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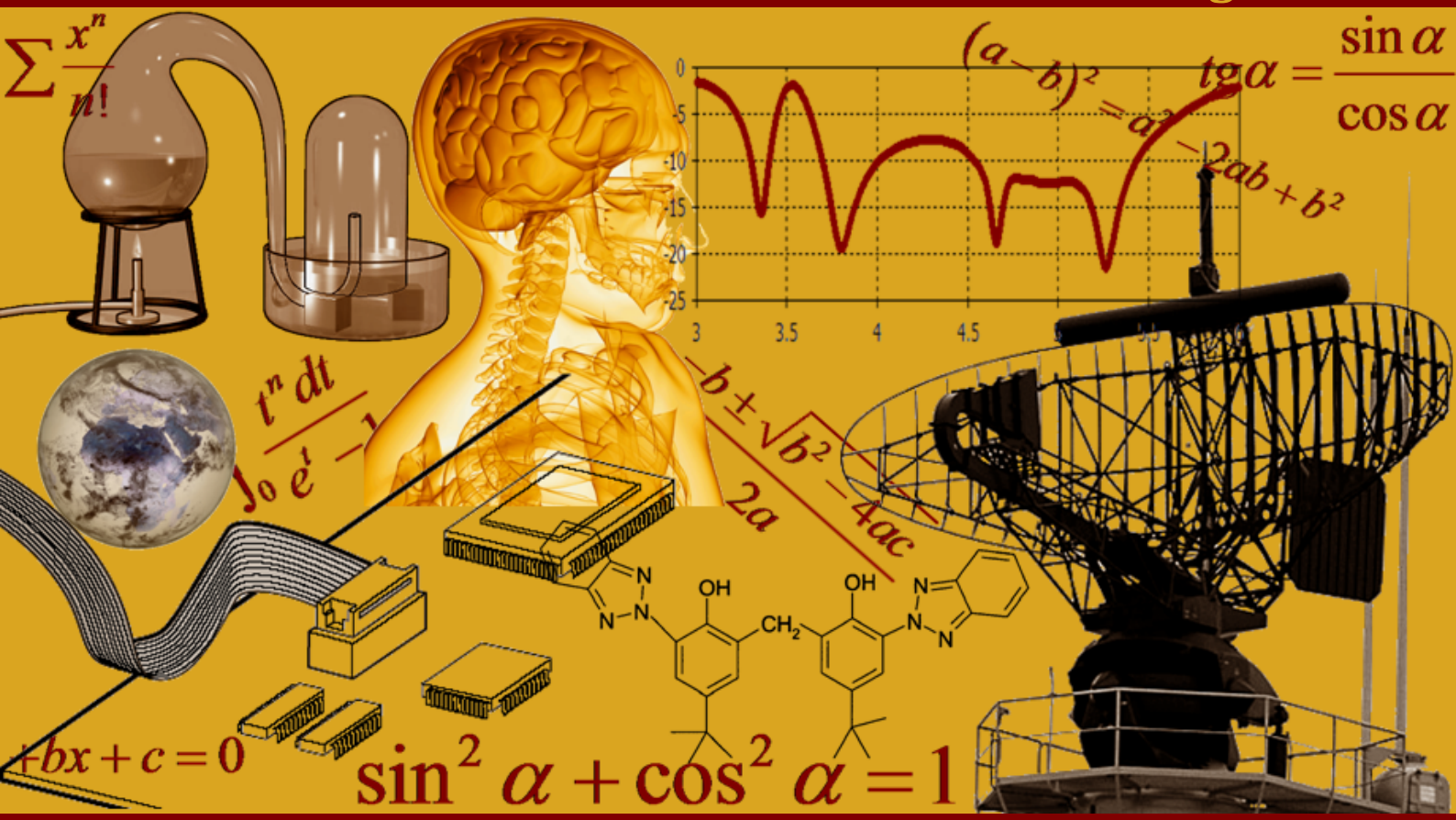

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THE EFFECT OF TISSUE HETEROGENEITY ON DOSE DISTRIBUTION INSIDE RANDO® WOMAN HETEROGENEOUS PHANTOM

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ABSTRACT: Human body organs and tissue have different values of density. The nature of interaction between radiation and organs is not the same due to differences in density of medium, and energy and type of radiation. Low density medium has high range of energetic radiation inside the medium with low values of mass attenuation coefficient. Treatment plan considers the densities of human tissues and organs like water density, so readings of predicted doses inside body have no accurate outputs. The use of real dosimetry inside human heterogeneous phantom gives answers of these differences. TLD-100H has high sensitivity for radiation doses than other TLD types and can be reused but it cannot keep signals after annealing procedures to get one signal by the use of Harshaw® TLD reader.

KEYWORDS: dosimetry, heterogeneity, MammoSite, radiation, treatment planning.

INTRODUCTION

Dosimetry is the practical part of measuring or calculating absorbed doses in a medium. In MammoSite balloon brachytherapy (MBS) which is used in breast cancer radiotherapy; it is used to determine dose distribution by the use of radioactive sources (Ir^{192}) inside surrounding tissues to plan for acceptable dose distributions, calculate patient doses, and to provide a prescription dose system [1]. Dosimetry in brachytherapy is becoming increasingly more important due to recent improvement in brachytherapy techniques enabling more accurate dose defining by the use of remote afterloading, CT scan data, MRI for volume definition, the use of low energy gamma radiation sources, and the possibility of real time biological and dosimetric optimization which has led to improve the accuracy of dose distributions and dose calculations in tissue equivalent materials to modify the algorithms [2]. Nucletron Oncentra is one of the treatment planning systems used for brachytherapy uses water based dosimetry which assumes a homogeneous medium by which a full scatter of radiation exists, this assumption may causes an errors due to the heterogeneous nature of human body which has distribution of different tissue densities [3].

The human body has heterogeneous compositions. The average densities of human organs and tissues have different values of 0.26, 0.89, 1.02, and 1.12 $g.cm^{-3}$ for lung, fat, soft tissue, and bone respectively [4].

THE INTERACTION OF RADIATION WITH TISSUES AND ORGANS

To understand photon interaction with different organs and tissues; some different items should be presented for organs and tissues, such as the effective atomic number (Z_{eff}), an energy dependent parameter due to its varying value with photon energy, and mass attenuation coefficient (μ/ρ) that identifies the number of scattered photons by coherent and incoherent interactions, or absorbed photons by photoelectric effect, pair or triple production, and photonuclear interactions by the target tissue, and effective electron density [5]. Photon with high energy transfers part of its energy to material. The

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secondary electron range results from the interaction, depends on incident photon energy and density of material. If electron range for certain energy has a value of x (cm) in water then its values will be $(\frac{x}{\rho})$, where ρ is the density of tissue or organ, for that the range for electron in lung, fat, soft tissue, and bone will be 3.8461x, 1.1236 x, 0.98 x, and 0.892 x respectively. It is clear then that photons and electrons have more range in lung tissues than in muscles or water then photons and electrons have more range in lung tissues than in muscles or water which means that electron radiation energy is absorbed in the more dense tissues close to the radioactive source [7]. Mass attenuation coefficient (μ/ρ) for lung tissue at average Ir^{192} radiation energy (0.38MeV) has a value of 0.10778 $cm^2.g^{-1}$, but it has a value of 0.1086 $cm^2.g^{-1}$ for water, mass energy-absorption coefficient, μ_{en}/ρ for lung tissues is 0.03235 $cm^2.g^{-1}$, and for water is 0.032616 $cm^2.g^{-1}$ [6].

The probability of photoelectric interactions depends on the atomic number (proportional to Z^3), which increases with increasing atomic number. Low photon energies and high atomic number of materials increase the probability of photoelectric interactions. On ther hand, materials with a significant proportion of hydrogen which have more electrons per gram enhance the probability of Compton interactions. In photoelectric interaction, tissues capture all photon energy, whereas in Compton interaction only a portion of its energy is absorbed [7]. Ir^{192} emits gamma radiation with energies extended from 0.1 to 1.1 MeV, so lower energy photons interact via photoelectric effect with atomic electrons then disappears, but for intermediate energy photons; Compton effect is the way for photon to lose some of its energy to atomic electron in the medium and continue in a new direction, then total attenuation coefficients consist of the previously mentioned interactions [7]:

$$\mu_{(total)} = \mu_{(photoelectric)} + \mu_{(Compton)} \quad (1)$$

MAMMOSITE BALLOON BRACHYTHERAPY

A new technique for partial radiotherapy is the MammoSite balloon HDR Ir^{192} brachytherapy, by which the balloon must be in contact with lumpectomy cavity surfaces with minimum 7 mm balloon surface to skin distance [8]. It is a fast and effective treatment method in early stages of breast cancer by the use of HDR Ir^{192} or electronic brachytherapy [9], and a modality for delivering radiation to the tumor in achieving local control due to the minimal toxicities and cosmetic outcomes [10]. The dose reduction for the smallest balloon is 9% compared to 12% for the largest balloon [3]. MammoSite RTS is simple for both physician and patient, by which the balloon surface conforms to the target. Tumor size, breast characteristics, and location and geometry of the lumpectomy cavity must be taken into consideration before treatment procedure [11].

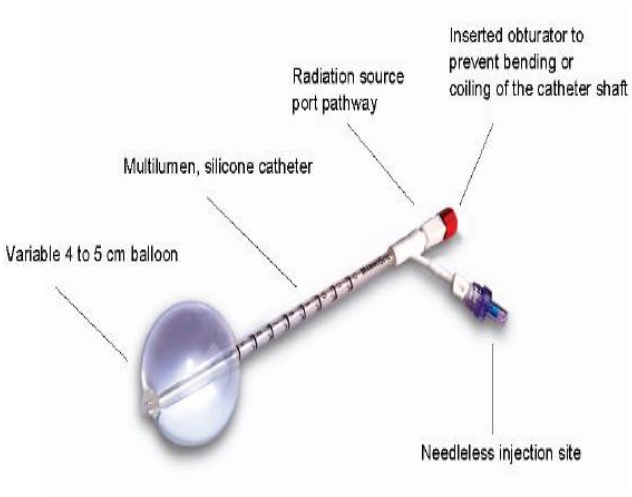

Fig.1: MammoSite balloon catheter [13]

This method is used after surgery by the use of intermediate radioactive source to kill any residual cancer cell surrounding the lumpectomy cavity; a balloon catheter is inserted inside the breast into the lumpectomy cavity and inflated with saline to stay there during the treatment period of not more than 5 days. A radioactive source with high dose rate (HDR) by afterloader machine (HDR unit) enters its centre to deliver a precise amount of dose to surrounding tissues around the balloon [13]. Five-year outcomes of MammoSite balloon brachytherapy concluded breast cosmetic outcome, low late toxicity, and excellent control of residual cancer cells [14]. MammoSite balloon catheter device insertion into lumpectomy cavity is easier than interstitial catheters and has only one entry side. However the risk of local infection may be increased due to the balloon

placement [15]. Factors like the balloon volume after inflation, the symmetry of balloon, the conformance of cavity to the applicator, and the balloon-skin distance must be considered within MammoSite brachytherapy [11].

DOSIMETRY

TLD-100H was chosen in the current study because of its high sensitivity and linearity to doses, low rate of fading, with good stability through a number of readout cycles, and tissue equivalent effective atomic number (Z) to represent the contribution of photons energy. Its sensitivity is 30-40 times higher than other TLDs. The readout protocol has a maximum temperature of 300°C, but some additional traps do not appear at this temperature. During radiation; the radiation induced population of the electron traps above Fermi level. To reuse the TLD, it is annealed in a furnace to allow the mobilization of holes and electrons in traps to the equilibrium positions. During readout, thermal energy is used to empty the trap to release photons of visible light in the process. The readout process is done using Harshaw 3500® [16].

TREATMENT PLANNING

The planning target volume (PTV) for MBS is defined as the volume of tumor bed expanded 1 cm from the balloon cavity placed between the chest wall and pectoral muscle allowing at least 5 mm margin from the skin without the present of seroma or air gap. The region of interest (ROI) is the region within the pectoral muscle, closest ribs, PTV, balloon volume for MammoSite, trapped seroma or air, and the skin surface [17]. Treatment planning system must take into account the effect of tissue heterogeneity and do the needed correction for this factor to make the accuracy to the planned dose distribution by a factor called dose modification factor (DMF), which is the dose rate ratio in homogenous medium at 10 mm depth behind the applicator surface to that of heterogeneous medium at the same distance. Little differences between the reality and planning system causes some differences while the delivery of doses during the treatment, but it may be affect the recurrence of cancer cells if the breast receives an insufficient dose. The distribution asymmetry can be achieved and the dose to skin can be reduced by eliminating or decreasing the dwell time when planning with partial breast irradiation (PBI) if the lumen is very close to surface of the skin, and the absence or lack of backscatter radiation can reduce skin dose. In the plan delivery, a single source traverses each lumen that stops for a planned period of time at each dwell position. If the tissue inhomogeneity correction is lacking in the treatment planning system, the dose in PTV of phantom geometry will be under dose by 7 to 12% and will raise the recurrence in some patients [18]. CT and CT based planning is needed for all patients to achieve the coverage of PTV and fixing the target volume [19]. The accurate planning of the target and more information about organs and organs at risk of the patient raise the possibility of conformal radiation by which the prescribed dose reaches the target with low radiation risk to surroundings and lower necrosis or fibrosis due to high dose [20].

MATERIALS AND METHODS

RANDO® woman heterogeneous phantom is divided into number of slices with 2.5 cm thickness. Each slice contains a number of pinholes for placement thermoluminescent dosimeters.

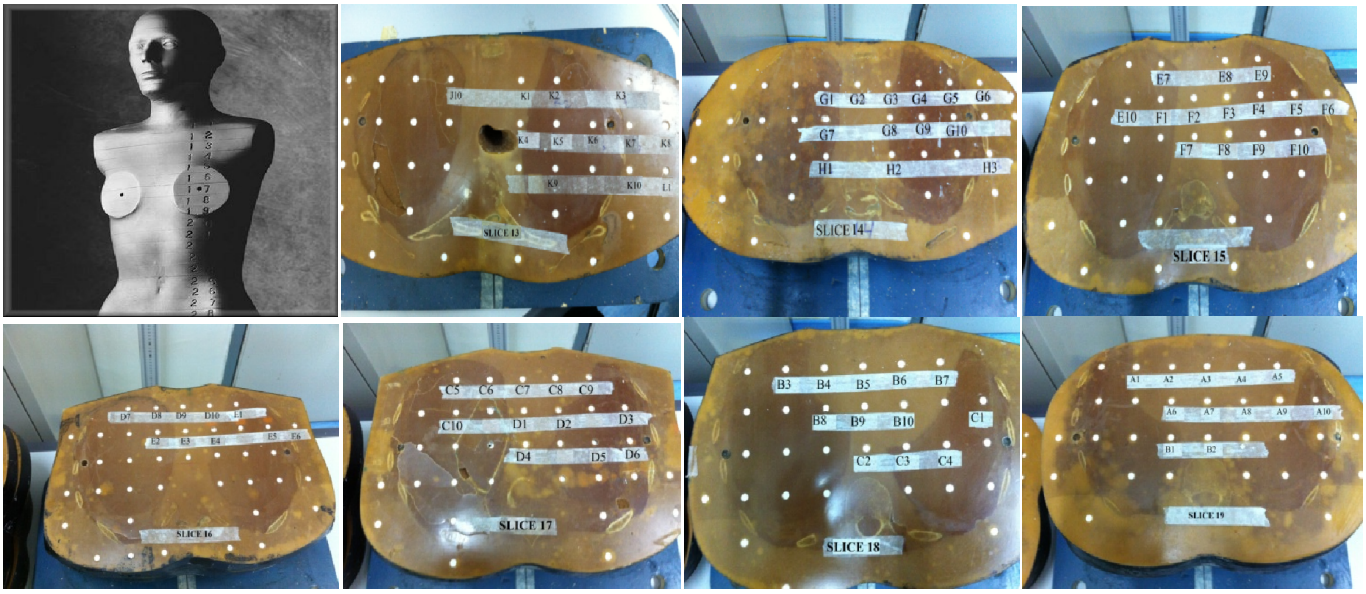

Fig.2: RANDO® phantom and TLD locations inside its pinholes

The vertical distance between centers of two adjacent pinholes is the same as the horizontal distance of 3 cm. Chest region (slices 10 to 23) has ribs, lungs, spine, sternum, and breasts.

The chosen brachytherapy technique is MammoSite balloon brachytherapy system (MBS). A homemade breast was made by mixing equal quantities of paraffin wax and beeswax [21] to get a mixture with density of 0.93 g.cm^{-3}. Balloon was inserted inside the phantom lumpectomy cavity and filled with saline to reach a diameter of 5 cm. Pinholes of slices from 13 to 19 were named as A1,…,L1 were placed inside lungs and trunk (soft tissues). CT scan of whole phantom was taken by the use of Philips Brilliance Big Bore CT scan as in figure 3.

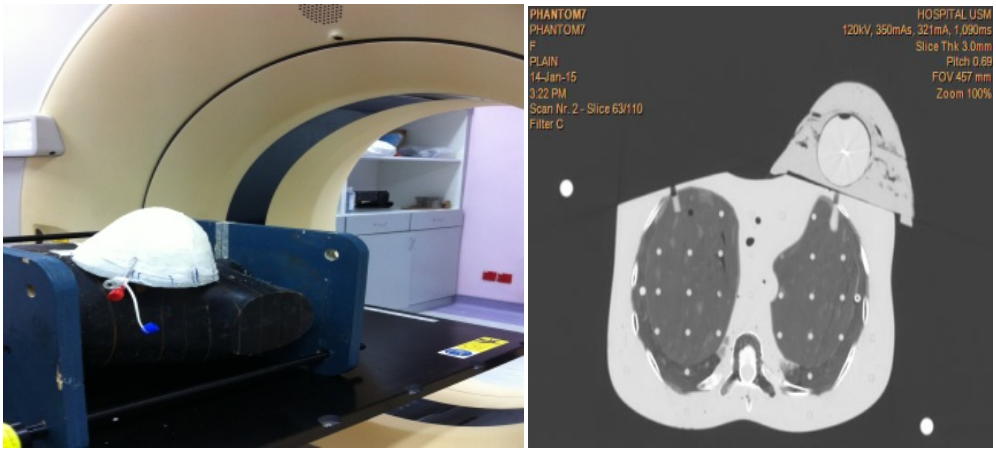

Fig. 3: CT scan for RANDO® phantom with MammoSite balloon inside left breast

Data from CT scan were transferred to treatment planning area to develop a suitable treatment plan by the use of Nucletron Oncentra Master Plan system (TPS). The first step was to define organs of interest (external, lungs, sternum, chest wall, and left breast), applicator, and PTV, then reconstruction of catheter and dwell positions to achieve recommendations of TG-43, and RTOG-0413 protocols. The activation of radioactive source (192-Ir-mHDR-v2) was to deliver 340 cGy for each fraction. MBS has 11 dwell positions with 11 dwell times through a single lumen. The treatment planning program considers a homogeneous phantom with water density (1 g.cm^{-3}).

Doses at TLD locations were measured as live dose option after approving the treatment plan and tabulated in table 2.

TLDs 100H were fixed at its own positions inside phantom slice pinholes. Radiation delivery was carried out using microSelectron v3 treatment unit (mSel v3 (18)) via MammoSite balloon catheter for 3 fractions.

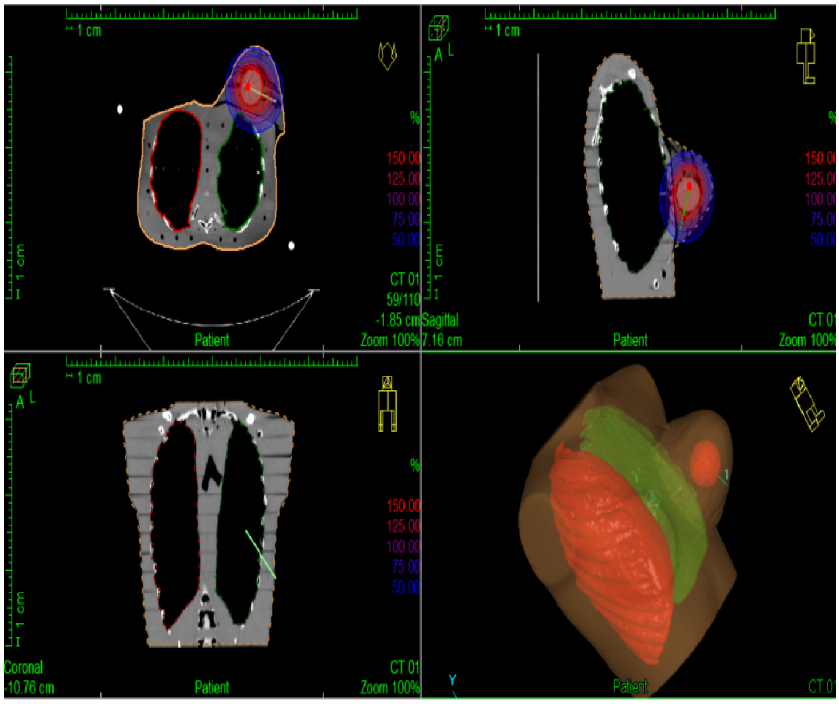

Fig. 4 : Target definition and source activation for MBS treatment plan

TL signals ($\mathrm{TL}(\mu\mathrm{C})$) were measured by Harshaw® 3500 and doses were calculated using determined factors such as TLD sensitivity, calibration factor ($\mathrm{CF}(\frac{\mathrm{cGy}}{\mu\mathrm{C}})$), and element correction coefficient (ECC) for each TLD. The TL dose reading ($\mathrm{D_{TL}}(\mathrm{cGy})$) was calculated by the use following equation:

$$\mathrm{D_{TL}}(\mathrm{cGy}) = \mathrm{TL}(\mu\mathrm{C}) \times \mathrm{CF}(\frac{\mathrm{cGy}}{\mu\mathrm{C}}) \times \mathrm{ECC} \quad (2)$$

Doses measured by TLDs were also tabulated in table 2.

RESULTS

Approving treatment plan was done based on recommendations of TG-43, and RTOG-0413 protocols. The recommendations are tabulated in table 1 with MBS output.

