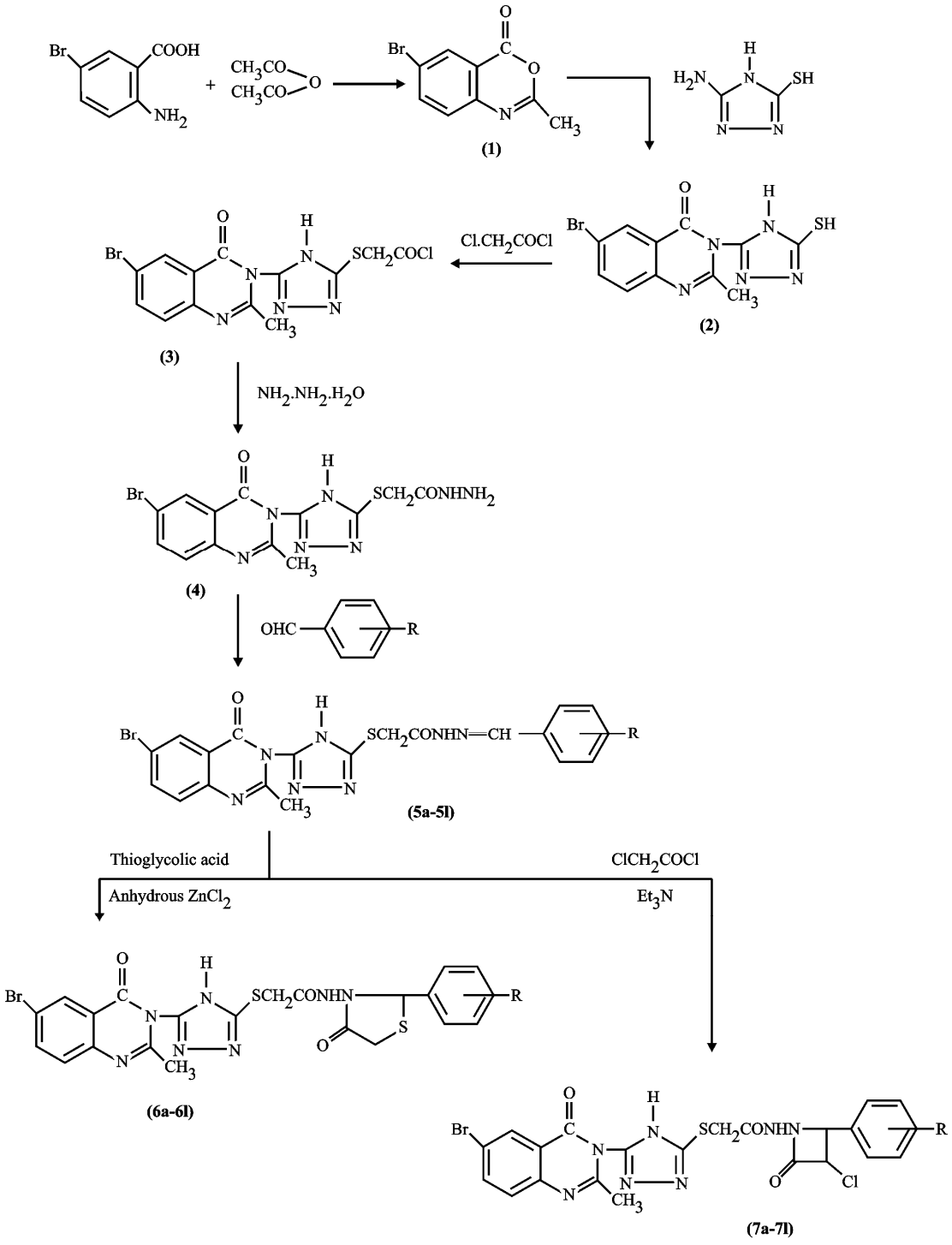
Compound 7k (Found: C, 46.80; H, 3.26; N, 16.69; Calc. for $C_{23}H_{19}N_7O_3SBrCl$: C, 46.91; H, 3.25;N, 16.65 %).

MS: $[M]^+$ at m/z 589.

2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro(4-methyl benzylidene)-4-oxoazetidin-1-yl) acet-amide (7l)

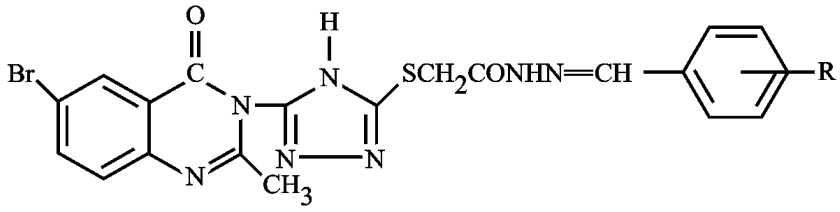
Yield 30%, m.p.191ºC, IR max/cm-^{1} 3340, 3040, 2928, 1745, 1735, 1715,1670,1625,1565,1470,745,710; ^{1}H-NMR ($CDCl_3$) δ in ppm.: 7.98-7.52 (m, 7H, Ar-H), 7.37 (ss, 1H of triazole nucleus, exchangeable with D_2O), 6.94 (d, 1H, CH-Ar), 3.73 (d, 1H, CH-Cl of Azetidinone ring), 3.45 (hump, 1H, CONH exchangeable with D_2O), 2.86 (s, 2H, SCH_2CO), 2.48 (s, 3H, CH_3 attached to quinazolin ring).Compound 7l (Found: C, 46.75; H, 3.27; N, 16.68; Calc. for $C_{23}H_{19}N_7O_3SBrCl$: C, 46.91; H, 3.25;N, 16.65 %).

MS: $[M]^+$ at m/z 589.


Br
COOH
NH2
CH3CO
CH3CO
O
(1)
H2N
SH
Cl.CH2COCl
SCH2COCl
(2)
(3)
NH2.NH2.H2O
SCH2CONHNH2
(4)
OHC
R
SCH2CONHN=CH
(5a-5l)
Thioglycolic acid
Anhydrous ZnCl2
ClCH2COCl
Et3N
SCH2CONHN
(6a-6l)
(7a-7l)
Cl
CH3

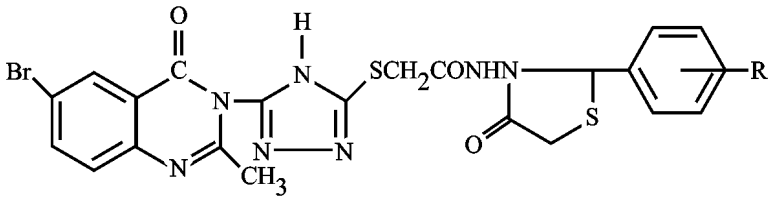
Scheme - I

Table-I: Physical and analytical data of (E)-2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazole-3-ylthio)-N-(substituted benzylidene) acetohydrazides (5b-5l)



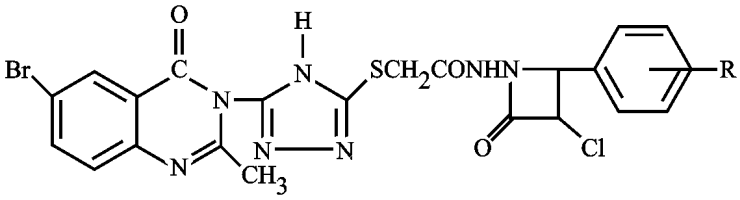
Comp.	R	M.P. (ºC)	Yield (%)	Recrysta-llization solvent	Molecular formula	Elemental analysis (%)					
						C %		H %		N %	
						Calcd.	Found	Calcd.	Found	Calcd.	Found
5b	4-Cl	201	67	Ethanol	$C_{20}H_{15}SN_7O_2ClBr$	45.09	45.27	2.84	2.85	18.40	18.47
5c	2-Br	222	65	Acetone	$C_{20}H_{15}SN_7O_2ClBr_2$	41.62	41.78	2.62	2.63	16.98	17.05
5d	4-Br	242	63	Benzene	$C_{20}H_{15}SN_7O_2ClBr_2$	41.62	41.78	2.62	2.63	16.98	17.05
5e	2,4-Cl_2	220	60	Methanol	$C_{20}H_{14}SN_7O_2Cl_2Br$	42.35	42.18	2.49	2.48	17.28	17.21
5f	2,4-Br_2	248	55	DMF Water	$C_{20}H_{14}SN_7O_2Br_3$	36.61	36.46	2.15	2.14	14.94	14.88
5g	2,6-Cl_2	228	65	Ethanol	$C_{20}H_{14}SN_7O_2Cl_2Br$	42.35	42.18	2.49	2.48	17.28	17.21
5h	2,6-Br_2	252	55	Benzene	$C_{20}H_{14}SN_7O_2Br_3$	36.61	36.46	2.15	2.14	14.94	14.88
5i	2-OCH_3	197	61	Acetone	$C_{21}H_{18}SN_7O_3Br$	47.74	47.93	3.43	3.44	18.56	18.63
5j	4-OCH_3	188	63	Methanol	$C_{21}H_{18}SN_7O_3Br$	47.74	47.55	3.43	3.42	18.56	18.49
5k	2-CH_3	176	58	Ethanol	$C_{21}H_{18}SN_7O_2Br$	49.23	49.43	3.54	3.55	19.14	19.22
5l	4-CH_3	182	56	Ethanol	$C_{21}H_{18}SN_7O_2Br$	49.23	49.03	3.54	3.53	19.14	19.02

Table-II: 2-[5-(6-Bromo-2-methyl-4-oxoquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(substituted benzyli-dene)-4-oxothiazolidin-3-yl) acetamides (6b-6l)



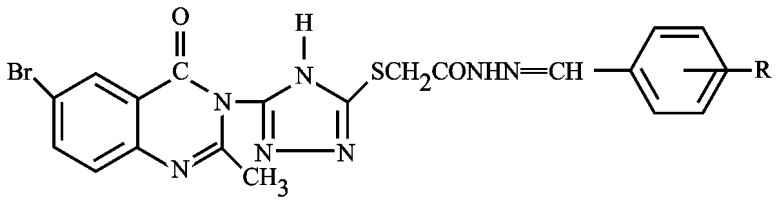
Comp.	R	M.P. (ºC)	Yield (%)	Recrysta-llization solvent	Molecular formula	Elemental analysis (%)					
						C %		H %		N %	
						Calcd.	Found	Calcd.	Found	Calcd.	Found
6b	4-Cl	211	50	Acetone	$C_{22}H_{17}N_7O_3S_2BrCl$	43.54	43.71	2.82	2.83	16.16	16.22
6c	2-Br	217	48	Benzene	$C_{22}H_{17}N_7O_3S_2Br_2$	40.57	40.41	2.63	2.62	15.05	15.11
6d	4-Br	228	45	DMF Water	$C_{22}H_{17}N_7O_3S_2Br_2$	40.57	40.41	2.63	2.62	15.05	15.11
6e	2,4-Cl_2	230	49	Ethanol	$C_{22}H_{16}BrCl_2N_7O_3S_2$	41.20	41.36	2.51	2.50	15.29	15.35
6f	2,4-Br_2	258	43	Benzene	$C_{22}H_{16}N_7O_3S_2Br_3$	36.18	36.04	2.21	2.22	13.43	13.38
6g	2,6-Cl_2	238	46	Ethanol	$C_{22}H_{16}BrCl_2N_7O_3S_2$	41.20	41.36	2.51	2.50	15.29	15.35
6h	2,6-Br_2	248	41	Acetone	$C_{22}H_{16}N_7O_3S_2Br_3$	36.18	36.04	2.21	2.22	13.43	13.38
6i	2-OCH_3	192	48	Benzene	$C_{23}H_{20}N_7O_4S_2Br$	45.85	45.67	3.35	3.34	16.27	16.33
6j	4-OCH_3	183	45	Ethanol	$C_{23}H_{20}N_7O_4S_2Br$	45.85	45.67	3.35	3.34	16.27	16.33
6k	2-CH_3	181	40	DMF Water	$C_{23}H_{20}N_7O_3S_2Br$	47.10	47.29	3.44	3.45	16.72	16.68
6l	4-CH_3	187	42	Acetone	$C_{23}H_{20}N_7O_3S_2Br$	47.10	47.29	3.44	3.45	16.72	16.68

Table-III: 2-[5-(6-Bromo-2-methyl-4-oxcquinazolin-3(4H)-yl)-4H-1,2,4-triazol-3-ylthio]-N-(3-chloro-2-(substituted phenyl)-4-oxoazetidin-1-yl) acetamides (7b-7l)



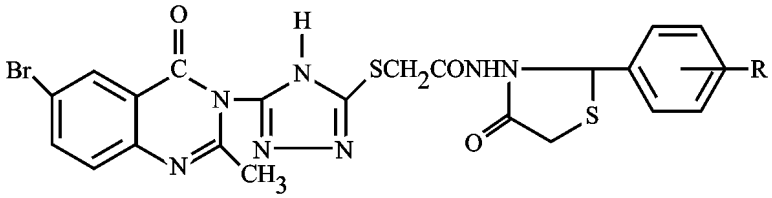
Comp.	R	M.P. (ºC)	Yield (%)	Recrysta-llization solvent	Molecular formula	Elemental analysis (%)					
						C %		H %		N %	
						Calcd.	Found	Calcd.	Found	Calcd.	Found
7b	4-Cl	221	35	Benzene	$C_{22}H_{16}N_7O_3SBrCl_2$	43.37	43.18	2.65	2.64	16.09	16.17
7c	2-Br	213	30	Acetone	$C_{22}H_{16}N_7O_3SBr_2Cl$	40.42	40.51	2.47	2.48	15.00	15.08
7d	4-Br	221	32	Methanol	$C_{22}H_{16}N_7O_3SBr_2Cl$	40.42	40.48	2.47	2.48	15.00	15.09
7e	2,4-Cl_2	237	28	Ethanol	$C_{22}H_{15}N_7O_3SBrCl_3$	41.05	41.18	2.35	2.31	15.23	15.21
7f	2,4-Br_2	253	30	Methanol	$C_{22}H_{15}N_7O_3SClBr_3$	36.07	36.22	2.06	2.05	13.38	13.30
7g	2,6-Cl_2	234	33	Acetone	$C_{22}H_{15}N_7O_3SBrCl_3$	41.05	41.16	2.35	2.33	15.23	15.28
7h	2,6-Br_2	243	29	Benzene	$C_{22}H_{15}N_7O_3SClBr_3$	36.07	36.25	2.06	2.05	13.38	13.29
7i	2-OCH_3	204	26	Methanol	$C_{23}H_{19}N_7O_4SClBr$	45.67	45.80	3.17	3.15	16.21	16.13
7j	4-OCH_3	184	23	Methanol	$C_{23}H_{19}N_7O_4SClBr$	45.67	45.51	3.17	3.16	16.21	16.13
7k	2-CH_3	186	25	DMF Water	$C_{23}H_{19}N_7O_3SBrCl$	46.91	46.80	3.25	3.26	16.65	16.69
7l	4-CH_3	191	30	Benzene	$C_{23}H_{19}N_7O_3SBrCl$	46.91	46.75	3.25	3.27	16.65	16.68

Table-IV: Anti-inflammatory, analgesic and toxicity data of compounds (5a-5j)



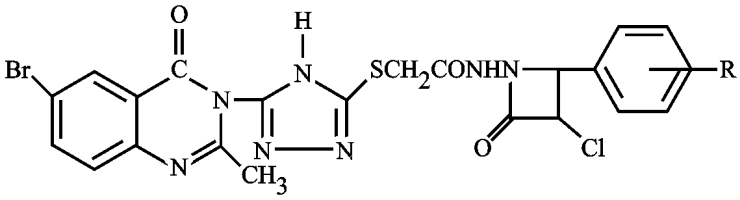
Comp.	R	Anti-Inflammatory Activity		Analgesic Activity		UD_{50} (mg./kg. i.p.)	Acute Toxicity ALD_{50} (mg./kg. p.o)
		Dose (mg./kg. p.o.)	% Inhibition of oedema	Dose (mg./kg. p.o.)	% Protection		
5a	2-Cl	50	10.12*	50	08.35*	-	> 1000
5b	4-Cl	50	16.15*	50	14.27*	-	> 1000
5c	2-Br	50	17.38*	50	15.26*	-	> 1000
5d	4-Br	50	18.76*	50	16.52*	-	> 1000
5e	2,4-Cl_2	50	14.82*	50	12.38*	-	> 1000
5f	2,4-Br_2	50	13.52*	50	11.40*	-	> 1000
5g	2,6-Cl_2	50	15.18*	50	13.45*	-	> 1000
5h	2,6-Br_2	50	12.92*	50	10.19*	-	> 1000
5i	2-OCH_3	50	16.65*	50	14.60*	-	> 1000
5j	4-OCH_3	50	14.38*	50	12.52*	-	> 1000
5k	2-CH_3	50	17.72*	50	15.14*	-	> 1000
5l	4-CH_3	50	13.23*	50	11.38*	-	> 1000

Table-V: Anti-inflammatory, analgesic and toxicity data of compounds (6a-6j)



Comp	R	Anti-Inflammatory Activity		Analgesic Activity		UD_{50} (mg./kg. i.p.)	Acute Toxicity ALD_{50} (mg./kg. p.o)
		Dose (mg./kg. p.o.)	% Inhibition of oedema	Dose (mg./kg. p.o.)	% Protection		
6a	2-Cl	50	21.18**	50	18.64*	-	> 1000
6b	4-Cl	50	26.47**	50	24.60**	-	> 1000
6c	2-Br	50	27.58**	50	24.38**	-	> 1000
6d	4-Br	50	28.24**	50	26.92**	-	> 1000
6e	2,4-Cl_2	50	30.19**	50	29.53**	-	> 1000
6f	2,4-Br_2	50	22.49**	50	20.63**	-	> 1000
6g	2,6-Cl_2	25 50 100	19.30** 40.69*** 71.62***	25 50 100	16.93** 38.54*** 62.39***	165.50	> 14000
6h	2,6-Br_2	50	26.83**	50	24.48**	-	> 1000
6i	2-OCH_3	50	23.39**	50	22.11**	-	> 1000
6j	4-OCH_3	50	25.63**	50	22.40**	-	> 1000
6k	2-CH_3	50	27.16**	50	25.61**	-	> 1000
6l	4-CH_3	50	22.36**	50	20.81*	-	> 1000

Table-VI: Anti-inflammatory, analgesic and toxicity data of compounds (7a-7j)



Comp.	R	Anti-Inflammatory Activity		Analgesic Activity		UD_{50} (mg./kg. i.p.)	Acute Toxicity ALD_{50} (mg./kg. p.o)
		Dose (mg./kg. p.o.)	% Inhibition of oedema	Dose (mg./kg. p.o.)	% Protection		
7a	2-Cl	50	30.68**	50	27.30**	-	> 1000
7b	4-Cl	50	34.27***	50	32.62***	-	> 1000
7c	2-Br	50	36.56***	50	34.54***	-	> 1000
7d	4-Br	50	37.52***	50	35.48***	-	> 1000
7e	2,4-Cl_2	50	35.63***	50	32.62***	-	> 1000
7f	2,4-Br_2	50	32.45**	50	30.59**	-	> 1000
7g	2,6-Cl_2	25 50 100	20.82** 45.76*** 75.30***	25 50 100	18.25** 42.37*** 65.48***	195.50	> 14000
7h	2,6-Br_2	50	33.37***	50	30.54***	-	> 1000
7i	2-OCH_3	50	31.28**	50	29.40**	-	> 1000
7j	4-OCH_3	50	34.22***	50	32.16***	-	> 1000
7k	2-CH_3	50	32.35**	50	29.27**	-	> 1000
7l	4-CH_3	50	35.53***	50	33.61***	-	> 1000
Phenyl butazone		25 50 100	17.50** 38.80*** 68.60***	25 50 100	15.80** 36.50*** 60.50***	66.60	

**P < 0.05; **P < 0.01; ***P <0.001*

Propylene glycol standard for control group

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العلاقة بين الغذاء ومرض السرطان

[The Relationship between food and cancer]

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ABSTRACT: Cancer is a potentially fatal disease caused mainly by environmental factors that mutategenes encoding critical cell-regulatory proteins. The resultant aberrant cell behaviour leads to expansive masses of abnormal cells that destroy surrounding normal tissue and can spread to vital organs resulting in disseminated disease, commonly a harbinger of imminent patient death. There are many kinds of cancer, but they all start because of out-of-control growth of abnormal cells.

This complex genetic disease is caused primarily by environmental factors. The cancer-causing agents (carcinogens) can be present in food and water, in the air, and in chemicals and sunlight that people are exposed to. Since epithelial cells cover the skin, line the respiratory and alimentary tracts, and metabolize ingested carcinogens, it is not surprising that over 90% of cancers occur in epithelia.

The causes of serious ill-health in the world are changing. Infection as a major cause is giving way to noncommunicable diseases such as cardiovascular disease and cancer. In 1996 there were 10 million new cancer cases worldwide and six million deaths attributed to cancer. In 2020 there are predicted to be 20 million new cases and 12 million deaths. Part of the reason for this is that life expectancy is steadily rising and most cancers are more common in an ageing population. More significantly, a globalization of unhealthy lifestyles, particularly cigarette smoking and the adoption of many features of the modern Western diet (high fat, low fibre content) will increase cancer incidence.

According to the latest studies of galaxies on the food that there is a relationship between certain types of food and the spread of cancer, and also there are foods contribute to the reduction or prevention or even a cure, for example, fat and alcohol contribute to the emergence of cancer of the stomach and intestines, while vegetables and legumes and fiber reduces of its occurrence, and this is what we will discover through this humble research.

KEYWORDS: Food, Cancer, Hormone Therapy, Radiotherapy, Chemotherapy, Malignant, Benign.

مقدمـة:

السرطان هو داء ارتبط اسمه مع اسم الموت حتى صار يضاهيه رهبة و فزعاً و صار كل من يسمع بِاسمه يشعر بالخوف و الحزن و الأسى سواء أكان هو المصاب أم أحد أقاربه أو معارفه، و الحقيقة أن السرطان هو داء خطير قد يؤدي إلى الموت لكن ليس بالضرورة، خصوصا مع التطورات الحاصلة في وقتنا الراهن. والسرطان بأشكاله المختلفة يأتي في المرتبة الثانية بعد أمراض القلب كمسبب لأعلى نسبة وفيات في الأمم الصناعية، إذ يموت واحد من بين كل ثلاثة أو أربعة أشخاص بالسرطان.

يتكون جسم الإنسان من خلايا مختلفة في أشكالها ووظائفها. بشكل مبسط كل خليه تحتوى على غلاف خارجي ونواه ، وفي النواة تُحفظ المعلومات الأساسية للخلية. هذه المعلومات في الحقيقة تكون موجودة في جزيء الحامض النووي . DNA - deoxyribonucleic acid يحتوي الحامض النووي على 26 كروم وزوم والتي تتكون بدورها من ملايين الجينات. هذه الجينات هي التي تحدد نظام وطريقة عمل الخلية. خلال حياتنا بعض خلايا الجسم تموت بشكل طبيعي ويقوم الجسم بتعويض ذلك النقص في الخلايا عن طريق الانقسام. عند الانقسام تقوم الخلية بإنتاج نسخه أخرى من الحامض النووي ثم تنقسم إلى خليتين. هذا ما يحدث في الخلية بشكل مبسط حيث أن عملية الانقسام أكثر تعقيداً من ذلك. عادة يحدث انقسام الخلايا بشكل منتظم بحيث يمكن لأجسامنا النمو أو لاستبدال أو إصلاح الأنسجة التالفة.