Table 1: Treatment plan for MBS and TG-43, and RTOG-0413 protocol recommendations.

Item	Recommendations	MBS
V90	≥ 90% PTV	108%
V150 for normal breast tissue	< 50 cm^3	19.42
V200 for normal breast tissue	< 10 cm^3	5.53
Maximum breast skin dose (%PD)	< 145%	100%
DHI	≥ 0.75	0.736
Dose (per each fraction)	340 cGy	340 cGy
DNR	≤ 0.35	0.264
CI	≥ 0.90	0.941
balloon volume (MSB)	≤ 30%	14%
balloon symmetry	≤ 2 mm	2 mm
balloon-surface distance	≥ 7 mm	16 mm
60% of whole breast volume receives	≥ 50% PD	68.9
V50	< 60% $V_{\text{total organ}}$	* 17% left lung *0% right lung

Treatment plan (TP) for MBS was used to determine doses inside phantom pinholes where the location of TLDs.

Table2: Doses (cGy) to TLD locations inside phantom by treatment plan.

TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)
A1	8	B7	105	D7	11	F9	29	I1	25	J9	7
A2	16	B8	15	D9	42	F10	30	I2	55	J10	8
A3	29	B9	25	D10	80	G1	11	I3	31	K1	2
A4	45	C2	15	E4	46	G2	19	I4	15	K2	5
A5	65	C3	23	E6	64	G3	29	I5	16	K3	11
A6	12	C4	28	E7	20	G4	38	I9	14	K4	13
A7	20	C5	12	E8	65	G5	42	I10	17	K5	16
A8	30	C6	21	F1	14	G6	38	J1	18	K6	17
A9	31	C9	15	F2	25	G7	7	J2	16	K7	16
B1	8	C10	8	F3	39	G8	17	J4	33	K8	13
B2	12	D2	48	D9	42	G10	24	J5	8	K9	9
B3	11	D3	70	F6	51	H1	4	J6	12	L1	7
B5	38	D4	17	F7	15	H2	9	J7	15		
B6	64	D5	30	F8	22	H3	11	J8	15		

After using the afterloader to deliver prescribed dose via MammoSite balloon catheter, each TL signal related to a certain amount of dose. Readings were done for three fractions and the average had been taken and tabulated in table 3.

The following TLD locations are inside lung tissues in the phantom: B3, C5, C10, D3, D5, D7, F10, G4, G5, G9, H2, K2, K5, K6, and K9, while others were inside normal tissues at trunk or under rib bones.

Table3: Doses (cGy) measured by exposed TLDs inside phantom.

TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)	TLD	D(cGy)
A1	13.64	B7	186.75	D7	16.55	F8	40.96	H1	11.36	J5	36.58
A2	26.44	B9	25.33	D8	34.28	F9	48.47	H2	26.17	J6	28.19
A3	36.49	C2	28.76	D9	74.83	F10	45.83	H3	19.34	J7	32.93
A4	75.83	C3	43.03	D10	165.85	G1	21.87	I1	39.30	J8	39.81
A5	90.02	C4	65.95	E4	117.45	G2	31.74	I2	78.94	J9	17.57
A6	17.90	C5	20.82	E6	67.51	G3	55.19	I3	48.82	J10	17.55
A7	38.77	C6	45.04	E8	119.54	G4	69.44	I4	19.95	K1	13.67
A8	52.22	C9	132.33	F1	27.53	G5	74.96	I5	28.04	K2	18.35
B1	9.43	C10	9.38	F2	50.01	G6	40.28	I9	16.31	K3	30.02
B2	20.79	D2	89.89	F3	47.34	G7	14.42	I10	30.55	K4	27.72
B3	18.15	D3	101.66	F5	81.23	G8	29.44	J1	17.69	K5	19.74
B5	67.22	D4	24.76	F6	72.92	G9	51.37	J2	18.97	K6	22.63
B6	128.91	D5	35.24	F7	22.43	G10	29.98	J4	47.06	K7	23.01
L1	9.32	K8	16.03	K9	18.26						

CONCLUSION

Dose values with comparison between treatment plan (TP) and dosimetry by TLD-100H have different values at same pinhole locations inside phantom tissues and organs, and as expected that TP readings have higher values inside lung due to higher attenuation coefficient for water than lung tissues, so the passing electron has more range in lung tissues than water. Soft tissue which has value of μ/ρ near to that of water has readings similar to that of TP.

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Gaps Influencing Implementation of the Witness Protection System in Kenya

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ABSTRACT: The objective of the paper was to establish the gaps influencing implementation of the Kenyan Witness Protection system. The study sought to achieve the following specific objectives: To establish the staffing capacity in the within protection program in Kenya; to examine the level of financial investment by the National government to the witness protection program; and to investigate the level of technological investment in witness protection program in Kenya. Data was collected from select key informants drawn from the Attorney General office, the Law Society of Kenya, The Director of Public Prosecution (DPP), the Kenya Police, The Ministry of Gender (Children's Department), Directorate of Witness Protection Agency, the Children's Court, and the representatives from the National Assembly. The findings of the study were expected to manifest how implementation of the witness protection programme in Kenya is influenced by both human and infrastructural capacity aspects. The findings of the study showed that there is lack of training resources such as facilities, training institutions and trainers. There are also limited financial resources to support the program attributed to poor funding and high cost of the program. The study found that there are poor infrastructural facilities to reach the witnesses.

KEYWORDS: Witness protection, Infrastructure.

INTRODUCTION

The paper focused on the gaps that surround the implementation and enforcement of witness protection measures in Kenya. The protection of witnesses and decline of their testimony because of their fear to be threatened is a new challenge to Kenya especially after the post election violence of 2007/2008. The ability of a witness to give testimony in a judicial setting or to cooperate with law enforcement investigations without fear of intimidation or reprisal is essential to maintaining the rule of law. Increasingly, countries are enacting legislation or adopting policies to protect witnesses whose cooperation with law enforcement authorities or testimony in a court of law would endanger their lives or those of their families.

Witness protection may be as simple as providing a police escort to the courtroom, offering temporary residence in a safe house or using modern communications technology (such as videoconferencing) for testimony. There are other cases, though, where cooperation by a witness is critical to successful prosecution but the reach and strength of the threatening criminal group is so powerful that extraordinary measures are required to ensure the witness's safety. In such cases, resettlement of the witness under a new identity in a new, undisclosed place of residence in the same country or even abroad may be the only viable alternative (United Nations Office on Drugs and Crime, 2008).

Initially, the primary objective of witness protection was to protect the physical security of witnesses for the purpose of securing their testimony in a criminal justice process. However, as protective practice has developed, improving witness-related conduct throughout the justice system has become important because of the need to achieve witness cooperation at each phase of the justice process. Psychological, health and socioeconomic considerations have taken on a more prominent role in the engagement and protection of witnesses prior to, during and after testimony (Lyon, 2007).

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PROBLEM ANALYSIS AND OBJECTIVES

People who witness crime, corruption and human rights abuses play a crucial role in law enforcement efforts to bring the perpetrators to justice. Often, however, challenges such as capacity gaps affects effective use of witnesses. The broad objective of the study was to investigate the capacity gaps in the implementation of witness protection program in Kenya and the underlying causes. The study sought to establish the staffing and infrastructural capacity in the witness protection program in Kenya; to examine the level of financial investment by the National government to the witness protection program and to investigate the level of technological capacity in witness protection program in Kenya.

OVERVIEW OF THE CONCEPT OF WITNESSING IN CRIMINAL JUSTICE SYSTEMS

The definition of "witness" may differ according to the legal system under review. For protection purposes, it is the function of the witness – as a person in possession of information important to the judicial or criminal proceedings – that is relevant rather than his or her status or the form of testimony. With regard to the procedural moment at which a person is considered to be a witness, the judge or prosecutor does not need to formally declare such status in order for protection measures to apply. Witnesses can be classified into three main categories: justice collaborators; victim-witnesses; and other types of witness (innocent bystanders, expert witnesses and others) (UNODC, 2008).

A justice collaborator is a person who has taken part in an offence connected with a criminal organization possesses important knowledge about the organization's structure, method of operation, activities and links with other local or foreign groups. An increasing number of countries have introduced legislation or policies to facilitate cooperation by such people in the investigation of cases involving organized crime. These individuals are known by a variety of names, including cooperating witnesses, crown witnesses, witness collaborators, justice collaborators, state witnesses, "supergrasses" and *pentiti* (Italian for "those who have repented"). There is no moral element involved in their motivation to cooperate. Many of them cooperate with the expectation of receiving immunity or at least a reduced prison sentence and physical protection for themselves and their families. They are among the main participants in witness protection programmes. The combination of lenience in (or even immunity from) prosecution with witness protection is considered a powerful tool in the successful prosecution of organized crime cases (United States Department of Justice, 2006). However, the practice can raise ethical issues as it may be perceived as rewarding criminals with impunity for their crimes. To address those concerns, a growing number of legal systems provide that the "benefit" to collaborators is not complete immunity for their involvement in criminal activities but rather a sentence reduction that may be granted only at the end of their full cooperation in the trial process (Fyfe and Sheptycki, 2006).

METHODOLOGY

The study was carried out at the judicial and legal institutions within Nairobi region. The study was focusing on the following institutions or departments: the Attorney General office, the Law Society of Kenya, The Directorate of Public Prosecution, the Kenya Police, The Ministry of Gender (Children's Department), Directorate of Witness Protection Agency, the Children's Court, and the representatives from the National Assembly. Secondary data was collected from case related legislative provisions and reports from national and international agencies advocating for human rights. The study considered this scope to be sufficient because most of these institutions have their headquarters within the Nairobi region, the offices in the region handle are highly influential on matters of policy formulations and implementation, and they handle the highest number of cases relating to participation of children in criminal proceedings. The Nairobi region includes the city of Nairobi (Nairobi central), Athi-River municipality, Ngong municipality, Thika municipality, Kikuyu municipality, Limuru municipality, Kiambu municipality and Ruiru municipality. This was arrived at based on the assumption that the research findings in Nairobi and surroundings easily be related to those of other areas of Kenya. Figure 3.1 below shows the map of the study area.

The study adopted a case study design. A case study approach was necessary considering the nature of the target respondents. The research utilized a case study design and qualitative mode of inquiry. In qualitative research different types of interpretative techniques are involved, which attempt to describe and facilitate an understanding of an event in the social world. Qualitative research encompasses several types of inquiry that explain the meaning of social phenomena without disrupting the natural environment. "Case study" is a term that may be used interchangeably with qualitative research; however, there are distinct features for case studies. In a case study the investigator has less control over events. This approach is usually recommended especially when questions of "how" or "why" come up. The purpose of the research was to provide strategic implementation profiles that use descriptive, historical and interpretive methods to document the

organization's experiences. The focus of the research was on the processes and challenges occurring in the implementation of the witness protection programme: its early development, its growth and changes, and the current status of the organization. In case studies the focus of the study is not necessarily to test a hypothesis, but to gather information in order to present a description of what was going on in a study environment (Ceci, et al., 1995). The required data was obtained through self-report methods, namely, in-depth interviewing and document analysis.

The study focused on 40 key informants drawn from the following: the Attorney General office, the Law Society of Kenya, The Directorate of Public Prosecution, the Kenya Police, The Ministry of Gender (Children's Department), Directorate of Witness Protection Agency, the Children's Court, and the representatives from the National Assembly. Five informants were obtained from each of the above areas.

According to Schutt (1996:593), unit of analysis is "the level of social life on which the research question is focused". The unit of analysis is thus the category across which the study's variables vary. The major units of analysis for the study were the gaps in implementation of witness protection programme in Kenya. The units of observation were the informants drawn from across various governmental agencies tasked with pursuit of justice as well as witness protection.

The sample for the study was drawn through purposive sampling. According to Kothari (2008), purposive sampling is ideal when the researcher intends to pick up subjects for the study that meet a defined criterion. The researcher applied this approach to select key informants from the Attorney General office, the Law Society of Kenya, The Directorate of Public Prosecution, the Kenya Police, The Ministry of Gender (Children's Department), Directorate of Witness Protection Agency, the Children's Court, and the representatives from the National Assembly. Being a non-probabilistic and subjective approach, the researcher intended to reach out to at most 40 key informants.

The primary data for the study was collected from the key informants drawn from the Attorney General office, the Law Society of Kenya, The Directorate of Public Prosecution, the Kenya Police, The Ministry of Gender (Children's Department), Directorate of Witness Protection Agency, the Children's Court, and the representatives from the National Assembly. The researcher would spend considerable time at offices identifying key informants (including key strategists) who were involved with the formulation of the witness protection programmes, reading the current and past correspondence dealing with the formulation of policies leading to the programme, and having extensive discussions with the select key informants.

Two methods of data collection were applied. They include: in-depth interviewing and document analysis. In qualitative research, the technique of in-depth interviewing is extensively used, as it facilitates an interaction with the interviewer and the interviewee with a defined objective of gathering valid and reliable data. In general, qualitative in-depth interviews are informal and less structured interviews. During the interviews, the researcher attempts to gain the participant's meaning and perspective of relevant topics. While collecting data, the researcher provides opportunities for the participants to describe their experiences and simultaneously to discuss their opinions regarding the level of success of the activities. The process of interviewing allowed the participant to describe and reconstruct details. Open-ended questions would enable the interviewee to elaborate and to recall additional information. Further, the researcher was able to lead the participant to providing more in-depth insights through these loosely structured interviews.

In the second approach of document analysis, the researcher was able to extract pertinent information from the research reports and policy papers. Historical perspectives assisted in the study of the appropriate period for the understanding of some events or processes. This time perspective was important in determining the linkages of events that created an important issue and the consequences of events. The researcher was also to use the two sources commonly cited in the data gathering literature: primary, which provide firsthand account of events; and secondary, which are reports concerning some event from third party sources.

After the fieldwork, qualitative data was analyzed through content analysis. According to Hancock (2002:17), content analysis involves coding and classifying data through categorizing or indexing. The basic idea was to identify from the transcripts the extracts of data that were informative in some way and to sort out the important messages hidden in the mass of each interview.

Ethical considerations like ensuring confidentiality of responses were assured before the data collection commences. This was necessary because it encouraged the respondents to be honest. No respondent was forced to take part in this study. The authority to visit the respective offices was sought from the respective Directorates. A research permit was also sought from the National Council for Science and technology.

RESULTS AND DISCUSSIONS

The objective of this paper was to examine the challenges facing the implementation of witness protection program in Kenya. Specifically, the study sought to achieve the following objectives: to investigate the capacity gaps in the Witness Protection Program and the underlying causes.

The data for the study was collected from key informants drawn from the Attorney General office, the Law Society of Kenya, The Directorate of Public Prosecution, the Kenya Police, The Ministry of Gender (Children's Department), Directorate of Witness Protection Agency, the Children's Court, and the representatives from the National Assembly. The researcher spent considerable time at offices identifying key informants (especially key strategists) who were involved with the formulation of the witness protection programmes, reading the current and past correspondence dealing with the formulation of policies leading to the programme, and having extensive discussions with the select key informants. The respondents had extensive experience in civil and criminal litigation issues, public policy formulation, and legislative procedures. All the target respondents had attained more than 10 years of experience in each of these three core areas.

The study sought to establish the gaps in the Witness Protection Programme in regard to availability of staffs. A majority of the interviewed informants revealed that one of the major challenges facing the roll out of the witness protection programme in Kenya is inadequate staffing capacity. It was notable that there are few experts available in the field of Witness Protection in Kenya. From those who were interviewed 27% of the respondents had that there are no professionally trained staffs to man the programs. Various factors were attributed to have affected availability of staffs. One respondent mentioned that the staffs available were drained from or seconded by various governmental departments with no clue on the program and they are mostly civil servants and/or government employees; inadequate fund to engage technical skilled persons; lack of training institutions for learning; inaccessibility of the staffs; the number of experts and staffs isn't known while one claimed that awareness has not been widely done to the public. The findings underscore that the capacity of the WPA to fully undertake its mandate is constrained by lack of adequate financial and human resource expertise base. Other issues cited include shortage of technical staff; lack of staff with specific witness protection advisory skills; few experts available; and lack of professionally trained staffs to man the programme since it's a new concept in Kenya.

In establishing the capacity gaps in the Witness Protection Program in Kenya and the underlying cause, the study found that there is a shortage of technical staffs and those present are not professionally trained to man the program. Indeed they are drained from or seconded from various governmental departments with no or little clue about the program. In terms of technological support, the staffs lack technological knowledge or are ignorant of the existing technology. There are also insufficient technological facilities, while some areas are remote for the technology to be recognized. Existing capacity gaps in regard to training of personnel are that officers of the program have undergone no or little training and most are self-proclaimed having undergone self-learning. There is also lack of training resources such as facilities, training institutions and trainers. There are also limited financial resources to support the program attributed to poor funding and high cost of the program. In terms of law enforcement approaches, law enforcement agency is not aware of the program and there legal provisions covering witness protection is not clear and not well implemented.

CONCLUSION

From the findings of the study, it can be concluded that there exist capacity gaps in terms of inadequate technical staff that are not adequately trained, lack of training facilities and training relevant personnel. Furthermore the study revealed that there exist capacity gaps in terms of inadequate technical staff that are not adequately trained, lack of training facilities and training staff, limited technological support, limited funding and limited knowledge of the Witness protection program. It can also be concluded that there are also inadequate infrastructural facilities in protecting the witness with non conducive court environment which are inaccessible for many witnesses.

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La course vers de nouveaux réseaux de solidarité dans le Cameroun contemporain: désolidarisation ou des solidarités autour de la famille?

[Being a member of social networks and new social movements in contemporary Cameroon: lack of solidarity or more solidarity around the family?]

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ABSTRACT: This paper attempts to define the place of the family nowadays with the expansion of digital social networks and associative movements in Cameroon. The interest of the study is to analyze the motivations and the reasons why individuals interact and join networks of solidarity outside their clan and family. We found that, issues of economic survival, social recognition, positioning and individual and collective affirmation in Cameroonian society are at the heart of emulation to new solidarity schemes. However, the family remains a bedrock to where people come back when the new forms of solidarities fail.

KEYWORDS: Yaounde, social networks, associative movements, solidarity, family.

RÉSUMÉ: Cet article tente de circonscrire la place qu'occupe la famille depuis l'expansion des réseaux sociaux numériques et des mouvements associatifs au Cameroun. L'intérêt de l'étude est d'analyser les motivations et les raisons qui poussent l'individu à interagir et à adhérer à des réseaux de solidarité extérieurs à son clan et sa famille. Au demeurant, les enjeux de survie économique, de reconnaissance sociale, de positionnement et d'affirmation individuelle et collective dans la société camerounaise sont au cœur de l'émulation vers des schémas inédits de solidarité. Toutefois, la famille reste un socle de dernier recours lorsque ces nouvelles solidarités connaissent des échecs.

MOTS-CLÉS: Yaoundé, réseaux sociaux, associations, solidarité, famille.

INTRODUCTION

L'Afrique a connu au cours des siècles de nombreux contacts avec l'extérieur. Ces relations se sont établies soit de manière violente (esclavage, décolonisation…), soit de manière plus insidieuse (globalisation, nouvelles technologies de l'information et la communication…). Ces différentes interactions ont conduit à une modification plus ou moins profonde des structures internes, des habitudes et des façons de faire des peuples africains. En ce qui concerne la famille, les rapports étaient hiérarchisés dans l'Afrique traditionnelle. Au sommet, on retrouvait un chef ou un patriarche. Ses opinions et ses décisions avaient force de loi. Pour Paul-Emile Latoki, « (…) le respect et toute la crainte qui entouraient sa personne décourageaient qu'il fut venu à l'esprit de quelqu'un l'idée de lui demander des comptes ». L'individu n'avait donc de valeur que parce qu'il était membre d'un groupe, d'une communauté ; et en cela, il était solidaire du groupe et le groupe répondait de lui. Pascal Lissouba parle de « solidarité primaire » [1] **(Latoki, 2009)**. Cependant, si certaines communautés restent

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encore attachées à leurs traditions, et à leurs coutumes, on assiste également à l'apparition de comportements sociaux nouveaux.

On note tout d'abord que, le centre de vie le plus convoité et le plus habité n'est plus le village, mais c'est désormais la ville. Ce qui introduit des changements dans les modes de vie. L'intégration des valeurs culturelles venues d'ailleurs ont aussi modifié la famille dans son sens initial. Elle n'est plus nombreuse (grand parents, oncles, neveux, cousins…) mais restreinte (parents et enfants exclusivement). On ne vit plus ensemble dans une seule et grande enceinte car la problématique et les configurations du logement dans les grandes villes ne permettent pas ce type de groupement élargi.

La crise économique frappe de plein fouet l'Afrique depuis les années 1990. Le coût de la vie est devenu beaucoup plus important que par le passé. Ceci amène les individus à ne se focaliser que sur leurs besoins propres. Ces changements socio-économiques majeurs conduisent à quelques constats. Les liens de sang deviennent de plus en plus secondaires, la prise d'initiatives hors du cadre familial n'est plus tabou, au contraire, la notion de liberté pousse les personnes à créer des regroupements autour de nouveaux réseaux et de nouveaux centres d'intérêts. L'adhésion à ces nouveaux réseaux hors des communautés d'origine a t-elle redéfini les contours de la notion de solidarité au Cameroun ? Comment s'expriment et se manifestent ces nouvelles formes de solidarité dans la société camerounaise ? Comment fonctionnent ces nouvelles formes de la solidarité ? La course vers de nouveaux mouvements de solidarité va-t-elle sonner le glas d'une désolidarisation définitive de la famille ?

Cette étude se propose de répondre à cette problématique par le biais d'une analyse documentaire d'une part, et par l'exploitation des réponses à un questionnaire soumis à un échantillon de 500 personnes âgées de 16 à 50 ans parmi lesquelles des jeunes étudiants, des cadres de la fonction publique, tous membres de diverses associations, groupes et réseaux sociaux dans la ville de Yaoundé, capitale du Cameroun. La première partie de notre analyse portera sur les mouvements associatifs et leur tendance à marginaliser la famille en raison des enjeux de survie économique, de reconnaissance sociale, de positionnement et d'affirmation individuelle et collective dans la société camerounaise et la deuxième s'attèle à présenter la famille comme un socle de dernier recours lorsque les nouvelles solidarités subissent des échecs.