عندما تعمل الخلايا كما هو مخطط لها فإننا نتمتع بصحة جيده لكن عندما يختل ذلك النظام فإننا نمرض. في حالة السرطان تنمو خلايا غير طبيعيه وبدلاً من تعويض الخلايا التالفة فقط ، تتكاثر تلك الخلايا بشكل كبير ودون توقف فتطغى على العضو المصاب مشكلة ما يسمى بالورم، وهذه الأورام تنقسم إلى أورام حميدة وأخرى خبيثة.

الأورام الحميدة غير سرطانية :Benign وهي عادة تكون مغلفه بغشاء وغير قابله للانتشار ولكن بعضها قد يسبب مشاكل للعضو المصاب خصوصاً إذا كانت كبيرة الحجم وتأثيرها يكون بالضغط على العضو المصاب أو الأعضاء القريبة منها مما يمنعها من العمل بشكل طبيعي. هذه الأورام من الممكن إزالتها بالجراحة أو علاجها بالعقاقير أو الأشعة لتصغير حجمها وذلك كاف للشفاء منها وغالباً لا تعود مرّة ثانيه.

الأورام الخبيثة سرطانية : (Malignant):

الأورام السرطانية تهاجم وتدمر الخلايا والأنسجة المحيطة بها ولها قدره عاليه على الانتشار.

وهي تنتشر بثلاث طرق :

أولاً:انتشار مباشر للأنسجة والأعضاء المحيطة بالعضو المصاب

ثانياً:عن طريق الجهاز اللمفاوي

ثالثاً:عن طريق الدم حيث تنفصل خليه (أو خلايا) من الورم السرطاني الأولي Primary وتنتقل عن طريق الجهاز اللمفاوي أو الدم إلى أعضاء أخرى بعيده حيث تستقر في مكان ما –غالباً أعضاء غنية بالدم مثل الرئة، الكبد أو العقد اللمفاوية -متسببة في نمو أورام سرطانية أخرى تسمى بالأورام الثانوية.Secondary .

بالرجوع إلى موضوع بحثنا فإن أحدث الدراسات المجرات على الغذاء تشير إلى أن هناك علاقة بين بعض أنواع الغذاء وانتشار مرض السرطان، وأيضا هناك أغذية تساهم في الحد منه أو الوقاية منه أو حتى علاجه، فمثلا الدسم و الكحول يساهمان في ظهور سرطان المعدة والأمعاء، بينما الخضار و البقول و الألياف تقلل من حدوثه، وهذا ما سنكتشفه من خلال هذا البحث المتواضع.

1- تعريف مرض السرطان:

السرطان هو مصطلح لورم خبيث أو نمو اعتلالي للخلايا التي تنتشر بعد ذلك إلى الأنسجة المجاورة لها وهذه الأورام ليست ذات فائدة وهي تنمو على حساب الأنسجة السليمة وبعض الخلايا السرطانية قد تخرج من الورم الأصلي وتنتشر بواسطة اللمفات أو الدم إلا الأجهزة البعيدة في الجسم في عملية تسمى "الإنبثات" Metastasis.

ومثل كل الخلايا تحتاج الخلايا الخبيثة إلى كل من الطاقة والعناصر الغذائية كي تحافظ على بقائها ونموها ومن الأرجح أن هذا الاحتياج هو السبب الرئيسي لفقدان الوزن الذي يحدث في مرحلة مبكرة من الإصابة حتى إذا كان المريض لم يقلل من عدد السعرات الحرارية التي يتناولها ولم يغير نوعية النشاط لجسماني الذي يؤديه.

وإذا لم يستجيب المرضى للعلاج فإن متطلبا عملية الأيض التي تقوم بها الخلايا السرطانية بالإضافة لفقدان الشهية والشعور بالغثيان القيء والمشاكل الأخرى المتعلقة بالتغذية تؤدي إلى فقدان كبير في الوزن وسوء التغذية كما تؤدي أيضاً للانهيار التام لعمليات الجسم وهذه هي المرحلة المتأخرة للمرض. [1]

2- أهم عوامل تشكل مرض السرطان:

إن الأسباب الحقيقية المؤدية إلى السرطان مازالت إلى حد ما مجهولة، و لكن هناك عوامل تساعد أو تهيئ لتشكل السرطان وهذه العوامل هي:

1/ الوراثة : إن معظم السرطانات المعروفة و الشائعة لا تنتقل عن طريق الوراثة إنما تكون حالات فردية لا علاقة للوراثة بها و لكن الأبحاث أثبتت دور الوراثة في بعض الأورام و أهمها ورم أورمة الشبكية في العين التي تورث في أغلب الأحيان من الأب لأبنائه و ليس بالضرورة إلى جميعهم و هي تصيب العينين معاً داء البوليات الكولونية العائلي الذي يورث إلى الأبناء ويتحول إلى سرطان كولون .

2/ التدخين : يطلق التدخين حوالي 3000 مادة تحوي مواد عديدة لها علاقة مباشرة مع السرطان أهم هذه المواد هي المسماة البنزبرين كما يقوم التدخين بإحداث تبدلات كبيرة على بشرة القصبات خاصة تحولها من بشرة تنفسية تقوم بعملها التنفسي إلى مجرد بشرة ساترة لا نقوم بأي عمل و هذا التغير يعتبر تغير قبل سرطاني و لا يحتاج إلا لخطوة واحدة ليتحول إلى سرطان .

3/ طبيعة الغذاء : تشير الدراسات المجراة على الغذاء إلى علاقة بعض أنواع الغذاء كالدسم و الكحول بالتأهيب للسرطان خاصة سرطانات المعدة و الأمعاء بينما الخضار و البقول و الألياف تقلل من حدوثه.

4/ الحمات الراشحة (الفيروسات): لقد ثبتت وجود علاقة بين بعض الحمات الراشحة وبعض أنواع السرطان و هي : –

حمى ابشتاين بار لها علاقة بنشوء سرطانات البلعوم الأنفي في الصين و ليمفوما بيركيت في إفريقيا المدارية

حمى التهاب الكبد النموذج ب لها دور في سرطان الكبد

5/ الأشعة : هناك علاقة بين الأشعة و سرطانات الجلد و الدم و الغدة الدرقية .

6/ التوزيع الجغرافي : لوحظ ازدياد بعض أنواع السرطانات في مناطق من العالم و قلتها في مناطق أخرى

7/ المهنة و التلوث : فهناك مواد مسرطنة يتعرض لها الإنسان سواءً في عمله أو في البيئة الملوثة[2].

3- أنواع السرطان-تعريفها- أعراضها- أسبابها-تشخيصها- الوقاية منها- علاجها:

1-سرطان الدماغ:

هو انقسام غير طبيعي و غير منتظم لخلايا الدماغ سواء في المخ, المخيخ أو الحبل الشوكي و الذي يُسبب انضغاط لأجزاء الدماغ الأُخرى و بالتالي فقدان لإحدى الحواس أو ضعفها.

و أورام الدماغ الأولية) أي التي منشأها الأصلي الدماغ) نادرة جداً, بعكس أورام الدماغ الثانوية التي تكون ناتجة عن انتشار المرض من أعضاء أُخرى بالجسم وصولاً إلى الدماغ.

أعراضه:أورام الدماغ سواءً كانت حميدة أو خبيثة تتسبب بأعراض متشابهة والتي تختلف بحسب مكان حدوثها من الدماغ. ومن هذه الأعراض

- الصداع خاصةً الذي يصيب الشخص صباحا
- الغثيان و التقيؤ
- حدوث تشنجات.
- ضعف بعض الأطراف كالعلوية أو السفلية.
- ضعف بعض الحواس أو تأثرها.

أسبابه:ليس له أسباب معروفه حتى الآن.
التشخيص:عمل أشعة مقطعية للرأس للتأكد من وجود ورم بعد عمل الفحص الإكلينيكي. كما أن فحص الجهاز العصبي مهم حتى يمكن معرفة مكان الإصابة في الدماغ.
ومن الفحوص الأخرى التي يمكن إجراؤها هو حقن مادة ملونة في احد الشرايين المغذية للمخ ثم تصوير الرأس حيث تظهر كافة الشرايين هناك. وهذا الفحص يجرى عادةً إذا كان هناك نية لإجراء عملية جراحية لاستئصال الورم.
طرق العلاج:

- التدخل الجراحي لاستئصال الورم إذا كان موضعي لإزالة الضغط الواقع على الأجزاء الأُخرى. ولكن أحيانا يكون من الصعب إجراء العملية إذا كان الورم قريب من مكان حيوي هام في المخ.
- العلاج الإشعاعي.
- العلاج الكيميائي مع أن الفائدة منه محدودة حيث أن العقاقير لا يمكنها الدخول الى المخ عن طريق الأوعية الدموية ولكن يمكن حقن العقار في السائل المخي الشوكي.

الوقاية منه:

لا يوجد طرق وقاية منه لعدم معرفة أسبابه أو العوامل المؤدية له.

أهم أنواع أورام الدماغ Gliomata :

- Glioblastoma Multiform
- Astrocytoma
- Acoustic Neurinoma
- Meningioma
- Pitutary Tumours

- انتقالات ثانوية لأورام أخرى مثل سرطان الرئة او سرطان الثدي .

2- سرطان الفم:

هو نمو غير طبيعي و غير متحكم به للخلايا المبطنة للتجويف الفمي .

أعراضه:

- ظهور قرحة في الفم لا تندمل أو تنزف بسهولة .
- ظهور ورم أو مساحة صغيرة حمراء أو بيضاء بشكل دائم في الفم.
- صعوبة في المضغ أو البلع .
- التهاب الحلق .
- يكون هناك تحديد في حركة اللسان و الفكين أو الإحساس بضيق عند لبس طقم الأسنان -الاصطناعية.
- نادراً ما يكون الألم أحد أعراض سرطان الفم في مرحلته المبكرة .

أسبابه:

- التدخين و استعمال التبغ (الذي يُمضغ و يُخزن في الفم)
- تناول القات .

- شرب الكحول, و بما أنه يكون في الغالب مصحوباً بإفراط في التدخين، فإن الجمع بين الاثنين يُشتبه في أنه يزيد من احتمال الإصابة بسرطان الفم.
- تدخين السجائر و الغليون الذي يزيد من احتمال الإصابة بسرطان الشفتين.

التشخيص:

أخذ عينه من الورم أو التقرح الموجود في الفم وفحصها تحت المجهر.

طرق العلاج:

- التدخل الجراحي.
- العلاج الإشعاعي.

الوقاية منه :

- الابتعاد عن التدخين و كذلك تناول القات .
- الابتعاد عن شرب الكحوليات.

3- سرطان البلعوم الأنفي:

هو نمو غير طبيعي و غير متحكم به للخلايا المبطنة للبلعوم الأنفي (الذي هو التجويف الواقع في مؤخرة التجويف الأنفي و يوصل بين التجويف الأنفي ونهاية التجويف الفمي و وظيفته إيصال الهواء الداخل عن طريق الأنف إلى الأجزاء العليا من الجهاز التنفسي في عملية الشهيق و العكس في عملية الزفير). و هذا النمو يؤدي إلى انسداد التجويف و من ثم الانتقال إلى الأجزاء و الأغشية القريبة ثم الانتقال عبر الغدد الليمفاوية الموجودة في الرقبة و أحياناً ينتشر الورم في أجهزة الجسم المختلفة خصوصاً العظام و الكبد

أعراضه :

- صداع .
- تغير في الرؤية .
- انسداد في الأنف.
- نزيف من الأنف.
- تنميل في الوجه.
- آلام في الرقبة.

و ليس بالضرورة أن يشكو المريض من كل هذه الأعراض بل في أغلب الأحيان تكون الشكوى مختصرة على عرض أو عرضين . كما انه من المهم ان هذه الأعراض قد تظهر أيضا في حالات التهاب البلعوم او اللوزتين.

أسبابه: ليس له سبب محدد و لكن التدخين والكحول من أهم الأسباب المرتبطة بهذا النوع من السرطان.

التشخيص:

- عمل أشعة مقطعية للرأس و الرقبة.
- أخذ عينه من الغشاء المبطن للبلعوم الأنفي.

طرق العلاج:

- التدخل الجراحي إذا كان من الممكن استئصال الجزء المصاب.
- العلاج الكيميائي.
- العلاج الإشعاعي.
- كما يجب استشارة طبيب أسنان في حال لزم أخذ أية احتياطات.

الوقاية منه :

لا يوجد طرق وقاية منه لكن الامتناع عن التدخين وشرب الكحول يساهم في تقليل نسبة الإصابة.

4- سرطان الرئة

هو نمو بعض خلايا الطبقة المبطنة للقصبة الهوائية بنسبة أسرع من المعدل الطبيعي و بشكل غير منتظم, مما يؤدي إلى تراكمها و حدوث تداخل في عملية إخراج المخاط، و تتطور بعض الخلايا المتضاعفة بسرعة و تصبح خبيثة. و هذه الخلايا تزاحم و تقضي على الخلايا الطبيعية، و تؤدي إلى احتباس المخاط في الرئة. و تؤلف الخلايا السرطانية كتلة أو ورماً يسد القصبة الهوائية، و هو أحد الأسباب الرئيسية لموت الرجال و النساء في معظم البلدان الصناعية .

أعراضه:

- ضيق في التنفس.
- صعوبة في إخراج البلغم من القصبة الهوائية .
- سعال مزمن.
- خروج دم مع البلغم
- الم نادراً.
- نقص كبير في الوزن دون سبب واضح مع إجهاد.
- صوت في الصدر أثناء التنفس (أزيز)
- صعوبة في البلع نتيجة ضغط الورم على المريء.

أسبابه:

- التدخين، حيث ثبت أن المدخنين يتعرضون بسهولة أكثر من غيرهم لسرطان الرئة .
- ارتفاع نسبة التلوث في الهواء .

التشخيص:

- عمل أشعة للصدر.

- فحص البلغم تحت المجهر.
- منظار للقصبات الهوائية.Bronchoscopy
- أشعة مقطعية.
- اخذ عينة من الورم بواسطة إبرة.

طرق العلاج :

- الاستئصال الجراحي إذا كان ذلك ممكناً.
- العلاج الإشعاعي وذلك بتعريض مكان السرطان للأشعة السينية.
- العلاج الكيميائي مهم لبعض أنواع سرطان الرئة كما انه يستخدم مع العلاجات الأخرى إذا كانت هناك انتقالات للسرطان خارج الرئة.

الوقاية منه:

- الابتعاد عن التدخين.
- فصل المصانع عن المدينة حيث يعيش السكان.

5- سرطان الثدي

هو أحد أكثر أنواع السرطانات شيوعاً بين النساء وهو يحدث غالباً بعد سن الخمسين ولكن هذا لا يعني أنه قد لا يظهر في سن مبكرة . أيضاً من المكن ظهور هذا المرض لدى الرجال ولكن بنسبة قليلة جداً مقارنة بالنساء .

أسبابه:

غير معروف لكن هنالك عوامل تساعد على زيارة احتمال الإصابة به منها وجود المرض في أحد الأقرباء) لذلك على من أصيبت أمهاتهن أو أخواتهن بهذا الورم التعود على إجراء الفحص الذاتي.(
هناك احتمال زيادة نسبة الإصابة بالمرض عند النساء اللواتي كان أول حمل لهن بعد سن الثلاثين. أيضا التدخين والإفراط في تناول الكحول هي من العوامل التي من المعتقد أن تكون مرتبطة بالمرض.

أعراضه:

ليس كل تغير في الثدي هو ورم وليس كل ورم هو خبيث ، لكن يجب عدم إهمال أي ورم أو تغير في شكل الثديين ومن المهم مراجعة الطبيب إذا لاحظت:

- ظهور كتلة في الثدي
- زيادة في سماكة الثدي أو الإبط
- إفرازات من الحلمة
- انكماش الحلمة
- ألم موضعي في الثدي
- تغير في حجم أو شكل الثدي

علماً بأن بعض هذه التغييرات تحدث طبيعياً عند الحمل أو الرضاعة أو قبل الحيض وبعده عند بعض النساء.
تكمن أهمية الكشف المبكر لسرطان الثدي بأن نسبة الشفاء تتجاوز 95% بإذن الله إذا كان الورم في مراحله الأولى .. لكن تأخير التشخيص ينقص بهذه النسبة إلى 25% فقط.

يتم التشخيص المبكر لسرطان الثدي بإتباع الخطوات التالية:

- الفحص الذاتي الشهري للثدي لمن تجاوزن سن الأربعين من النساء
- التصوير الإشعاعي للثدي Mammography كل سنتين للنساء اللواتي تجاوزن الخمسين

طرق العلاج

هناك أربع طرق لعلاج هذا المرض فإما بالجراحة أو العلاج الكيميائي أو إلا شعاعي أو الهرموني، قد يستخدم الطبيب طريقة أو أكثر من هذه الطرق وذلك تبعاً لطبيعة الورم حيث أن خطة العلاج تعتمد على نوع الورم وحجمه ومرحلته وعمر المريضة وحالتها الصحية ، عادة يتم استئصال الورم أو كامل الثدي مع أو بدون العقد الليمفاوية في الإبط كمرحلة أولى ويتبع هذا علاج كيميائي وعلاج إشعاعي لبعض المريضات أو علاج إشعاعي فقط وذلك حسب الحالة .

العلاج الكيميائي :(chemotherapy)

يتم العلاج الكيميائي باستخدام مجموعة مركبة من العقاقير الكيميائية والتي يكون تأثيرها على الخلايا السرطانية أقوى منه على الخلايا السليمة ، ويكون العلاج إما على شكل حقن في الوريد أو أقراص في الفم ، ومن آثار العلاج الجانبية تساقط الشعر ، التقيؤ ، والإسهال لكن كل هذه الآثار مؤقتة. أيضاً قد بسبب انخفاض عدد كريات الدم البيضاء ولذا يتم عادة فحص الدم بشكل مستمر وينصح بالابتعاد عن من يشكوا من أمراض معدية مثل الأنفلونزا إذا كان عدد كريات الدم البيضاء منخفضاً.

العلاج بالأشعة : Radiation therapy - Radiotherapy

يتم العلاج بالأشعة باستخدام أشعة سينية مكثفة ذات طاقة عالية ، ويكون تأثير هذه الأشعة عالياً على الخلال السرطانية حيث أنها أكثر حساسية للإشعاع من الخلايا الطبيعية وتتعافى بصورة أبطأ ، ويكون العلاج عادة أما 20 أو 25 جلسة إشعاعية (حسب الحالة) وكل جلسه تستمر لأقل من 10 دقائق علماً بأن العلاج نفسه خلال الجلسة قد لا يستغرق أكثر من دقيقتين

الآثار الجانبية المتوقعة للعلاج :

تكون عادة بسيطة منها:

- التهاب جلد منطقة العلاج ، عليه من الضروري عدم استخدام الصابون أو أي نوع من الكريمات على منطقة العلاج خلال فترة العلاج

•الشعور بالإجهاد العام وفقدان الشهية ، كل هذه الآثار تحدث خلال الجلسات وتتلاشى عادةً بعد أسبوعين من نهاية العلاج.
العلاج الهرموني :(Hormone Therapy) هذا العلاج يبدأ بعد نهاية العلاج بالأشعة ويعطى لبعض المريضات اللاتي تجاوزن سن الخمسين .. ليس كل المريضات يحتجن للعلاج الهرموني علماً بأن هذه العلاج قد ليستمر مدى الحياة

6- سرطان المعدة:

هو نمو غير طبيعي و غير متحكم به للخلايا المبطنة للجدار الداخلي للمعدة.

أعراضه:

يصعب تشخيص سرطان المعدة في مرحلة مبكرة و ذلك لطول الفترة بين ظهور السرطان و بداية الأعراض, و هي تشمل:

- انتفاخ المعدة.
- فقدان الوزن.
- فقر الدم و الإعياء.
- ألم مستمر لا يستجيب للعلاج.
- قيء.

أسبابه:

- وجود أورام حميدة بالمعدة.
- المعدة المتبقية بعد استئصال المعدة الجزئي.
- التهاب المعدة الذاتي.autoimmune
- الإصابة بعسر هضم طويل الأمد.
- وجود قرحة بالمعدة لا تُشفى .
- التكوين الجيني و لقد وُجد أن نسبة أعلى لسرطان المعدة تحدث في الناس ذوى فصيلة الدم (أ)

التشخيص:

- عمل أشعة للمعدة بعد شرب مادة ملونة بيضاء.Barium
- عمل منظار للمعدة.
- عمل أشعة فوق صوتية للبطن.
- اخذ عينة من الورم (خلال عمل المنظار) ودراستها تحت المجهر.

طرق العلاج:

- التدخل الجراحي:

و يكون إما باستئصال جزئي للمعدة للسرطانات الموضعية أو باستئصال المعدة التام في حال السرطانات المنتشرة .
-العمليات الجراحية الملطفة :مثل عمل توصيلة معدنية, و يمكن تخفيف المعاناة عند حالات انسداد الفؤاد المعدي بوضع أنابيب بلاستيكية عبر الورم.
- العلاج الكيميائي يستخدم بشكل محدود للقضاء على الانتقالات السرطانية في الأعضاء الأخرى.

الوقاية منه:

- الابتعاد عن مسببات قرحة المعدة ألا و هي التدخين, شرب الكحول, شرب القهوة بكثرة, أكل التوابل الحارة باستمرار, كثرة الانفعال الشديد.

7- سرطان البنكرياس:

هو نمو غير طبيعي و غير متحكم فيه لخلايا البنكرياس, و يكون سواء في رأس البنكرياس أو جسمه أو ذيله.

أعراضه :

لا يوجد له أعراض معينة و هذا السبب في صعوبة تشخيصه, و لكن قد يكون أحياناً مُتخفي على صورة التهاب في المرارة, و آلام في أعلى البطن مصحوبة بحصى بالمرارة.

أسبابه:

يُعتقد أن هناك مادة في الجسم تلعب دوراً في نشوء و نمو و استمرار الخلايا السرطانية للبنكرياس و هي .NF-Kappa B كما يعتبر إدمان الكحول والتهابات البنكرياس من الأسباب المهمة في حدوثه.

التشخيص:

- عمل أشعه فوق صوتية للبطن.
- عمل أشعة مقطعية للبطن.

طرق العلاج:

- الاستئصال الجراحي في 10% إلى 15% من الحالات فقط.
- العلاج الكيميائي جميسيتابين.(Gemzar)

الوقاية منه:

لا يوجد طرق وقاية منه.

8- سرطان الكبد:

هو نمو غير طبيعي و غير منتظم لخلايا الكبد في حال كان الورم أولي, أما إذا كان ثانوي فإنه يكون منتشر من عضو آخر بالجسم وصولاً للكبد .

أعراضه :

- اصفرار الجسم و مقلة العين.
- آلام في أعلى البطن.
- فقدان الشهية و الوزن.

- الغثيان و التقيؤ.
- ارتفاع في درجة الحرارة.
- إحساس بتعب و خمول.

أسبابه:

- الإصابة بالالتهاب الكبدي الفيروسي بي أو سي.
- شرب الكحول بكثرة.

التشخيص:

- عمل أشعة مقطعية للبطن.
- عمل تصوير بالأشعة المغناطيسية.
- تحليل دم.
- الفحص بالجاليوم المشع وهو مهم للتمييز بين الأورام والأمراض الأخرى التي قد تصيب الكبد.
- اخذ عينة من الورم ودراستها تحت المجهر.

طرق العلاج:

- التدخل الجراحي إذا كان المرض موضعي أو في أحد فصوص الكبد.
- العلاج الكيميائي عن طريق الوريد أو مباشرة إلى شريان الكبد الأساسي.
- العلاج الإشعاعي كعلاج تلطيفي.
- علاج الورم بالتجميد.
- زراعة الكبد.

الوقاية منه:

- عدم التعرض للالتهاب الكبدي بي أو سي و ذلك عن طريق أخذ الحيطة عند نقل الدم, و بعدم استخدام حقن استخدمت من قبل. والأهم بأخذ اللقاح الخاص بالتهاب الكبد الوبائي.
- الابتعاد عن شرب الكحول .

9- سرطان القولون والمستقيم:

تبدأ جميع أنواع سرطان القولون و المستقيم بسليلات مخاطية حميدة. و تتكون هذه الأورام غير الخبيثة في جدار الأمعاء الغليظة و قد يكبر حجمها في نهاية المطاف و تتحول إلى سرطان. و استئصال السليلات الحميدة هو أحد نواحي الطب الوقائي الذي يُحقق نتائج طيبة .

أعراضه:

- حدوث نرف من المستقيم.
- تغيرات في عادات الأمعاء مثل الإمساك أو الإسهال. (تظهر هذه الأعراض أيضا عند الإصابة بأمراض أخرى، لذا ينبغي أن تجرى فحوص شاملة إذا حدثت مثل هذه الأعراض.(
- ألم البطن.
- نقص الوزن و هي أعراض تظهر في وقت متأخر عادة و هي تشير إلى احتمال انتشار المرض.

أسبابه:

- وجود سرطان القولون و المستقيم و السليلات المخاطية في التاريخ العائلي.
- إصابة الشخص بالتهاب القولون التقرحي و السليلة القولونية أو بالسرطان في أعضاء أخرى، لا سيما الثدي و الرحم.
- هناك اعتقاد أن البواسير يؤدي إلى الإصابة بسرطان القولون و هو اعتقاد خاطئ.

ملاحظه:

البواسير قد تُظهر أعراضاً شبيهة بالسليلات المخاطية أو سرطان القولون, فإذا ظهرت مثل هذه الأعراض يجب التوجه إلى الطبيب لفحصها وتقييمها، ويفضل أن تراجع أخصائي جراحة ليقوم بالكشف و إجراء بعض التحاليل و منظار للقولون.

التشخيص:

- منظار كامل للقولون.
- عمل أشعه فوق صوتيه عن طريق فتحه الشرج لأورام المستقيم .
- عمل أشعه مقطعيه للبطن و الحوض مع ضرورة استعمال الصبغة للوريد والأمعاء.
- عمل أشعه مغناطيسه للحوضإن توفرت.

طرق العلاج:

- **أورام القولون :**استئصال الورم و الغدد اللمفاوية المجاورة. و بعد الشفاء من العملية و الإطلاع على نتيجة الفحص المهجري قد يُعطى للمريض علاج كيماوي إذا انتشر الورم للغدد الليمفاوية.
- **أورام المستقيم:** معظم الحالات تحتاج إلى علاج كيميائي و إشعاعي وقد يُعطى المريض علاج كيميائي بعد العملية إذا انتشر الورم للغدد الليمفاوية. و الطريقة المُثلى لإجراء العملية الجراحية هي

استئصال المستقيم مع المنطقة المحيطة به التي هي الدهون المحيطة بالمستقيم و يتم إخراجها كجزء واحد بعد ذلك و يوصل القولون بالقناة الشرجية حسب موقع الورم.

يستعيد نحو 80-90% من المرضى عافيتهم بصورة تامة إذا تم اكتشاف السرطان و علاجه في المراحل المبكرة. و لكن نسبة الشفاء تنخفض إلى 50% أو دون ذلك إذا تم التشخيص في مرحلة متأخرة. وكنتيجة لما توصلت إليه التقنية الحديثة فإن أقل من 5% من جميع مرضى سرطان القولون والمستقيم يحتاجون إلى إجراء فتحة مفاغرة (فتحة تصريف صناعية يتم استحداثها من القولون جراحياً.(

الوقاية منه:
- إزالة السليلات الحميدة بواسطة تنظير القولون, بالإضافة إلى القيام بفحص دقيق و شامل للأمعاء الغليظة.
- قد يلعب النظام الغذائي دوراً هاماً في منع الإصابة بسرطان القولون و المستقيم. و على حد علمنا فإن الغذاء قليل الدهون الغني بالألياف هو الطريقة الغذائية الوحيدة التي قد تقي الإنسان من الإصابة بسرطان القولون و المستقيم.
- يجب ملاحظة التغيرات التي تطرأ في عادات الأمعاء و التأكد من إجراء فحص للأمعاء ضمن الفحص الطبي المنتظم الذي يجرى عادة حالما أصبح الشخص من فئة الأشخاص الأكثر عرضة للإصابة بالمرض.

10- سرطان القناة البولية:Bladder Cancer

هو نمو غير متحكم به و غير منتظم للخلايا المبطنة للحالب أو للمثانة البولية و الذي ينتج عنه تراكم للخلايا و بالتالي انسداد للحالب.

أعراضه:
- وجود دم مع البول.
- الإحساس المتكرر بالحاجة إلى التبول و عدم القدرة على ذلك.
- الألم في الظهر أو البطن مصحوبة بتقلصات في الحالب.
- ضعف في قوة خروج البول مع حرقة شديد.
- أنيميا ونقص في الوزن.
- إجهاد سريع.

أسبابه:
- التدخين.
- الإصابة بالتهابات الجهاز البولي المتكررة.
- الإصابة بالبلهارسيا.
- التعرض لمادة الأنيلين المستخدمة في الأصباغ و الطباعة.

التشخيص:
- فحص البول.
- عمل أشعة فوق صوتية للمثانة.
- عمل أشعة سينية للبطن و الظهر.
- عمل أشعة بالصبغة.
- عمل منظار للمثانة.
- اخذ عينة للورم ودراستها تحت المجهر.
- عمل أشعة مقطعية .

طرق العلاج:
- التدخل الجراحي: و يكون إما باستئصال الورم أو الحالب المُصاب أو في الحالات الشديدة استئصال المثانة البولية.
- العلاج الكيميائي.
- العلاج الإشعاعي.

الوقاية منه:
- الابتعاد عن التدخين.
- علاج التهابات المسالك البولية و عدم إهمالها.
- أخذ الحيطة من عدم الإصابة بالبلهارسيا.
- أخذ الحيطة عند التعرض للأصباغ

11- سرطان المبيض

تبدأ خلايا المبيض في النمو بطريقة غير منتظمة و ذلك يؤدي إلي حدوث أورام المبيض الحميدة أو السرطانية . و معظم سرطانات المبيض تنمو في القشرة الخارجية التي تغطي المبيض، و بعضها ينمو في الخلايا التي تقوم بإفرازات البويضات و البعض الآخر ينمو في الأنسجة التي تقوم بإفراز الهرمونات .

أعراضه :
- وجود ورم بالبطن مع ألم.
- انتفاخ و عسر هضم و غثيان .
- نقص في الوزن غير معروف السبب.
- الإحساس بضغط على المثانة و الأعضاء الموجودة في منطقة البطن .
- تغير في طبيعة حركة الأمعاء مثل إمساك أو إسهال.

أسبابه:
- وجود سرطان الثدي أو المبيض في التاريخ العائلي.
- عدم الحمل و عدم الإرضاع .
- استخدام عقاقير لعلاج العقم لفترة طويلة من الزمن .
- التعرض لكمية كبيرة من هرمون الجونادوتروبين الذي يُحفز المبيض على إنتاج الإستروجين الذي يقوم بدوره على تحفيز خلايا المبيض على الانقسام الذي قد يُصبح غير منتظم.

التشخيص:
- الفحص المهبلي و فحص المستقيم و البطن.
- عمل أشعة فوق صوتية للحوض.
- فحص الدم مهم جداً لتشخيص المرض حيث ترتفع نسبة عامل بروتيني يُسمى CA 125 في الدم بنسبة كبيرة في السيدات اللاتي يصبن بسرطان المبيض.
- عمل منظار من خلال البطن وأخذ عينة لفحصها تحت المجهر.
- عمل أشعة مقطعية.

طرق العلاج :
- التدخل الجراحي و ذلك باستئصال المبيضين و قناة فالوب و الرحم و الغدد الليمفاوية المجاورة و جزء من الغشاء الذهني في الحوض المحيط بالمبيضين.
- العلاج الكيميائي.
- العلاج الإشعاعي.

12- سرطان بطانة الرحم:

هو نمو غير منتظم للخلايا المبطنة للرحم و التي قد تتحول فيما بعد لسرطان.

أعراضه:
- نزيف شديد و مستمر لمدة طويلة للسيدات فوق سن الأربعين.
- ألم أسفل البطن و تقلصات في منطقة الحوض.
- نزيف رحمي غير عادي مع تغيرات في الدورة الشهرية و قد يكون على شكل نزف مهبلي للسيدات بعد سن انقطاع الطمث .

أسبابه:
- السمنة.
- ارتفاع ضغط الدم .
- تعدد الحويصلات في المبيضين .
- مرض السكر .
- بدء الدورة الشهرية مبكراً و تأخر سن انقطاع الطمث .
- السيدات اللاتي لا يحملن علي الإطلاق و اللاتي يصبن بالعقم لأي سبب و لا تستطعن الحمل.
- السيدات اللاتي أصبن من قبل بأورام ليفية بالرحم.
- زيادة مستوي هرمون الإستروجين و ذلك بتناول هرمونات الاستروجين الصناعية في علاج أعراض سن انقطاع الطمث.
- أنيميا نتيجة استمرار حدوث نزيف رحمي.

التشخيص:
- فحص مهبلي لفحص الرحم من حيث الحجم و الشكل و فحص الأعضاء المجاورة .
- إجراء عملية توسيع لعنق الرحم و أخذ عينة من الغشاء المبطن لجدار الرحم و فحصه معملياً.
- عمل أشعة مقطعية.

طرق العلاج:
- التدخل الجراحي: و ذلك باستئصال الرحم و قناة فالوب و المبيضين و الغدد الليمفاوية المجاورة.
- العلاج الكيميائي.
- العلاج الإشعاعي.

الوقاية منه:
- فحص طبي دوري مستمر بعد سن الأربعين .
- عندما تعالج السيدة بهرمون الإستروجين و تشعر بأي من الأعراض السابقة عليها باستشارة الطبيب على الفور.

13- سرطان عنق الرحم

يحدث سرطان عنق الرحم عندما تبدأ خلاياه في التغيير من طبيعتها و وظيفتها نتيجة تدمير الخلايا و هذه الحالة تؤدي إلي تعثر نمو هذه الخلايا بصورة طبيعية و حدوث السرطان الذي يمتد تأثيره إلي الأنسجة المجاورة.

وعندما تبدأ هذه التغيرات السرطانية في الحدوث تكون محدودة في الطبقة الخارجية من عنق الرحم لمدة تتراوح من 2 - 10 سنوات قبل أن تبدأ في مهاجمة الطبقة العميقة من عنق الرحم و بعد ذلك تبدأ في مهاجمة الأنسجة و الأعضاء المجاورة للرحم و المثانة و المستقيم.

أعراضه :
- إفرازات مهبلية قد لا يكون لها لون أو مصحوبة بدماء و غير مصحوبة بحكه.
- نزيف دموي بعد الممارسة الجنسية.
- الم خلال الممارسة الجنسية.

أسبابه :
- التدخين.
- استعمال حبوب منع الحمل لفترة طويلة.
- تعدد الممارسات الجنسية غير الشرعية .
- الإصابة بالهربس أو السفلس .

التشخيص:
- أخذ عينة من عنق الرحم وفحصها معملياً للتأكد من وجود خلايا سرطانية من عدمه.

- تصوير الجهاز البولي مع استخدام مادة ملونة.Barium
- تصوير القولون مع استخدام مادة ملونة.Barium
- عمل أشعة مقطعية .

طرق العلاج:

- التدخل الجراحي باستئصال عنق الرحم و أحياناً الرحم.
- العلاج الإشعاعي خارجي وداخلي لعنق الرحم.

طرق الوقاية:

- التوقف عن التدخين .
- الإقلال من استعمال حبوب منع الحمل لفترة طويلة.
- عدم ممارسة الاتصال الجنسي غير الشرعي لتجنب الإصابة بالفيروسات التي قد تدمر خلايا عنق الرحم.
- القيام بعمل فحص مهبلي دوري لتشخيص أية تغيرات قد تحدث في عنق الرحم مبكراً.

14- سرطان الخصية:

يوجد شكلان للأورام الخبيثة في الخصية, الأورام المنوية (Seminomas)و الأورام الغير منويه " الجينية .(Teratomas) "و تبدأ الخلايا بانقسام غير منتظم و الذي لا يمكن التحكم فيه مما يؤدي إلى وجود الورم .

الأورام المنوية 60% تنشأ من خلايا القنوات المنوية و هي تحصل عادةً ما بين السن 30-40 عاماً، وهي بطيئة النمو نسبياً, و يكون الورم صلباً و تختلف الخلايا من خلايا منوية جيدة التمايز إلى خلايا دائرية غير متمايزة. أما الأورام الجنينية 40% فهي تحدث في فئة العمر الأصغر و ذروة الحدوث ما بين 20-30 سنة, و الأصل الدقيق لنشوئها غير معروف، و لكن يظن أنها تنشأ من خلايا منوية أقل تمايزاً و لديها مظهر كيسي واضح، وكانت تسمى في السابق مرض التليف الكيسي.

أعراضه:

- تظهر أورام الخصية عادةً على شكل خصية متورمة غير مؤلمة و قاسية، و قد تحوي أحياناً سائلاً مدمي.
- نادراً يظهر انتفاخ متزايد بسرعة و مؤلم و الذي يُشخص خطأ على أنه التهاب بالخصية.
- يظهر أحياناً كتلة بطنية نتيجة إصابة العقد الليمفاوية البطنية، أو تضخم العقد الليمفاوية الرقبية.

أسبابه:

ليس له سبب معروف ولكن من العوامل التي تزيد من نصبة الإصابة هي عدم نزول الخصية من البطن إلى الصفن بعد الولادة.

التشخيص:

- عمل أشعة فوق صوتية.
- عمل أشعة مقطعية للبطن و الحوض.
- تحليل دم لمعرفة مستوى علامات الورم AFP و.HCG

طرق العلاج:

- التدخل الجراحي: باستئصال الخصية بعد أخذ عينه منها في غرفة العمليات و إرسالها للفحص كعينة مُجمدة وعند التأكد من وجود الورم يتم استئصالها.
- العلاج الإشعاعي للأورام المنوية.
- العلاج الكيميائي للأورام الجينية.[3]

4- الصلة بين الحمية ومرض السرطان:

تشير البحوث إلى أن هناك عوامل غذائية تتدخل في نمو السرطان مثل تناول الدهون, مجموع السعرات الحرارية, نقص الألياف, الأطعمة التي بها نقص فيتامين (أ) والكاروتينات كما يحتمل وجود دور للكحول مع فيتامين ج, هـ, البروتين السلينيومي Selenuim Protein المملحات, ملح التخليل وأطعمة غيرها.

وقد أصدرت لجنة الحمية والصحة المنبثقة عن المجلس القومي للبحوث بأمريكا التوصيات التالية التي تتعلق بالحمية ومخاطر مرض السرطان:

1. تخفيض مجموع الدهون إلى 30% أو أقل من مجموع السعرات الحرارية.
2. أكل خمس بدائل أو أكثر من الخضروات والفواكه خاصة الخضروات الصفراء والخضراء والموالح كل يوم. ولم تحدد بعد أهمية العوامل المسئولة عن الدور الوقائي لهذه الأطعمة على سرطانات الرئتين, المعدة وسرطان الأمعاء الغليظة وقد ثبت أن قلة تناول الكاروتينات (الصبغ الجذري) الموجود في الخضروات الخضراء والصفراء يساهم في زيادة خطر الإصابة بمرض سرطان الرئة.
3. المحافظة على تناول بكميات متوسطة وقد ارتبط تناول الحميات الغنية باللحوم بزيادة خطر الإصابة بسرطان الثدي والقولون.

5- الغذاء ومرض السرطان

إن السرطان ليس مرضاً واحداً, بل مجموعة من الأمراض لها علاقة بالتكاثر العشوائي لبعض الخلايا في الجسم, والتي تتكتل, وتصبح مجموعة وتتحوّل إلى ورم.

يمكن أن تبقى الأورام موضعية, كسرطان الثدي الموضعي, أو تنتشر لتطال أنحاء مختلفة من الجسم, بينما ما زال الباحثون يفتشون عن أسباب السرطان وطرق علاجه, يبدو أن ملايين الحالات, في العالم كله, ترتبط بنمط الحياة وطريقة الغذاء. يمكن أن نتفادى حوالي الثلاثين بالمائة من السرطانات بمجرد تغيير النظام الغذائي, ويشمل أنواع وكمية الأطعمة المستهلكة, بالإضافة إلى طريقة التحضير.

6- النظام الغذائي للوقاية من السرطان:

ليس من طعام أو مغذّ واحد كفيل بالوقاية من السرطان, إنما مجموعة من الإرشادات علينا أو نتبعها لتفادي المرض, وهي تساعد أيضاً في الوقاية من أمراض أخرى, كأمراض القلب, والسكري, والسمنة, إليك خطة من ثلاث مراحل, تغير فيها نمط غذائك وحياتك.

المرحلة الأولى:

حوّل غذاءك من غني باللحوم إلى غنيّ بالخضر, والحبوب والفاكهة, ولتكن الحبوب والخضر الجزء الأهم من الوجبة, بينما اللحوم الجزء الثاني.

إن الحبوب والبقوليات, والفاكهة والخضر:

- "غنية بالألياف التي تجرّ معها السموم الموجودة في المصران, فيتخلص الجسم منها من خلال عملية التبرز, وكلما زاد استهلاكك للألياف انخفضت إصابتك بسرطان المصران وخاصة الغليظ, أكثر من استهلاك العدس, والبرغل, والخضر, والفاكهة الطازجة مع قشرتها: قشرة البطاطا, والتفاح, والإجاص...
- أفضل مصدر للفيتامينات والمواد الطبيعية المضادة لتأكسد الخلايا, تحميها من الإصابة بالسرطان وتساند عمل جهاز المناعة.
- شبه خالية من الدهنيات, خاصة المشبعة. لأن استهلاك الدهون الحيوانية مرتبط بسرطان البروستات عند الرجال, وسرطان الرحم والثدي عند النساء. كما أن الدهنيات إجمالاً , تزيد من الوزن, والسمنة عند الرجال والنساء عامل مهم في ازدياد نسب السرطان عالمياً.
- أخيراً تشير المنظمة الأمريكية لمكافحة السرطان, إلى أنه إذا استهلك كل واحد منا يومياً خمس حصص من الفاكهة والخضر, تنخفض نسبة الإصابة بالسرطان عشرين بالمائة وأكثر.

المرحلة الثانية:

إن كنت من المدخنين توقف عن التدخين. يمكن أن تفعل ذلك تدريجياً, فإن التدخين السبب الرئيسي لسرطان الرئة, والفم والمعدة, والكبد, إن شرب الكحول مرتبط أيضاً بسرطان الثدي, والحنجرة, والفم والكبد, إن كنت تشرب الكحول, فإنك تضاعف خطر إصابتك بالسرطان.

تساعد الرياضة كثيراً في الإقلاع عن التدخين, كما تمنع زيادة الوزن, خاصة عند التوقف عن التدخين. نعرف أن المطلوب هو نصف ساعة يومياً من الحركة على الأقل, لكنّ الجديد , أنه ليس من الضروري ممارستها دفعة واحدة بل يمكن تقسيمها إلى ثلاث أو أربع مرات في اليوم كالرجوع من المكتب مشياً ثم الذهاب إلى التسويق ومن بعدها نزهة حول البيت.

المرحلة الثالثة:

خفف من استهلاك المواد المدخنة, والمخللة بالملح, والمشوية على الفحم, والمعالجة, كالمارتديلا واللحوم المعلبة. إن اللحوم المدخّنة أو المشوية على الفحم يمكن أن تحتوي على مواد سرطانية من الدخان المتصاعد من النار الطليقة والذي يغلف سطح اللحم إن كنت تتناول المشويات منحين إلى آخر, فالخطر قليل على كل حال عند تحضيرك وجبة من اللحوم المشوية, اطبخها أولاً في الفرن لتستوي قليلاً ولا تضطر لتعريضها وقتاً طويلاً للنار المشتعلة والدخان الطليق.

إن اللحوم المدهنة عند تقطرها فوق النار, تزيد من الدخان المؤذي الذي يترسّب على سطح الأطعمة, اختر اللحم الخالي من الدهون وانقعه أولاً بالخلّ والحامض الذي يخفف من مضار هذه المواد السرطانية, أما بالنسبة للحول المعلبة والباردة كالمارتديلا فقد أضيف لها مواد خاصة تحافظ على لونها الزهري وتبعد عنها الجراثيم, لكنها مواد كيميائية يمكن أن تتحول في المعدة إلى مواد سرطانية.

7- الأطعمة التي تحارب السرطان

القرنّبيط, الملفوف, البروكولي, اللفت وهي:
غنيّة بمواد كيميائية طبيعية (Phytochemicals) تبيّن أنها تحارب وتقي من المواد السرطانية.
الثوم والبصل
تحتوي على المركبات الأليلية (allyl compounds) المسئولة عن رائحتها المميزة, تساهم في التخلص من المواد السرطانية من الجسم.
الحمضيات
البرتقال والليمون الحامض والليمون الهندي, والفاكهة, والخضر الغنيّة بالفيتامين C, كالفليفلة, والبقدونس, والكيوي, والمانغو تحتوي جميعها, إضافة للفيتامين C على مواد طبيعية تمنع تأكسد خلايا الجسم وانتشار السرطان.
الصويا
غنية بالهرمونات النباتية (Phytoesrogens) لوحظ أن نسبة سرطان الثدي, والمبيض, والرحم, والبروستات أقل بكثيرفي بلاد الصين واليابان حيث يدل الصويا ضمن غذائهم التقليدي.
الشاي
كثرت الدراسات التي تشير إلى دور الشاي الفعّال في محاربة أنواع مختلفة من السرطان والوقاية منها, خاصة الشاي الأخضر, يعود ذلك إلى غناه بالمواد الفينولية والفلافونية (Phenols, flavonoids) التي تمنع تكوين الأورام السرطانية في الجسم.
البندورة
بكل أشكالها: الطازجة, والمطبوخة, والصلصة أو الرّب. تحتوي على مادة طبيعية تدعى ليكوبين (lycopene) وتشير الدراسات إلى أنها أكثر فعالية من الكاروتين (beta carotene) في منع انتشار الخلايا السرطانية. كلما استهلكت البندورة وصلصة البندورة انخفض عندك خطر الإصابة بسرطان البروستات والمصران.

8-النظام الغذائي للمصاب السرطان:

عند مقاومتك أي مرض, أنت بحاجة لغذاء جيد, فيكف إذا كان هذا المرض السرطان!.. إن التغذية الصحية ضرورية لمساعدة عمل جهاز المناعة, ولمكافحة العوارض الجانبية للعلاج الكيميائي والإشعاعي. وكلما كان غذاء مريض السرطان مناسباً تضاعفت فرصه بالبقاء على قيد الحياة. بصورة عامة. ويمكن للطبيب أن يعدلها بعض الشيء حسب حالة المريض.. إن لعلاج السرطان عوارض جانبية للطعام وصعوبة في المضغ والابتلاع, ومعها كمية غير كافية من الغذاء. من الضروري أن نحارب هذه الحالات, لأن عشرين بالمائة من مرضى السرطان يتوفون من سوء التغذية وليس من المرض.