1 LES MOUVEMENTS ASSOCIATIFS ET LEUR TENDANCE A LA MARGINALISATION DE LA FAMILLE

En Afrique aujourd'hui, avec l'évolution et les différents changements qu'ont connus les structures familiales, l'individu fait appel à d'autres regroupements pour se définir. Premièrement, il habite en ville et cohabite désormais avec d'autres individus qui ne font pas partie de son clan originel (personnes avec lesquelles il n'a aucun lien de sang). Il reste également membre de sa propre famille (plus ou moins restreinte). Par conséquent, il interagit avec d'autres individus, d'autres groupes puisqu'il est désormais en contact avec d'autres horizons. Ces nouveaux centres d'intérêts se trouvent et s'identifient de plus en plus hors du cadre familial primaire. Ils correspondent mieux aux aspirations et aux ambitions que l'individu nourrit par rapport à son propre devenir. Il adhère à ces nouvelles communautés parce qu'il les a choisies (1.1), elles sont le centre de ses interactions sociales. Par contre, le choix d'adhérer ou non à ces réseaux obéit à des motivations très précises qu'il sied de circonscrire (1.2).

1.1 LES DIFFERENTES FORMES DE NOUVEAUX RESEAUX SOCIAUX DANS LA VILLE DE YAOUNDE

John A. Barnes a établi une classification des relations sociales qui permet de procéder à une définition des réseaux sociaux. Il les perçoit comme étant, un champ social sans frontières bien définies et constituant l'ensemble des relations informelles entre individus formellement égaux, connaissances, voisins, ou parents [2] (**Mercklé, 2004**). Nous examinons dans cette séquence trois types de nouvelles formes de solidarité. Le premier des types de regroupements que nous analysons dans cette partie est une forme de solidarité mis en valeur par le numérique : les réseaux sociaux. Le deuxième mouvement étudié est celui qui se construit autour d'une certaine appartenance ; généralement les membres de ce type de réseaux décident de garder et de fortifier les liens qui les unissent que parce qu'ils ont appartenu a certaines institutions. Il s'agit des regroupements anciens élèves autour des grandes écoles ou d'établissements scolaires réputés et « prestigieux ». Le troisième type s'intéresse aux cercles de solidarité à caractères messianiques révolutionnaires qui sont de plus en plus présents dans les grandes villes africaines. A Yaoundé où l'étude a été menée elles ont pour réputation de s'inscrire dans la rupture avec les mouvements religieux classiques.

1.1.1 LES RÉSEAUX SOCIAUX NUMÉRIQUES

Les Nouvelles Technologies de l'Information et de la Communication (NTIC) ont offert aux populations citadines africaines de nombreuses facilités dans leur vie quotidienne. Les moyens traditionnels de communication (la lettre et le téléphone classique) relativement coûteux n'étaient pas assez accessibles aux populations des villes et, limitaient les relations à un entourage proche. C'est dire qu'il fallait bien souvent, des contacts préalables avant que ce lien communicationnel ne s'établisse. Le boom d'internet et du téléphone portable est venu redynamiser les relations entre les individus. L'adhésion des citadins aux réseaux sociaux numériques traduit véritablement à quel point la nature des relations sociales a changé. En effet, là où l'importance était accordée aux relations et aux contacts physiques, on y oppose désormais des relations virtuelles. Le besoin de se déplacer pour signifier la proximité ou les rapports privilégiés que l'on entretient avec quelqu'un est devenu secondaire. Il suffit désormais d'un clic pour demander une amitié, pour confirmer, en bloquer ou en annuler une autre. Même si le premier cercle des gens que l'on connait sur internet provient des relations construites dans la vie réelle, à travers le numérique, on peut l'élargir à une multitude de personnes que l'on ne connaît pas et que parfois l'on ne rencontrera jamais physiquement.

Le réseau social le plus prisé et regroupant un grand nombre de membres est définitivement Facebook[1]. On y est ami avec des amis, des connaissances, des proches les amis des amis… et même des inconnus. A ce propos, les enquêtés rapportent qu'en moyenne, 58 % de leurs contacts sur les réseaux sociaux sont des personnes qu'ils n'ont jamais rencontrées physiquement. C'est une illustration de cette marginalisation de la famille. Les internautes prennent le risque de naviguer vers des sites et des personnes-personnages inconnus et méconnus au détriment des contacts plus ou moins familiers. Par ailleurs, les internautes partagent et échangent activement sur leur quotidien à travers la publication de photos, d'informations, de blagues qui font généralement l'objet de commentaires entre eux. Il s'agit ici d'une solidarité de vie, d'opinion, de goûts. Une sorte de tri sélectif de ses contacts, de sa famille, de son entourage, de ses amitiés et des inimitiés. En effet, l'individu n'est en contact ici qu'avec les personnes avec lesquelles il désire communiquer. Il fixe ses propres règles et lorsque ses goûts changent, il modifie également l'identité et la nature de ses contacts.

L'adhésion à ces réseaux sociaux va jusqu'à la création des sites internet par des locaux qui même s'ils n'ont pas la renommée des sites occidentaux montrent à quel point ils ont intégré le quotidien des populations urbaines camerounaises. Nous avons pu ainsi identifier l'espace électronique www.mycombi.net. Pour ce cas d'espèce, « *Combi* » veut dire « ami » en langage courant camerounais[2] [3] (**Tsofack, 2006**). Selon ses créateurs, l'originalité de ce site internet tient du fait que ses créateurs sont tous camerounais d'origine et que les contenus que les membres y publient peuvent apparaitre simultanément sur les autres réseaux sociaux auxquels l'utilisateur de Mycombi.net appartient également.

Cependant, ce serait une erreur de penser que la montée en puissance des réseaux numériques est venue mettre un terme à ce qu'on pourrait appeler des réseaux sociaux physiques. Premièrement parce que même si internet est devenu un objet de masse, il ne s'est pas popularisé. Et deuxièmement, le contact physique reste une donnée importante dans les relations en Afrique et dans ce contexte, il faudrait compter aussi avec l'élitisme de certains regroupements associatifs comme les réunions d'anciens élèves des grandes écoles de plus en plus présentes à Yaoundé.

1.1.2 LES MOUVEMENTS ASSOCIATIFS AUTOUR DES « GRANDES ECOLES »

Ces mouvements associatifs regroupent, généralement, les anciens élèves ou enseignants des différentes grandes écoles ou institutions réputées au Cameroun. Le principal objectif de ce type d'associations est de rester en contact et de maintenir des liens d'amitié et de solidarité entre les anciens camarades de promotion passés par ces écoles et institutions et d'établir

[1] *Facebook* reste le réseau social le plus populaire pour les populations vivant à Yaoundé. *Facebook* est utilisé par tous les enquêtés soit 100 %. Par ordre décroissant, suivent les utilisateurs de *yahoo* (60 enquêtés), twitter (55 enquêtés), *netlog* (15 enquêtés), *skype* (15 enquêtés), *skyrock* (15 enquêtés), *twoo* (10 enquêtés), *badoo* (5 enquêtés), *myspace* (5 enquêtés) et *meetic* (5 enquêtés).

[2] L'expression « langage courant camerounais » renvoie ici à ce que Jean-Benoît Tsofack a théorisé sous le vocable « *Camfranglais* ». Le *camfranglais* se définit alors comme « un mot formé par coalescence de trois expressions : Cameroun, français et anglais qui désigne une espèce de langue cocktail en usage au Cameroun dont la structure de base est le français, mais qui se nourrit d'un lexique emprunté aux langues diverses comme le pidgin-english, l'anglais, les langues camerounaises et même européennes ». Voir, TSOFACK, J.B. (2006), « Le camfranglais ou la norme du français en péril au Cameroun ? », in Analyses (Langages, textes et sociétés), n° 11, Revue franco-africaine des Sciences du langage (en ligne), CPST, Université de Toulouse Le Mirail, pp. 31-50.

de nouveaux partenariats entre les différentes générations formées dans leurs enceintes. Les contacts sociaux se font certes ici loin des sentiers battus du cadre familial mais il s'agit pour les membres de ces regroupements d'appartenir à une autre forme de famille.

Dans la ville de Yaoundé, on dénombre plusieurs associations et amicales des institutions formant des hauts cadres et aussi, des écoles d'enseignements secondaires ayant une certaine réputation d'excellence. Prenons par exemple, le cas de l'Association des Ingénieurs Diplômés de l'École Polytechnique de Yaoundé. L'une des conditions pour être membre c'est d'être diplômé de l'école. L'article 3 du règlement intérieur de ladite association précise que l'adhérent doit notifier son année de sortie de l'école et sa filière [4].

C'est donc une condition restrictive qui concourt au sentiment élitiste qui anime cette association. D'ailleurs, le deuxième point du préambule constitutif de leur statut général est sans ambiguïté : « Convaincus de l'impact positif d'un regroupement d'élites sur les valeurs humaines les plus nobles, dont entre autres… ». La conviction ou la nécessité de faire perdurer l'appartenance à une certaine classe de la société transparaît dans la plupart des dispositions régulant l'organisation et le fonctionnement de cette association. La différence entre ce type de réseaux et les réseaux virtuels c'est la programmation des rencontres et l'organisation des activités déjà prévues par les textes. Ainsi, pour l'Association des Ingénieurs Diplômés de l'Ecole Polytechnique de Yaoundé, les textes sont précis sur la fréquence des rencontres. L'Assemblée Générale se réunit une fois tous les trois ans[3] et le Conseil d'administration se réunit en session ordinaire deux fois par an[4]. Ceci dénote une régularité des rencontres et des occasions de contacts physiques. Ce souci de rencontres, de retrouvailles et regroupements à travers des activités organisées par l'association se retrouve également dans les missions de l'Association des Anciens Élèves Professeurs de l'École Normale Supérieure de Yaoundé[5] [5].

1.1.3 LES NOUVEAUX MOUVEMENTS RELIGIEUX

A Yaoundé, il est de plus en plus fréquent de voir dans le paysage urbain des affiches ou des banderoles annonçant des grandes nuits de prières ou de délivrances toutes promettant des grands changements dans la vie de leurs fidèles. C'est le fait de ce que l'on appelle ici « les nouvelles églises » ou « les églises de réveil ». Il est certes vrai qu'avec le vent de démocratie qui a soufflé au Cameroun dès les années 1990 et à la suite de la loi sur la liberté des associations [6], de nombreux regroupements ont vu le jour avec pour la plupart des évangiles divers et variés. Mais le plus grand boom est celui des nouvelles chapelles qui prolifèrent dans des quartiers populaires, dans des habitations modestes ou dans des bâtiments plus luxueux. Ces nouveaux mouvements religieux attirent de plus en plus d'adhérents au détriment des églises « traditionnelles » [7]. Leurs dénominations montrent leur volonté de s'inscrire dans une perspective de rupture : La Mission du Plein Evangile, La Cathédrale de La Foi, Eglise Christ Roi des Anges, Vient et suit Moi, God for Live, Le Ministère Va et Raconte, La Vraie Eglise de Dieu, notamment.

L'esprit qui règne au sein de ces églises est une forme de communautarisme. D'ailleurs, leurs fidèles considèrent qu'ils appartiennent à une sorte de groupe « d'élus de Dieu », se considérant entre comme des « frères », « des frères en christ ». Le reste de la société qui ne partage pas leurs préceptes est généralement étiqueté comme des « mondains ». Cette rupture continue parfois pour les adhérents au sein de leurs familles traditionnelles, rompre toute relation avec ces dernières si elles ne s'engagent sur le même chemin qu'eux peut devenir une nécessité. Les membres de leurs communautés devenant alors leur « vraie famille ». Pour attirer un maximum d'adhérents, les méthodes des « pasteurs » de ces nouvelles obédiences s'inscrivent aussi dans une perspective de différenciation des chapelles classiques, leurs équipes font du porte à porte pour prêcher « la bonne parole » et lorsqu'elles ont un nouveau membre, il est suivi jour après jour par ces dernières jusqu'à son adhésion complète[6].

Que ce soit à travers les réseaux sociaux numériques ou des réseaux sociaux physiques ou au sein de « nouvelles » congrégations religieuses, le besoin pour les individus et les citadins africains en particulier d'établir des relations en dehors de leur entourage traditionnel obéit à des motivations que nous allons essayer de circonscrire dans cette section.

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[3] Article 12 alinéa 2 du règlement intérieur de l'association.
[4] Article 12 alinéa 3 du règlement intérieur de l'association.
[5] Cf. Point 2 du Préambule du règlement intérieur de l'Association des Anciens Elèves professeurs de l'école normale supérieure de Yaoundé (AAEPENSY en abrégé). <http ://www.ens.cm/spip.php?article361>. Page consultée le 11 mai 2013.
[6] Eléments recueillis lors des interviews avec quelques membres de ces « nouvelles églises ».

1.2 LES RAISONS D'ADHESION AUX RESEAUX SOCIAUX

A chaque type de regroupement situé en dehors de la famille au sens africain du terme correspond des raisons spécifiques, des besoins particuliers que le membre ou l'utilisateur cherche à satisfaire. Et même si dans certains cas ces objectifs d'adhésion peuvent se confondre ou se recouper, les motivations sont beaucoup plus affichées dans certains regroupements que dans d'autres. Nous avons pu pour notre analyse identifier quelques unes : le désir de communiquer, les motivations affectives et les interactions professionnelles.

1.2.1 LE BESOIN DE COMMUNIQUER

La communication est essentielle dans la vie de chaque être humain [8] (**Laulan, 1979**). D'ailleurs, l'homme passe le plus clair de son temps à communiquer, que ce soit lors des simples conversations ou pour transmettre d'autres informations plus élaborées. Les sociologues définissent la communication comme l'ensemble de phénomènes qui résultent lorsqu'un individu transmet une information à un ou plusieurs autres individus à l'aide du langage. A travers les réseaux sociaux numériques, la communication atteint d'autres dimensions et toute publication y suscite des réactions, des commentaires. Par exemple, les utilisateurs rythment leur quotidien en communiquant sur leurs états d'âme, leurs opinions. Parfois également, ils manifestent leur solidarité en interagissant avec leurs amis virtuels à travers leurs commentaires. Le gain de temps est aussi appréciable dans la mesure où les utilisateurs peuvent annoncer des évènements personnels et procéder directement à la distribution des invitations.

La société camerounaise est un espace assez sensible aux apparences. En effet, il y est assez commun de s'informer sur ce qui se passe chez les autres et de communiquer sur ces succès. Le terme *kongossa*, utilisé par les camerounais, traduit assez fidèlement cette habitude. Le *kongossa* se définit dans l'environnement camerounais comme étant l'habileté à faire circuler la rumeur ou des informations douteuses juste pour faire dans le sensationnel ou donner bonne impression. Les réseaux sociaux semblent mettre au paroxysme cette habitude. Dans le cadre de notre enquête, 13 % des personnes interrogées avouent se ruer vers les réseaux sociaux numériques pour « se faire connaitre ». Ce sont les personnes âgées de 16 à 20 ans et celles appartenant à la tranche d'âge de 31 à 40 ans qui revendiquent davantage cette motivation.

Le besoin de communiquer dans ce cas précis prend la forme d'un exhibitionnisme personnel que les utilisateurs de *Facebook* pratiquent régulièrement. Ils y exposent leur vie, leurs opinions, leurs couleurs et leurs goûts de manière volontaire et peuvent recevoir en retour des commentaires élogieux et admiratifs. Et cette exhibition se retrouve également au sein des « chapelles de réveil » où chaque membre de la communauté est appelé à prendre la parole régulièrement pour témoigner en séance publique de ses difficultés ou de ses qualités et initier des liens de proximité avec les autres membres de l'assemblée.

Les réseaux sociaux offrent donc aux citadins des facilités au niveau des contacts avec d'autres personnes. Des individus peuvent rendre des services à d'autres et en demander également sans passer par des relais. Les réseaux sociaux de tout type sont aussi intéressants à analyser du point de vue affectif en raison des nouvelles formes d'amitié et des nouveaux procédés amoureux qu'ils permettent de mettre sur pied.

1.2.2 LES MOTIVATIONS AFFECTIVES

Pour cette étude, l'affectif est appréhendé sur deux variables. D'une part, les liens d'amitié, et d'autre part, les relations sentimentales. Pour ce qui est des motivations affectives en rapport avec l'amitié poussant les internautes à s'inscrire dans les réseaux sociaux numériques, l'enquête montre qu'il s'agit la plupart du temps de rester en contacts avec des amis que l'on a pas toujours l'opportunité de rencontrer facilement parce que installés hors de la Yaoundé ou partis à l'étranger. L'autre motivation affective est le désir de retrouver des amis d'enfance dont on a perdu la trace depuis un moment. Dans tous les cas, le souci de « retrouver des amis » apparaît comme la principale raison qui pousse les internautes camerounais vivant à Yaoundé à courir les réseaux sociaux numériques. En effet, lors de notre enquête, 57 % des *yaoundéens* ont rapporté s'inscrire dans ces plateformes pour retrouver des amis. Il s'agit donc là de rester en contact avec les êtres chers et de faire de nouvelles rencontres.

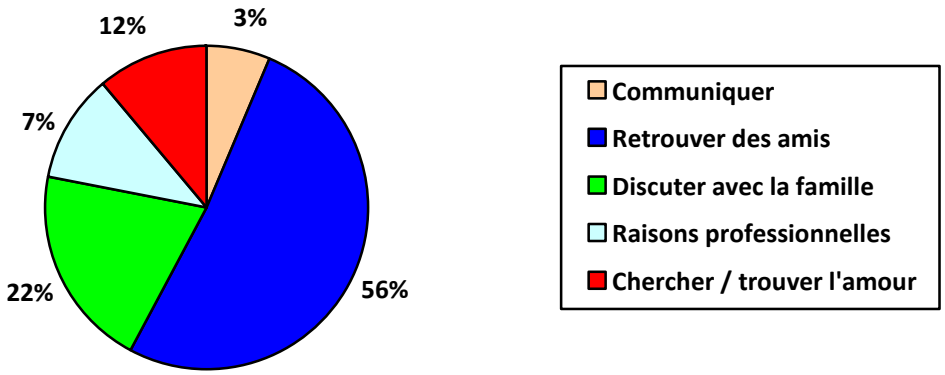
Quant à l'affectif en rapport la recherche et la construction de relations sentimentales et amoureuses, de nombreux habitants de Yaoundé avouent avoir déjà eu recours à internet de façon générale, et aux réseaux sociaux numériques en particulier pour essayer de trouver l'amour. Que ce soit pour des motivations plus pragmatiques (contracter des relations avec des occidentaux pour avoir un accès plus rapide à l'immigration), plus burlesques (changer de personnalité et avoir un maximum de conquêtes) ou encore pour des raisons sincères (relation sentimentale plus ou moins sérieuse). Internet est

devenu une méthode assez courante pour animer la vie amoureuse. Dans le cadre de notre enquête de terrain, 26 % des enquêtés avouent avoir déjà eu recours aux réseaux numériques pour tenter de trouver l'amour sur internet. Dans le même temps, seuls 7 % se sont inscrits dans des réseaux sociaux numériques pour essayer de trouver l'amour. Cette catégorie de personnes interrogées pense que les réseaux sociaux numériques permettent de briser facilement la glace et rendent téméraires ou courageux ceux qui dans la vraie vie pourraient avoir du mal à aller vers des futurs partenaires. Au final, la plupart des personnes interrogées estiment recourir à internet pour trouver l'amour, pour combler des moments de solitude et considèrent cette pratique comme un exutoire pendant les instants de jeunesse animés par une certaine fébrilité. Pour d'autres c'est une course à l'aventure, vers l'inconnu à la recherche du bonheur et de l'amour dont les enquêtés pensent ne pas connaître la plateforme la plus prolifique et préfèrent essayer d'y parvenir par tous les moyens.

1.2.3 LES INTERACTIONS PROFESSIONNELLES

Dans un contexte où trouver un emploi n'est pas une tâche aisée et où la situation économique demeure peu fluorescente, les populations ont recours à des méthodes plus ou moins parallèles pour trouver du travail. Dans cette course effrénée à la recherche de l'emploi, être membre d'un réseau peut faciliter le contact avec les individus relais susceptibles de promouvoir des offres d'emploi.

Les réseaux sociaux permettent également une visibilité professionnelle qui peut permettre aux promoteurs des structures, grandes ou petites de se faire connaitre les activités, les prestations et les services qu'elles offrent, voire de trouver des partenaires commerciaux. Les coûts publicitaires n'étant pas toujours abordables, plusieurs utilisateurs font usage des réseaux sociaux numériques gratuits pour faire de la publicité et avoir des nouveaux clients tout en fidélisant les anciens. Les photos de leurs offres de services ou de leurs produits sont ainsi régulièrement mises à jour. Les soldes, les promotions d'articles, les invitations de relance et les campagnes publicitaires y sont régulièrement organisées. En contactant directement leurs clients et par le biais des commentaires, les promoteurs des structures parviennent ainsi à cibler précisément les attentes de leurs clients et ils peuvent proposer des produits plus intéressants. Dans ce sillage, de nombreux camerounais utilisent les réseaux sociaux pour faire la promotion de leurs activités économiques. On retrouve alors sur la toile beaucoup de petites boutiques de vêtements, des pages d'accueil de restaurants et des hôtels. Pour notre enquête, 12 % des personnes interrogées estiment s'être inscrits sur les réseaux sociaux pour des raisons professionnelles. Dans tous les cas, voici un récapitulatif des raisons qui poussent les *Yaoundéens* à adhérer aux réseaux sociaux numériques (graphique 1).



Graphique 1 : Motivations des inscriptions dans les réseaux sociaux numériques à Yaoundé

Les activités au sein de ces réseaux sociaux sont parfois très prenantes au détriment de la vie de famille. C'est un choix volontaire qui traduit le désir de se faire ses propres relations, d'appartenir à des groupes dans lesquels on se reconnait et avec lesquels on partage un certain nombre de valeurs et dans ce sens, il existe au Cameroun des milliers d'associations dans lesquelles les individus se retrouvent et qui leur permettent de manifester leur solidarité au quotidien en cas de deuil, mariage, première communion, maladie etc. Dans ce que l'on appelle ici « réunions » au biais des cotisations. Pour Sévérin Cécile Abéga et Noel Solange Ngo Yebga, ce type de réunions est généralement animé par des femmes qui y retrouvent une forme d'exutoire social en cela que les activités qui y sont organisées leur permettent de souffler de leurs nombreuses

responsabilités [9] (**Abéga et Ngo Yebga, 2001**). Cependant, sur le plan social ce serait une analyse trop rapide et qui ne pourrait pas permettre de mettre en lumière tous les mécanismes complexes des éléments de la solidarité au quotidien. Car lorsque le besoin se fait sentir, le repli identitaire est également le moyen pour les populations d'atteindre certains objectifs. La famille au sens large du terme devient alors valeur et acteur de consensus d'un type de mouvement associatif au Cameroun.

2 LE RETOUR VERS LA FAMILLE : VALEUR ET ACTEUR DE CONSENSUS DANS L'EXPRESSION DES MOUVEMENTS ASSOCIATIFS AU CAMEROUN

La ville de Yaoundé est une ville assez cosmopolite et éclectique en ce qui concerne les origines de ses populations. Capitale politique du Cameroun, elle abrite la majorité des institutions administratives et politiques. Ceci constitue un atout majeur dans l'attrait qu'elle exerce auprès de ceux qui viennent y vivre. A Yaoundé, les groupes ethniques nationaux les plus représentés selon Antoine Socpa sont les Fang (Bulu et Beti), les Bamilekés, les Peuls, les Bamoun, les Bassa, les Duala [10] (**Sopca, 2003**).

Pour maintenir les liens avec leurs racines, plusieurs associations basées sur le critère tribal ont vu le jour. Kengne Fodouop a au cours d'une étude dénombré près de 408 associations ou comités de développement de ce genre dans la ville de Yaoundé dans les années 2000 [11] (**Fodouop, 2003**). Cela dénote de l'importance de la notion d'ethnie au Cameroun. Ces différents regroupements ont pour principal objectif de mener des actions de solidarité pouvant aider leurs membres d'une part et d'aider leurs régions d'origine ou leurs villages d'autre part. Sur ce point, il nous a semblé utile que de procéder à une analyse quantitative de ces associations. Qui plus est, dans une analyse qualitative, il s'est agi et d'examiner quelques mouvements associatifs qui font véritablement preuve d'un certain dynamisme en matière d'engagement envers leur région d'origine tout en étant présents dans la ville de Yaoundé (2.1) et d'analyser également les raisons d'un tel engouement (2.2).

2.1 ANALYSE DE QUELQUES ASSOCIATIONS A CARACTERE ETHNIQUE DANS LA VILLE DE YAOUNDE

Plusieurs définitions existent sur la notion d'ethnie. Nous reprendrons ici celle donnée par G. Nicolas cité par Jean Loup Amselle et Elikia M'bokolo qui considère l'ethnie comme « un ensemble social ayant un nom, des coutumes, des valeurs, une langue propre … » [12] (**Amselle et M'bokolo, 1985**). La nécessité de se retrouver entre des personnes ayant en commun ces critères, surtout dans les grandes villes est une réalité avec laquelle il faut compter lorsqu'il faut analyser les tendances et les dynamiques des mouvements associatifs en milieu urbain. A Yaoundé, certaines ethnies sont véritablement actives dans le domaine associatif. Il s'agit des ressortissants des ethnies Bamiléké, Beti et Peul qui possèdent dans la ville des regroupements codifiés, structurés et des normes de solidarité unanimement respectées. À côté des ces associations à caractère ethnique formellement déclarées se greffent d'autres regroupements similaires qui sont peu ou prou informels. Mais ceux-ci restent présents, visibles et ils traduisent également la volonté de maintenir ou de construire une forme d'unité autour de leur famille de *jus sanguinis*.

2.1.1 LES REGROUPEMENTS DE RESSORTISSANTS BAMILEKE VIVANT A YAOUNDE

Pour Séverin Cécile Abéga et Noel Chantal Ngo Yebga, s'il existe de nombreuses associations Bamiléké l'une des raisons est le fait que cette ethnie est fortement peuplée. Toujours est-il que cette ethnie fait preuve d'un dynamisme certain en matière de regroupement et de rassemblement. Selon les mêmes auteurs, les associations des ressortissants Bamiléké brillent par « leur longévité, inventivité, discipline, et l'importance que leurs membres leur accordent ». A Yaoundé, on peut en l'occurrence citer « Le Conseil Supérieur du Ndé de Yaoundé ».

2.1.2 LES AUTRES REGROUPEMENTS ETHNIQUES

Au Cameroun, les bamilékés ne sont pas le seul groupe ethnique qui parvient à se regrouper que se soit dans ses frontières d'origine ou en dehors de celles-ci. D'autres ethnies créent également des communautés, des comités et des associations de leurs ressortissants. Ces différents regroupements souhaitent généralement rassembler leurs ressortissants

tout en se distinguant par leur notoriété ou leurs réalisations sur le plan social. Dans ce sillage, le cas de l'association dénommée *Mbororo Social Cultural Development Association* (MBOSCUDA) est intéressant. De par ses statuts, l'association promeut des objectifs de développement culturel, social et économique de ses membres. En outre, cette association compte également au rang de ses priorités la scolarisation des populations de leur région[7]. C'est un aspect non négligeable car les populations du Grand Nord du Cameroun en général et les filles en particulier connaissent des problèmes d'accès à l'éducation. C'est un chantier qui entreprend donc la réduction du taux d'analphabétisme des populations Mbororo.

On retrouve également le même souci de développement dans les comités de développement Béti[8], le cas de l'Association des Ressortissants, Amis et Sympathisants de l'Arrondissement de SA'A[9] qui, lors de l'assemblée générale de 2010, a tenu à réaffirmer en l'article 4 de son statut général sa volonté de participer au développement économique et culturel de leur arrondissement. Ces différentes associations tendent donc, de manière commune, à remplir des objectifs de développement et de rayonnement identitaire et culturel de leur région par le biais de l'entraide entre les membres de l'association et envers les ressortissants du groupe ethnique à travers des modalités généralement prévues et fixées par les textes qui les régissent.

2.2 LES PRINCIPALES RAISONS DE LA SOLIDARITE ETHNIQUE

Les mécanismes de solidarité mis en place par les urbains qui se retrouvent dans les associations ethniques traduisent à la fois un mélange de responsabilité morale envers leur région d'origine, des raisons économiques et des ambitions politiques.

2.2.1 LA RESPONSABILITÉ MORALE

La responsabilité d'aider les « frères » qui sont restés au village est souvent un sentiment qui anime les populations citadines. Cette aide peut se présenter sous diverses formes. Kengne Fodouop, dans son étude, a distingué 3 types d'aide : « le soutien monétaire, l'envoi d'espèces en nature ; le don de biens et la combinée ; les espèces et les biens » (**Fodouop, 2003**). Cette assistance permet donc de maintenir un contact avec ceux qui sont restés en milieu rural. Et lorsque l'on se retrouve au sein d'une association des ressortissants de sa localité d'origine, c'est la volonté d'aider la localité dans son ensemble à travers des investissements à caractère public qui domine. Et dans ce domaine, les associations des Bamiléké sont les plus présentes. Ainsi, selon le même auteur, les 3/5 du réseau routier du village de Banjoun, à l'Ouest Cameroun, soit 138 kilomètres sur une distance totale de 230 kilomètres ont été réalisés par ce canal (**Fodouop, 2003**). Avec la crise économique, la mise sur pied de ce type d'associations permet aussi de faciliter les transactions financières entre leurs membres pour la réalisation de nombreuses activités génératrices de revenus.

2.3 L'ACCÈS AU CRÉDIT

La situation économique instable du pays fait que les banques n'accordent pas toujours des crédits ou alors cela ne se fait que sur présentation d'énormes garanties. Cette situation pousse les populations urbaines à développer des solutions parallèles pour avoir accès au crédit. L'une des solutions est de se retourner vers les associations ou les réunions dans lesquelles ils sont membres. La plupart de ces associations qu'elles soient ethniques ou pas, possèdent bien souvent en leur sein des structures de crédits que l'on appelle « tontine ». Sévérin Cécile Abéga et Noel Solange Ngo Yebga définissent la « tontine » comme étant « une épargne personnelle et tournante qui est collectée à chaque réunion, auprès de tous les membres et reversées à l'un d'entre eux ou aux caisses et qui sont utilisées pour réaliser des objectifs fixés au départ » (**Abéga et Ngo Yebga, 2001**). Cet argent sert à réaliser des projets ou encore à résoudre certaines difficultés ponctuelles comme les rentrées scolaires. Ainsi, au sein de l'association familiale Man Zoa, créée le 27 février 2011 à Yaoundé, l'un de ses domaines d'intervention est l'organisation d'une caisse d'épargne scolaire[10] qui permet aux différents membres le moment venu d'alléger les coûts de scolarité de leurs enfants.

[7] MBOSCUDA est une association créée en 1987 et matérialisée en 1992, elle est basée à Yaoundé.
[8] L'ethnie Beti regroupe les personnes originaires de la région du Centre et du Sud.
[9] Statut général de l'Association ARAMSA, révisé en assemblée générale en 2010.
[10] Cf. article 4 du règlement intérieur de l'association.

2.3.1 LES ENJEUX POLITIQUES

L'adhésion aux associations à caractère ethnique est parfois motivée par des raisons et des ambitions politiques. Il arrive que très souvent les responsables de ces associations soient ou veulent devenir des personnages politiques importants ou influents. Les associations auxquelles ils appartiennent peuvent alors constituer une base de soutien considérable. Comme le considère Antoine Sopca, les appels ethniques ont « une capacité de mobilisation » considérable (**Sopca, 2003**). Pour avoir une assise électorale dans sa région d'origine, il suffit aux responsables de faire acte de solidarité et de multiplier les actes de générosité envers les populations du même groupe ethnique qu'eux, à travers les distributions de produits alimentaires, de sommes d'argent et la matérialisation de promesses de toutes sortes.

Ces associations lorsqu'elles comportent des élites politiques en leur sein peuvent être utilisées pour revendiquer auprès du gouvernement soit des infrastructures, soit des nominations. Il est certes vrai que la plupart des auteurs qui ont écrit sur les ethnies au Cameroun, ont souligné à quel point cette considération est utilisée comme charge d'assaut du tribalisme et vectrice de conflits ; mais ce qui nous a intéressé dans cette étude était d'apprécier les mécanismes de solidarité mis en place par les différentes associations à caractère ethnique pour tirer des avantages ou des bénéfices auprès de leurs membres ou du gouvernement pour attirer un maximum de réalisations vers leur localité d'origine. Au Cameroun, ce jeu est bien perceptible à travers la lecture des motions de soutien. Elles sont généralement adressées au président de la république par tel ou tel comité ethnique ou d'autres regroupements de différente nature pour lui demander des services ou pour le remercier et le supplier de se représenter. A ce titre, cinq volumineux tomes d'un ouvrage qui recueillait d'innombrables motions de soutien adressées au président Paul Biya pour qu'il présente à nouveau, une quatrième fois, sa candidature à l'élection présidentielle de 2011 [13].

Alors, que ce soit le mouvement de la *Kirditude* (pour la défense des Kirdi du Nord), le mouvement *Essigan* (pour les Beti), le *Laakam* (pour les Bamiliké de l'Ouest), le Mouvement Sawa (pour les populations du Littoral), au Cameroun, chaque regroupement essaye de tirer son épingle du jeu pour le rayonnement culturel et le développement socio-économique de ses ressortissants.

CONCLUSION

Sous l'influence d'une forte urbanisation, de la mondialisation et de l'expansion croissante des nouvelles technologies de l'information et de la communication, les rapports entre l'individu et sa famille se trouvent modifiés et perturbés de façon manifeste. L'individu a tendance à courir vers des réseaux de solidarité qui sont extérieurs au cercle et à l'environnement familial. Dans ce sillage, à Yaoundé, au Cameroun, les jeunes adhèrent davantage aux réseaux sociaux numériques et aux nouveaux mouvements religieux où ils pensent pouvoir trouver des solutions pérennes à leurs besoins professionnels et personnels. Toutefois, à côté de ces réseaux de solidarité modernes, il subsiste des mouvements associatifs à caractère ethnique qui prolifèrent considérablement dans les agglomérations. Ces associations à caractère ethnique sont le cadre d'expression d'un rapprochement familial privilégié par les personnes qui ont connu des aventures peu heureuses ailleurs ou des individus nourrissant des ambitions politiques et qui pour ce faire tiennent à se constituer une base électorale dans leur localité ou leur région d'origine. Au Cameroun, l'adhésion aux réseaux sociaux n'est donc pas une œuvre philanthropique. De prochaines recherches pourraient alors s'appesantir sur les rapports entre les différents réseaux sociaux pour apprécier notamment si l'adhésion des membres s'y déroule de façon concurrentielle, agressive, ou de façon loyale.

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Teneurs en polyphénols et évaluation de l'activité antioxydante des extraits de deux espèces du Haut Atlas du Maroc: *Rosmarinus Officinalis* et *Thymus Satureioides*

[Polyphenols content and antioxidant activity of two species from Moroccan High Atlas: Rosmarinus officinalis and Thymus satureioides]

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ABSTRACT: Aromatic and medicinal plants are a source of biologically active secondary metabolites such as polyphenols. These substances have many biological properties, such as antimicrobial, anti-inflammatory and antioxidant ones. The aim of our work is to valorize two aromatic and medicinal plants growing wild in Moroccan Eastern High Atlas through quantifying phenolic compounds of both species and evaluation of extracts' antioxidant activity. These species are Rosmarinus officinalis and Thymus satureioides

Both plants were subjected to a phytochemical screening to highlight their secondary metabolites' qualitative composition. This analysis shows the presence of flavonoids, tannins, saponins, sterols and triterpenes, free anthraquinones and catechols. But alkaloids, carotenoids and reducing compounds were not observed.

Total polyphenols extraction was made by maceration in methanol 80%. Yields were approximately 13.06% and 11.66% for Rosmarinus officinalis and Thymus satureioides. Then, methanol's crude extract was fractionated using successively three organic solvents of various polarities: chloroform, ethyl acetate and n-butanol.

Polyphenol dosage with Folin Ciocalteu's reagent showed that ethyl acetate fractions of both species Rosmarinus officinalis and Thymus satureioides, are more rich in phenolics than the other fractions.

Antioxidant activities of ethyl acetate extracts by DPPH test were quantified by spectrophotometry and 50% inhibitory concentrations' values (IC50) were determined graphically. They were equal to 103,86µg / ml and 109,98µg / ml for Rosmarinus officinalis and Thymus satureioides respectively. The concentration 52,5µg / ml was obtained for ascorbic acid used as a reference.

In this present study, fractionation method with solvents used in polyphenols'extraction indicates phenolics richness of both species. These substances have an important antioxidant power.

KEYWORDS: Antioxidant activity, polyphenols, extracts, ethyl acetate.

RESUME: Les plantes aromatiques et médicinales représentent une source de métabolites secondaires biologiquement actifs tels que les polyphénols. Ces substances présentent plusieurs propriétés biologiques, telles que les activités antimicrobienne, anti-inflammatoire et antioxydante. L'objectif de notre travail est la valorisation de deux plantes aromatiques et médicinales poussant à l'état spontané dans le Haut Atlas Oriental du Maroc par la quantification des

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teneurs en composés phénoliques de ces deux espèces et l'évaluation de l'activité antioxydante de leurs extraits, il s'agit de *Rosmarinus Officinalis*, et *Thymus Satureioides.*

Les deux plantes ont été soumises à un criblage phytochimique pour mettre en évidence leur composition qualitative en métabolites secondaires. Cette analyse montre la présence des flavonoïdes, des tanins, des saponosides, des Stérols et des triterpènes, des anthraquinones libres et des catéchols. Mais il a été observé l'absence des alcaloïdes, des Caroténoïdes et des composés réducteurs.

L'extraction des polyphénols totaux a été faite par macération en présence du méthanol à80%. Le rendement est de l'ordre de 13,06 % pour *Rosmarinus Officinalis* et 11,66% pour *Thymus Satureioides*. Ensuite, le fractionnement de l'extrait méthanolique brut a été mené en utilisant successivement trois solvants organiques de polarités différentes : le chloroforme, l'acétate d'éthyle et le n-butanol.

Le dosage des polyphénols par la méthode de Folin Ciocalteu a montré que les fractions d'acétate d'éthyle de deux espèces Rosmarinus Officinalis et Thymus Satureioides, sont plus riches en composés phénoliques que les autres fractions.

Les activités antioxydantes des extraits d'acétate d'éthyle par le test de DPPH ont été quantifiées par spectrophotométrie, et les valeurs des concentrations inhibitrices à 50 % (CI50) ont été déterminées graphiquement. Elles sont égales à 103,86µg/ml et 109,98µg/ml pour *Rosmarinus Officinalis* et *Thymus Satureioides* respectivement, contre 52,5µg/ml pour l'acide ascorbique utilisé comme référence.

Dans cette présente étude, la méthode d'affrontement par les solvants appliquée dans l'extraction des polyphénols indique une richesse de ces deux espèces en composés phénoliques. Ces substances sont dotées d'un pouvoir antioxydant important.

MOTS-CLEFS: Activité antioxydante, polyphénols, extraits, acétate d'éthyle.

1 INTRODUCTION

Ces dernières années, plusieurs recherches scientifiques ont été développées pour l'extraction, l'identification et la quantification des antioxydants naturels à partir des substances naturelles à savoir, les plantes médicinales et les produits agroalimentaires.

Les plantes aromatiques et médicinales constituent une grande source d'antioxydants et d'antibactériens naturels pour l'industrie agroalimentaire, pharmaceutique et cosmétique. L'oxydation des lipides dans les produits alimentaires induit non seulement une diminution de la valeur nutritive de l'aliment, mais aussi des effets reconnus nuisibles pour le consommateur et qui peuvent être associés à des risques de plusieurs maladies chez l'homme **[1], [2]**. La présence d'antioxydants dans l'alimentation est devenue essentielle pour la qualité et la sécurité de l'aliment. Les effets négatifs des antioxydants synthétiques encouragent à leur substitution par des agents naturels. Des investigations scientifiques ont été effectuées sur des polyphénols qui ont été isolés et caractérisés dans certaines plantes aromatiques et médicinales.

Dans ce contexte nous nous sommes intéressés à l'étude des extraits de deux plantes spontanées du haut Atlas Oriental du Maroc, il s'agit de Rosmarinus Officinalis, et Thymus Satureioides.

Le romarin (Rosmarinus officinalis) est une plante de la famille des Lamiacées poussant à l'état spontané sur le pourtour méditerranéen. Elle se présente sous forme d'arbuste, sous arbrisseau ou herbacée mesurant environ de 0.8 à 2m de hauteur **[3]**. Cette plante affectionne les régions arides et sèches, les collines et montagnes peu élevées ainsi que les substrats calcaires, schisteux, argileux et rocailleux **[4]**. Son utilisation depuis l'antiquité dans la médecine traditionnelle se justifie par ses propriétés antiseptiques **[5]**, antirhumatismale **[6]**, anti-inflammatoire, antispasmodique **[5], [7]**, antimicrobienne et anti hépatotoxique **[8]**. Son appréciation en tant qu'épice aussi bien pour l'assaisonnement que pour la conservation des produits alimentaires **[9]**. est soutenue par son activité anti-oxydante très élevée **[10]**.

Thymus Satureioides connu localement sous le nom commun "Zaetra" en arabe et "Azoukeni" en berbère est l'une des plantes les plus utilisées comme épices et extraits à fort pouvoir antibactérien et anti inflammatoire dans la pharmacopée traditionnelle. En effet, cette espèce est très utilisée en médecine traditionnelle sous plusieurs formes : les feuilles sont utilisées en infusion contre la toux, en décoction pour guérir les maux de tête, hypertension et gastrites, en usage externe comme cicatrisants et antiseptiques. Son action antiseptique s'exerce également sur le système digestif et notamment en cas de diarrhée et il est aussi vermifuge **[11], [12].** Au Maroc, le genre Thymus est représenté par 21 espèces dont 12 sont endémiques **[13].**

L'objectif de notre travail est de quantifier les teneurs en composés phénoliques des extraits de Rosmarinus Officinalis et Thymus Satureioides et d'évaluer leur pouvoir antioxydant par la méthode de DPPH.

2 MATÉRIELS ET MÉTHODES

2.1 MATÉRIEL VÉGÉTAL

Rosmarinus Officinalis et *Thymus Satureioides* ont été récoltées ; au moment de leur floraison (mois de mars et mai 2013 pour *R. Officinalis* et *T. Satureioides* respectivement) ; dans la commune rurale Mzyzle à 15Km de Rich au Haut Atlas oriental du Maroc. Ensuite, Ils ont été séchés à l'ombre pendant une dizaine de jours. L'identification botanique des espèces a été réalisée au laboratoire de Floristique de l'Institut Scientifique à Rabat.

2.2 ETUDE PHYTOCHIMIQUE

2.2.1 SCREENING PHYTOCHIMIQUE

La phytochimie qualitative, basée sur des réactions de coloration et de précipitation par des réactifs chimiques spécifiques, a été réalisée sur des extraits des deux espèces.

Les tests de caractérisation de différents groupes chimiques ont été effectués selon le protocole de DOHOU et *al* **[14]** ; JUDITH **[15**]; DIALLO **[16]** ; BEKRO **[17]** ; Bruneton **[18]** et N'Guessan et al **[19].**

Les extraits nécessaires ont été obtenus par extraction avec les solvants suivants : l'éther de pétrole, le méthanol, l'éthanol, le chloroforme et l'eau distillée.