اتبع الإرشادات التالية لتحسّن من وضعك الغذائي:

- تناول وجبتك في مكان هادئ, بعيداً عن الضجيج والإزعاج.
- لا تنتظر حتى يحين وقت الوجبة, عليك أن تأكل عند الإحساس بالجوع حتى ولو كان ذلك بين الوجبات.
- حاول أن تتناول الأطعمة التي تحبها, واطلب من الذي يحضّر طعامك أن تكون ضمن لائحتك المفضلة.
- ابتعد عن الروائح التي تزعجك واطبخ المأكولات ذات الرائحة الزكيّة استعمل التوابل, والخردل, عصير الليمون والفاكهة لتحسين مذاق الأطباق.
- تناول العسل, والحليب, والمربى مراراً خلال النهار لمزيد من الطاقة.
- إن كنت تشكو من الغثيان, ابتعد عن الدهنيات والمقليات, وتناول الخبز المحمّص والكعك, واشرب القليل من السوائل خلال الوجبة, لا تجبر نفسك على الأكل كي لا تضطر للاستفراغ.
- إن كنت تشكو من تقرحات في الفم. ابتعد عن البهارات, والحوامض والموالح, اطبخ الطعام جيداً, ليسهل مضغه وابتلاعه, اطحن المأكولات إذا لزم الأمر, استعمل أنبوبة ماصة للشرب.
- استشر طبيبك لينصحك بالأدوية المناسبة لتخفيف الغثيان أو لفتح الشهية.[4]

9- أهم الدراسات المتعلقة بالسرطان والغذاء:

في الدراسات الأخيرة وجدوا أن العنب الأحمر يحتوي على مادة تسمى »رزفيراترول» استطاعت تخفيض حالات الأورام الخبيثة في جلد الفئران بنسبة 88% . ويحتوي الشاي الأخضر على مادة (بوليفينول تدي EGCG (لها تأثير على كبح الجذور الحرة يساوي 20 ضعف تأثير فيتامين (E) و500 ضعف تأثير فيتامين.(C)

مادة اللايكوبين هي الصبغة التي تعطي الطماطم لونها الأحمر المميز. ولكنك لا تستطيع الاستفادة من هذه المادة حتى تطبخ الطماطم لأنها تكون مرتبطة بقوة بالبروتين والألياف في الطماطم الطازجة. وفي عام 1995م كانت هناك دراسة على عينة (بلغت 48.000 رجل) في جامعة هارفارد ووجدوا أن أولئك الذين كانوا يتناولون أغذية غنية بالطماطم أكثر من عشر مرات في الأسبوع انخفضت عندهم حالات سرطان(البروستاتا) إلى النصف. وأثبتت دراسات أخرى أن الطماطم ساعدت في الوقاية من حالات سرطان الثدي وسرطان الرئة.

ويحتوي الثوم على مادة (كبيريتدات الألآيل) وهي تساعد في كبح الكيميائيات التي تسبب الأورام الخبيثة. وتوجد كبريتيدات الألايل أيضاً في البصل والثوم المعمر. وتعمل كبريتيدات الألايل على تعديل نشاط إنزيمات الطور الأول من عملية تكوين الأورام الخبيثة، وتقلل من بقايا الطور الثاني. وللاستفادة القصوى من الثوم

يجب طبخه أو تقطيعه وتركه لمدة عشر دقائق على الأقل لتتكون مادة كبريتيدات الألايل. أيضاً يمكن شراء الثوم المعمّر الذي أظهر فعالية كبيرة في الدراسات المعملية.

تحتوي النباتات من الفصيلة الصليبية مثل البروكلي والقرنبيط والملفوف على مادة السلفورافين التي تعزز من إنتاج إنزيمات الطور الثاني، والتي تنقل البقايا خارج الجسم.

و لا ننسى دور الدهون الغذائية. لقد أثبتت الدراسات السكانية أن أولئك الذين تساهم الدهون بأكثر من 40% من السعرات الحرارية في غذائهم يكونون أكثر عرضة للإصابة بالأورام الخبيثة من أولئك الذين تكون مساهمة الدهون الغذائية أقل من 20% من السعرات لديهم.

أيضاً، فإن الزيوت المستخرجة من الكتان والزيتون تساعد في مكافحة السرطان .وتساعد الأسماك المدخنة والتونا والساردين على الوقاية من الإصابة بالأورام الخبيثة وكل ذلك بإذن المولى سبحانه وتعالى .

الخضار والفواكه تحارب السرطان ثبت علمياً أن الغذاء -وبالتحديد الخضار والفواكه -مفيد في إبعاد شبح الإصابة بالسرطان، وأن استهلاكها (الخضار والفواكه) بانتظام يمكن أن يقلل من خطر التعرض للسرطانات بنسبة تصل إلى 40 %خصوصاً سرطان جهازي التنفس والهضم .

وسعى الباحثون لوضع أيديهم على المركبات أو العناصر التي تدخل في تركيب الأغذية الواقية، في محاولة منهم للتعرف على هويتها وفهم الآلية التي تقوم عليها لدرء الإصابة بالسرطان. و توقع العلماء وجود عدة مئات من العناصر الغذائية الواقية من السرطان في الفواكه و الخضار.

فمثلا نصف فص ثوم يومياً تجنبك سرطان القولون! حيث نشرت مجلة «لانست» العلمية الصادرة في بريطانيا دراسة علمية نيوزيلاندية جديدة أوضحت أن تناول فص أو نصف فص من الثوم يومياً مع الطعام خصوصاً السلطة قد يحمي من سرطان القولون .أجرى الدراسة الدكتور «ريكس ماندي» من مركز هاملتون للبحوث الزراعية النيوزيلاندية والهدف منها تحديد كمية الثوم التي يمكن أن يستفيد منها الإنسان. و أجرى ماندي التجربة أولاً على الفئران التي أطعمها الثوم لمدة خمسة أيام خصوصاً مادة (ديولفيد) الموجودة في الثوم، التي تكافح السرطان ووجد ماندي أن تلك المادة تزيد من نسبة الإنزيمات الهضمية التي تكافح السرطان بمعدل من 20 إلى 60%، وثبت من التجربة أن كمية الثوم التي تقي من السرطان هي بمعدل 0.57 إلى 0.3 مليجرام أي ما يعادل نصف فص من الثوم للإنسان طبقاً لما نشرته مجلة «لانست .«

أما عن نبتة الجنسنج فقد بحثت دراسات كثيرة عن علاج للسرطان أو الوقاية منه بالأعشاب. ومن بين هذه الدراسات تلك التي تحاول إثبات القدرة الوقائية لنبات الجنسنج ضد السرطان. وفعلاً ثبت على نطاق ضيق أن لجذور هذا النبات العجيب قدرة على الوقاية من السرطان (بإذن الله تعالى) عند حيوانات التجارب. ولكن ماذا عن الإنسان؟ لمحاولة الإجابة عن هذا السؤال قام فريق بحثي بإجراء دراسة في منطقة (كونجواهيوب) Kwangwha- eup أشهر مناطق زراعة الجنسنج في كورياعلى 4634 فرداً وهؤلاء الأفراد كانت أعمارهم في بداية الدراسة تزيد على 40 سنة وكل ما تم في هذه الدراسة هو تصنيف الأفراد إلى أفراد يداومون على تناول الجنسنج يومياً على شكل خلاصة من الجذور الطازجة، وأفراد لا يتناولون الجنسنج نهائياً. هذه الدراسة لم تلتفت لأي عوامل خطورة بالنسبة للإصابة بالسرطان مثل التدخين أو الوراثة. وإنما ركزت فقط على استهلاك الأفراد للجنسنج. وبعد السنوات الخمس الأولى من المتابعة كان هناك 137فرداً من أفراد العينة قد أصيبوا بأنواع مختلفة من السرطان مات منهم 79 حالة. ووجد من التحاليل الإحصائية أن هناك انخفاضاً (معنوياً) في الإصابة بالسرطان عند الأفراد الذين يستهلكون الجنسنج. فما هو الجنسنج؟

يعتبر الجنسنج من أشهر الأعشاب الصينية فقد اشتق اسمه من الاسم الصيني «Renshen»ويعني جذر الإنسان. ومن الصين انتشر إلى كوريا وبقية دول شرق آسيا وروسيا وأمريكا ثم العالم وهو نبات له أوراق نخلية خضراء صغيرة تظهر في نهاية الصيف. أما الجزء المستخدم منه فهو الجذور. والجنسنج أنواع يعتقد أن أقواها تأثيراً وفائدة هو النوع الكوري، ثم الصيني و (السيبيري) من روسيا. أما المواد الفعالة فيه فهي (جليكوسيدات) نوع من الكربوهيدرات المعقدة مثل (جليكوسيدات الصابونين وستيرويل وزيت طيار).

أما فوائده فهي متعددة يعتقد بها من أجرى عليه أبحاثاً من الصينيين والكوريين بل والأمريكيين فهو محفز ومنشط للجهاز العصبي المركزي، ومنشط بصورة عامة ومحفز للهمة، ومقو للعضلات. كما أنه مخفض لمستوى سكر الدم ويؤقلم الجسم على الاسترخاء. وينصح به في فترات النقاهة من الأمراض ولكبار السن للاعتقاد بأنه يجدد نشاط الخلايا. ويستخدمه الصينيون لفتح الشهية للطعام ولتقوية الذاكرة من النسيان وللخفقان والأرق والتعرق وغير ذلك! ولكن يحذر من استخدامه في حالات القلق والأرق والاكتئاب، أو في حالات أمراض الالتهابات الحادة. كما أن هناك حساسية عند بعض الناس من استخدامه تظهر على صورة صداع.[5]

وجدت إحدى الدراسات التي ألقت نظرة واسعة على المخاطر البيئية المحتملة على الصحة أن السرطانات على امتداد العالم ترتبط بثلاث أمور مضرة هي : التدخين ، منتجات اللحوم ، المواد الكحولية .قامت هذه الدراسة بتحليل البيانات منذ عام 2008 وذلك لتظهر كيف حدث 21 نوعاً من السرطانات في 157 بلداً ،87 منها لديه بيانات موثقة لحالات الإصابة بالسرطان.

القائم بهذه الدراسة هو وليم غرانت مدير مركز Nutrition Sunlight ومركز البحوث الصحية في سان فرانسيسكو ، أراد أن يعرف ما إذا كانت هذه النسب من الإصابة بالسرطانات مرتبطة بعوامل الخطر المتعددة مثل العمر،نوع الطعام ، والمنتجات الإجمالية للبلد.

أظهرت البيانات التي تم توفيرها من قبل الدول 87 أن التدخين واستهلاك المنتجات الحيوانية مسؤولة عن أكثر من نصف حالات الإصابة بالسرطان ، وهناك بعض الاختلافات بين الرجال والنساء حيث أن التدخين يؤثرعلى الرجال أكثر بمرتين من تأثير تناول منتجات الحيوانات ، بينما أظهرت النساء عكس هذا الأمر .وباستثناء سرطانات الرئة فإن التدخين وتناول منتجات الحيوانات تعد مسئولة عن 70 % من حالات الإصابة بالسرطان في هذه البلدان.30% من حالات الوفاة بالسرطان والتي كانت عام 2008 تقدر بحوالي7 ، 5مليون شخص كانت بسبب خمسة من التصرفات والأطعمة الأساسية : البدانة)ارتفاع كتلة الجسم (، قلة الخضروات والفواكه ، قلة الحركة، التدخين، الكحول.للمنتجات الحيوانية علاقة قوية مع عدة أنواع من السرطانات لان هذا النوع من الأغذية يحفز نمو الجسم كما يفعل مع الأورام، وأنواع السرطانات المحتملة نتيجة هذه الأغذية سرطان الثدي و المبيض والكلية والبروستات و الخصى والغدد الدرقية [6].

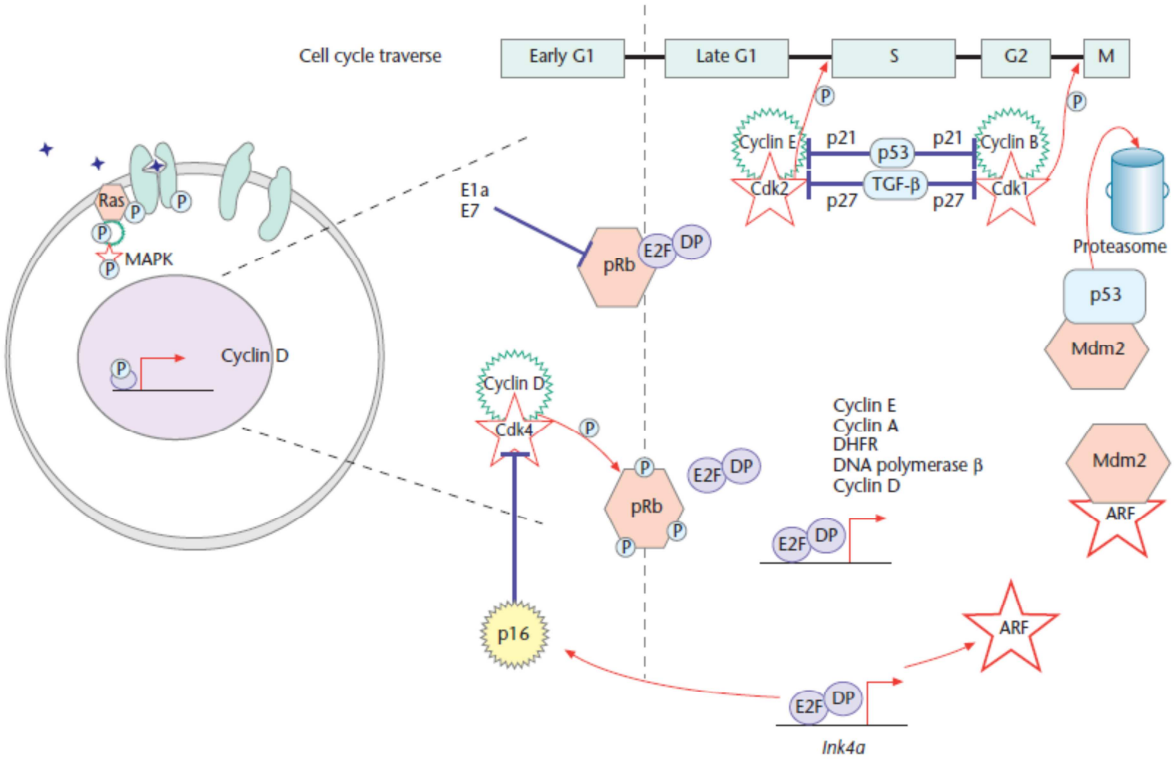


Figure 1 Overview of cell cycle regulation. Growth factor binding leads to receptor dimerization and phosphorylation, activation of Ras and the mitogen-activated protein kinase (MAPK) signal transduction pathway leading to cyclin D production. Many of the genes encoding growth factors, receptors, components of the signal transduction pathway and cyclins are proto-oncogenes, genes that when activated by mutation (now oncogenes) can contribute to cancer development. pRb, p53 and the cyclin-dependent kinase inhibitors (CKIs) all act as a brake on cell cycling and are the products of tumour suppressor genes (TSGs); when inactivated by mutation, loss or viral proteins, they also contribute to cancer development. The phosphorylation of pRb is necessary for the release of E2F–DP dimers that promote the transcription of cell cycle-associated genes. pRb can be inactivated by virally encoded oncoproteins such as adenovirus E1a and human papillomavirus (HPV) E7. p53 is negatively regulated by Mdm2, an enzyme required to produce a polyubiquitinated p53 for degradation by the proteasome. p53 can be disabled by adenovirus E1b and HPV E6. The *Ink4a* locus also encodes $p14^{ARF}$ whose function is to activate p53 by binding to and inactivating Mdm2, making *ARF* another TSG. DNA, deoxyribonucleic acid; DHFR, dihydrofolate reductase; TGFβ, transforming growth factor β.

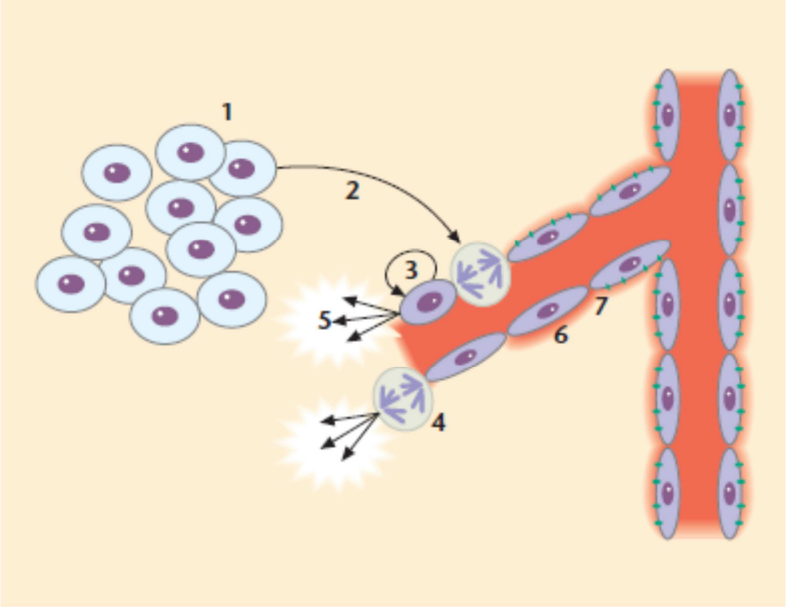


Figure 2 Summary of angiogenesis. (1) 'Stressed' tumour cells, perhaps suffering from hypoxia, release (2) proangiogenic growth factors that, in concert with (3) growth factors produced by the endothelial cells themselves acting in an autocrine manner, stimulate (4) endothelial cell migration and division. The stimulated endothelial cells release (5) extracellular matrix (ECM)-busting enzymes such as urokinase-type and tissue-type plasminogen activators, and collagenases, as well as inhibitors such as plasminogen activator inhibitor 1. Endothelial cells also (6) release basement membrane components such as laminin, type IV collagen and tenascin, and (7) express ECM receptors such as the $\alpha_5\beta_3$ and $\alpha_5\beta_5$ integrins.

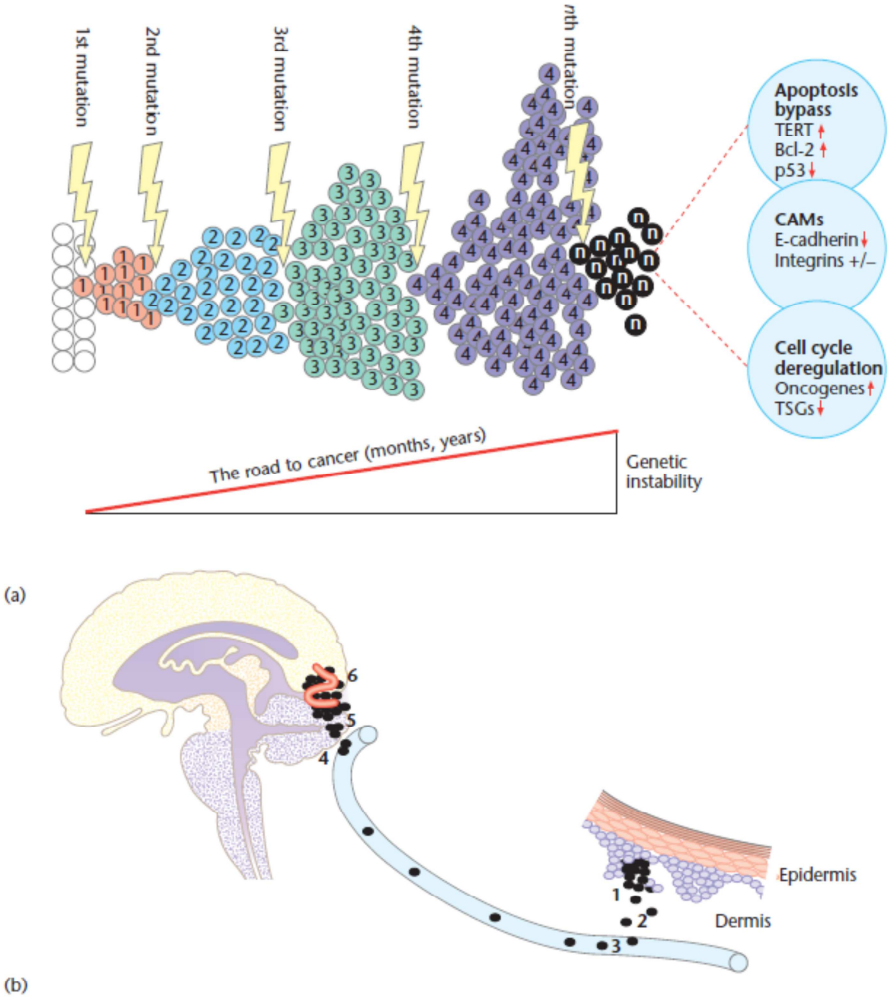


Figure 3 (a) Multistage carcinogenesis from the genetic perspective. (b) The consequent malignant phenotype.
(a) The development of a malignant tumour begins with a mutation in a long-lived cell, probably a stem cell. That mutation gives the cell a growth advantage over its normal neighbours and it undergoes clonal expansion. Other mutations that give any progeny a growth advantage lead to successive rounds of mutation and clonal expansion until the malignant genotype is acquired. In many cases, one of the first mutations is likely to be in a 'caretaker' gene that maintains genome integrity. The malignant phenotype is likely to be a manifestation of disturbances in the control of cell proliferation, cell death and cell adhesion. CAM, cell adhesion molecule; TERT, telomerase reverse transcriptase.
(b) Malignant tumours can (1) invade beyond normal tissue boundaries, (2) detach from the primary tumour mass and (3) enter vascular or lymphatic vessels before (4) adhesion to suitable endothelium and exit from the circulation. Establishment of the metastasis requires (5) local tissue invasion and (6) induction of angiogenesis.

Encyclopedia of life sciences ; 2001 ; nature publishing group ; www.els.net; 10/9/2014 :**المصدر**

خـــــاتمـة:

نستنتج من خلال كل ما سبق أن هناك علاقة كبيرة بين ما نتناوله من أغذية وبين ظهور وانتشار مرض السرطان، وهذا ما تبين لنا خاصة من خلال مختلف الدراسات التي تناولت هذه العلاقة، وبذلك نجد أن مرض السرطان يتأثر كثيرا بالغذاء، حيث قد يساهم هذا الأخير في زيادته، أو الحد من انتشاره والتخفيف من آثاره ومضاعفاتهّ، ولذلك يجب علينا ان نولي غذاءنا أهمية بالغة وأن نحرص على تنوعه وغنائه بالعناصر الضرورية المفيدة لبنية أجسامنا وطبيعتها، وفي الأخير تبقى الوقاية خير من العلاج.

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Heavy Metal Contamination Profile of Four Selected Seafoods Harvested on Itu River in the Niger Delta Region of Nigeria

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ABSTRACT: The Niger Delta region is notorious for oil and remains the most exploited region. As a result, pollution from anthropogenic sources is on the increase. Heavy metals mercury (Hg), lead(Pb), cadmium(Cd), iron(Fe), copper(Cu) and zinc(Zn) were studied in four species namely *Austropotamobius pallipes*, *Penaeus notialis, Tympanotonus fuscatus* and *Archachatina maginata* at two different periods of three months interval. The samples were analysed using atomic absorption spectrophotometer and triplicate results obtained were analysed using ANOVA. Hg and Pb were not detected (<0.0001ppm) in both study periods and species examined. Zn, Fe, Cu and Cd were detected in all species but were all below maximum allowable limits of international guidelines. Thus, all four seafoods studied are safe for consumption. However, there is need to monitor seafoods coming out from the region from to time.

KEYWORDS: Heavy Metal, Contamination Profile, Seafoods Harvested, Itu River, Niger Delta, Nigeria.

1 INTRODUCTION

Heavy metals are defined as electronegative metals that are chemically inert with densities 5g/cm^3 and above. These metals are toxic to not just human but to other organisms. Physiologically, they form bonds with sulphur atom in the body and also have the ability to attack the free amino and carboxylic acid groups of proteins. Other mechanisms exist that they use to disrupt basic and important physiological functions in the body [1], [2]. Since they are inert or stable, they are very difficult to degrade and thus tend to accumulate in soils, water, atmosphere and also bioaccumulate in aquatic organisms [1], [3], [4]. The metals are introduced into the environment via natural cycles but also worrisomely through a number of anthropogenic activities [1], [2], [3], [4]. At low concentration, these metals do not cause any health or environmental issues but do so at high concentrations [3], [5].

The Niger Delta region which is the economic hub of the country is not spared by the resultant exploitation of its abundant oil and mineral resources. The effect is seen by the incessant crude oil spillages such as that recently revealed by the UNEP report on Ogoniland spillage where it was concluded that this little part of the Niger Delta is heavily contaminated by crude oil and its numerous fractions and that clean efforts could take between 20-30 years costing some $100million. [4], [6]. Given the coastal nature of the region, it is therefore not surprising that fishing is a major employer of labour and as a result, seafood both shelled and fleshy form a major part of the diet of the people of the region. A number of studies abound on the effect of crude oil and heavy metals on both land and aquatic floras and funas in the region. Studies have shown that heavy metals can accumulate in seafood in this region and beyond [4], [5], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17]. The study by Nkpaa *et al* have shown that fish and crustacean harvested from the polluted region of the Ogoni land are contaminated with heavy metals and in concentrations above permissible levels [4]. Another study by Gbaruko *et al* raised alarm about high levels of metals such as mercury and lead in plants and seafood [5]. While Otitoju *et al* did not detect any heavy metal above allowable limits [9].

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Unlike water pollution which may be visible to the naked eye even without further analytical studies, heavy metal contamination of floras and funas are more difficult to see physically. However, given the toxic nature of these heavy metals on floras and funas, increasing urbanisation and the possibility of bioaccumulation in economically important aquatic organisms, we decided to study the accumulation of cadmium (Cd) , copper (Cu) , iron (Fe), mercury (Hg), lead (Pb), and zinc (Zn) on two crustaceans (crayfish and shrimps) ,and also two molluscs (perewinkle, snails) harvested on Itu River and sold on the Itu River Head Bridge, which divides two oil rich states of Akwa Ibom and Cross River.

2 MATERIALS AND METHODS

Study Site

Samples for this study were obtained directly from merchants at the Itu head Bridge in Itu Local Government Area of Akwa Ibom State of Nigeria. The seafoods sold on both sides of the bridge were harvested by local fishermen and they did so using nets or baits. The geographical coordinates of the study area is 5^{o} 39' North and 8^{o} 0' East. This river is an important one in the region because it demarcates both states of Akwa Ibom and Cross River State and also employs the locals. The area also houses Calabar-Itu Express road which connects Cross River State with the rest of the country and is quiet a busy route. There are no heavy industries in the area and the main source of income still remains fishing, farming and petty trading. The map of the study area is as given below.



Figure 1 (Source: Google Map). The river is the long blue line and the bridge is located is located where the river meets the road A342 in the south eastern part of the map (position of the arrow)

Sampling and Collection of Samples

The four different species used in this study were purchased at random from the traders without size or quality preference. Once the right species was identified, they were bought from the vendors. As informed by the vendors, harmless species were handpicked and the rest caught with traps or nets. None was harvested with chemicals. The molluscs and crustaceans picked were *Austropotamobius pallipes* (crayfish), *Penaeus notialis* (shrimps), *Archachatina maginata* (giant Snail) and *Tympanotonus fuscatus* (perewinkle). Samples were washed thoroughly and rinsed with distilled water. They were then transported to the laboratory in ice. The samples were collected twice over a period of three months.

Treatment and Analysis of Samples

In the laboratory, the samples were oven dried at about 90^{o}C and then made into powder using a clean and dry mortar and pestle. The grinded samples were then sieved using a 2mm sieve and stored in clean and air tight desiccators. They were further oven dried to obtain fine powder or ash and allowed to cool down. From each of the four samples, about 5grams was weighed out and made was moist with a few drops of distilled water and 10ml of HCl added to the samples. The resulting samples were then filtered into a cylinder and made into a 20ml solution with distilled water. The samples were then

analysed for heavy metals using Scientific Atomic Absorption Spectrophotometer 200A Model. The instruction of the manufacturer was followed completely during the chemical analysis. The carrier gas was air acetylene gas and was used with the right cathode lamps.

Analysis of Data

The resulting data were then analysed with ANOVA using Graphpad Prism version 6.0. The average concentration for each metal studied is presented as mean ± S.E.M (ppm). Significance was also tested at 0.05 probability level and results of analysis are presented in tables 1 and 2.

3 RESULTS AND DISCUSSION

Mercury (Hg), Lead (Pb) and Cadmium (Cd)

In the last decade, a number of heavy metals have been studied extensively and they include tin, manganese, titanium, iron, vanadium, cobalt, nickel, copper, zinc, mercury, lead, and cadmium. Mercury, lead and cadmium top the list because they are more damaging to organisms and the environment [4], [10], [18]. Mercury occurs naturally in nature but can be released into the environment via industrial activities. As a metal it can accumulate in soils, sediments and surface water. It is present in seafood as methylmercury, where it has the potential to bioaccumulate in the food chain and cause damage to the kidney and central nervous system. The developing brain of foetus is even more sensitive [2], [3], [5]. The permissible tolerable weekly intake of mercury has been set at 5µg/kg body weight, equalling 300µg mercury/week for a 60kg person [19]. For crustacean, fish and shellfish, the maximum level of contamination is set at 0.5mg/kg. However, in all samples collected and analysed, this latent neurotoxin was not detected (below 0.0001ppm) in all seafood studied during the two study periods.

Lead has the potential to accumulate in the body and also affect the nervous system, kidneys and reproductive system [3]. It is also been linked to reduced cognitive development in children [10]. In our study, it was also not detected in all samples collected during both study periods. However, the European Commission sets the limit at 0.2ppm in canned fish [20]. Cadmium was not detected in all samples analysed during the first study period. In the second period, it was detected in all species except *Austropotamobius pallipes*. The mean concentration did not vary much in *Penaeus notialis, Tympanotonus fuscatus* and *Archachatina maginata.* The allowable limit in shellfish is set at 2mg/kg and this is well below our maximum mean value of 0.011ppm. All mean concentrations of Hg, Cd and Pb were less than those obtained by Zodpa *et al* in 2011 in India. In another study, Hg was not detected in tissues, soil and water samples from Itu and Abuloma Rivers but was 64.2mg/kg in Oron River sediment [10]. In nearby Warri, Hg and Cd were not detected in a similar study in *Tympanotonus fuscatus* [18]. The below detectable levels of Hg and Pb could be explained by the absence of industries close by as opposed to other parts of the Niger Delta region.

Table 1. Mean concentration (ppm) of the heavy metals during study period 1

Seafoods	Copper	Iron	Zinc
Austropotamobius pallipes	0.062 ± 0.001	0.120 ± 0.001	0.123* ± 0.002
Penaeus notialis	0.006 ± 0.001	0.121 ± 0.001	0.112 ± 0.002
Tympanotonus fuscatus	0.063 ± 0.001	0.117 ± 0.001	0.007 ± 0.001
Archachatina maginata	0.005 ± 0.001	0.130 ± 0.001	0.063 ± 0.000

**Values are expressed as Mean±SEM (ppm). Cadmium, Mercury and Lead were not detected during the first sample period. The differences across the rows are all significant (P<0.05).*

Table 2. Mean concentration (ppm) of the heavy metals during study period 2.

Seafoods	Cadmium	Copper	Iron	Zinc
Austropotamobius pallipes	-	0.034 ± 0.001	0.060 ± 0.000	0.096* ± 0.002
Penaeus notialis	0.010 ± 0.001	0.035 ± 0.002	0.050 ± 0.001	0.082 ± 0.002
Tympanotonus fuscatus	0.010 ± 0.000	0.034 ± 0.001	0.050 ± 0.001	0.082 ± 0.001
Archachatina maginata	0.011 ± 0.000	0.031 ± 0.003	0.079 ± 0.001	0.081 ± 0.002

**Values are expressed as Mean±SEM (ppm). Mercury and Lead were again not detected. Across the rows, the differences are all significant (P<0.05).*

Copper (Cu), Zinc (Zn) and Iron (Fe)

Copper, Zinc and Iron are important cellular components of organisms but have been found to be toxic under certain condition and at high concentrations. Their major inputs include natural and anthropogenic sources [1], [2], [21]. Unlike, mercury and lead which were not detected during both sampling periods, Zn, Fe and Cu were all detected in all species and in varying concentrations. More of iron and zinc were seen in the species compared to copper in both study periods. More iron was detected in study period 1 than 2. It was observed in this sequence: *A. Maginata > P. notialis > A. pallipes > T. Fuscatus,* for period 1. In the second period, the highest of iron was seen in *A. Maginata* and the least seen in *A. pallipes.* When compared to the 100µg/g World Health Organization maximum allowable limit in food, the concentrations recorded were far lower. It is also lower than the concentrations previously reported [4], [10], [22]. Copper another important cellular constituent [21] was detected in all species studies during both study periods. The highest and lowest concentration of copper was recorded in first study period. During this period, the pattern of accumulation was *T. fuscatus> A. pallipes > P. notialis > A. maginata.* During period two, the concentrations were fairly same across all species studied. Again, these concentrations were much lower than previously recorded and also that of WHO maximum limit of 30µg/g. [4], [10], [22]. Zinc was also detected in all samples studied and during both study periods. Just like Fe, Zn was the second most abundant heavy metal in this study and was more consistent in period 2 than 1. The highest concentration of Zn was observed in *A. pallipes* in both periods and the least seen in *T. Fuscatus.* When compared with the previously reported studies, the concentration of Zn was lower than of Nkpaa *et al* but was in range to that of Chukwujindu *et al* [4], [15] in the Niger Delta. In other regions of the world it was lower than those previously reported [13], [14].

4 CONCLUSION

The present study reveals the presence of heavy metals zinc, iron, copper and cadmium, but not mercury and lead in *T. Fuscatus, A. pallipes, P. notialis,* and *A. maginata.* All metals detected were well lower than acceptable maximum limits set by WHO and FAO. This therefore indicates that the studied Seafoods within study 1 and 2 harvested and a sold along Itu Bridge are very safe for consumption. However, there is need for continuous monitoring of the seafoods for heavy metals and other pollutants. There is also need to monitor already operational industries so that they treat their effluents before discharging them into the environment, and to extend the study to include species of fishes commercially available on the bridge head as well.

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Synthesis and Optimization of PVA based paper lamination adhesives

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ABSTRACT: Polyvinyl alcohol (PVA) and polyvinyl acetate (PVAc) are the polymers of great interest because of many desirable characteristics. They can be used for many purposes. One of the major uses of these polymers is they can be used to produce adhesives for paper converting, packaging and laminating. The purpose of this work is to develop a suitable process for producing PVA based adhesives. In this work, both polyvinyl acetate and polyvinyl alcohol adhesives were prepared. Adhesives were prepared by the polymerization and alcoholysis of vinyl acetate monomer (VAM). Different performance tests were conducted after preparing these adhesives. In this study it was found that better quality adhesives can be prepared from polyvinyl alcohol. Different performance tests were conducted on the adhesives prepared. It was found from the performance tests that polyvinyl alcohol adhesive is the best adhesive that can be used for lamination. Drying time for polyvinyl alcohol was found 12.9 minutes which was better than polyvinyl acetate adhesives. Moreover, pull-off test shows that maximum allowable pressure for PVA adhesive is higher than PVAc adhesives and the value is 195 psi.

KEYWORDS: Polyvinyl alcohol, polyvinyl acetate, Vinyl acetate monomer, Adhesive, Polymer.

1 INTRODUCTION

An adhesive is any substance applied to the surfaces of materials that binds them together and resists separation [1]. The importance of using paper lamination adhesive is increasing day by day. In Bangladesh, all the adhesives used for different purposes such as, paper lamination, book binding, book cover preparing is imported from different countries. Using imported adhesive is costly. This study work is based on producing foreign quality adhesive at low cost.

The use of adhesives offers many advantages over other binding techniques such as sewing, mechanical fastening, thermal bonding, etc. These include the ability to bind different materials together, to distribute stress more efficiently across the joint, the cost effectiveness of an easily mechanized process, an improvement in aesthetic design, and increased design flexibility [2]. Properties of adhesive and applications may vary depending on the raw materials used to prepare those adhesives. Vinyl ester family is the most important polymers that can be used to produce different adhesives [3]. Vinyl ester is a synthetic polymer. PVA adhesives are water based adhesives [4]. They are mainly used for mounting paper, paper products canvas etc. Polyvinyl acetate latexes were the first synthetic polymer latexes made on an industrial scale, beginning in Germany in the 1930s [5]. With the addition (and/or generation in situ) of PVA as an emulsifier, PVA latexes became one of the major products of the adhesive and surface coating industries.

PVA based adhesive preparation is a complex process. It shows complexity of polymerization reaction such as initiation, propagation, termination and is time consuming [6]. It is, therefore, an object of this invention to provide a practical and economical process for producing polyvinyl acetate adhesives having a lower degree of crystallizability. A further object is to provide an improved method of polymerizing vinyl acetate to yield polyvinyl acetate that may be converted to polyvinyl

alcohol having a low degree of crystallizability. Optimization of different methods of adhesive preparation and the selection of most cost effective method is another motto of this study.

2 MATERIALS AND METHODS

2.1 MATERIALS

The main materials used here are Polyvinyl Alcohol and Vinyl acetate monomer. Sodium Hydrogen Carbonate was used as a buffer solution and Potassium persulfate as initiator. Detergent was used surfactant solution and all of these were found from local market.

2.2 METHODOLOGY

Different types and grades of binders can be produced from polyvinyl Alcohol (PVA) and polyvinyl acetate (PVAc). Paper converting, packaging wood, tile and home handyman adhesive can be produced from polyvinyl Acetate. On the other hand polyvinyl alcohol binders are mainly used for paper applications and in textile industries. Synthesis processes of these adhesives are different depending on the use of the adhesives. Our goal is to study a process for producing commercial grade paper lamination binder. To achieve this goal, we have prepared both PVA and PVAc based adhesives.

2.3 POLYVINYL ACETATE PREPARATION

Two different tests were conducted to prepare polyvinyl acetate adhesive. The basic difference between the two experiments was in the use of raw materials. In the first experiment no polyvinyl alcohol was used while polyvinyl alcohol was used in the second experiment. Adhesives of two different grades have been found from two different experiments. Polyvinyl alcohol is a water soluble polymer and it was used to partially hydrolyze polyvinyl acetate. Thus, adhesive prepared in the second experiment has better bonding characteristics than the one prepared from the first experiment.

2.4 METHOD 1

The raw materials used for this method was vinyl acetate monomer (VAM), potassium persulfate, sodium bicarbonate and surfactant solution. Potassium persulfate was used as the initiator of the polymerization reaction. Sodium persulfate was used as buffer solution. 0.12 g sodium bicarbonate and 0.12 g potassium persulfate was dissolved in 5ml water respectively. 0.2 g surfactant solution was dissolve in 20 ml water. 40 ml water was added to 30 ml vinyl acetate monomer solution. All the prepared solutions were mixed together in a polymerization bottle. Then the solution it was heated using magnetic stirrer for 8 hours. The temperature was kept at 70-80^{o}C. After 8 hours of heating, polyvinyl acetate was found. The problem with this method is plastic was formed with prepared adhesive and this plastic formation was found as precipitation. The quality of the prepared adhesive was decreased because of the plastic formation. Another problem of this plastic formation is that it hindered the movement of magnetic stirrer and thus the proper mixing of the solution.

2.5 METHOD 2

Method 2 is a modification of the first method as; plastic was formed in the first method. In this method additional polyvinyl alcohol was used in the solution. 0.2 g PVA was dissolved in water and added to the polymerization bottle. PVA partially hydrolyzes polyvinyl acetate and the adhesive produced in this method has a better binding quality. All procedures are same as the previous method. The adhesive found in this process has no plastic precipitation, has a better binding quality than the previous one. The reason behind this better quality is polyvinyl alcohol was used in this method. But still, the desired quality couldn't be achieved. So, another experiment was conducted to produce polyvinyl alcohol (PVA) adhesive.

2.6 POLYVINYL ALCOHOL PREPARATION

Polyvinyl alcohol cannot be prepared directly from vinyl alcohol monomer [7]. So, it was prepared from vinyl acetate monomer. PVAc was prepared from vinyl acetate monomer. The procedure is just as discussed in the previous section. Then PVA was prepared by the alcoholysis of PVAc. Methanol was used for the alcoholysis of PVAc. NaOH was used as the catalyst. The solution was refluxed for 1 hour at 80^{o}C. PVA was found as precipitate. It was separated by filtration and the PVA binder was prepared by hydrolyzing the solid PVA. The adhesive prepared in this method has very good binding characteristics. Its quality is almost same as the imported adhesives used in the local market.

3 PERFORMANCE TESTS

After preparing adhesives using three different methods, different performance tests were conducted to measure their strengths. The tests we have conducted were:

1. Pull-off test
2. Peel test
3. Drying time test

The results found from these tests have shown the strength and quality of the different adhesives prepared. The tests were conducted to conclude whether the adhesives prepared in this work is good or not.

3.1 PULL OFF-TEST

Pull-off adhesion testers measure the force required to pull a specified diameter of coating away from its substrate [8]. This test provides a direct indication of the strength of adhesion between the coating and the substrate. Equipments required for this test were pressure source, pressure gauge and actuator. The flat surface of a paper is adhered to the coating to be evaluated. A coupling connector from the actuator was attached to the paper, after allowing for the bonding adhesive to cure. Pressure is slowly increased to the actuator within the system. Separation occurs when the pressure in the actuator becomes greater than the bond strength between the coating and the substrate. The pressure at which separation occurs is the maximum allowable pressure for the adhesive used.

3.2 DRYING TIME

Drying time is the period of time recommended for the adhesive to set after it is covered with the substrate. Drying time was calculated manually. A stop clock was used to measure the drying time of the adhesives. The time required for each sample to complete drying is observed.

3.3 T-PEEL TEST

Peeling is the most important test conducted for adhesives [9]. Because, paper lamination binders are applied in a way that papers can be separated by peeling easily rather than tearing. An Admet eXpert 7600 series machine was used for the t-peel test. High frequency data points were captured by the tester and a characteristic curve was found for each of the samples. Each end of the sample was loaded into opposite tensile grips. The grips were separated at a constant rate and the average load and the peak load were noted.

4 RESULTS AND DISCUSSION

4.1 PULL OFF-TEST

Maximum allowable pressures found from the pull-off test were different for all the samples. Maximum pressures for all the samples are shown in table-1.

Table-1: Pull-off test result for different samples

Name of the sample	Sample 1	Sample 2	Sample 3	Market product
Maximum pressure (psi)	55	80	195	210

The maximum allowable pressure is different for different samples (Figure 1).

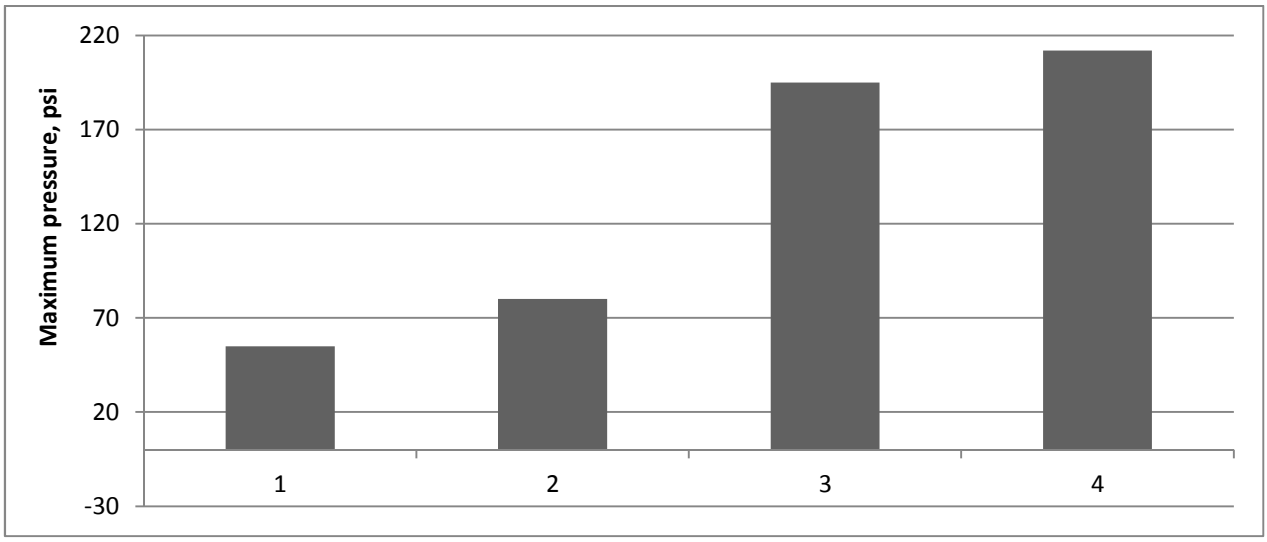


Figure 1: Graphical representation of pull-off test result

From the bar diagram it can be said clearly that the adhesive prepared in the third experiment has the best adherent quality and the maximum allowable pressure is nearly equal to that of the market product.

4.2 DRYING TIME

The drying time was calculated manually. Using the stop clock, the drying time for the adhesive to set after it is covered with the substrate. Drying time for different samples is shown in table-2.

Table-2: Drying time for different samples

Sample name	Sample1	Sample 2	Sample 3	Market product
Drying time (min)	23.4	21.1	12.9	10.1

The drying time is noted for different samples and market product and it is found that Sample 3 is close to market adhesive (Figure-2)

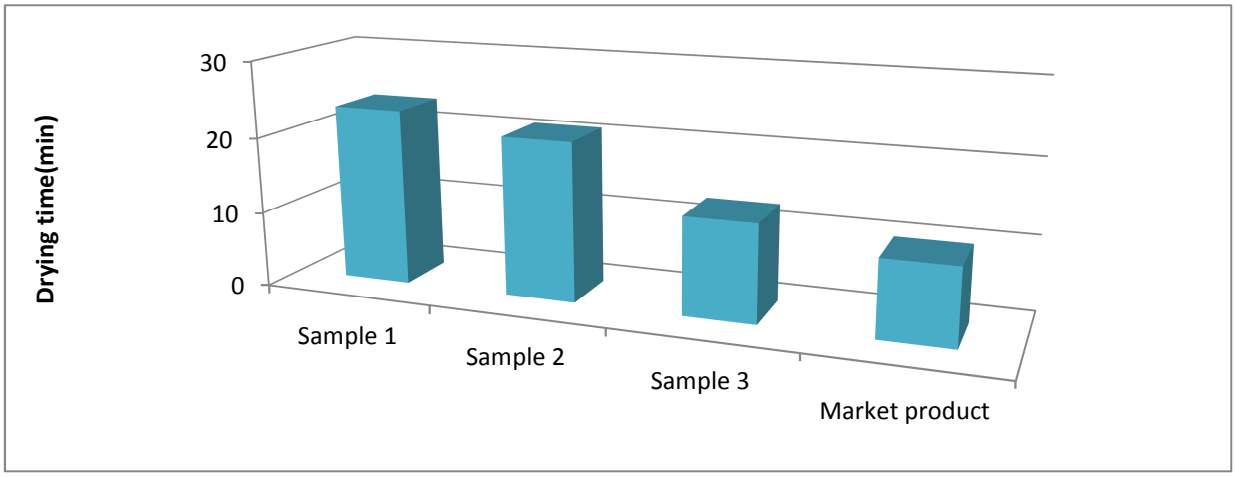


Figure 2: Drying time of various samples

4.3 T-PEEL TEST

In T-peel test, laminating films are detached by the pneumatic tension grip. Different loads need to separate the films and displacements of the arms were observed.