Le criblage phytochimique s'est basé aussi sur l'utilisation de plusieurs réactifs. La recherche des alcaloïdes a été assurée par le réactif de Dragendorff. La caractérisation des tanins catéchiques s'est effectuée par l'alcool isoamylique et l'acide chlorhydrique et les tanins galliques par le réactif de Stiasny, l'acétate de sodium et le chlorure ferrique. Pour détecter les stérols et les triterpènes, nous avons employé l'anhydride acétique et l'acide sulfurique concentré. L'alcool chlorhydrique dilué, les copeaux de magnésium et l'alcool isoamylique ont été utilisés pour rechercher les flavonoïdes. Le chloroforme, l'ammoniaque diluée et l'acide chlorhydrique ont permis de rechercher les substances quinoniques.

2.2.2 PRÉPARATION DES EXTRAITS

L'extraction des polyphénols a été effectuée à froid par macération de 30g de la poudre végétale (feuilles et sommités fleuries) dans 200ml du méthanol en solution (80%) pendant 48heures. Les filtrats obtenus ont été soumis à une évaporation sous vide à 50 °C.

LE FRACTIONNEMENT

L'extraction des polyphénols a été réalisée selon la méthode de Bruneton **[20]** avec une légère modification**.** Elle est basée sur le degré de solubilité des poyphénols dans les solvants organiques. Le fractionnement de l'extrait hydrométhanolique brut a été mené en utilisant successivement trois solvants organiques de polarités différentes ; le chloroforme, l'acétate d'éthyle et le n-butanol. En plus de la fraction hydrométanolique (F_0), nous avons récupéré quatre fractions, la fraction chloroformique (F_1), la fraction d'acétate d'éthyle (F_2), la fraction butanolique (F_3) et la fraction aqueuse (F_4), les différents extraits ont été conservés jusqu'à leur utilisation. La Figure 1, résume les étapes de fractionnement de l'extrait brut.

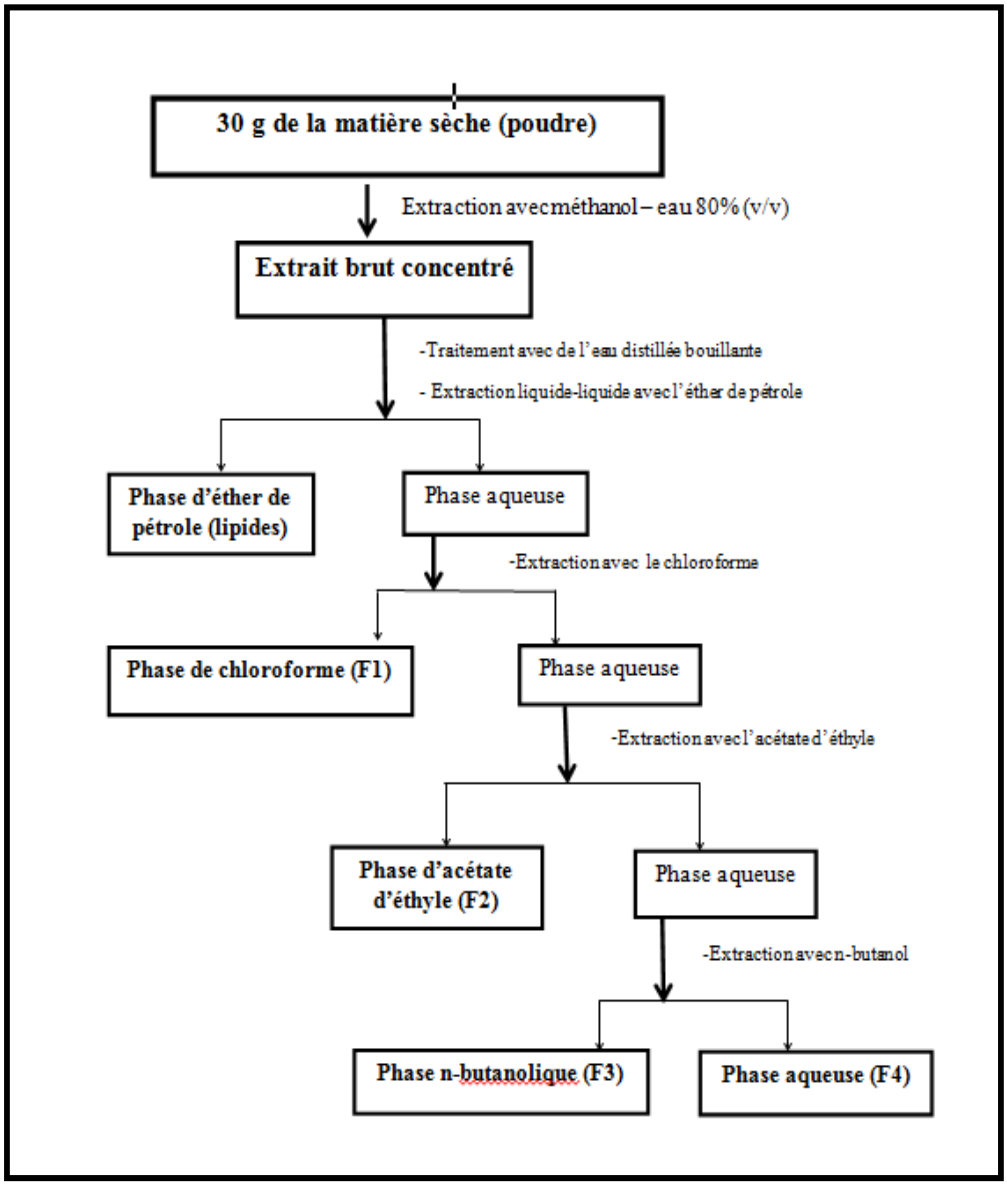

Figure 1 : les étapes de fractionnement des polyphénols

2.2.3 DOSAGE DES PHÉNOLS TOTAUX

La teneur en phénols totaux des extraits a été déterminée par la méthode de Folin–Ciocalteu **[21].**

Dans une fiole jaugée de 100ml, une quantité de 40 µl de chaque extrait est mélangée avec 1,5ml de réactif de Folin–Ciocalteu à 10% et 1,5ml d'une solution aqueuse de carbonate de sodium à 7,5% (m/v). Ensuite, la fiole est complétée avec de l'eau distillée puis laissé pendant 30 minutes à température ambiante, et la lecture est effectuée contre un blanc à l'aide d'un spectrophotomètre (UV mini-1240) à 765 nm. Une courbe d'étalonnage est réalisée en parallèle dans les mêmes conditions opératoires en utilisant l'acide gallique comme contrôle positif. Les résultats sont exprimés en milligramme équivalent d'acide gallique par gramme d'extrait (mg GAE/g)

2.3 EVALUATION DE L'ACTIVITÉ ANTIOXYDANTE

- **TEST AU DPPH**

PRINCIPE :

Le composé chimique 2,2- diphényl -1-picrylhydrazyle (DPPH) possède un électron non apparié sur un atome du pont d'azote. Du fait de cette délocalisation, les molécules du radical ne forment pas des dimères et restent dans leur forme monomère relativement stable à température ordinaire. La délocalisation provoque aussi la couleur bleue violette bien caractéristique de la solution de DPPH. La mesure de l'efficacité d'un antioxydant se fait en mesurant la diminution de la coloration bleue due à une recombinaison des radicaux DPPH, mesurable par spectrophotométrie à 515-518 nm **[22].** En présence des piégeurs de radicaux libres, le DPPH (2.2 diphényl- 1- picryl hydrazyle) de couleur violette se réduit en 2,2 diphényl -1- picryl hydrazine de couleur jaune (Maataoui et al ., 2006).

PROTOCOLE :

200µl de chaque solution éthanolique de la fraction d'acétate d'éthyle obtenue avec l'acétate d'éthyle F2 (F2 étant la fraction la plus riche en polyphénols, figures 2 et 3) à différentes concentrations (16 ; 32 ; 48 ; 64 ; 80 ; 96 ; 112 ; 128 ; 144 ; 160 ; 176 et192µg/ml) sont ajoutés à 2,8 ml de la solution éthanolique du DPPH (0,024g/l). Parallèlement, un contrôle négatif est préparé en mélangeant 200µl de l'éthanol avec 2,8 ml de la solution éthanolique de DPPH. La lecture de l'absorbance est faite contre un blanc à 515nm après 30 min d'incubation à l'obscurité à température ambiante. Le contrôle positif est représenté par une solution d'un antioxydant standard, l'acide ascorbique dont l'absorbance a été mesuré dans les mêmes conditions que les échantillons et pour chaque concentration. Le test est répété trois fois. Les résultats ont été exprimés en pourcentage de réduction de DPPH (PI%).

$$PI\% = [(Abs\ contrôle - Abs\ test)/Abs\ contrôle] \times 100$$

Les valeurs des concentrations pour inhiber ou réduire 50% de la concentration initiale du DPPH (CI50) ont été déterminées graphiquement par la régression linéaire.

Comme il n'existe pas de mesure absolue de la capacité antioxydante d'un composé, les résultats sont souvent portés par rapport à un antioxydant de référence, comme l'acide ascorbique.

3 RÉSULTATS ET DISCUSSIONS

3.1 CRIBLAGE PHYTOCHIMIQUE

Les résultats du criblage phytochimique pour les deux espèces sont résumés dans le tableau 1.

Tableau 1: Résultats du criblage phytochimique des extraits du Rosmarinus Officinalis et Thymus Saturioides

Groupe chimique	Résultats	
	R.Officinalis	*T.Saturioides*
Alcaloïdes	-	-
Flavonoïdes	++	++
Anthocyanes	-	-
Leucoanthocyanes	-	-
Catéchols	++	++
Tanins galliques	++	++
Tanins catéchiques	+	-
Saponosides	++ (IM=230)	++ (IM=142)
Stérols et triterpènes	++	++
Anthraquinones libres	++	+
Anthraquinones combinées	+	+
Composés réducteurs	-	-
Mucilages	++	-
Hétérosides cardiotoniques	+	+
Caroténoïdes	-	-
Oses et holosides	-	-
Tétrahydrocannabinols	-	-

(+) : présence ; (++) : abondance ; (-) : absence

Les résultats des tests de caractérisation phytochimique pour les deux espèces ont permis de mettre en évidence la présence des flavonoïdes, des tanins, des Stérols et triterpènes, des saponosides, des anthraquinones libres, Hétérosides cardiotoniques et des catéchols. Mais il a été observé l'absence des alcaloïdes, des composés réducteurs, Caroténoïdes, Oses et holosides, Tétrahydrocannabinols et des coumarines. D'un autre coté les mucilages ont été présents dans *Rosmarinus Officinalis* par contre ils ont été absents dans *Thymus Satureioides.*

La richesse du Rosmarinus et du Thymus en stérols explique leur effet diurétique. D'autre part, les anthracénosides ont un effet irritant et laxatif sur le gros intestin cela explique l'effet stomachique du Romarin.

3.2 RENDEMENTS DES EXTRAITS

Les rendements des extraits hydrométhanoliques bruts de *R. Officinalis* et de *T.Satureioides* sont respectivement de l'ordre de 13,6% et 11,66% (tableau 2).

Pour le fractionnement des extraits bruts de deux espèces, les résultats montrent que la fraction butanolique représente le rendement le plus élevé (5,84% ; 5,31%) suivi de la fraction aqueuse (2,25% ; 2,93%) puis la fraction d'acétate d'éthyle (1,24% ; 2,2%). Par contre, le rendement le plus faible est obtenu avec la fraction chloroformique (1,06% ; 1,1%) pour R. Officinalis et T.Satureioides respectivement.

Les rendements sont calculés par rapport à 1g de la matière sèche.

Tableau 2 : Rendements des extraits et des fractions de Rosmarinus Officinalis et Thymus Satureioides.

Espèce végétale	Rendements des extraits et des fractions (%)				
	Extrait brut	Fraction chloroformique	Fraction d'acétate d'éthyle	Fraction butanolique	Fraction aqueuse
R. Officinalis	13,6	1,06	1,24	5,84	2,25
T.Satureioides	11,66	1,1	2 ,2	5,31	2,93

3.3 TENEURS EN PHÉNOLS TOTAUX

La spectrophotométrie UV/Visible a permis de quantifier le taux des polyphénols présents dans les extraits préparés des deux plantes, les résultats sont représentés dans les figures 2 et 3.

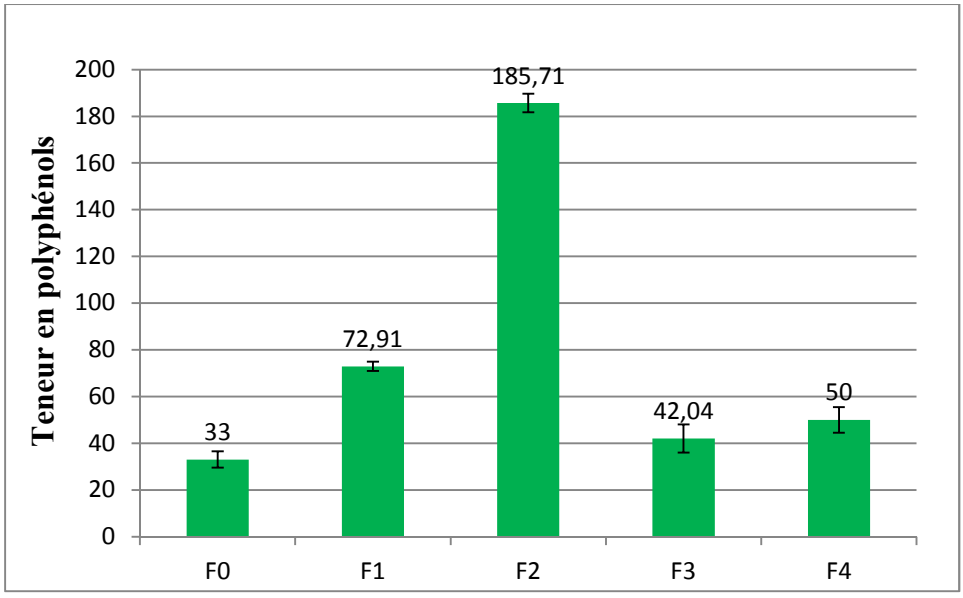

Figure 2 : Teneurs en polyphénols des fractions de Rosmarinus Officinalis exprimée en milligrammes d'équivalents d'acide gallique par gramme d'extrait (mg eqAG/g).

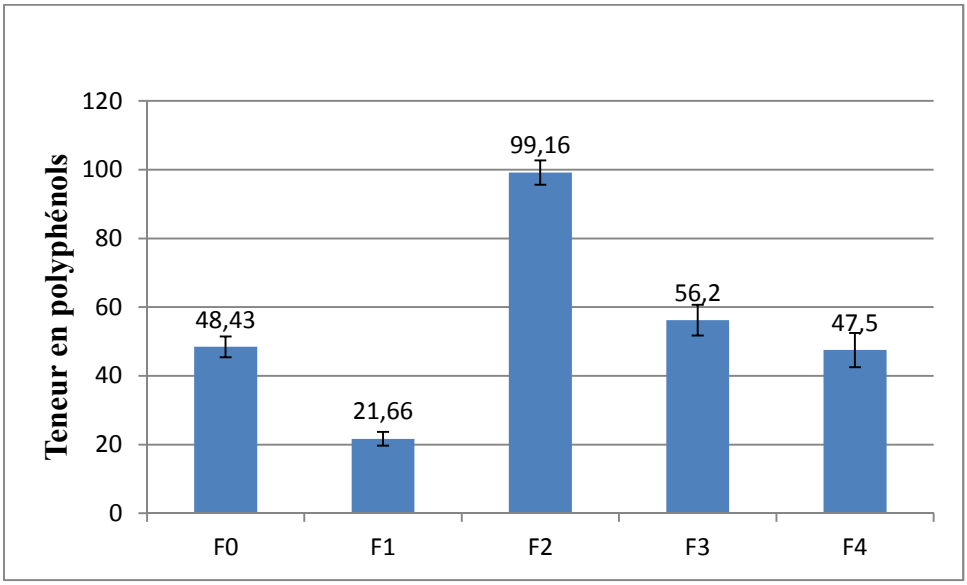

Figure 3 : Teneurs en polyphénols des fractions de Thymus Satureioides exprimée en milligrammes d'équivalents d'acide gallique par gramme d'extrait (mg eqAG/g).

Les résultats obtenus montrent que les deux plantes sont riches en polyphénols avec une teneur en phénols totaux pour toutes les fractions qui varie entre 21,66±2mg et 185,71±4mg d'équivalent d'acide gallique par gramme d'extrait.

Nous constatons aussi que les fractions d'acétate d'éthyle renferment des concentrations assez élevées en polyphénols par rapport aux autres fractions pour les deux espèces. Par ailleurs nous remarquons que la concentration des polyphénols dans la fraction d'acétate d'éthyle de *Rosmarinus Officinalis* (185,71±4 mgeqAG/g) est plus grande que celle de *Thymus Satureioides* (99,16±3,5 mgeqAG/g) (Figure 2 et Figure 3).

Nos résultats sont proches à ceux de **[23]** dont les concentrations en polyphénols pour l'extrait brut de *Rosmarinus Officinalis sont* entre 34.1 et 119 mgeqAG/g.

La distribution des métabolites secondaires peut changer pendant la croissance de la plante. Ceci peut être lié aux conditions climatiques (la température élevée, exposition solaire, sécheresse, salinité), qui stimulent la biosynthèse des métabolites secondaires tels que les polyphénols **[24], [25].**

La teneur phénolique d'une plante dépend aussi d'un certain nombre de facteurs tels que, les conditions climatiques, le moment de la récolte, le solvant d'extraction, les conditions de stockage **[26].**

3.4 ACTIVITÉ ANTIOXYDANTE

LES RESULTATS OBTENUS LORS DU TEST DE MESURE DE POURCENTAGE D'INHIBITION DU RADICAL DPPH SONT ENREGISTRES DANS LA FIGURE 5.

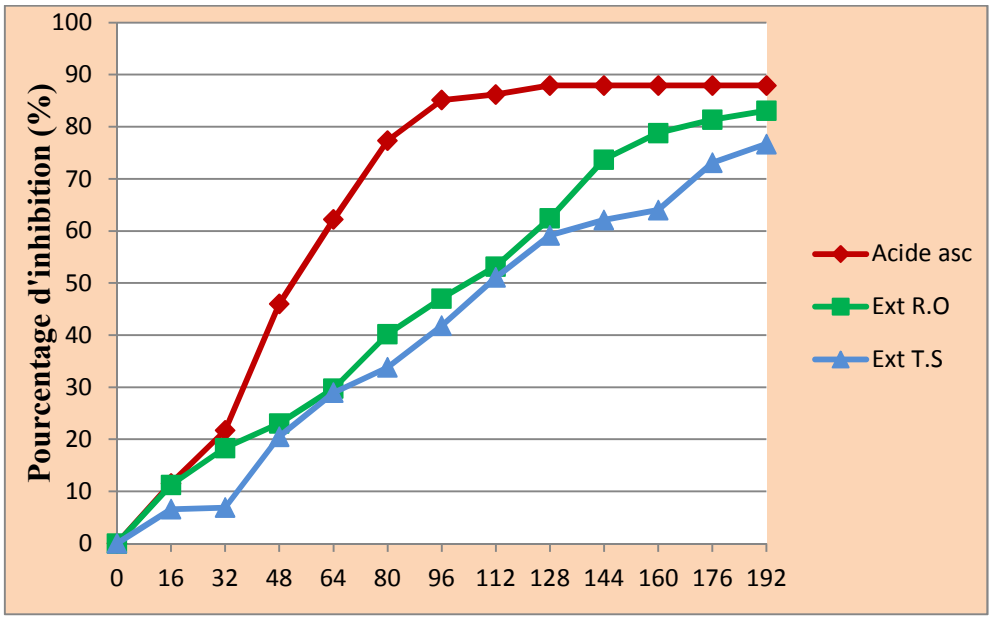

Figure 5 : Pourcentages d'inhibition du DPPH en fonction des concentrations des fractions d'acétate d'éthyle de Rosmarinus officinalis et Thymus Satureioides.

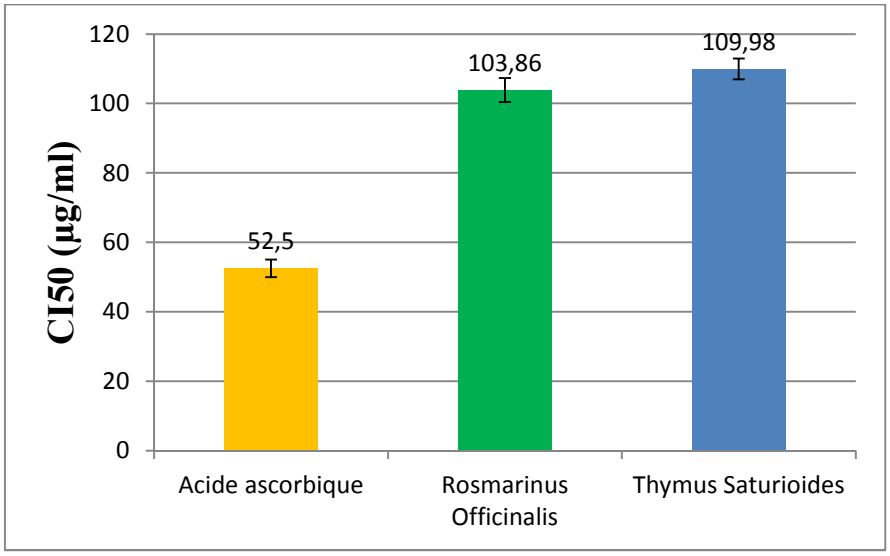

Figure 6 : Concentrations de réduction de 50% de DPPH.

Les résultats obtenus montrent que la fraction d'acétate d'éthyle de *Rosmarinus officinalis* et celle de *Thymus Satureioides* présentent des activités antioxydantes très importantes, avec des CI_{50} de 103,86±3,5µg/ml et 109,98±3µg/ml pour *Rosmarinus officinalis* et *Thymus Satureioides* respectivement. Ces activités sont inférieures à celle de l'acide ascorbique pris comme antioxydant de référence (CI_{50} =52,5±1,5µg/ml).

Une valeur faible d'CI50 indique une activité antioxydante forte.