Table-3: T-peel test result for different samples

Sample 1		Sample 2		Sample 3		Market product	
Displacement (mm)	Load (N)	Displacement (mm)	Load (N)	Displacement (mm)	Load (N)	Displacement (mm)	Load (N)
0	10	0	10	0	10	0	10
2	55	2	75	2	129	2	168
4	41	4	32	4	67	4	72
6	25	6	28	6	76	6	70
8	31	8	28	8	64.5	8	68
10	25	10	27.5	10	65	10	68

The grips were separated at a constant rate and the average load and the peak load were noted (figure-3).

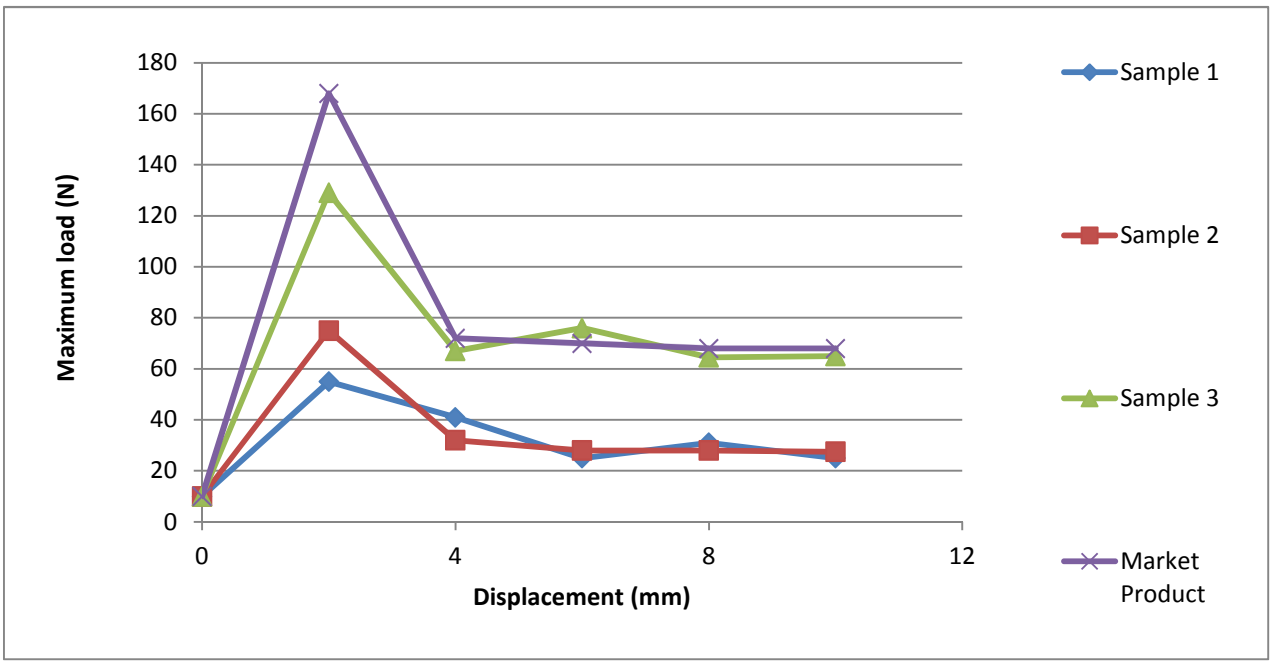


Figure 3: T-peel test for various samples

From analyzing all the results it is clearly stated that market product is still better than ours. Some reasons are liable for that such like: Using local detergent instead of AMA, AOT which caused foam during PVA synthesis, using Vinyl acetate monomer in fist two sample tests which formed plastic during operation, running semi batch instead of batch system, presence of air bubble in the final product etc.

5 CONCLUSION

It can be stated that the synthesis and optimization of PVA based adhesive constitutes a mature field of research with commercial opportunities and a promising future in the forthcoming years. The objective of this study was to establish a simplified and economically feasible process for PVA adhesive production. From analyzing the results it is concluded that method 3 is the optimized method. It is clearly mentioned that using polyvinyl acetate will not be feasible for this study. PVA adhesive has less drying time of 87s which confirms that it dries faster. From pull off test it is proved that PVA adhesive can tolerate up to a pressure of 195 psi which is approximate to existing market adhesive. Drying time and T peel test also proved

its properties as a fine quality adhesive. Experimental study showed that it was a time consuming process and needs great inspection.

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Interaction and association between genetic mutations and clinical risk factors in developing ischemic stroke in Moroccan population

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ABSTRACT: In this paper, we focus on the importance of interaction between adverse genetic mutations, and clinical risk factors in the development of ischemic stroke, knowing that this disease is multifactorial common that is affected by a number genetic mutations and environmental factors.

The apolipoprotein E4 allele (APO e4), Factor II G20210A prothrombin (blood clotting protein), and Factor V genotypes were examined in 165 patients with ischemic Stroke group and 165 Control group, at the Laboratory of Human Genetics and Molecular Pathology, University Hassan II- Faculty of Medicine in Casablanca and the department of neurology at the campus teaching hospital of Casablanca and Rabat. Logistics regression models and bivariate correlation analysis with Karl Pearson's method were used to estimate the role of co-occurrences of the clinical risk factors and genetic mutations in ischemic stroke. The presence of the APO e4 is dominant in Stroke group than Control group and its association with hypertension, smoking and cholesterol increases the risk of ischemic stroke. FV mutation in association with hypertension or diabetes mellitus reveals a strong correlation in ischemic stroke. We found no significant relationship between the ACE D / D, FII, MTHFR 677TT genotype and clinical factors.

In some combinations, pairing of adverse genetic factors, which alone confer non-significant risk, with clinical risk factors can greatly increase the risk of having an ischemic stroke.

KEYWORDS: Ischemic stroke, Clinical risk factors, Correlation, Logistic regression, Apolipoprotein E (ApoE), FV and Allele frequency

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1 INTRODUCTION

Stroke remains a leading cause of death worldwide and the first cause of disability in the western world. Ischemic stroke accounts for almost 80% of the total cases of strokes and is a complex and multifactorial disease caused by the combination of vascular risk factors, environment and genetic factors.

A number of frequent polymorphisms and mutations have been proposed as genetic risk factors. [1], [2] Although some of them can give rise to a specific stroke subtype as minor but significant risk factors, most of them alone have not proved to be significant risk factors for ischemic stroke overall. It has been demonstrated that clustering of unfavorable mutations can lead to strokes or other circulatory disorders even if alone they have not proved to be significant risk factors. [6], [7] The Apolipoprotein e4 allele (APO e4), the Factor V and FII [8], [9] are considered minor or insignificant adverse factors genetic risk for ischemic stroke.

In this current study, we calculated the allele frequencies of Apo E, FII and FV in our population comparing with countries around the world to find the dominant alleles in the cases group of ischemic stroke in our study. Then we examined whether these genetic factors can affect measurable change on clinical risk factors and may increase the relative risk of ischemic stroke.

2 MATERIALS AND METHODS

2.1 MATÉRIALS

This is a prospective study for 3 years. She focused on 360 subjects whose victims 165 cases of ischemic stroke and admitted in the laboratory of Genetics and Molecular Pathology, Faculty of Medicine, Casablanca LGPM in collaboration with the departments of neurology of the University Hospital of Casablanca and Rabat.

After clinical examination, neurological assessment, cardiovascular and explorations such as biological, physiological and radiological conducted for each patient so different from those balance, patients were classified according to the International Classification TOAST

LGMP (laboratory of Genetics and Molecular Pathology) and neurology CHU Casablanca and Rabat provided us the results of the genetic and clinical analysis of 165 samples, this analysis consisted of 9 genes (MTHFR, FII, ACE, FV, APOE, IPA, ENOS, APOA5, ALOX5AP) and several clinical factors (hypertension, diabetes, smoking, alcoholism and cholesterol ....)

2.2 MÉTHODS

The results are presented as percentages. Data are analyzed using the "SPSS" software. Genetic factor data were compared in different categories from test "ANOVA" Logistic regression and Odds ratio (OR) used to analyze associations and interactions between the APOE genetic risk factors, FII, FV ACE and other clinical factors such as hypertension, diabetes, smoking, alcoholism and cholesterol.

We performed a bivariate correlation analysis with the method of Karl Pearson in 1986 which offers a mathematical formula for the concept of correlation and an estimate of this quantity [5], [14];

In the first part we calculated the allele frequency of different genotypes for Stroke group and control group was started by The genetic polymorphism of Apo E that is in the coding portion of the gene and modifies the function of the protein produced. The genetic polymorphism of Apo E has three alleles (E2, E3, E4) encoding three forms of Apo E structurally and functionally different (E2, E3, E4) [10].

The variation of the frequency of alleles of Apolipoprotein E is different from one population to another in the world, in all studies, E3 is the most common allele which varies between 60 and 80% [15], [16] is considered normal, the E2 allele was less frequent. Regarding the E4 allele, frequencies vary from about 5% in the Far Eastern populations to 36.8% in the populations of Polynesia. [11] In most populations studied, three ApoE alleles are present. La E4 allele frequency is low in Japan and raised in Finland [15].

Most studies on the relative frequencies of alleles of the ApoE were made without considering the kind of individual. However, some studies have calculated the allelic frequency of ApoE separating men and women. In these cases the allele frequencies in women were not significantly different from those of men [12], [13].

It was then necessary to calculate the odds ratios and confidence interval in order to find the correlation between the dependent variables (APOE, FII, FV, ACE) and clinical factors hypertension, diabetes, smoking, excessive alcohol and cholesterol. We started by calculating the odds ratio "OR" [3] or relative risk [4], is a statistical measure often used in epidemiology, expressing the degree of dependence between qualitative random variables. It is used in Bayesian inference, and logistic regression, and can measure the effect of a factor.

Table 1. Contingency table "cross between disease and exposure"

	Cases group	Controls group
Exposed	a	b
Not exposed	c	d
Total	a+c	b+d

In contrast, the odds of developing the disease given exposure is a/b and of developing the disease given non-exposure is c/d The odds ratio, OR, is the ratio of the two, [cf. table 1].

Which can be rewritten as : OR = (a/b)/(c/d) or: OR = (a × d)/(b × c)

Given the algebraic rule of cross products, the second formula will produce the same result as the other two formulae for odds ratio and is the more commonly reported formula.

Significance Tests for the Odds Ratio

The first thing to understand when considering a significance test for the OR is that the true neutral value (indicating equal odds for both conditions) is one (1), not 0 (zero). Several significance tests can be used for the Odds Ratio. The most common are the Fisher's Exact Probability test, the Pearson Chi-Square and the Likelihood Ratio Chi-Square.

It should be remembered that the concept of "no difference" in most statistics refers to a difference of zero, and is generally measured with the variable means. The OR is different. The "no difference" value for this statistic is 1 and therefore, when a confidence interval includes the value of 1, the researcher or clinician will know that the odds of the measured outcome are the same for both (or all) treatment groups, even without a significance test.

3 RESULTS AND DISCUSSION

The study of the distribution of allele frequencies of ApoE in the Ischemic Stroke in the Moroccan population is 8% for the E2 allele, 82% for the E3 allele and 10% for the E4 allele. Comparison with other populations in the world Table 2 show that in all populations studied E3 allele is the most common (62.6% -87.5%) followed by the E4 allele (4% - 29.7%) and 'E2 allele less frequent (0% -14%). [cf. table 2] and fig.1

Allele frequencies of ApoE of the Moroccan population is E3 = 82%, E4 = 10% and E2 = 8%.

Our results show that the frequency of alleles of the ApoE is similar to what is reported for populations of Southern Europe: Italy, Spain, France, Turkey, and also that of Algeria and Asian populations. Against them by different populations of Europe, North and Sudan and Nigeria or E4 allele is more than twice that of our population (22.7%, 29.1% and 29.7% vs 10%), respectively.

Table 2. Allelic frequencies of Apo E in different populations

Populations	Allelic frequencies		
	E2	E3	E4
Germany [17]	0.077	0.773	0.15
Chine [25]	0.076	0.875	0.049
Spain [18]	0.057	0.811	0.071
France [19]	0.061	0.802	0.117
Italy [20]	0.073	0.827	0.100
Morocco	0.080	0.820	0.100
Finland [17]	0.041	0.733	0.227
Nigeria [17]	0.027	0.667	0.297
Sudan [17]	0.083	0.626	0.291
Turkey [23]	0.083	0.833	0.084
Kuwait [21]	0.057	0.854	0.090
Saudi Arabia [22]	0.036	0.846	0.120
India [24]	0.140	0.810	0.040
Amazonian [26]	0.000	0.831	0.169

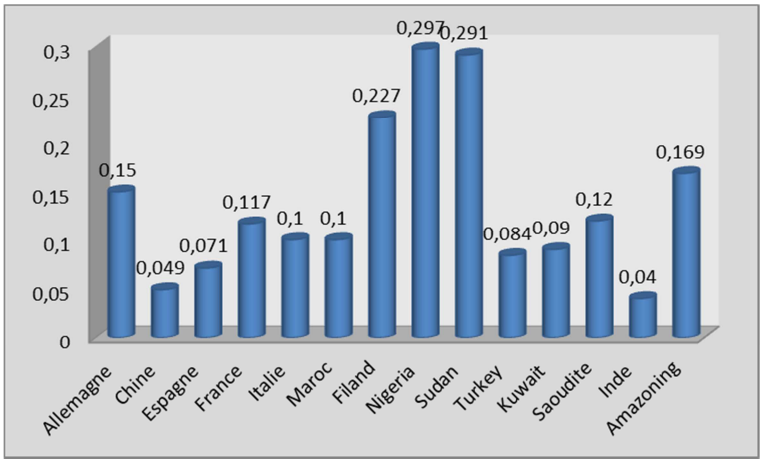


Fig. 1. E4 allele frequency in different populations.

In European populations the frequency of the E4 allele is in descending order from north to south, Germany have the highest frequency (15%) than northern populations such as France 11.7%, the Italy 10%, Spain 7.1%.

The distribution of genotype frequencies in ischemic stroke has the same descending order as controls group, but with different frequencies. E4/E4 genotype is more common (12.7%) in this group, it increased by 11.5% compared to controls (1.2%) as the E2/E4 genotype is increased by 22.4% compared to controls [cf. table 3].and fig.2

Table 3. Genotypic frequencies of Apo E in ischemic stroke

Genotypes	Cases		Controls	
	N	(%)	N	(%)
E2/E2	*2*	1,2	*2*	1,2
E2/E3	*12*	7,3	*18*	10,8
E2/E4	*42*	25,4	*5*	3
E3/E3	*75*	45,4	*118*	71,5
E3/E4	*13*	7,9	*20*	12,3
E4/E4	*21*	12,7	*2*	1,2
TOTAL	*165*	100	*165*	100

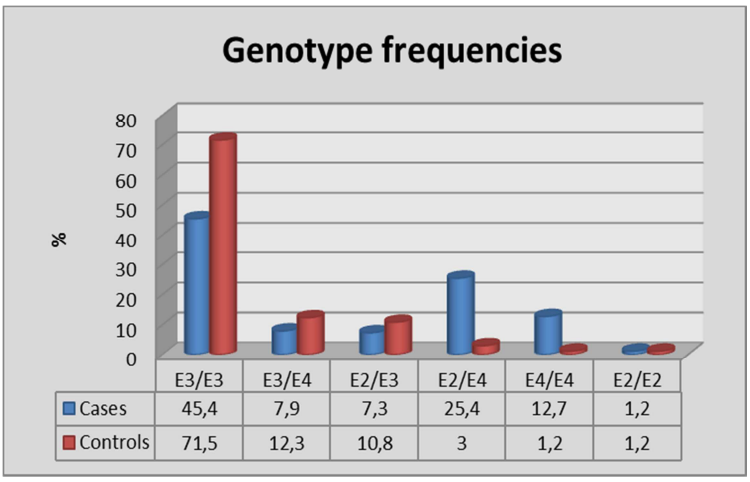


Fig. 2. Genotypic frequency of ApoE in ischemic stroke in the Moroccan population

For allelic frequencies of Apo E in the Moroccan population in the ischemic stroke, Table 4 [cf. table 4] and fig.3 show a difference in the increase in allelic frequency E4, compared with controls (29% vs 10%) 3 times higher.

Table 4. Allelic frequencies of Apo E in Case-Control of ischemic stroke.

	E2	E3	E4
Cases	18%	54%	29%
Controls	8%	82%	10%

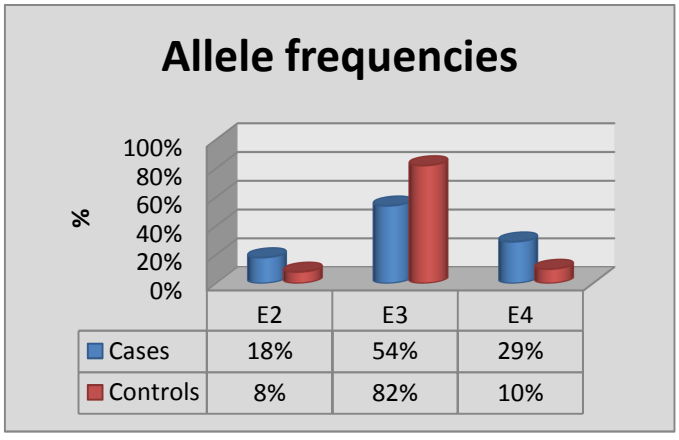


Fig. 3. Allele frequencies of Moroccan population in ischemic stroke

Our results show that E4 allele frequency is dominant in cases group than controls group and its association with hypertension, smoking and cholesterol increases the risk of ischemic stroke. [cf. table 5].In this case OR > 1 and 1 ∉ IC95% → statistically significant association between hypertension and APO E4 allele with same for smoking and cholesterol

Table 5. The relative frequencies of hypertension, diabetes, smoking, drinking and cholesterol in cases of Ischemic stroke with and without the APO e4 allele

		Ischemic stroke cases with APO e4 allele n= 76	Ischemic stroke cases without APO e4 allele n= 89
Hypertension*	Oui	45	38
	Non	31	51
		OR = 1.95 IC 95% =[1.05 ; 3.64] ***p ≤ 0.01***	
Diabetes	Oui	12	22
	Non	64	67
		OR = 0.55 IC 95% =[0.25 ; 1.21] p < 0.20	
Smoking*	Oui	32	24
	Non	44	65
		OR = 1.97 IC 95% =[1.04 ; 3.80] ***p ≤ 0.02***	
Drinking	Oui	3	8
	Non	74	80
		OR = 0.41 IC 95% =[0.1 ; 1.59] p < 0.10	
Cholesterol*	Oui	13	5
	Non	63	84
		OR = 3.47 IC 95% =[1.18 ; 10.23] ***p ≤ 0.01***	

FV mutation in association with hypertension or diabetes mellitus reveals a strong correlation in ischemic stroke. [cf. table 6]

Table 6. The relative frequencies of hypertension, diabetes, smoking, drinking and cholesterol in cases of Ischemic stroke with and without the FV mutation

		Ischemic stroke cases with FV mutation n= 112	Ischemic stroke cases without FV mutation n= 53
Hypertension*	Oui	63	20
	Non	49	33
		OR = 2.16 IC 95% =[1.10 ; 4.14] ***p ≤ 0.01***	
Diabetes*	Oui	29	6
	Non	83	47
		OR = 2.74 IC 95% =[1.06 ; 7.07] ***p ≤ 0.01***	
Smoking	Oui	36	20
	Non	76	33
		OR = 0.78 IC 95% =[0.39 ; 1.55] p < 0.50	
Drinking	Oui	11	3
	Non	101	50
		OR = 1.82 IC 95% =[0.48 ; 6.8] p < 0.50	
Cholesterol	Oui	12	5
	Non	100	46
		OR = 1.1 IC 95% =[0.37 ; 3.32] p < 0.50	

We found no significant relationship between the ACE D / D, FII, MTHFR 677TT genotype and clinical factors.

Comparing our results with those of other populations in the world as a study was made in Hungary [27] show that V Leiden mutation in association with hypertension or diabetes mellitus increases the risk of ischemic stroke. They found synergistic effects between the ACE D / D and MTHFR 677TT genotypes and drinking or smoking, what is not the case in our study. The presence of the APO e4 reveals a strong correlation of hypertension and smoking and the incidence of ischemic stroke, what is similar to that we found in our population.

4 CONCLUSION

In addition to the classical clinical risk factors there are unfavorable genetic mutations that will increase the risk of ischemic stroke, and this can lead to more effective prevention.

Our results may be useful in everyday medical practice, and the detection of some adverse change, in combination with certain clinical risk factors could be an alarm and draw attention to the need for strict preventive measures.

A better understanding of the interaction between genotypes and clinical risk factors may facilitate the detection of the appropriate mutation.

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Behavioral explanation of beta variation: French market case

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ABSTRACT: In this study, we test whether investor learning, herding, and prospect theory explain the variation of beta across different return regimes and return frequencies. Empirically, we use quantile regressions to analyze beta change on the French financial market from January 2000 to December 2012.

For daily data, we find a larger estimated impact of systematic shocks on extreme quantiles of firm's returns as compared to intermediate quantiles. The beta pattern is probably symmetrically suggesting that whatever the type of shocks have similar effects. This finding can be explained by herding behavior and investor learning. These behaviors lead to beta- increasing in the extreme returns case.

For monthly data, beta evolves asymmetrically across return regimes with a greater impact of the market in the lower tail of returns distribution. This finding provides strong evidence in favor of prospect theory explanation. Overall, constant beta estimated by ordinary-least squares overestimates the systematic risk of stock in normal times and underestimate the risk in extreme conditions or financial crisis.

KEYWORDS: systematic risk, quantile regression, investor learning, herding, prospect theory, behavioral finance

1 INTRODUCTION

The relationship risk- return is a fundamental financial relationship that affects expected rates of return on every existing asset investment. The most common pricing model proposed to describe this relation is the Capital Asset Pricing Model "CAPM", developed by Sharpe (1964), Lintner (1965) and Mossin (1966). The model proposes that high-expected returns are associated with high levels of risk. Particularly, CAPM suggests that the expected return on an asset above the risk-free rate is linearly related to the non-diversifiable risk as measured by the asset's beta. Substantial empirical work has been conducted to investigate the validity of the model. The CAPM assumes that beta of a stock is constant over time, while empirical literature shows that beta may be varied with data frequency (daily, weekly or monthly) and different regimes of returns. Then, several models have been developed to incorporate the time varying beta (e.g. [6]).

Behavioral finance introduces the investor behavior to understanding the evolution of beta over time. According to Hwang and Salmon [7] the beta becomes biased in the presence of herding behavior. This behavior leads investors to change their beliefs to follow the performance of the overall market more than they should in the CAPM. In other words, they ignore the equilibrium in the CAPM and try to move towards the return for each asset with the market (e.g. [9]).

Moreover, Patton and Verardo [15] propose learning behavior as an explanation the time varying beta. They show a temporary increase of beta around quarterly announcements days. Verardo and Patton suggest that this finding can be explained by investors learning about the profitability of a given firm using information about other firms.

More recently, Savor and Wilson [14] show that the stock market has much higher returns in the days of macroeconomic announcements. Their model is based on the dependence of stock market returns on macroeconomic variables such as expected economic growth in the long term and inflation. Intuitively, the market tends to exercise badly in the days of macroeconomic announcements which make the investment more risky.

In 1979, Kahneman and Tversky demonstrate that investors behave as if maximizing an S-shaped value function. This value function is defined on the basis of gains and losses rather than levels of wealth and it is concave (risk-averse) in the domain of gains and convex (risk-seeking) in the domain of losses, both measured relative to a reference point. More importantly, prospect theory can provide additional explanation of the asymmetric beta. Indeed, if investors are risk-seeking (risk-averse) over losses, beta is expected to be higher (lower) in negative (positive) market conditions.