Nous constatons aussi que l'extrait d'acétate d'éthyle de *Rosmarinus officinalis* a présenté une activité plus élevée que celle de *Thymus Satureioides.*

D'un autre côté, nous notons qu'il ya une corrélation entre la concentration des polyphénols et l'activité antioxydante, ce qui confirme que les polyphénols sont des antioxydants puissants capables d'inhiber la formation des radicaux libres et de s'opposer à l'oxydation des macromolécules. Ces résultats sont conformes à ceux de plusieurs auteurs qui ont rapporté une telle corrélation positive entre le contenu phénolique total et l'activité antioxydante **[27], [28], [29], [30].** En effet **[24]** a montré que l'activité antioxydante ne dépend pas seulement de la concentration des polyphénols, mais également de la nature et la structure des antioxydants dans l'extrait. Généralement, les polyphénols ayant un nombre élevé des groupements hydroxyles présentent une activité antioxydante très importante **[31], [32].**

4 CONCLUSION

Dans ce travail, nous avons essayé de quantifier les teneurs en polyphénols dans les deux espèces Rosmarinus officinalis et Thymus Satureioides. Nous avons constaté que les deux plantes sont riches en métabolites secondaires, en particulier en polyphénols avec des teneurs qui varient entre 21,6mg et 185,71mg d'équivalent d'acide gallique par gramme d'extrait pour toutes les fractions de ces deux plantes.

L'étude in vitro de l'activité antioxydante par la méthode de DPPH a montré que les fractions d'acétate d'éthyle des deux espèces ont une grande capacité de piéger le radical DPPH avec des concentrations inhibitrices responsables de 50% de l'activité antiradicalaire (CI50) de l'ordre de 103,86±3,5µg/ml et 109,98±3µg/ml pour Rosmarinus officinalis et Thymus Satureioides respectivement. D'autres recherches complémentaires sont en cours, nécessaires pour caractériser et identifier les molécules bioactives présentes dans toutes les fractions des deux plantes par l'analyse HPLC.

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Qualité du lait cru destiné à la fabrication d'un fromage à pâte molle type Camembert dans une laiterie de Constantine (Est algérien)

[Quality of raw milk for the manufacture of a Camembert -type soft cheese in a dairy of Constantine (eastern Algeria)]

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ABSTRACT: Thirty samples of raw milk intended for processing, were analyzed during the period of high lactation. The results of the physico-chemical characteristics similar standards, only the fat content is relatively low, with an average of 30,9 g/L.
Microbiological analysis included nine microbial groups: hygiene indicators among groups (total flora, psychrotrophic flora, heat-resistant flora and coliforms) and some potentially pathogenic groups (coagulase-positive *Staphylococci*, *Salmonella* and *Escherichia coli*). The enumeration of mesophilic aerobic total flora, psychrotrophic and heat resistant serves to underline the high contamination of the samples analyzed with respective averages of $28,8.10^6$CFU/mL $12,3.10^5$CFU/mL and $44,2.10^4$ CFU/mL.
Milk samples are also contaminated with total coliforms, faecal coliforms and faecal streptococci with respective average rates of $50,3.10^5$CFU/mL $36,7.10^4$CFU/mL and $55,4.10^5$CFU/mL. The *E.coli* germ is present in 64% of the analyzed milks. The presence of pathogens is largely attributed to *Staphylococci* averaging $37,5.10^2$CFU/mL, 80% of strains were coagulase positive. In contrast, all samples are free of *Salmonella*. In view of the Algerian standards, the hygienic quality of all samples analyzed milks, is bad.

KEYWORDS: Raw milk, Quality, Constantine, Hygiene, Contamination.

RESUME: Trente échantillons de lait cru de vache, destinés à la transformation, ont été analysés durant la période de forte lactation. Les résultats des caractéristiques physico-chimiques sont proches des normes, seul le taux butyreux est relativement faible, avec une moyenne de 30,9 g/L.
L'analyse microbiologique a porté sur neuf groupes microbiens : parmi les groupes indicateurs d'hygiène (flore totale, psychrotrophes, thermorésistants et coliformes) et certains groupes potentiellement pathogènes (staphylocoques à coagulase positive, salmonelles et *Escherichia coli*).
Le dénombrement de la flore mésophile aérobie totale, des psychrotrophes et des thermorésistants permet de souligner la forte contamination des échantillons analysés avec des moyennes respectives de $28,8.10^6$UFC/mL, $12,3.10^5$UFC/mL et $44,2.10^4$UFC/mL.
Les échantillons de laits sont également contaminés par les coliformes totaux, les coliformes fécaux et les streptocoques fécaux avec des taux moyens respectifs de $50,3.10^5$UFC/mL, $36,7.10^4$UFC/mL et $55,4.10^5$UFC/mL. Le germe *E.coli* est présent dans 64% des laits analysés. La présence de germes pathogènes est essentiellement attribuée aux staphylocoques avec une moyenne de $37,5.10^2$ UFC/mL, 80% des souches isolées sont coagulase positive. Par contre, tous les échantillons sont exempts de salmonelles. Au vu des normes algériennes, la qualité hygiénique de tous les échantillons des laits analysés, est mauvaise.

MOTS-CLEFS: Lait cru, Qualité, Constantine, Hygiène, Contamination.

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1 INTRODUCTION

L'Algérie est le premier consommateur de lait au Maghreb, avec près de 3 milliards de litres par an [1-2] soit une moyenne de (120L/hab/an). Cet aliment occupe une place prépondérante dans la ration alimentaire des algériens, puisqu'il apporte la plus grande part des protéines d'origine animale [3-4].

En outre, la production de lait a connu un accroissement notable durant la période (2000-2012) grâce aux actions du PNDAR (Plan National de Développement Agricole et Rural) dans le cadre du programme lait, mais les quantités produites restent toujours insuffisantes pour couvrir les besoins de la population [4].

L'intégration du lait local dans le circuit de la production au niveau des laiteries connait une évolution encourageante. Son utilisation comme matière première dans la fabrication de nombreux produits dérivés du lait tel que le fromage est tributaire de sa qualité (physique, chimique et hygiénique), souvent instable et douteuse. Ces conditions exigent un approvisionnement régulier et de qualité en adéquation avec l'activité de la laiterie et l'écoulement de ses produits [5].

Dans cette optique s'inscrit l'engagement de l'Algérie en matière de sécurité alimentaire qui se traduit par l'adoption des programmes de mise à niveau dans de nombreuses entreprises agroalimentaires dont la laiterie en question. Ces programmes sont en collaboration avec la commission Européenne, dans un objectif de certification iso 22000.

Un travail préliminaire, a porté sur une analyse des dangers liés à l'innocuité du Camembert [6]. De cette analyse, il ressort que l'origine des dangers serait microbiologique et la principale cause est le lait réceptionné par la laiterie.

Notre objectif est de confirmer l'identification des dangers microbiologiques, par une étude exhaustive du lait cru intégré à 100% dans le circuit de la fabrication du fromage. Cette étude permettra de déceler les défaillances en amont de la filière afin d'apporter des mesures correctives nécessaires à l'amélioration de la qualité des laits crus.

2 MATÉRIEL ET MÉTHODES

2.1 ECHANTILLONNAGE

Trente échantillons de lait cru de grand mélange ont été analysés. Trois prélèvements pour chaque échantillon sont réalisés dès réception de la quantité globale de la production soit à peu prés 5000L. Ils ont fait l'objet d'analyses physico-chimiques [7] et microbiologiques [8].

2.2 ANALYSES PHYSICO-CHIMIQUES

- *Détermination de la densité* :

La densité est mesurée à 20°C à l'aide d'un thermo- lactodensimètre.

- *Détermination de l'acidité titrable :*

L'acidité est déterminée par le dosage de l'acide lactique à l'aide de l'hydroxyde de sodium (NaOH) à N/9. La présence de phénolphtaléine, comme indicateur coloré, indique la limite de la neutralisation par changement de couleur (rose pale). Cette acidité est exprimée en degré Dornic (°D) où: 1°D représente 0,1 g d'acide lactique dans un litre de lait.

- *Détermination de la matière grasse par la méthode acido- butyrométrique :*

Le principe de cette méthode est basé sur la dissolution de la matière grasse à doser par l'acide sulfurique. Sous l'influence d'une force centrifuge et grâce à l'adjonction d'une faible quantité d'alcool isoamylique, la matière grasse se sépare en couche claire dont les graduations du butyromètre révèlent le taux exprimé en g/L.

2.3 ANALYSES MICROBIOLOGIQUES

Germes dénombrés : germes aérobies, germes thermorésistants, psychrotrophe, coliformes totaux et fécaux, *E.coli*, *Staphylococcus aureus*, salmonelles, streptocoques fécaux. Des dilutions (10^{-1} à 10^{-6}) ont été préparées pour chaque échantillon.

- *Flore mésophile aérobie totale* :

La boite de Pétri est inoculée avec 1mL de chaque dilution auquel est ajouté de la gélose nutritive. Après 72 heures d'incubation à 30°C, toutes les colonies sont dénombrées et les résultats exprimés en unités formant colonies par mL de lait (UFC/mL).

- *Flore psychrotrophe :*

On introduit 1 mL de chaque dilution dans une boite de Pétri, puis on verse environ 12mL de gélose nutritive fondue et refroidie à 46-47°C. On incube pendant 10 jours à une température située entre 5-7°C.

- *Flore thermorésistante :*

10mL de lait sont transférés dans un tube à essai stérile, ce dernier est plongé au ¾ dans un bain d'eau réglé à 63°C pendant 30 minutes, puis disposé dans un mélange d'eau et de glace afin de ramener la température du contenu à 10°C. L'inoculation s'effectue de la même technique que celle utilisée pour le dénombrement de la flore aérobie milieu de culture et paramètres d'incubation.

- *Coliformes totaux :*

Le milieu VRBG est ensemencé en profondeur par 1 mL de chaque dilution. Les boites sont incubées à 37°C pendant 24 à 48 heures.

- *Coliformes fécaux :*

On utilise le même milieu VRBG. Les boites sont incubées à 44°C pendant 24 à 48 heures.

- *Identification E.coli :*

Elle se fait par le test Mackenzie. A partir des tubes positifs du test présomptif (BLBVB), on inocule l'öse bouclée dans :

- ✓ Un tube d'eau peptonée tamponnée exempte d'indole.
- ✓ Un tube de bouillon lactosé bilié au vert brillant muni d'une cloche de DURHAM.

Les deux tubes sont placés aussitôt dans une étuve réglée à 44°C pendant 24 heures. Après 24 heures puis 48 heures, on recherche l'indole dans le premier tube qui est révélé par le réactif de KOVACS et on note l'existence ou l'absence de gaz dans le second.

- *Streptocoques fécaux :*

La recherche comporte deux tests.

- ✓ Test présomptif transférer 1ml des dilutions dans le milieu sélectif de Rothe à raison de trois tubes par dilution. L'incubation se fait à 37°C pendant 24 à 48heures. Sont considérés comme positifs les tubes présentant un trouble microbien.
- ✓ Test confirmatif Chaque tube de Rothe trouvé positif lors du test de présomption fera l'objet d'un repiquage à l'aide d'une öse bouclée dans un tube de milieu EVA Litsky. L'incubation se fait à 37°C, pendant 24 heures. Sont considérés comme positifs, les tubes présentant à la fois :
  - Un trouble microbien,
  - Une pastille blanchâtre ou violette au fond du tube.

La lecture finale s'effectue selon les prescriptions de la table de Mac Grady en tenant compte des tubes EVA positifs [8].

- *Recherche des salmonelles :*

Leur recherche comprend 3 étapes.

- ✓ Pré-enrichissement: il a été fait par une mise en suspension de 25 mL de l'échantillon dans 225 mL d'eau peptonée tamponnée. Ce bouillon est incubé à 37 °C pendant 16 à 20 heures.
- ✓ Enrichissement: Le milieu utilisé est le bouillon au sélénite de sodium. L'ensemencement se fait à partir des cultures pré-enrichies. Incubation à 37°C pendant 24 heures.

- ✓ Isolement: le milieu utilisé est la gélose SS. L'ensemencement du milieu est effectué par stries de la culture enrichie à la surface de la gélose. Incubation à 37°C pendant 24 heures. Sur ce milieu, les salmonelles et shigelles apparaissent incolores transparentes de petite taille.

La confirmation de la présence de *Salmonella* est nécessaire. Nous avons utilisé pour cela les galeries classiques d'identification, après avoir purifié et isoler les colonies suspectes sur milieu Mac Conkey [9,10].

- *Recherche de staphylocoques coagulase positive* :

C'est un germe halotolérant, qui peut se multiplier en présence de concentrations élevées de chlorure de sodium (en général jusqu'à 10%). En fonction de leur capacité à coaguler le plasma de lapin : on distingue ainsi des espèces à coagulase positive et des espèces à coagulase négative.

Le dénombrement a été effectué sur milieu Chapman par étalement en surface de 0,1 mL de chaque dilution. L'incubation se fait à 37°C pendant 24 à 48 heures. Les colonies d'aspect caractéristique, jaune doré sont comptées.

La recherche du caractère pathogène se fait par un examen microscopique (*cocci* Gram+ groupés en grappes), épreuve de la catalase (catalase +) et recherche de la coagulase staphylococcique, le plasma de lapin a été choisi pour son excellente spécificité [8] vis-à-vis de la coagulase staphylococcique et son aptitude à produire rapidement un coagulum après une revivification dans le milieu cœur cerveau.

3 RÉSULTATS ET DISCUSSION

3.1 ANALYSES PHYSICO-CHIMIQUES

Les résultats des analyses physico-chimiques des échantillons de laits sont illustrés dans le***Tableau 1***.

Tableau 1 : Caractéristiques physico-chimiques des laits analysés et normes du lait cru de vache

Paramètres	Minimum	Maximum	Moyenne	Ecart-type	Normes FIL-AFNOR
Acidité (°D)	16	20,5	17,8	1	16-18
Densité à 20°C	1,028	1,031	1,029	0,001	1,030-1,032 (lait de mélange)
MG (g/L)	28	34	30,9	1,2	34-36

***MG** : matière grasse*

- L'acidité des échantillons de laits crus est globalement acceptable avec une moyenne de 17,8±1°D, l'écart type montre une faible variabilité des résultats ; six échantillons soit, 20% ont une acidité dépassant 18°D avec une valeur maximale de 20,5°D. Ces acidités titrables dépassent la norme FIL-AFNOR de l'acidité du lait frais fixée entre 16-18°D, elles peuvent être naturelles dues au stade de lactation, à la teneur en caséine, en sels minéraux et en ions, ou bien développées dues aux conditions hygiéniques lors de la traite, de la flore microbienne totale et de son activité métabolique [7]. L'étude réalisée par Aggad [11] dans l'Ouest algérien, a donné lieu à des acidités titrables des laits crus de mélange du même ordre de grandeur. Ces similarités peuvent être liées au climat, au stade de lactation, à la saison (même période d'étude) et à la conduite d'élevage notamment l'alimentation et l'apport hydrique [12].
- La densité moyenne des laits mesurée à 20°C est de 1,029±0,001, les fluctuations autour de la moyenne sont très faibles avec un écart type de (0,001). On note que 21 échantillons soit, 70% ont une densité inférieure aux normes FIL-AFNOR (1,030-1,032) avec une valeur minimale de 1,028. En dehors de tout mouillage du lait, la densité d'un lait varie selon sa richesse en matière sèche, et est inversement proportionnelle au taux de matière grasse [7]. La moyenne de densité des laits crus de mélange retrouvé par Aggad [11] à l'Ouest algérien se rapproche sensiblement de notre résultat.
- La teneur en matière grasse varie entre 28 et 34g/L, avec une moyenne de 30,9±1,2g/L, les variations liées à ce taux sont relativement faibles. Elles restent cependant en dessous des normes FIL-AFNOR du lait, qui tolèrent des valeurs se situant entre 34 à 36 g/L. Seul un échantillon de lait présente un taux butyreux de 34 g/L. Ces résultats ont été obtenus lors de la mise à l'herbe période qui s'accompagne souvent d'une chute du taux butyreux jusqu'à 3g/L. Ils peuvent être aussi à

l'origine d'une traite incomplète des vaches ou à une alimentation déséquilibrée [13]. Nos résultats se rapprochent de ceux obtenus par Labioui [12] au Maroc et Sboui en Tunisie [14].

3.2 ANALYSES MICROBIOLOGIQUES

Les caractéristiques descriptives des flores dénombrées sont résumées dans le ***Tableau2***. La fréquence de distribution des flores étudiées est illustrée dans la ***Figure2***.

Tableau 2 : Caractéristiques descriptives des flores étudiées et normes du lait (UFC/mL)

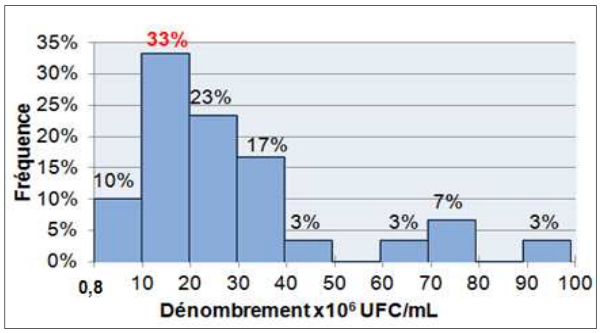
Flores (UFC/mL)	Minimum	Maximum	Moyenne	Ecart-type	Normes (UFC/mL)[1]
F.T.M.A (10^6)	0,8	98,0	28,8	22,8	10^5
F.ther. (10^4)	0,01	294,0	44,2	76,0	3.10^4
F.psy. (10^5)	1,6	33,0	12,3	10,3	/
Strept. f. (10^4)	1,3	250,0	55,4	74,2	Absence/0,1 ml
Staph. (10^2)	0	260,0	37,5	54,2	Absence
Col.t. (10^5)	4,0	360,0	50,3	66,0	/
Col.f. (10^4)	0	220,0	36,7	57,4	10^3
Salmonelles		Absence			Absence

***F.T.M.A** : Flore totale aérobie mésophile ; **F.ther**.: Flore thermorésistante ; **F.psy.** : Flore- psychrotrophe ; **Strept.f**.: Streptocoques fécaux ; **Staph.:** Staphylocoques ; **Col.t**.: Coliformes totaux ; **Col.f**.: Coliformes fécaux.*

Les germes dénombrés sont considérés comme des indicateurs de la qualité globale du lait et des pratiques de l'hygiène. Ceux-ci ont permis de constater des contaminations cumulées de la production jusqu'au stockage en cuve du lait cru.

- Flore totale :

La charge microbienne totale est importante pour les trente échantillons analysés avec une valeur moyenne de $28,8.10^6 \pm 22,8.10^6$ UFC/mL, cette valeur indique une très mauvaise qualité du lait cru au regard des normes requises qui sont de 10^5UFC/mL, elle est également très variable. On note une fréquence majoritaire de 33% pour des contaminations se situant entre 10.10^6 à 20.10^6 UFC/mL. L'origine des contaminations est le non respect des bonnes pratiques de production. L'étude menée par Ameur [15] confirme d'ailleurs la défaillance notoire en matière de nettoyage des tanks de réception au niveau des fermes de la région de Freha (Algérie). Le report des laits traits le soir mélangés avec les laits du lendemain matin et la multitude des transvasements, favorise également les altérations précoces du lait [16]. L'effet température étant écarté, la période de l'étude est relativement froide. Nos résultats sont en accord avec ceux rapportés par Labioui [12], Mennane [17], Srairi [18] au Maroc, Bonfoh [19] au Mali.



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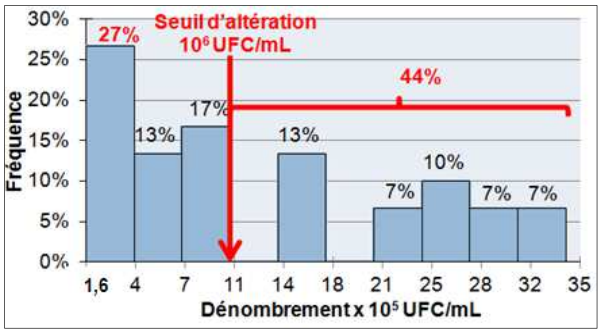

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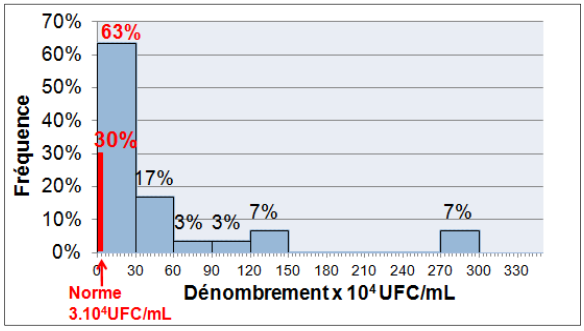

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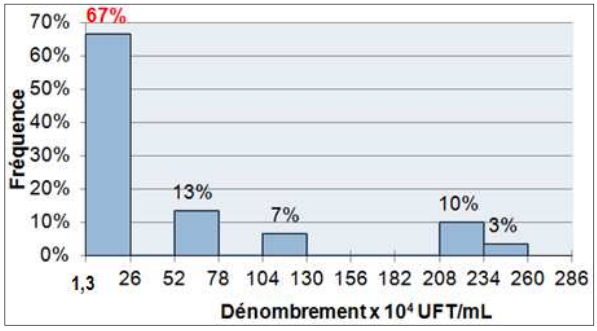
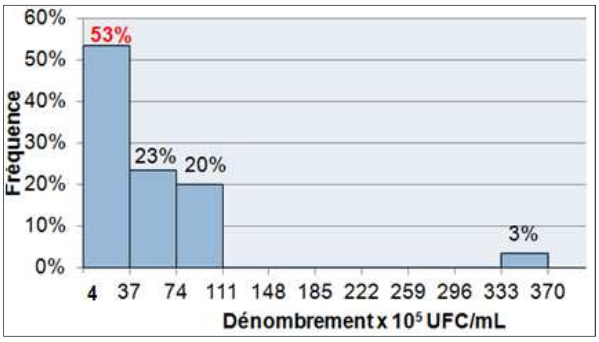


Strept.f



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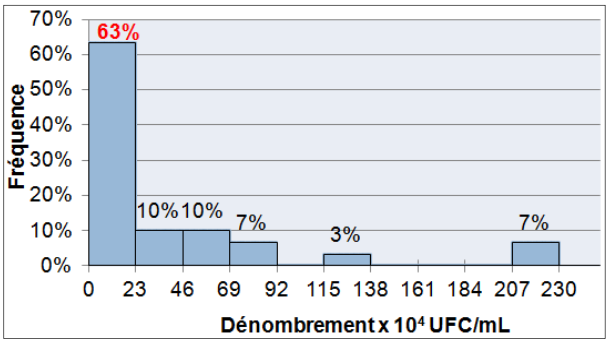

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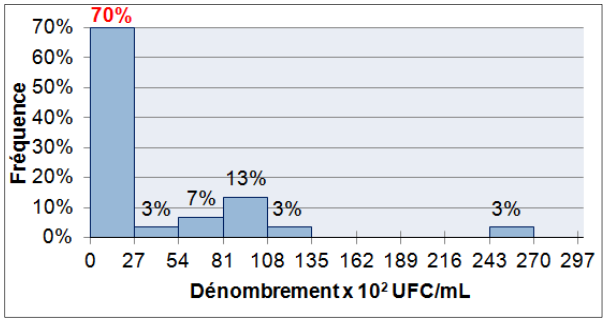

Staph.