This paper considers the hypothesis that investor behavior affects the beta and provides economic explanations of his variation. Particularly, we test if investor learning, herding, and prospect theory explain the variation of beta across different return regimes and return frequencies. This study adds to the existing literature by analyzing betas for different return regimes and return frequencies within a quantile regression framework. The main advantage of quantile regression over least-squares regression is its robustness to extreme observations in the dependent variable.

The rest of the paper is organized as follows. Section 2 presents literature review. Section 3 describes the hypotheses, the methodology and the data. Section 3 presents the empirical results. Section 6 concludes the paper.

2 LITTERATURE REVIEW

The CAPM assumes that beta of a stock is constant over time, while empirical literature shows that beta may be changed with data frequency (daily, weekly or monthly) and may vary with investor behavior. Several studies demonstrate that the variation of stock betas can be explained by investor behavior such as investor learning, herding and loss aversion in prospect theory.

Patton and Erardo [15] provide evidence that individual stocks betas increase significantly amount on days of quarterly earnings announcements, and revert to their average levels two to five days later. They explain this finding by investor learning, such as investors interpret the profitability of a company given by using information for other companies.

Baur and Schulze [2] demonstrate that the beta of individual stocks varies across the entire return distribution and that the variation depends on the return frequency. Their results show that there is a symmetric increase of beta in extreme conditions of the market for daily data and an asymmetric reaction of beta for weekly data. They explain this finding with investor learning and herding for shorter investment horizons and prospect theory for longer investment horizons.

Calvo and Mendoza [5] develop a model in which investors preferences are characterized by an indirect expected utility function. They show that relative information costs at shock can lead to herding behavior if these costs are too expensive to prevent investors from collecting and interpreting this information. In the context of changing betas, their argument can be applied to the following situation: if a major shock affects the market and investors do not have time to collect and interpret information (or the information costs are too expensive), they follow the market which leads to higher betas in period of extreme shocks.

In the same way, Hwang and Salmon [7] show that beta-herding increases with the market sentiment. Specifically, if market sentiment is positive (negative), stocks returns tend to increase (decrease), independently of their systematic risk, which will increase (decrease) the beta herding. Their results confirm a significant positive relationship between beta herding and market sentiment. Boujelbène Abbes [4] found that herding behavior increases volatility in financial markets during crisis period.

In 1979, Kahneman and Tversky have analyzed the decision making under risk and they proposed the prospect theory which incorporates human emotions to better describe the human decision. The S-shaped value function described by Kahneman and Tversky [11] is concave over gains (risk aversion for gains) and convex over losses (risk-seeking for losses) and, it is steepest in the loss domain. Based in this theory, Baur and Schulze [2] suggest that stock's returns exhibit higher volatility in a loss regime (negative returns) as compared to gain regime (positive returns). Moreover, the cross-sectional dispersion of returns is larger in a loss regime than in a gain regime. Also, investor behavior affects a firm's beta. If investors are risk-seeking in adverse market conditions, betas will be higher than in more favorable market conditions. Empirically, Baur and Schulze [2] show that the beta varies across different firm-specific return regimes conforming to the value function in Prospect Theory.

3 HYPOTHESES, METHODOLOGY AND DATA

3.1 HYPOTHESES

By considering the literature presented above, we test three major hypotheses in our empirical work:

H1: Investor learning explains the symmetric increase in the stocks- beta for the extreme daily return.
H2: Herding bias explains the symmetric increase in U-shaped beta for the extreme daily returns.
H3: Prospect theory explains the asymmetric variation in the stocks-beta under different regimes for monthly returns.

3.2 METHODOLOGY

Allen et al. [1] suggest that the traditional OLS regression becomes less effective when it comes to analyze the extreme returns, which are often a major interest for investors and risk managers. Based in this suggestion we use the quantile regression to test the three hypotheses described above. The estimator of the quantile regression is not affected by the observations found in the extreme quantiles. Also, the technique of quantiles provides estimates of beta for different regimes of returns which is in conformity with a fundamental proposal of prospect theory.

We estimate the following model:

$$R_{it} = a_i + b_i R_{mt} + v_{it}, \quad (1)$$

$$Q_r (\tau \mid R_{it}) = a_i (\tau) + b_i (\tau) R_{mt} \quad (2)$$

Where, R_{it} is the return of stock *i* at time *t;* R_{mt} is the market return and $Qr (\tau \mid R_{it})$ is the τ -th conditional quantile of a stock's return R_{it}, assumed to be linearly dependent on the market return R_{mt}.

This model is estimated with the quantile regression method and can thus assess the impact of R_{mt} on different quantiles of R_{it}.This approach provides estimates of the coefficients and (pseudo-) R squares for any conditional quantile for each stock.

3.3 DATA AND VARIABLES

We use daily and monthly data of the *CAC40* index and all constituent stocks of this index from January 2000 until December 2012. The basic variables of this study are individual stock returns and market return. An individual stock return is defined as follows:

$$R_{it} = \frac{P_{it} - P_{it-1} + D_{it}}{P_{it-1}} \quad (3)$$

Where, P_{it} and P_{it-1} represent respectively the price of stock *i* at time *t* and *t-1* and D_{it} : dividend of stock *i* at time *t*.

Figures 1 plots the movements of daily returns on the CAC40 index. The Figure indicates that CAC 40 index exhibits lower volatility in period of 2004-mid2007. This finding is confirmed to the results of Ellouz S. [8]. But, during the period from July-2007 until 2009, return index shows enhanced volatility reflecting the impact of 2007- US crisis on the French market. This finding supports the results of Jayech et al. (2011) reporting the presence of financial contagion during the subprime mortgage crisis of 2007 in French market.

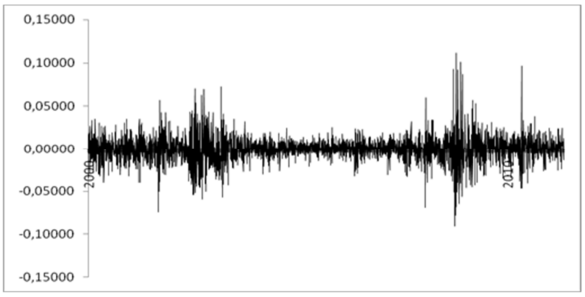


Fig. 1. Monthly moving of CAC40 index returns

Table 1 reports descriptive statistics on daily returns of CAC40 index and the 40 firms which currently constitute this index. This table provides information on the number of observations, mean, median, maximum, minimum, standard deviation, the skewness, the kurtosis, the Jarque-Bera test, the ADF test, and the critical value of 1%.

The CAC40 index has an average positive return, but very low, with a minimum of -0.0903 and a maximum of 0.1118.

The normality test results show that the distributions of CAC 40 and all listed firms are not normal (Skewness ≠ 0 and kurtosis ≠ 3). The results of stationary test show that CAC40 return and the 40 firms' series are stationary.

Table 1. Descriptive statistics for cac40 index and its constitutes

	CAC	ACCOR	AIR LIQ	ALC	ALS	A M	AXA	BNP
Mean	0,00001	0.000442	0.000399	-0.000179	9.85e-05	0.000669	0.000124	0.000351
Median	0.000204	0	0.000592	0.000000	0.000000	0.000605	0.000000	0.000000
Max	0,1118	0,2248	0,11	0,4054	0,5072	0,2844	0,2187	0,209
Min	-0,0904	-0,1947	-0,086	-0,177	-0,5533	-0,3019	-0,1841	-0,1724
Std. Dev.	0.015556	0.031963	0.017291	0.035588	0.044644	0.029737	0.028921	0.024332
Skewness	0.227334	0.276980	0.147524	0.639076	0.495506	-0.004645	0.716064	0.724125
Kurtosis	8.408.287	7.558.571	6.772.959	1.213.685	3.101.652	1.626.973	1.072.089	1.379.666
J-B	3.561.756	2.549.823	1.731.205	10291.90	95029.33	17322.44	7.456.098	14348.61
Test ADF	-2.507.721	-2.520.065	-2.153.723	-2.499.536	-2.491.252	-2.309.313	-2.420.446	-1.895.956
Crit V 1%	-3.961.223	-3.961.223	-3.961.229	-3.961.222	-3.961.223	-3.961.960	-3.961.223	-3.961.236
	BOUYG	**CAP G**	**CAR**	**CR AGR**	**DAN**	**E D F**	**E I N**	**EADSP**
Mean	9.30e-05	-0.000168	-0.000183	0.000151	0.000307	0.000114	0.000596	0.000344
Median	0.000000	-0.000388	-0.000520	-0.000359	0.000000	0.000277	0.000000	0.000000
Max	0,169595	0,263889	0,099495	0,263158	0,101887	0,159794	0,14167	0,134002
Min	-0,143587	-0,229656	-0,110351	-0,133663	-0,104969	-0,104782	-0,125364	-0,263179
Std. Dev.	0.024630	0.030164	0.019593	0.026272	0.016332	0.020016	0.017218	0.026318
Skewness	0.350828	0.251363	-0.003397	0.683826	0.139754	0.224226	0.617342	-0.126666
Kurtosis	7.852.665	8.404.112	6.399.242	1.200.918	7.344.604	9.557.033	1.021.806	8.522.747
J-B	2.906.919	3.561.861	1.397.179	8.317.412	2.291.819	2.516.155	6.484.136	3.695.807
Test ADF	-1.978.226	-2.486.552	-2.094.617	-8.185.728	-9.374.203	-5.945.359	-1.008.080	-9.321.293
Crit V 1%	-3.961.232	-3.961.222	-3.961.229	-3.961.865	-3.961.207	-3.964.632	-3.961.207	-3.961.207
	F T	**GDF S**	**GEN**	**LAF**	**LVMH**	**MICH**	**NAT**	**OREAL**
Mean	-0.000361	0.000954	0.000273	-6.78e-05	0.000333	0.000450	0.000189	0.000193
Median	-0.000867	0.000000	0.000000	0.000000	0.000000	0.000218	0.000000	0.000000
Max	0,255014	2,969332	0,238938	0,139091	0,169014	0,165535	0,388047	0,147292
Min	-0,161966	-0,792819	-0,155556	-0,114303	-0,122644	-0,102053	-0,37193	-0,111183
Std. Dev.	0.027388	0.061853	0.026541	0.022147	0.021476	0.022802	0.028513	0.018309
Skewness	0.885233	3.747.415	0.366064	0.070227	0.499674	0.213458	0.752767	0.217888
Kurtosis	1.252.454	1.840.787	9.978.724	7.048.813	8.477.951	6.863.854	3.585.161	7.251.988
J-B	11348.19	4.09e+08	5.953.767	1.984.559	3.749.221	1.827.247	130770.8	2.209.063
Test ADF	-8.585.884	-9.318.776	-8.633.003	-9.105.640	-9.129.250	-8.995.653	-8.844.661	-9.678.489
Crit V 1%	-3.961.207	-3.961.208	-3.961.207	-3.961.207	-3.961.207	-3.961.207	-3.961.207	-3.961.207
	PERN	**PEUG**	**PPR**	**PUB G**	**REN**	**SA G**	**SAN**	**SCH EL**
Mean	0.000635	0.000193	4.87e-07	0.000295	0.000290	0.000314	0.000280	0.000394
Median	0.000000	0.000000	-0.000435	0.000000	0.000000	0.000000	0.000000	0.000000
Max	0,113227	0,138259	0,179319	0,160093	0,1625	0,185921	0,146612	0,163745
Min	-0,136332	-0,141349	-0,128315	-0,120925	-0,145038	-0,225	-0,103488	-0,20398
Std. Dev.	0.019263	0.022807	0.023104	0.024048	0.026235	0.024917	0.019070	0.022716
Skewness	0.151959	0.229431	0.487618	0.332652	0.081061	0.158086	0.164712	-0.015402
Kurtosis	9.250.566	6.670.026	9.162.710	7.380.566	7.396.315	1.133.204	6.770.633	9.464.977
J-B	4.735.332	1.654.097	4.707.295	2.373.834	2.340.206	8.406.482	1.732.276	5.050.457
T ADF	-9.830.721	-8.682.214	-8.829.981	-8.747.914	-8.733.705	-9.361.693	-9.366.517	-9.020.662
C V 1%	-3.961.207	-3.961.207	-3.961.207	-3.961.207	-3.961.207	-3.961.207	-3.961.207	-3.961.209
	STM EL	**S E**	**TECH**	**TOTAL**	**UNIB R**	**V C S**	**V ENV**	**VINCI**
Mean	-0.000242	-2.19e-05	0.000701	0.000239	0.000601	0.001368	6.91e-05	0.000661
Median	-0.000767	-0.000309	0.000924	0.000580	0.000648	0.000520	0.000000	0.000000
Max	0,170646	0,137214	0,169988	0,136376	0,119111	0,257976	0,16103	0,181284
Min	-0,126543	-0,088538	-0,191888	-0,091904	-0,167722	-0,160698	-0,411088	-0,124367
Std. Dev.	0.027891	0.020431	0.026176	0.017781	0.017598	0.026011	0.022712	0.019916
Skewness	0.334631	0.567433	-0.099516	0.310993	-0.225891	0.403541	-2.700.925	0.674855
Kurtosis	5.392.802	9.449.638	8.214.196	8.428.431	8.996.500	8.954.328	6.041.358	1.139.686

J-B	7.464.688	1.282.999	3.292.253	3.608.690	4.372.603	4.365.745	276709.2	8.745.786
T ADF	-8.700.128	-4.583.570	-9.492.434	-9.314.982	-9.483.463	-9.460.089	-7.536.478	-9.315.160
C V 1%	-3.961.207	-3.970.921	-3.961.207	-3.961.208	-3.961.207	-3.961.207	-3.962.648	-3.961.207

	VIV
Mean	-0.000197
Median	0.000000
Max	0,224731
Min	-0,25523
Std. Dev.	0.025668
Skewness	-0.523853
Kurtosis	2.035.003
J-B	36531.50
T ADF	-8.352.558
C V 1%	-3.961.207

Note: the full names of the CAC 40 constitutes are presented in the annex.

3.4 RESULTS

This section presents the estimation results of 40 quantile regressions based on the time-series for each firm for daily and monthly data (each regression yields 9 different quantile coefficient estimates for beta). Table 1 and 2 present a summary of the estimation results for several selected quantiles, respectively for daily and monthly data. The tables contain two types of coefficient estimate, the ordinary least square (OLS) coefficient and the quantile regression coefficient (QR).

3.4.1 DAILY DATA

Table 1 show that the average coefficient estimate for beta based on a least-squares regression model is 0,855. Indeed, the estimate of beta by Least Square provides a constant measure across time. An alternative is a time-varying beta obtained by fitting a quantile regression model. For all quantiles, the coefficient of market return is significantly positive.

The average estimate of beta coefficients for the quantile 10% is 0,928; it decreases to 0,903 for the quantile 50% and increases to 0,968 for the quantile 90%. Consequently, we note the presence of U-shape pattern.

Table 2. OLS and quantile regression results for 40 firms, daily data

	a	**b**
OLS -Coef	0,0248 (0,765)	0,8547 (40,8904)
EST QR (10%)	-0,0187 (-27,5589)	0,9285 (27,3882)
EST QR (20%)	-0,0109 (-26,6382)	0,9146 (31,205)
EST QR (30%)	-0,0065 (-19,7879)	0,9081 (32,1309)
EST QR (40%)	-0,0031 (-10,5279)	0,9027 (32,0055)
EST QR (50%)	-0,0001 (-0,4261)	0,9026 (32,351)
EST QR (60%)	0,0029 (9,5579)	0,9055 (32,4184)
EST QR (70%)	0,0065 (18,6611)	0,9085 (31,5762)
EST QR (80%)	0,0112 (25,2002)	0,9159 (29,3659)
EST QR (90%)	0,0198 (27,488)	0,9292 (27,5874)

To better presenting the beta variation across quantiles, we present in figure 2 the evolution of the beta coefficients for different quantiles. The graph clarifies the U-shaped pattern of the coefficients across quantiles.

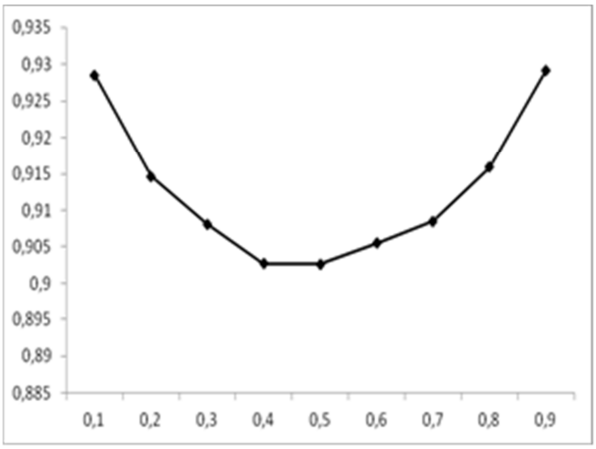


Fig. 2. The evolution of beta across quantiles - daily data

We show that aggregate market affects differently individual stock returns depending on the firm's return regime. Indeed, the figure indicates the larger estimated impact of the market on return-extreme quantiles as compared to intermediate quantiles. Indeed, beta increases in the tails of the distribution. This increasing is probably symmetry suggesting that whatever the type of shocks have similar effects. This finding can be explained by herding behavior. In the event of appearance of shock on the market, the investor does not find time to interpret information; he will follow the market trend what involves, leading to an increase in beta in the extreme return case. This result confirms our second hypothesis suggesting that herding bias explains the symmetrical increase in U-shaped beta for the extreme daily returns.

An alternative explanation for the beta variation is the investor learning. If large return surprises occur, beta increases, affecting extreme quantiles' returns. If news announcements are small or within a "normal" range, investors do not use this information for other firms and beta does not increase. The variation of betas and its U-shape pattern across quantiles support our first hypothesis suggesting that betas are regime-dependent. This finding can be explained with a theoretical model where investors learn about the profitability of other firms by using information on a given firm.

3.4.2 MONTHLY DATA

Table 3 presents the coefficient estimates of beta for monthly data. The average estimate of the beta coefficients for the quantile 10% is 0,899, while the value of the coefficient decreases to 0,773 for the quantile 50% and it is 0,472 for the quantile 90%. Consequently, the positive impact of market returns on individual stocks' returns decreases for lower quantiles to higher quantiles. Moreover, the Least Squared beta (0.8185) overestimates the risk in lower quantiles and underestimates the risk in intermediate and higher quantiles which can affect the investor and manger decisions.

Table 3. OLS and quantile regression results for 40 firms, monthly data

	a	b
OLS- Coef	0,0085 (0,6228)	0,8185 (4,3998)
EST QR (10%)	-0,09 (-7,0506)	0,8989 (3,5445)
EST QR (20%)	-0,0542 (-5,4807)	0,8537 (3,543)
EST QR (30%)	-0,0315 (-3,5489)	0,8304 (3,679)
EST QR (40%)	-0,0143 (-1,5813)	0,7975 (3,4042)
EST QR (50%)	0,0025 (0,2475)	0,7735 (3,1284)
EST QR (60%)	0,01945 (1,9005)	0,7281 (3,0595)
EST QR (70%)	0,03895 (3,5635)	0,6448 (2,7737)
EST QR (80%)	0,06335 (5,1918)	0,5865 (2,5214)
EST QR (90%)	0,1003 (6,2577)	0,4717 (2,3699)

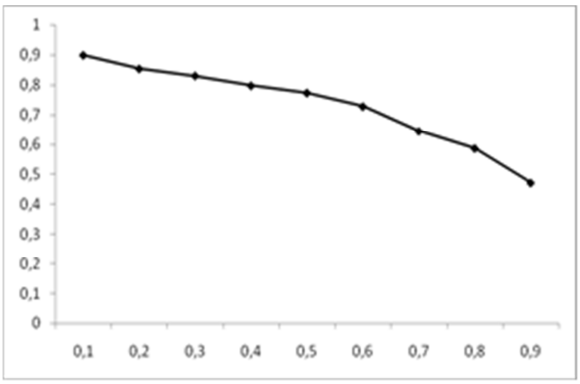


Fig. 3. The evolution of beta quantiles, monthly data

We show an asymmetrical evolution of beta across quantiles with a higher estimated impact of shocks if the stock exhibits extreme negative returns than if the stock exhibits average or extreme positive returns. Indeed, beta is 0.899 in the quantile 10% and it is 0.472 in the quantile 90%. This asymmetrical variation of beta cannot be explained by learning investor or herding behavior since they suggest a symmetrical evolution of beta. This finding is consistent with the fundamental proposition of prospect theory which models the differential behavior of investors when faced with losses or gains. According to prospect theory investors are risk-seeking over losses and risk-averse over gains, which leads them to gamble in falling markets and prefer “no gamble” in rising markets. This behavior explains the cross-sectional dispersion asymmetry in falling and rising markets. Indeed, in a loss-regime, investors are risk-seeking and thus increase the range of possible return realizations across firms. Similarly, in a gain-regime investors are risk-averse and thus decrease the range of possible return realizations across firms.

The difference between monthly and daily results can be explained by the change of investor behavior at different investment horizons. By differentiating between gains and losses, prospect theory provides a convening explanation to monthly results. Indeed, it is reasonable to assume that investors change their behavior following an estimation of gains and losses on a monthly basis and not on a daily basis. Therefore, it is not surprising that prospect theory can explain the results for monthly return frequencies, but not for daily.

4 CONCLUSION

One of the most striking patterns in the financial markets is the variation of beta. In this study, we examine on the French market, the ability of behavioral finance to explain the beta change. Empirically, Investor learning, herding and prospect theory are applied to explain the variation in beta across different return regimes and return frequencies. The main contribution of this paper is the application of quantile regression to the analysis of beta change. Quantile regression is a suitable tool to analyze variation of beta in the extreme tails of aggregate returns distribution.

For daily data, we find a strong impact of aggregate and systematic shocks depending on stocks' return regimes. The impact of systematic shocks in stock return tends to be larger extreme returns than in normal return regimes. This variation can be explained by the herding behavior suggesting that investor follows the market trend in the appearance of new information. This behavior leads to beta increasing in the extreme returns case.

In addition, the increase in beta is more robust in the good announcements than in the bad announcements. This result can be explained with investor learning. In case of larger return surprises, beta increases affecting extreme quantiles' returns. But, in case of smaller or normal return surprises, investors do not use this information for other firms and beta does not increase.

For monthly data, beta evolves asymmetrically across return regimes with a greater impact of the market in the lower tail of returns distribution than in the upper tail of returns distribution. This finding provides strong evidence in favor of prospect theory explanation. Indeed, in a loss-regime, investors are risk-seeking and thus increase the range of possible return realizations across firms. Similarly, in a gain-regime investors are risk-averse and thus decrease the range of possible return realizations across firms.

Overall, constant beta estimated by ordinary-least squares overestimates the systematic risk of stock in normal times and underestimate the risk in extreme conditions or financial crisis. This finding has fundamental implications for investors and portfolio managers.