Figure 1 : Fréquence de distribution des flores étudiées

- Flore Thermorésistante :

Le niveau de contamination en thermorésistants est en moyenne de $44{,}2.10^4 \pm 76.10^4$ UFC/mL, le seuil retenu pour l'évaluation de la qualité du lait cru est de 3.10^4 UFC/mL (norme lait pasteurisé), cette charge est importante et très variable. En effet, 70% des laits crus ont une charge en thermorésistants dépassant la norme et présentent donc un risque d'altération post-pasteurisation précoce. La flore thermorésistante contamine le lait à la ferme dans les installations et les appareils mal nettoyés et mal désinfectés. Le refroidissement trop lent du lait cru favorise également la sélection de la flore thermophile [20].

- Flore Psychrotrophe :

Les résultats montrent un niveau de contamination par cette flore en moyenne de $12{,}3.10^5 \pm 10{,}3.10^5$ UFC/mL. Ce dernier très élevé, dépasse même le seuil critique d'altération du lait cru estimé à 10^6 UFC/mL. L'évolution de cette flore au cours du stockage est favorisée par de basses températures [21]. La mise en évidence de cette flore est fréquemment significative d'une activité protéolytique et lipolytique. Les enzymes microbiennes sont thermorésistantes et dégradent les constituants du lait notamment les protéines ce qui abaisse le rendement fromager [22]. La croissance des levains lactiques, lors de la fabrication de fromages à pâte molle au lait pasteurisé est compromise par l'effet inhibiteur qu'exercent les acides gras libres (produits par la lipolyse induite par ces bactéries) sur la croissance des levains lactiques [23]. Nos résultats se rapprochent de ceux obtenus par Mankaï [24] en Tunisie.

- Coliformes totaux, fécaux, Streptocoques fécaux :

Leurs nombres est important dans les laits crus analysés, avec des moyennes respectives de $50{,}3.10^5 \pm 66.10^5$ UFC/mL, $36{,}7.10^4 \pm 57{,}4.10^4$UFC/mL et $55{,}4.10^4 \pm 74{,}2.10^4$UFC/mL, avec des fréquences de contamination de plus de 50% pour des charges bactérienne inférieures à 10^5UFC/mL. Ces niveaux de contamination dépassent largement les normes en vigueur qui sont de 10^3 UFC/mL pour les coliformes fécaux et absence dans 0,1mL de lait cru analysé pour les streptocoques fécaux. Leur présence est souvent associée aux contaminations d'origine fécale et leur importance témoignerait de conditions hygiéniques dégradées lors de la traite, peau des trayons mal nettoyés ou au cours du transport [25]. Nos résultats en coliformes totaux sont supérieurs à ceux rapportés par Ouazzani [26], toutefois ils sont inférieurs aux dénombrements retrouvés par Ouinine [27] au Maroc. Pour les coliformes fécaux, nos résultats sont supérieurs à ceux rapportés par Ghazi et Niar [28], dans la région de Tiaret en Algérie, ils se rapprochent des résultats obtenus par Afif [29] dans l'une des coopératives laitière à Tadla (Maroc), mais sont nettement inférieurs aux résultats rapportés par Ouinine [27]. Des charges en streptocoques fécaux dépassant les normes ont été également observées par Aggad [11], par Labioui [12] et par Affif [29] au Maroc dans des laits de mélange. Cependant, les dénombrements sont moins importants.

- *E.coli* :

La présence de ce germe est décelée dans 64% des échantillons, la contamination peut être d'origine fécale nettoyage avec une eau contaminée ou provenir d'une mammite à *E.coli* [30].

- *Staphylococcus aureus* :

Sur les trente échantillons analysés 84% d'entre eux contiennent des staphylocoques dont 95% sont à coagulase positive. La charge moyenne en ce germe est de $37{,}6.10^2 \pm 54{,}2.10^2$ UFC/mL, la fréquence de contamination est de 70% pour des charges inférieures à 27.10^2UFC/mL. La norme algérienne prévoie l'absence de ce germe dans le lait cru. La présence de staphylocoques dans le lait peut avoir deux origines principales, soit elle résulte d'une contamination primaire, due à la présence dans un troupeau de mammites à *Staphylococcus aureus*, soit c'est une contamination humaine. Ce germe provoque des intoxications alimentaires par ingestion des toxines qu'il secrète, ces dernières ne sont détruites ni par la pasteurisation du lait, ni au cours de l'affinage du fromage [25-27]. Nos résultats sont en accord avec ceux de Aggad [11], ils se rapprochent également des résultats obtenus par Affif [29] dans la région de Tadla au Maroc, mais restent largement inférieurs à ceux obtenus par Mennane[17] et Ouazzani [26] au Maroc.

- Salmonelles :

L'analyse microbiologique de ce groupe microbien pathogène n'a pas montré de contamination. En général l'isolement des salmonelles dans le lait cru est difficile à mettre en évidence [29].

4 CONCLUSION

La présente étude a montré que la qualité du lait cru destiné à la fabrication du fromage à pâte molle type Camembert est non satisfaisante, les laits sont fortement contaminés, révélant des pratiques d'hygiène douteuses, que même des conditions de réfrigération optimales ne peuvent, en aucun cas, masquer.

Les résultats des analyses physico-chimiques, sont généralement, compris dans des intervalles proches des normes internationales retenues pour le lait, seul, le taux butyreux est en moyenne, faible, il reste lié à la teneur en fourrages et à la nature des fibres des concentrés utilisés dans les rations pour vaches laitières.

Ces résultats confirment la nécessité d'un appui technique dans ce domaine, couplé à la révision du mode de paiement du lait. Ces démarches permettront de pérenniser et d'encourager la filière laitière en Algérie.

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Spatio-Temporal Factors and Dynamics of Population Growth in Ondo State Nigeria (1970-2010)

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ABSTRACT: Everyone is aware of space and place, of change over time and since everything exists in space and time, population is not an exception. This paper examines the influences of time on population growth and space. The study adopts both descriptive and quantitative statics and relied on secondary data source as a major means of data collection. The findings reveal that there is positive relationship between population growth and time and population density varies from area to area within the state. The practical implication of this study is that it provides an answer to whether population varies over time and space. Over the years Ondo state has witnessed increase in population. The implication of this increase in population in relation to space is overpopulation resulting to congestion in areas that are densely populated.

KEYWORDS: Population, Population density, Time, Space and Ondo States.

INTRODUCTION

Population is the totality of persons in a place or area. It is dynamic by nature i.e. it either increases or decreases over a period of time as the case may be and has become an important research issue. This is so because population in terms of structure and dynamics has implications for change and development in every society. Nigeria is going through a demographic transition (declining death rates and high birth rates). With a rapid annual population growth of **2.8%** the population explosion that has been experienced in the last two decades in Nigeria cannot be compared with what it used to be.

In geography, where spatial and temporal distribution of issues and phenomena are of interest, population increase with reference to time could be seen as a factor of spatial differences. Everyone is aware of space and place and of changes overtime and since everything exists in space and time, therefore population is not an exception. Recent research, however, has pointed out that it is not sufficient to take into account simply the growth in population, as demographic effects are significantly more complex. Over the past 20 years, Nigeria has seen a rapid an annual population growth of 2.8% vis-à-vis with population figures unevenly distributed across the nation (UNFPA 1996). This population explosion is dynamic and seems so intractable.

The rapid growth of Ondo state as a result of mass exodus of people and increase in birth rate after the colonial era has continued to attract the attention of individual and government. The state which was under western region before its creation in 1976 then has now blossomed into full-fledge state with eighteen local governments' area and one state capital. Hence the state has since growth both spatially and demographically and is characterized by continuous change in population structure and distribution.

Matching population growth with development is the real object of global and country action towards improved welfare and human development and economic growth. The puzzling phenomenal difference in levels of welfare and development among the populations of countries are largely explained by the divergence in the nature and magnitude of the dynamics of

populations (Ogujiuba, 2006). The changing patterns in the size, structure and distribution of population provide useful leads into the persistent shifts in the choice of approaches for managing development. Among the causal factors that indicate the pattern of population growth is the pattern of change in population density.

Population density plays a vital role in explaining the land mass occupied by group of persons. As population increases, so does population density. Louis Wirth, (1938) holds that as population density increases, stress on the human will also increase. Manifestations of this could be overstretched of social amenities compared to less dense areas. However, most planners argue that increased population density is good because "there are economies of density in the production of certain services. This study seeks to analyze the growth trends of population in Ondo State over a period of forty years (1970-2010) and characterize population densities in the study area, to determining the relevance of the characteristics on development. The study achieves its objectives using population growth and its densities to test for the following hypotheses:

(i) There is no significant relationship between population growth and time.

(ii) There are no significance differences amidst population densities from area to area.

THEORETICAL FRAMEWORK AND RELEVANT LITERATURE

THE SCOPE OF POPULATION DYNAMICS

In analyzing the dynamics of population growth, three aspect of population growth are important. These are the size of a population; its growth rate, and its distribution. The relationship between population size, its growth rate and distribution is the subject to which optimum population theory has been addressed (Samuelson, 1975). The question of whether a given population is larger is very difficult to answer in any concrete situation. Thus, a population may be in a stage of sharply diminishing returns, whereas after a generation a population of the same size might be of optimum or even sub-optimum size. Therefore the size of population depends upon the availability of other factors.

This brings us to the second factor that may be considered in analyzing the dynamism of population. The significant feature of population growth as such is that a higher rate of population growth implies a higher level of resources development. The relationship between population growth and resources has served as one of the principal underpinnings for the theory of stagnation that was popular in the 1930s (Galor, 2004). Here the point was made that economic stagnation is caused by inadequate level of new development, and that new development is sometimes deficient in part because of the slow growth of population

The third factor, in an analysis of dynamics of population growth, is the distribution of population in term of its age and sex, which turns out to be strongly influenced by the same elements that determine the rate of population growth. If one deals with a closed population (namely, one in which gains or losses by migration are negligible), the principal determinant of the distribution is the course of fertility. Persistent high levels of fertility give a broad -based distribution that tapers rapidly with age; persistent low levels of fertility give a narrow - based age distribution. If fertility is low enough, even irregularities such as gaps and humps in an age distribution are usually the result of variations in fertility.

The three demographic factors identified as basic in an analysis of the dynamism of population i.e. size, rate of population growth, and distribution effects are never independent. A continuation of a more rapid population growth inevitably produces, in a closed population, larger numbers. A slower rate of population growth brought by a reduction in birth rate inevitably has age - distribution effects.

DEMOGRAPHIC TRANSITION

It has long been realized that population growth varies over space. Therefore, Ondo State is not an exception. All demographic transition models emphasized the synchronization of respective mortality and fertility patterns. Placing mortality decline as a pre-condition for fertility decline formed the cornerstone of the theory. The experience of some African countries also shows that fertility can decline independently of the degree of socio-economic development (Kirk, 1996).

According to the theory of demographic transition (ECA 2001 and Cowgil 2002), the shift towards low mortality and fertility rates occurs when there is a process of overall modernization resulting from industrialization, urbanization, education, as well as substantial overall socio-economic development. Such a shift leads initially to a drop in mortality through progress in hygiene and medicine and, subsequently, to a decline in fertility occasioned by economic growth.

Although the theory has experienced a great deal of critical analysis, it remains a useful framework for discussing the dynamics of fertility and mortality changes and population changes in general. The theory is silent on the role of migration even though the experience of Europe has demonstrated that external migration provided a relief for internal population pressure. Europe, which experienced remarkable population growth in the nineteenth century, had the historic possibility of spilling over its surplus population through migration and transfer to the colonies. Currently, however, with so many restrictions on international migration, the opportunity of spilling over its surplus population to other regions through migration is not available to Africa.

Available data show that Nigeria has started the demographic transition. A major issue, however, is whether the decline in fertility is real or due to problems with the data. While some evidence suggests that there has been an underestimation of births, data on other proximate determinants of fertility appear to be inconclusive. Economic difficulties in maintaining large families as a result of the economic crisis is forcing people to change traditional beliefs in large family sizes and the traditional system of African extended family that had hitherto led to high fertility rates.

At the same time, the desire for child bearing is still strong in Nigeria particularly in the rural areas. This has given rise to the strong view that the levels of fertility and contraception use are not likely to change until there is a drop in desired family size and until the idea of reproductive choice is widely accepted. Rapid population growth has had many adverse effects on the economy. Nigeria has some of the fastest rates of urbanization in Africa mainly as a result of natural population increase and rural-urban migration. Poverty and unemployment have increased. An estimated 28.9 per cent of the population lived on less than $1 a day between 1981 and 1995 while the unemployment rate is estimated to have averaged 2.8 per cent in 1996 (World Bank, 1997). Excessive pressure on social services, rapid increase in imports of food and consumer goods and the emerging phenomenon of street children are some of the other impacts of rapid population growth in Nigeria.

POPULATION SITUATION IN NIGERIA

The rapid increase in Nigeria population is attributed mainly to fertility, mortality and migration. Recently there has been increase in birth rate while the mortality rate has reduced. The total fertility rate (TFR), the average number of children a woman is expected to bear during her lifetime was 7.2 in 1990. Survey shows that only 7.6% of Nigerians reported using any contraceptives, modern or traditional. Only 45.7% of married women of reproductive age reported ever knowing of contraceptive method. Currently 15% of married women use any type of contraceptives, while 7%use modern method. (Afolayan 1999)

Due to improved standard of living and public health the trend of events indicates that mortality is declining. This is particularly true of infant mortality. In 1960s the crude death rate CBR) was about 27 deaths per 1000 population, this has declined to about 14 deaths per 1000 at present. Infant mortality has dropped from 187 in the 1960s to about 65 deaths per 1000 live births by 2006. Life expectancy has increased from 37 years to 52 years within the same period. (NPC 2006) In terms of population density, there are about 136 people per square kilometer on the average while 36.3% live in urban area and the remaining 63.7% live in rural area.

Given the above conditions there is every indication that Nigeria has a high rate of population growth. The rate of growth of population increased from 2.5% in the period between 1965-1980 to 3.3% between the periods 1981 to 1988. At present the growth rate is about 2.8%. (National Population Commission)

The existence of towns of moderate size in Nigeria predates the coming of the colonialist into Nigeria. (Mabogunje 1968 and Adepoju 1983) Adepoju however assert that Nigeria has experienced centuries of urban experience but many factors (political, economic and ecological) have transformed the early growth pattern to contemporary urban development. Though the rate of urbanization is more in less developed countries, it is occurring at faster rate in Nigeria than anticipated (Fadamiro, Babadoye and Adelowo 2005). Generally urbanization in Nigeria can be classified historically into pre-colonial, colonial and post-colonial periods. Some towns existed before the tenth centuries such as Kano, Zaria, Ondo and Ile-Ife. They grew rapidly either as a result of their location along the major trade routes.

Some towns adjust themselves to the physical settings. It may be said that the settlement pattern of most parents' towns in Ondo is closely associated with relief features which provided suitable means of refuge during emergencies. Smailes (1965) describes the geographical context of towns in terms of location, site and situation. The site is a function of physical features that have favoured the sitting of towns. These features remain the basin and a dominant figure in the setting of towns in Ondo which is the basic origin of the growth of urban characteristics (Adedibu, Adindu and Ogbonna, 1998).

METHODOLOGY

The study adopts descriptive analysis and relied on secondary data source. Secondary data include population density of Ondo state, actual and projected population figure of Ondo state was used in order to appreciate the rate of population growth with time in the study area. This was gotten from publications and National Population Commission (NPC) Akure. Correlation analysis was employed to test the relationship between population growth, time and space. In addition, time series analysis was also employed in order to know the relationship between population and time.

RESULTS

RELATIONSHIP BETWEEN POPULATION GROWTH AND TIME

The population estimates used was the ones gotten from National Population Commission and Demographic and Vital Statistics Department Ministry of Economic Planning and Budget, Akure Ondo State. From the estimates on Table 1, the population of Ondo state which was 903,309 in 1970 increased to 987,199 in 1980. It further increased to 2,249.548 in 1991 as a result of consequent influx of people to the city. The population increased rapidly to 3,460,877 in 2006 and by year 2015, it is projected to reach about four million if the current growth rate of 3.0 per annum is maintained.

Table 1: Actual and Projected Population of Ondo State: 1970 -2015

	Male	Female	Total
1970 (projected)	**475,558**	**427,751**	**903,309**
1975 (projected)	**499,633**	**454,774**	**954,407**
1980 (projected)	**517,749**	**467,550**	**987,199**
1985 (projected)	**610,254**	**543,877**	**1,154,131**
1991 (census)	**1,121,898**	**1,127,650**	**2,249,548**
1995 (projected)	**1,132,953**	**1,332,887**	**2,465,840**
2000 (projected)	**1,527,812**	**1,310,405**	**2,838,217**
2005 (projected)	**1,660,563**	**1,572,218**	**3,232,781**
2006 (census)	**1,745,057**	**1,715,820**	**3,460,877**
2010 (projected)	**1,962,302**	**1,933,065**	**3,895,367**
2015 (projected)	**2,323,756**	**2,193,271**	**4,517,027**

Source: National Population Commission 2013

For further analysis of the above observation, time series analysis was created to analyze the trends of population growth in Ondo state over the period of forty years (1970-2010)

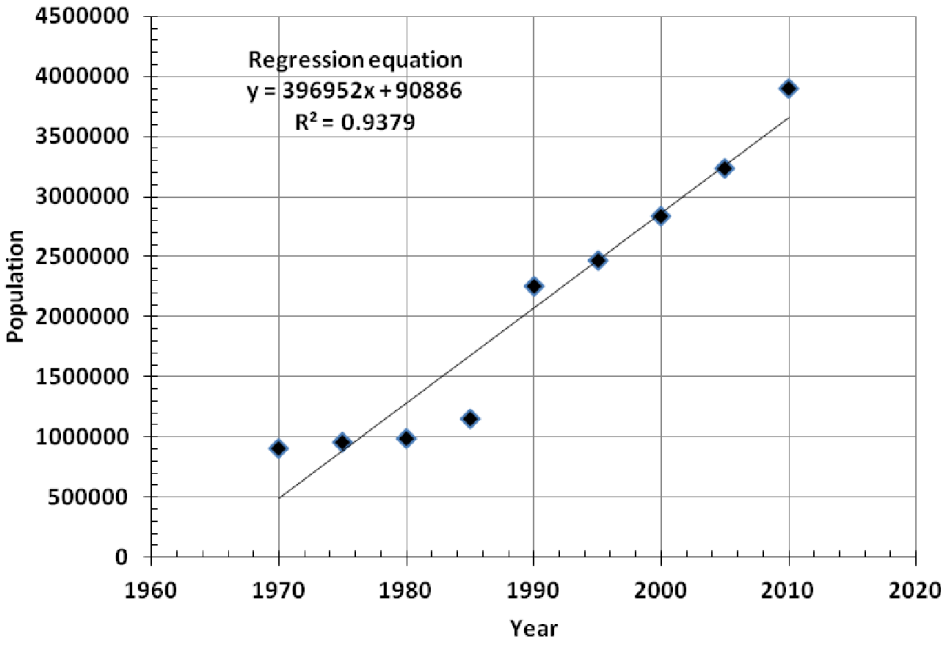

Figure 1: Scatter Diagram and the Best-Fit Regression Line for the Population of Ondo State with Year.

With reference to Figure 1, population has significantly increased with year. The prediction model (y = 396952x + 90886) explains about 94% of the relationship between population and time, and therefore reliable. Population increase was however slow between 1970 and 1985, it however became spontaneous from 1990, and has been rapid thereafter.

Hypothesis i:

In addition a null and alternate hypothesis (H_0 & H_1) was stated:

H_0: there is no significant relationship between population growth and time.

H_1: there is significant relationship between population growth and time.

Pearson correlation method of analysis was adopted to determine the type of relationship that exist between the two variables i.e. population growth and time. Time (Year) was used as a parameter to measure population growth. Time (Year) is the dependent variable while population growth is the independent

Table 2: Hypothesis Result

		year	pop
year	Pearson Correlation	1	.968**
	Sig. (2-tailed)		.000
	N	9	9
pop	Pearson Correlation	.968**	1
	Sig. (2-tailed)	.000	
	N	9	9

** Correlation is significant at the 0.01 level (2-tailed).

Sources: Author's compilation 2013.

A Pearson correlation value of 0.968 was obtained at an approximate significance level of 0.01. The Pearson correlation value of 0.968 signifies a direct relationship. A comparison of the significance level of 0.968 with the standard value in social science research (i.e. 0.050 suggests that this relationship is significant. From the foregoing, H_1 is accepted and H_0 rejected. Hence, there is significant relationship between population growth and time.

RELATIONSHIP BETWEEN POPULATION GROWTH AND SPACE

Table 3 shows Ondo state area and population density by local government based on 2006 population census. Between the year 1976 when the state was created and 2006, the state has witnessed a rise in population growth and this has also been reflected in the total land area of each local government and the population density. This may be attributed to the changes that took place in the socio-political life of the state.