ABBREVIATIONS

CAC40 Composition	Abbreviation
ACCOR	*ACCOR*
AIR LIQUIDE	*AIR LIQ*
ALCATEL	*ALC*
ALSTOM	*ALS*
ARCELORMITTALREG	*A M*
AXA	*AXA*
BNP PARIBASACT.APARIBAS ACT.A	*BNP*
BOUYGUES	*BOUYG*
CAP GEMINI	*CAP G*
CARREFOUR	*CAR*
CREDIT AGRICOLE	*CR AGR*
DANONE	*DAN*
EUROPEAN AERONAUTIC DEFENCE AND SPACE COMPANY	EADSP
ELECTRICITE DE FRANCE	*E D F*
ESSILOR INTERNATIONAL	*E I N*
France TELECOM	*F T*
GDFSUEZ	*GDF S*
OREAL	*OREAL*
LAFARGE	*LAF*
LVMH	*LVMH*
MICHELIN	*MICH*
NATIXIS	*NAT*
PERNOD RICARD	*PERN*
PEUGEOT	*PEUG*
PPR	*PPR*
PUBLICIS GROUPE	*PUB G*
RENAULT	*REN*
SAINT GOBAIN	*SA G*
SANOFI	*SAN*
SCHNEIDER ELECTRIC	*SCH EL*
GENERALE	*GEN*
STMICRO ELECTRONICS	*STM EL*
SUEZ ENVIRONNEMENT COMPANY	*S E*
TECHNIP	*TECH*
TOTAL	*TOTAL*
UNIBAIL RODAMCO	*UNIB R*
VALLOURE CUSINE SATUBESDELOR	*V C S*
VEOLIA ENVIRONEMENT	*V ENV*
VINCI	*VINCI*
VIVENDI	*VIV*

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Forms of Intimate Partner Violence among Women in the Informal Sector in Nakuru Municipality, Kenya

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ABSTRACT: Different forms of Intimate Partner violence are experienced in various cultures and affect people across societies irrespective of their economic status. Similar experiences have also been reported in Kenya as shown by the results of this study whose focus was to determine the forms of Intimate Partner violence among women in the informal sector in Nakuru Municipality, Kenya. The study employed *ex-post facto* research design to undertake inquiry into the occurrence of Intimate Partner Violence (IPV) while simple random sampling was used to select 176 participants who were victims of intimate partner violence and had registered the violence in the five rescue institutions. The researcher administered questionnaire and focus group discussions were used to collect data. The study found out that women experience different forms of IPV which included physical, economic, sexual and verbal. Each of these forms of IPV was further investigated using descriptive statistics and the findings revealed that about 62% of physical cases of violence were due to slapping while in economic violence monitoring expenditure was most common at 52.3%. Regarding sexual violence and verbal violence the study revealed that 61.4% of women experienced forced sexual violence and 58.5% experienced name calling respectively. The findings revealed the most common cases of IPV in each form of violence which should therefore constitute areas of intervention in undertaking measures to reduce its occurrence.

KEYWORDS: Intimate Partner Violence, Women, Informal Sector, Kenya

1 INTRODUCTION

Intimate Partner Violence (IPV) is a common practice which adversely affects relationships among intimate partners. It occurs when a partner or ex partner attempts to physically, economically, sexually, verbally or psychologically dominate another. It is the use of force or threat by a partner for the purpose of coercing and intimidating a woman into submission. The violence often refers to violence between spouses but can also include cohabitants and non married intimate partners. The same forms of IPV have been reported by by O'Connell (1994) to be commonly experienced among intimate partners. The author further reported that these forms of IPV can occur at various stages of intimate partner relationships ranging from dating and courtship to old stage of marriage. In Kenya for example studies conducted in 2008 revealed that 75% of women reported that they have been abused by their intimate partners MHR (2010). Abuse can manifest itself in any of the aforementioned forms of violence and can therefore affect intimate partner relationship. A survey carried out in the USA by Bachman, Ronet and Saltzman, (1995) revealed that women are about six times as likely as men to experience IPV. Other studies in Barbados revealed that 30% of women surveyed experienced IPV while in Canada it was 29%. In the other parts of the world such as Egypt, New Zealand, Swaziland and the USA, the respective experiences were 34%, 35%, 21% and 22%, other countries such as Nicaragua revealed the same trend (Tonia & Hamel 2007). Elsewhere in Tanzania, cases of IPV have been encountered as well. This was revealed following a study in which 21% of 1444 women reported cases of IPV over a period of 12 months while 26% reported that the violence can be sporadic in a relationship (McCloskey, Williams and Larsen, 2005). In this study, physical abuse and forced intercourse were reported to be the most commonly experienced forms of IPV.

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2 LITERATURE

Each of the forms of violence may be executed through a number of cases. For example physical violence manifests itself through hitting, slapping, punching, choking, pushing, burning and other types of contact that result in physical injury to the victim. This can cause serious injuries and long lasting health problems as reported by Ondicho (2000) and Wamalwa (1987). Similarly Bonomi, Thompso, Anderso, Reid, Carrell, Dimer, and Rivara (2006) reported pronounced negative health outcomes for abused women when compared to their non-abused counterparts. In the case of economic violence a victim is abused when one intimate partner has control over the other partner's access to economic resources. It may involve preventing a partner from resource acquisition, limiting the amount of resources used or by exploiting one's economic resources (Boyle, Robinson & Atkinson, 2004). Areas where economic violence is experienced include preventing the victim from obtaining education, finding employment, maintaining or advancing their careers, and acquiring assets. Others include, closely monitoring how the victim spends money, spending victim's money without permission and completely spending a partner's savings (Fagan& Jeffrey, 1995). Another form of violence that was investigated in this study is sexual violence which involves any situation in which force or threat is used to obtain participation in unwanted sexual activity. The same sentiments are expressed by (Follingstad & DeHart, 2000). Cases of sexual violence include forced sex, bullied to have sex, inappropriately touched, compelled to watch sexual act and refused to use birth control. Cases of sexual abuse as reported in Health People (2010) revealed that among 486 women seeking abortion, about 40% of them reported sexual abuse. This is an indication of the magnitude of the problem because under normal circumstances victims shy away from going public whenever it occurs especially among married couples. The report by (KNBS, 2010) in which 13% of married women were raped by the spouses but never reported confirms this. The fourth form of IPV that was investigated is verbal violence which includes name calling, scolding and insulting statements. This form of violence is more often than not casually used but has degrading effects. This is confirmed by Anderson (2001) where the author emphasized that the partner becomes a target of angry outbursts, sarcasm, or cool indifference. Such outbursts have long lasting effects on the victims.

2.1 FORMS OF IPV

According to Tjaden and Thoennes (2000), IPV cuts across all socio-economic and cultural boundaries and is seen in both developing and developed countries. IPV is the systematic, intentional use of physical, emotional and/or sexual abuse that one person in a relationship exerts over their partner in order to maintain power and control. Sattler (2000) argued that, abusive relationships cause devastating conditions most often labelled as "power and control". That is, the abuser takes all power in the relationship in order to control the partner. The power may include controlling the finances; keeping the car keys; determining what friendships a partner may have; and all of the other small, day-to-day experiences that are hardly noticed until their effects have reached a damaging extent. Bonomi, Thompso, Anderso, Reid, Carrell, Dimer, and Rivara (2006) reported pronounced negative health outcomes for abused women when compared to their non-abused counterparts. The negative outcomes included smoking, engaging in heavy drinking, and major and minor depressive symptoms. Coker, Davis, Arias, Desai, Sanderson, Brandt and Smith (2002) also reported poor perceived mental and physical health, substance abuse, symptoms of posttraumatic stress disorder (PTSD), depression, anxiety, lowered self esteem and suicide among abused women. With respect to physical health, IPV victims are more likely to report joint disease, current asthma, activity limitations, and HIV risk factors than non-IPV victims (Breiding, Black & Ryan, 2005).

The common forms of IPV as presented by O'Connell (1994) are physical, economic, religious, verbal, sexual and psychological violence. These forms of IPV occur at various stages of intimate partner relationships ranging from dating and courtship to old stage of marriage. Any of the forms of violence can influence intimate partner relationship and therefore performance at workplace. The distinct types of IPV namely physical, economic sexual and verbal It is important to note that all these forms of IPV are interrelated and most often occur concurrently. Research suggests that physical violence in intimate relationships is often accompanied by psychological abuse and, accompanied by sexual abuse in one-third to over one half of the cases (Leibrich, Paulin, & Ransom, 1995).

2.1.1 PHYSICAL VIOLENCE

Physical abuse includes hitting, slapping, punching, choking, pushing, burning and other types of contact that result in physical injury to the victim. Physical abuse can also include behaviours such as denying the victim of medical care when needed, depriving the victim of sleep or other functions necessary to live, or forcing the victim to engage in drug/alcohol use against his/her will. If a person is suffering from any physical harm then they are experiencing physical abuse. This pain can be experienced at any level. It can also include inflicting physical injury onto other targets, such as children or pets, in order to cause psychological harm to the victim (U.S. Department of Justice, 2007).

Physical violence involves doing what causes pain and physical body damage to another. It may include assault, physical aggression, torture, rape, wild husband battering and death. It is the most common form of violence in Kenya. Although disagreement and debate about the extent of IPV in Kenya is not clear or rages on, there is an underlying consensus that the incidence of men being beaten, has increased quite substantially in the last few decades (Ondicho, 1997; Wamalwa, 1987). Some cases have captured public attention due to various reasons namely; the sheer magnitude of the battering resulting into multiple injuries or murders; the high status of the victim or the perpetrator because the battering was horrific in other respects.

Battering has been determined as a significant risk factor for a variety of physical health problems treated in outpatient, primary care settings, as well as in emergency departments (Ondicho, 1997; Wamalwa, 1987). The authors further reported that injuries or the aftermath of injuries from abuse such as pain, broken bones, facial trauma, and tendon or ligament can be followed up and verified in outpatient settings. Because battered women do not frequently report untreated loss of consciousness as a result of abuse, the chronic headaches often described by battered women may be inadequately diagnosed. Subsequently, these may affect the women's productive work, hence the need for follow up in outpatient settings.

2.1.2 ECONOMIC VIOLENCE

Economic violence is a form of abuse when one intimate partner has control over the other partner's access to economic resources. Economic abuse may involve preventing a spouse from resource acquisition, limiting the amount of resources used by the victim, or by exploiting economic resources of the victim (Boyle, Robinson & Atkinson, 2004). The motive behind preventing a spouse from acquiring resources is to diminish victim's capacity to support herself, thus forcing her to depend on the perpetrator financially, which includes preventing the victim from obtaining education, finding employment, maintaining or advancing their careers, and acquiring assets. In addition, the abuser may also put the victim on an allowance, closely monitor how the victim spends money, spend victim's money without her consent and creating debt, or completely spend victim's savings to limit available resources (Fagan& Jeffrey, 1995). Economic violence involves denying a person's legitimate economic right and situation. In Kenya, husbands most often control the family finances and may dictate what their wives should buy or not buy (Ondicho, 1997; Wamalwa, 1987).

2.1.3 SEXUAL ABUSE

Sexual abuse is any situation in which force or threat is used to obtain participation in unwanted sexual activity. Coercing a person to engage in sexual activity against their will, even if that person is a spouse or intimate partner with whom consensual sex has occurred, is an act of aggression and violence. Sexual violence is defined by World Health Organization (WHO) as: any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed, against a person's sexuality using coercion, by any person regardless of their relationship to the victim, in any setting, including but not limited to home and work (Follingstad & DeHart, 2000).

Marital rape, also known as spousal rape, is non-consensual sex in which the perpetrator is the victim's spouse. As such, it is a form of partner rape, domestic violence and sexual abuse. In the US spousal rape is illegal in all 50 states. In Canada, spousal rape was outlawed in 1983, when several legal changes were made, including changing the rape statute to sexual assault, and making the laws gender neutral. Criminalization of spousal rape in Australia began with the state of New South Wales in 1981, followed by all other states from 1985 to 1992. New Zealand outlawed spousal rape in 1985 and Ireland in 1990. In England and Wales, spousal rape was made illegal in 1991, when the marital rape exemption was abolished by the Appellate Committee of the House of Lords, (O'Grady, 2007). In Kenya marital rape is socially and culturally tolerated and as such has not been covered in the Kenyan legislation explicitly. However, the Demographic and Health Survey carried out in Kenya in 2008-09 reported that about 13% of married women are raped by the spouses but they don't report (KNBS, 2010). This is because they are afraid to report the violence since they rely financially on their husbands for their upkeep and children's maintenance. Others feel unable to speak out due to fear and humiliation.

Categories of sexual violence include: use of physical force to compel a person to engage in a sexual act against his or her will, whether or not the act is completed; attempted or completed sex act involving a person who is unable to understand the nature or condition of the act, unable to decline participation, or unable to communicate unwillingness to engage in the sexual act, e.g., because of underage immaturity, illness, disability, or the influence of alcohol or other drugs, or because of intimidation or pressure. This involves having sex with unwilling person. It is often accompanied by physical and emotional abuse. Most often the victim is bullied into complying with abusers demand to engage in sexual act**.** Healthy People (2010) further reported that among 486 women seeking abortion, about 40% of them reported sexual abuse.

The true extent of sexual violence in accordance with the WHO definition is unknown, though varied studies highlight its incidences as reported in WHO (2005). The report provides the first comparative data across the world including three African countries, namely Namibia (the capital), Tanzania (a rural and urban setting) and Ethiopia (a rural setting). According to the report, between 16% and 59% of women from Africa had ever experienced sexual violence from intimate partners although they hardly report it as noted in the Kenyan case (KNBS, 2010). The report further shows that between 18% and 43% of younger women of less than 15years are more likely to report forced sex in their first encounter. Contrary to the married women, the younger unmarried ones report such cases because the society doesn't allow it and legally it is treated as rape case which is an offence.

Ondicho (2000) stated that there is no representative data on sexual violence that existed in Kenya until the publication of Kenya Demographic and Health Survey in 2003. In this study 29% women reported experiencing sexual violence in the year foregoing the survey, and the highest proportion was among women aged 20–29 years. In the recent years, rapid disintegration of traditional socio-cultural norms and values that used to regulate wife beating, such as, the transformation from extended to nuclear family, urbanization, and modernization along with the newly introduced wage economy, education, and migration have altered the circumstances under which the violence occurs. Adepojua and Oppong (1994) stated that the education of women, the increase in female labor force participation, the improved status of women and the diminishing role of the extended family in resolving marital disharmony render them vulnerable to violence.

In East Africa, cases of IPV are also common as reported in a case study carried out in Tanzania (McCloskey et al. 2005). In this study 1444 women with partners were interviewed. The results showed that 21% of the women reported having experienced IPV such as physical abuse and sexual violence. The study further revealed that 26% of the women reported that IPV occurs anytime. In Kenya, studies conducted in 2008 revealed that 75% of women reported that they have been abused by their partners MHR (2010).

3 METHOD

3.1 THE STUDY LOCATION

This study was conducted in Nakuru Municipality of Nakuru County Kenya. This is situated within the Great Rift Valley. The county is the home of Lake Nakuru known for its large number of flamingoes. Agriculture, manufacturing and tourism are the main economic activities. Due to the high agricultural potential in the environs of the town, agro based industries have flourished in the town providing opportunities for entrepreneurship. Dairy farming is another major economic activity which has also attracted increased attention. The municipality is also a center for various retail businesses that provide goods and services to the manufacturing and agricultural sectors. These production sectors show the high potential of informal and formal employment. As a result of these, production institutions of small and large scale in both formal and informal sector have emerged providing opportunities for women engagement. On the other hand, there has been an increase of IPV in the Municipality. This is evidenced by the centers where IPV management is done. Examples are Filadelfia Crisis Centre, Tumaini Jipya Centre, St. Gabriel Learning Centre, NALEP, Catholic Diocese of Nakuru and Lanet Deanery.

3.2 STUDY POPULATION AND SAMPLE SELECTION

The study population for this research was drawn from the institutions in Nakuru Municipality dealing with victims of IPV. These include: Filadelfia Crisis Centre, Tumaini Jipya Centre, St. Gabriel Learning Centre, NALEP, Catholic Diocese of Nakuru. Purposive sampling was used to select the rescue centers which deal with women who have undergone IPV. The participants of the study were women who had experienced IPV and were participating in productive work in the informal sector. A sample size of 176 was used. To get representative sample, the accessible population was stratified based on the rescue institutions and proportionate simple random sampling was used to determine the number of participants from each strata. Proportionate simple random sampling procedure was used to select the participants for focus group discussions. This was carried out in two groups of 10 participants each giving a total of 20 participants for the focus group discussion. The 20 participants were drawn proportionately from the five institutions using the percentage proportion.

3.3 STUDY INSTRUMENTS

The study used researcher-administered questionnaires and focus group discussions to determine the various forms of intimate partner violence as experienced by women in the informal sector within Nakuru municipality. The use of the researcher's administered questionnaire and focus group discussions helped in triangulation of the results. In addition to this, they facilitated information flow from the respondents given that they were likely to comprehend issues differently.

Furthermore the researcher administered questionnaires provided in-depth information important for the study. During focus group discussions some respondents felt encouraged to speak after hearing what their fellow women were going through. This made them open up and share their experiences freely within the forum.

DATA ANALYSIS

The study collected both qualitative and quantitative data, which was then coded organized and cleaned for any errors and keyed into the SPSS programme. Content analysis was used for qualitative data, which was then coded and organized into thematic areas. Quantitative data was analyzed using frequency distribution and presented using frequency table.

4 RESULTS

The four forms of physical violence which were found to be commonly experienced among women in Nakuru Municipality are Physical, sexual, economic and verbal. Investigation on physical violence revealed 10 common cases. The frequency of occurrence of these cases as was found out during the study is shown in Table 1.

Table 1: Physical Forms of Intimate Partner Violence

Type of physical violence the women were exposed to	Frequency	Percentage
Slapping	109	61.9
Pushing	73	41.5
Punching	70	39.8
Pulling	64	36.4
Kicking	60	34.1
Threatened with weapon	57	32.4
Denial of medical care	42	23.9
Scratching	29	16.5
Burning	23	13.1
Forced to engage in drugs	19	10.8

n=176

Majority of the respondents interviewed had experienced more than one type of physical violence from their intimate partners. A large majority of the women 61.9%, had experienced slapping from their intimate partners, while 39.8% had experienced physical violence in the form of punching and 41.5% had been pushed by their partners. Severe cases such as threats using a weapon were experienced by 32.4% of women. Furthermore, 23.9% of the women confessed of being denied medical care by their own partners.

Regarding economic violence, women were requested to provide responses of their experiences in various cases. The results are given in Table 2.

Table 2: Types of Economic Violence Reported by the Women

Types of economic violence	Frequency	Percentage
Prevented from gaining education	39	22.2
Prevented from finding employment	60	34.1
Prevented from advancing or maintain career	59	33.5
Prevented from acquiring assets	74	42
Partner monitors how you spend money	92	52.3
Partner spent your money without consent	88	50
Partner spent your savings	88	50

n=176

The Table shows seven cases of economic violence experienced in Nakuru Municipality. Among the respondents, 52.3% indicated that their own partners strictly monitored how they spent money, meaning that the women had to account for every cent they had spent on household and other expenditures. In many cases, because of this strict monitoring, the women lacked the initiative to make financial decisions. 22.2% of the women were prevented by partners from pursuing education; leading to lack of skills required for employment ability and reduced knowledge on productive and economic matters.

Sexual violence was also investigated and it was reported that it occurs among the intimate partners by both the married and the single. The women were asked to provide information on the cases of sexual violence that they had experienced and the results are given in Table 3.

Table 3: Types of Sexual Violence in intimate relationship Reported by the Women

Type of sexual violence	Frequency	Percentage
Forced to have sex	108	61.4
Inappropriately touched	74	42.0
Compelled to watch sexual acts	44	25.0
Refused to use birth control	64	36.4

n=176

The results in the Table show that 61.4% of respondents were forced to have sex at one point or another by their intimate partners. This percentage was closely followed by 42% of the women who were inappropriately touched, while 25% of the women indicated that their own partners had forced them to watch sexual acts of one nature or another.

Regarding verbal violence, three different types were reported as shown in Table 4.

Table 4: Types of Verbal Violence Experienced Among Intimate Partners

Type of verbal violence	Frequency	Percentage
Name calling	103	58.5
Scolded	96	54.5
Insulting statements	97	55.1

The Table shows that majority of the women 58.5% had experienced degrading name calling, while 54.5% of the women had been scolded by their partners which was the least. However the variation was small as shown.

5 DISCUSSION

The results of this study focused on cases experienced in the four forms of IPV, namely physical, economic, sexual and verbal violence. Among the ten cases of physical violence that were found to be commonly experienced among women in Nakuru Municipality, slapping was generally found to be the most common one. Similar findings have also been reported by Johnson *et al.,* (2003) who indicated that slapping as a type of violence was reported by a majority of women in a study carried out in North England. Slapping could have been common because it is more of a reflex action. Forced engagement in drugs emerged as the least form of physical violence 10.8%. This can be explained by the fact that it is an emerging form of violence and that drug abuse is outlawed and culturally not tolerated. Furthermore the aftermath can also be proved hence the perpetrators exercise it with restraint.

Economic violence as argued by Boyle *et al* (2004) takes different forms namely, preventing a spouse from resource acquisition, limiting the amount of resources used by the partner, or by exploiting economic resources of the partner. Among the different forms of economic violence that were identified in this study, monitoring expenditure by abusive partner emerged was the highest at 52.3% in comparison to the seven other types. The purpose of monitoring the victim's expenditure is to limit the amount of resources used by the victim as argued by Boyle *et al*. (2004). The least form of economic violence experienced by women was preventing victim from acquiring education which was 22.2%. The results show that comparatively fewer men prevent their partners from acquiring education. This can be explained by the fact that education improves literacy level and therefore is more acceptable. Furthermore the results revealed that prevention of career development and finding employment were experienced by a number of women at 34.1% and 35.5% respectively.

These types of economic violence may have been used by the abuser as a way of controlling their partners. This may be because career development enhances the ability of the partner to find employment which empowers them in terms of resource acquisition thus giving them the potential to exercise independence in a relationship. This challenges the male dominance in a relationship as it will most likely diminish his powers to control the partner (Chung *et al.,* 2008).

With regard to sexual violence, the results revealed that majority of respondents, 61.4% were forced to have sex at one point or another by their intimate partners. This percentage was closely followed by 42% of the women who were inappropriately touched, while 25% of the women indicated that their own partners had forced them to watch sexual acts of one nature or another. These results are contrary to the findings by the Kenya demographic and health survey carried out in 2008-2009 (KNBS) which revealed that about 13% are raped by their intimate partners. The high percentage, almost five times higher, revealed in this study may be due to the fact that this study was based on the actual interviews of the affected partners. Also the conducive environment created by the researcher may have enabled the participants to speak freely knowing that the information they were was to be treated with confidentiality.

The other three forms of sexual violence namely, inappropriately touched, compelled to watch sexual acts and refused to use birth control have relatively low percentages of 42%. Compelled to watch sexual acts is the lowest at 25% and is likely to be so due to the common position usually taken by the partners to discourage the same in the family. Regarding birth control, most female partners practice it as a family planning method and therefore there is minimal force applied by the partner regarding its use.

Although sexual violence within intimate relationships is an issue among intimate partners and has been recognized and outlawed in developed countries (O'Grady, 2007), in developing countries including Kenya, the situation is different. Instead, it is governed by customary laws which don't recognize it as an issue among intimate partners and as a result most cases are not reported (KNBS, 2010). The magnitude of this type of sexual violence is therefore not known to the public as it is couple affair. Therefore the revelation of this study gives an indication of the extent to which it occurs hence the need for a framework to manage it. Verbal abuse was the other form of intimate partner violence that was investigated by the study. The results of the study revealed three different types of verbal violence, namely name calling, scolding and insulting statements. Majority of the respondents about 58.5% had experienced name calling, while 54.5% of the respondents had been scolded by their partners. According to Anderson (2001), the victim of verbal abuse is often the target of angry outbursts, sarcasm, or cool indifference which may cause health problems.

6 CONCLUSION

Based on the findings from the study findings IPV occurred in the informal sector through different manifestations. The women in the informal sector in Nakuru municipality mainly experience physical, economic, sexual and verbal violence in their intimate relationships. These forms of violence manifest themselves in several cases. Among the physical cases of violence slapping was the most common in informal sector in Nakuru Municipality compared with forced to engage in drugs which were the least common. In the case of economic violence monitoring how the partner spends the money was the most common while prevention from gaining education was the least common. Regarding sexual violence, forced sex was the most common compared partners compelled to watch sexual which was least common. Concerning verbal violence, name calling was the most common form of IPV compared to scolding which was least common.

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