Table 3 ONDO STATE AREA AND POPULATION DENSITY BY LOCAL GOVERNMENT AREA BASED ON 2006 POPULATION CENSUS

S/N	LOCAL GOVERNEMENT AREA	2006 POPULATION CENSUS			AREA (SQ KM)	% OF TOTAL AREA	POPULATION DENSITY PER SQ KM
		M	F	T			
1	AKOKO NORTH EAST	92456	86636	179092	398.8	5.17	449.08
2	AKOKO NORTH WEST	107076	104791	211867	489.6	6.42	432.74
3	AKOKO SOUTH EAST	42175	40268	82443	462.0	2.38	178.45
4	AKOKO SOUTH WEST	114733	113650	228383	340.1	6.68	671.52
5	AKURE NORTH	66526	64239	130765	676.7	3.73	193.44
6	AKURE SOUTH	178672	181596	360268	318.0	10.41	1132.92
7	ESE ODO	79812	78444	158256	1,406.8	4.57	112.49
8	IDANRE	67531	62264	129795	1,543.4	3.75	84.10
9	IFEDORE	89574	86798	176372	583.0	5.10	302.62
10	ILAJE	146859	142979	289838	708.3	8.37	409.31
11	ILE-OLUJI OKEIGBO	87104	84772	171876	824.1	4.97	208.06
12	IRELE	72861	71275	144136	939.6	4.16	153.40
13	ODIGBO	116299	115988	232287	1,710.0	6.71	135.80
14	OKITIPUPA	117594	116544	234138	650.0	6.77	360.21
15	ONDO EAST	38851	37241	76092	360.0	2.20	211.37
16	ONDO WEST	141759	147109	288868	950.8	8.35	303.82
17	OSE	73119	71020	144139	1,44.3.8	4.16	99.83
18	OWO	112056	110206	222262	993.8	6.42	223.65
	TOTAL	**1745057**	**1715820**	**3460877**	**14,798.8**	**100**	**233.86**

Source:-National Population Commission, 2006

As can be seen from the Table above, there is a kind of relationship between population figure of each local government, aerial size and population density. For example the total population of Akure South was 360,268 persons with land area coverage of 318Km^2 and population density of 1132.92 persons per square kilometer. This local government i.e Akure South has the highest population density probably because is the state capital. Some local government has land area that is more than Akure south but their population density is less than that of Akure South. Odigbo, Idanre, Ese-Odo and Ilaje local government area falls in this category.

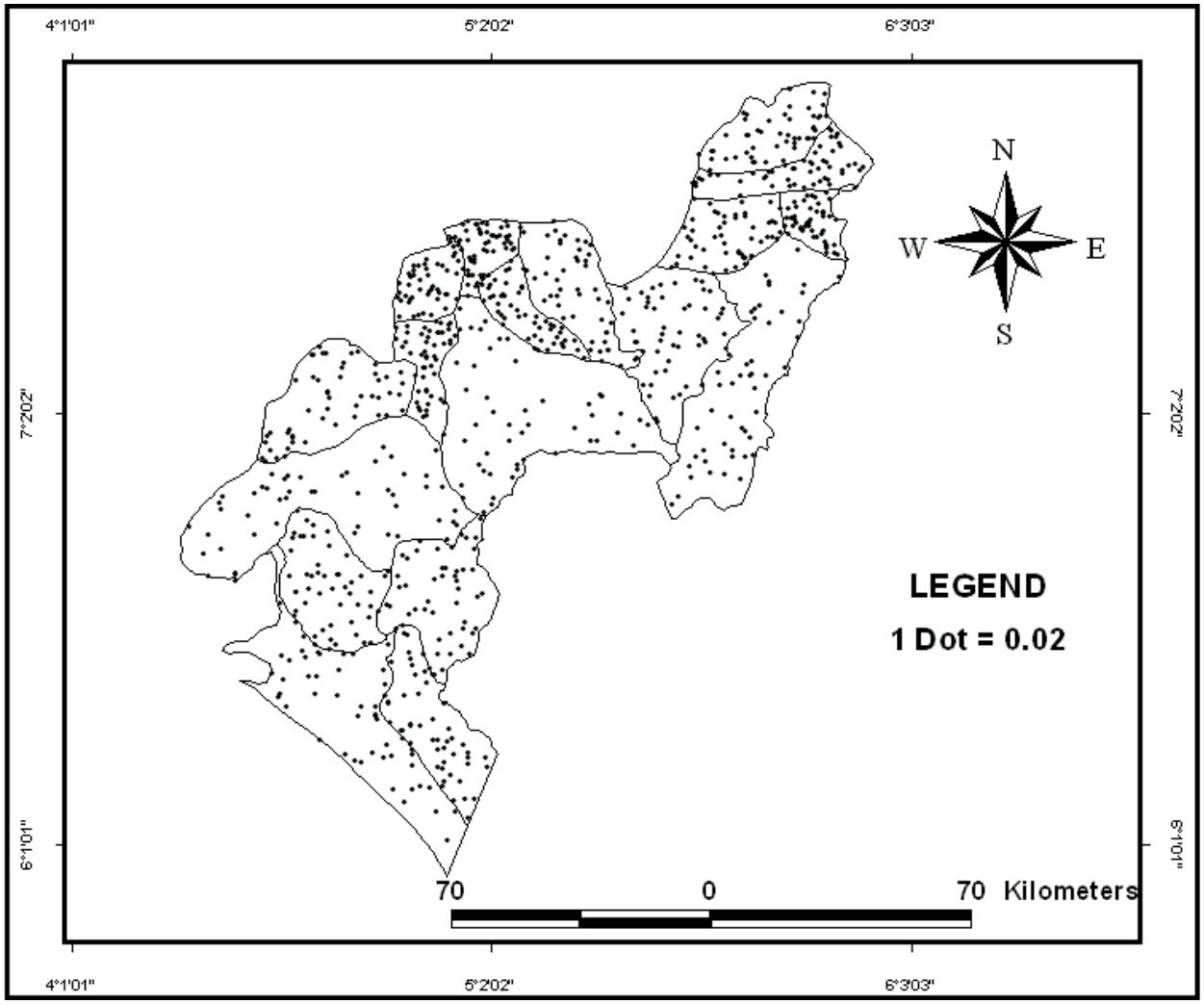

Figure 2: Dot map showing population densities of Ondo state.

Usually population densities tends to varies amidst the local government area as mentioned in the study Figure 2 some area are densely populated, some are moderately populated while other are sparsely populated. This could be as a result of environmental factors as the case of Idanre and Ose which are sparsely populated. Those that are densely populated could be as a result of economic and social advantage over others

Hypothesis ii

Furthermore, analysis of differences amidst population densities from area to area was carried out. A null and alternate hypothesis (H_0 & H_1) was stated thus:

H_0: there are no significance differences amidst population densities from area to area.

H_1: there are significance differences amidst population densities from area to area

T-test method of analysis was adopted to determine if there are differences amidst population density from area to area.

TABLE 4: HYPOTHESIS RESULT One-Sample Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Density	5.243	17	.000	314.60056	187.9917	441.2094

Source: Author's Compilation, 2013.

From table 4, T-test value of 5.243 was obtained at significance level of 0.000. (i.e. T =5.243, P =0.000) From the foregoing, H_1 is accepted and H_0 rejected. Hence there are significance differences amidst population densities from area to area

CONCLUSION

This study focused on the Spatio-temporal factors and dynamic of population growth in Ondo state. The study employed secondary data. The results of the research are revealing and point to the fact that Ondo state population has not only increase over the years, but has increased very rapidly which are attributed to both natural increase and rapid in-migration which is the characteristic of the state within the study period (1970-2010)

In addition the findings reveal that there is positive relationship between population growth and time and population density varies from area to area within the state. The practical implication of this study is that it provides an answer to whether population varies over time and space. Over the years Ondo state has witnessed increase in population. The implication of this increase in population in relation to space is overpopulation resulting to congestion (fig. 2) in areas that are densely populated.

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Performing Load Capacity Test for Web Applications

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ABSTRACT: The main objective of this research is to measure the performance of a web application in terms of the perceived user experience. The study was done to determine the number of users a web page can support before recording an error. Different scenarios were used to demonstrate how the web page would respond under normal load and under peak load. The virtual campus "Moodle" was used for this demonstration. Two computers, one working as a server hosting a XAMPP as a web server and Moodle as web platform and the other working as client with Apache JMeter tool that measured the capacity and capacity test were used. The load testing started with a small number of virtual users and then, the load was increased to normal peak. From this, it was possible to observe how the application performed during this gradually increasing load conditions. In this experiment when there were 125 concurrent connections, the system recorded some errors. At the end of the research, some of the conclusions arrived at on the possible ways of ensuring maximum operation of web applications, were to increase the number of sockets in the server so that, it would increase the number of requests/responses and to reconfigure the httpd. mpm file of the Apache web server to allow more concurrent users.

KEYWORDS: Load test, capacity test, web application, performance testing, Moodle.

1 INTRODUCTION

Web applications have become critical components of the global information infrastructure, and it is important that they be validated to ensure their reliability. Therefore, many techniques and tools for validating web applications have been created [1]. Web applications are among the fastest growing classes of software systems in use today. These applications are being used to support a wide range of important activities: business functions such as product sale and distribution, scientific activities such as information sharing and proposal review, and medical activities such as expert-system based diagnoses [2]. Given the importance of such applications, unreliable web applications can have far-ranging consequences on businesses, economies, scientific progress, and health. It is important that web applications be reliable and to achieve this there is the need for constant load and capacity testing as a way of validating its performance [1]. Internet connectivity is growing massively and most enterprises are migrating to the use of web based services for services provision [3]. As enterprises take on the Internet as a new business tool whether to sell, to collaborate or to communicate – web applications have become the obvious source of security target of any organization [4]. Technological innovations are fundamentally changing the way people live, work, play, study, share information and communicate with each other [4]. This is seen to be sharpening organizations competitive edge as it provides customers, rapid access to information. Website performance has a direct relationship to business goals therefore, if a business is in the business of making money and have a website related to other businesses, it must at least consider doing some web load testing in order to stand the competition from competitors [5].

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In practice, there are different forms of testing that can be performed to determine how websites perform. Some of these tests are performance, load, stress, and endurance/duration testing. While the differences may seem subtle when it comes to testing web applications, the time, effort, and goodwill lost when a manager and tester use these terms to mean different things must be appreciated [5].

2 RELATED WORK

Web load testing is how one determines how much traffic a website or web application can accommodate without "breaking" or causing your customers to blog about how painfully slow it is [5].

Website load testing may also refer to subjecting a web server to a ramping number of simulated users. The resulting analysis can measure a server's existing capacity and is an integral part of improving the performance of any web-based application [4].

[6] explained load testing as the process of putting demand on a web application to measure its response. Load testing may also refer to the practice of modeling the expected usage of a software program by simulating multiple users accessing the program concurrently. As such, this testing is most relevant for multi-user systems; often one built using a client/server model, such as web servers.

[7] posited that performance testing is a type of testing intended to determine the responsiveness, throughput, reliability, and/or scalability of a system under a given workload. Performance testing is commonly conducted to accomplish one or all of the following: Assess production readiness, evaluate against performance criteria, compare performance characteristics of multiple systems or system configurations, find the source of performance problems, support system tuning and find throughput levels.

[6] further explained that performance testing is the process of identifying how an application responds to a specified set of conditions and input. The main goal of performance testing is to identify how well your application performs in relation to your performance objectives some of which are:

- Identify bottlenecks and their causes.
- Optimize and tune the platform configuration (both the hardware and software) for maximum performance.
- Verify the reliability of your application under stress.

Performance testing helps you identify response time, throughput, maximum concurrent users supported, resource utilization in terms of the amount of CPU, RAM, network I/O, and disk I/O resources your application consumes during the test, behaviour under various workload patterns including normal load conditions, excessive load conditions, and conditions in between an application breaking point [6].

According to [7];

- Response time is a measure of how responsive an application or subsystem is to a client request.
- Throughput is the number of units of work that can be handled per unit of time; for instance, requests per second, calls per day, hits per second, reports per year, etc.
- Resource utilization is the cost of the project in terms of system resources. The primary resources are processor, memory, disk I/O and network I/O.

Capacity testing is a test to determine a server's ultimate failure point. A capacity test is conducted to identify future growth such as an increased user base or increase of data on web applications. For example, to accommodate future loads you need to know how many additional resources such as CPU, RAM, disk space and or network bandwidth are necessary to support future usage levels. Capacity testing also helps in identifying a scaling strategy to determine whether one should scale up or scale out and can be useful in determining how many users and/or transactions a given system will support and still meet performance goals [6].

3 METHODOLOGY

The main objective of this study is to measure a web application performance in terms of the perceived user experience. There are many reasons for load-testing a Web application. The most basic type of load testing is used to determine the Web application's behaviour under both normal and anticipated peak load conditions. This test was conducted using two PC's with a UTP Cat 5e LAN cable connecting them. One performed the function of a web server and the other worked on the client side doing the performance test of the web server technology. The server hosted a web-platform and the client computer

had the tool to perform the load test and the capacity test. Whiles the server-computer had XAMPP as a web server and Moodle as web platform to stimulate a real web page, the client computer had Apache JMeter tool that measured the capacity and load test. Microsoft Excel was also used to realize the graphs shown as part of this work. For the load testing, it started with a small number of virtual users and then, the load was increased to normal peak. From this, it was possible to observe how the application performed during this gradually increasing load conditions. Eventually, it crossed a threshold limit for the performance objectives. The various processes (scenarios) involved in the load testing are explained below:

3.1 PREPARING THE SCENARIO

A customer's visit to a Web site would comprise series of related requests known as a user session. User sessions can be explained as a sequence of actions in a navigational page flow, undertaken by a customer visiting a website. The process of identifying one or more composite application usage profiles for use in performance testing is known as workload modeling. The "virtual campus" (moodle) has been selected for this experiment with which the next model had been defined:

- The user access to the moodle page: Here a webpage is shown with the option to enter the username and password.

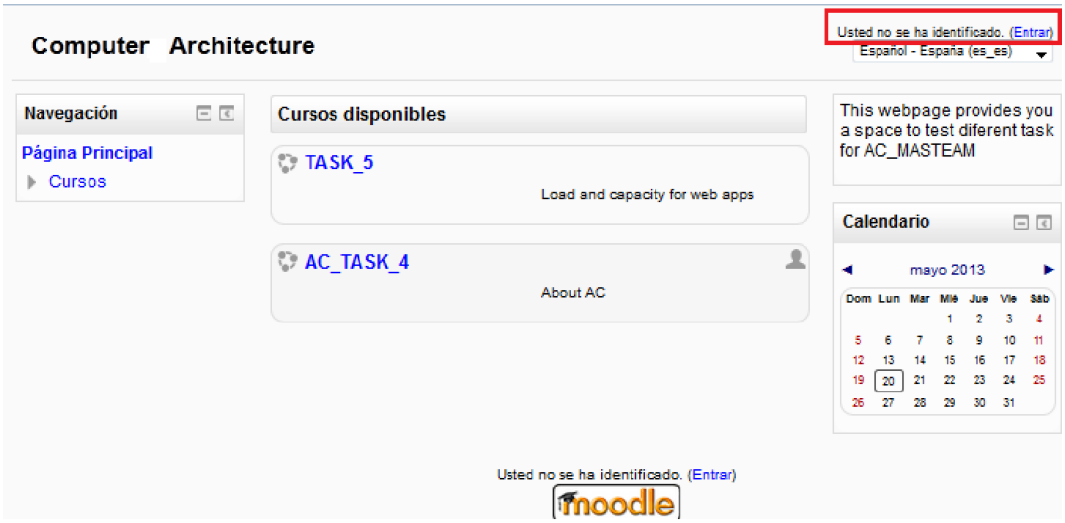

Figure 1: User modelling accesss

- The user enters his/her username and password and logs into the platform.

Figure 2: User modelling authentification

- The user select between two possible courses, “AC_task4” or “Task5”

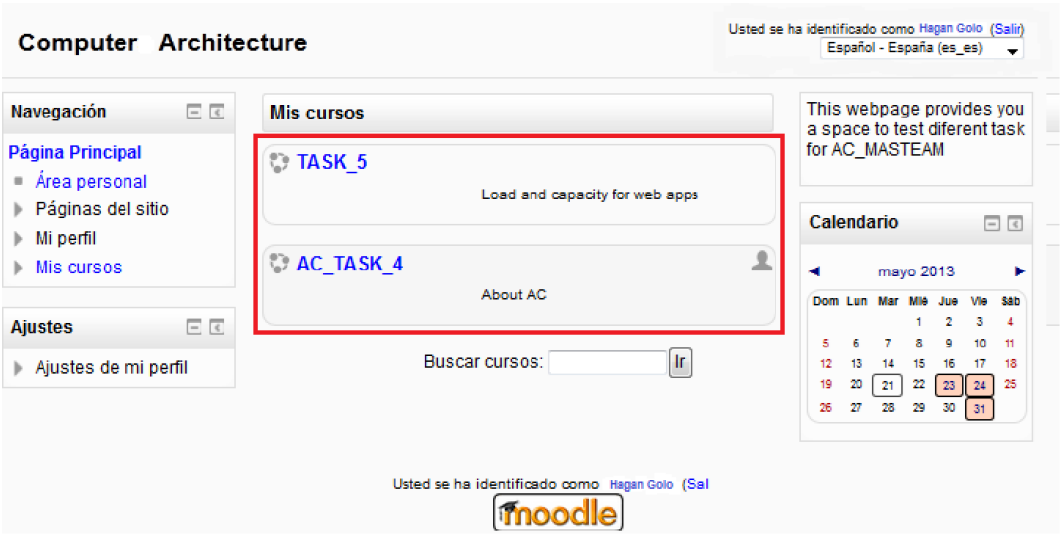

Figure 3: User modelling course selection

- The user checks his/her grades for the last two controls (tests) by clicking on the corresponding link.

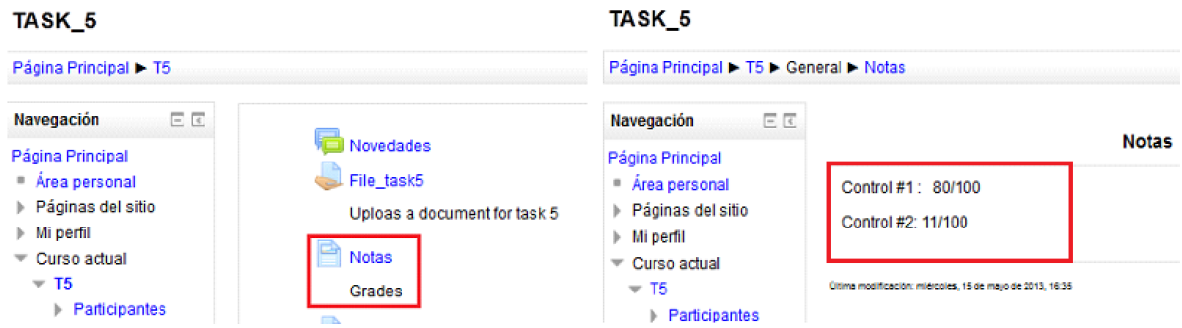

Figure 4: User modelling score check

- A user returns back to the main page of the course where a link can be accessed to upload a file for the task (activity).

Figure 5: User modelling of a file uploaded

- The user uploads a new file or overwrites an existing upload and the confirmation of this process is shown.

Figure 6: Confirmation of the upload

- Finally, the user logs out of the session.

3.1.1 TEST SCENARIO

In order to do the tests, particular applications were required. On the server side, a web server which hosted a web-platform, and on the client side, the tools to realize the load test and the capacity test.

3.1.2 HARDWARE

To perform this test two PC's were used, one doing the function of web server and the other one working at the client side and doing the performance test of the web server technology. The equipment selected for the test is the following:

Table 1. Computers Specification

Server	Client
○ ***Model:*** Samsung ○ **OS:** Windows 7 ○ ***CPU:*** Intel Core i5 @ 2.50 Ghz x 4 ○ ***RAM:*** 5.7 Gb ○ ***HD:*** 500 Gb ○ ***Wired interface (LAN):*** 1 Gbps (Gigabit Ethernet). ○ ***Cable:*** UTP Cat 5e. ○ ***Protocol used:*** HTTP 1.1(keep-alive connections)	○ ***Model:*** Dell ○ ***OS:*** Windows 7 ○ ***CPU:*** Intel Core i3 M370 @ 2.40 Ghz x 4 ○ **RAM:** 3.8 Gb ○ **HD:** 283 Gb ○ ***Wired interface (LAN):*** 100 Mbps (Fast Ethernet) ○ ***Cable:*** UTP Cat 5e. ○ ***Protocol used:*** HTTP 1.1(keep-alive connections)

3.1.3 SOFTWARE

On the server-side, *XAMPP* has been used as web server and *Moodle* as web platform to simulate a real web page and on the client-side, *JMeter* tool was used to realize the capacity test and the load test.

3.1.4 MOODLE

Moodle is an open-source web platform to create online learning sites. To install Moodle, first it is necessary to download the setup from https://moodle.org/ and place it in a public directory of the web server.

Once it is decompressed, the installation has easy configurations to do:

- Folder to place Moodle files.
- Definition of admin user.
- Connection between Moodle and database

After the installation, the user configuration, modules and classes in the environment all oriented to getting different web pages to be tested from the client side was set.

3.2 APACHE JMETER™

The Apache JMeter™ desktop application is an open source software, a 100% pure Java application designed to load test functional behaviour and measure performance under heavy concurrent load. Apache JMeter may be used to test performance both on static and dynamic resources (files, Servlets, Perl scripts, Java Objects, Data Bases and Queries, FTP Servers and more).

To make the first and second test, thus static page and SSL static page, it was enough to use only a thread group with the HTTP request configuration and the report with the results. To make the “Database test” and “Upload a File test” it was necessary to load cookies and use a proxy to create a test plan. These two extra tools are briefly explained below.

3.2.1 SETTING A PROXY SERVER

To create a test plan and conduct the test of uploading a file a proxy that records the requests sent to the server was used. A guide with the steps taken can be found in the URL below:

http://jmeter.apache.org/usermanual/jmeter_proxy_step_by_step.pdf

A screenshot with the basic configuration used is shown below.

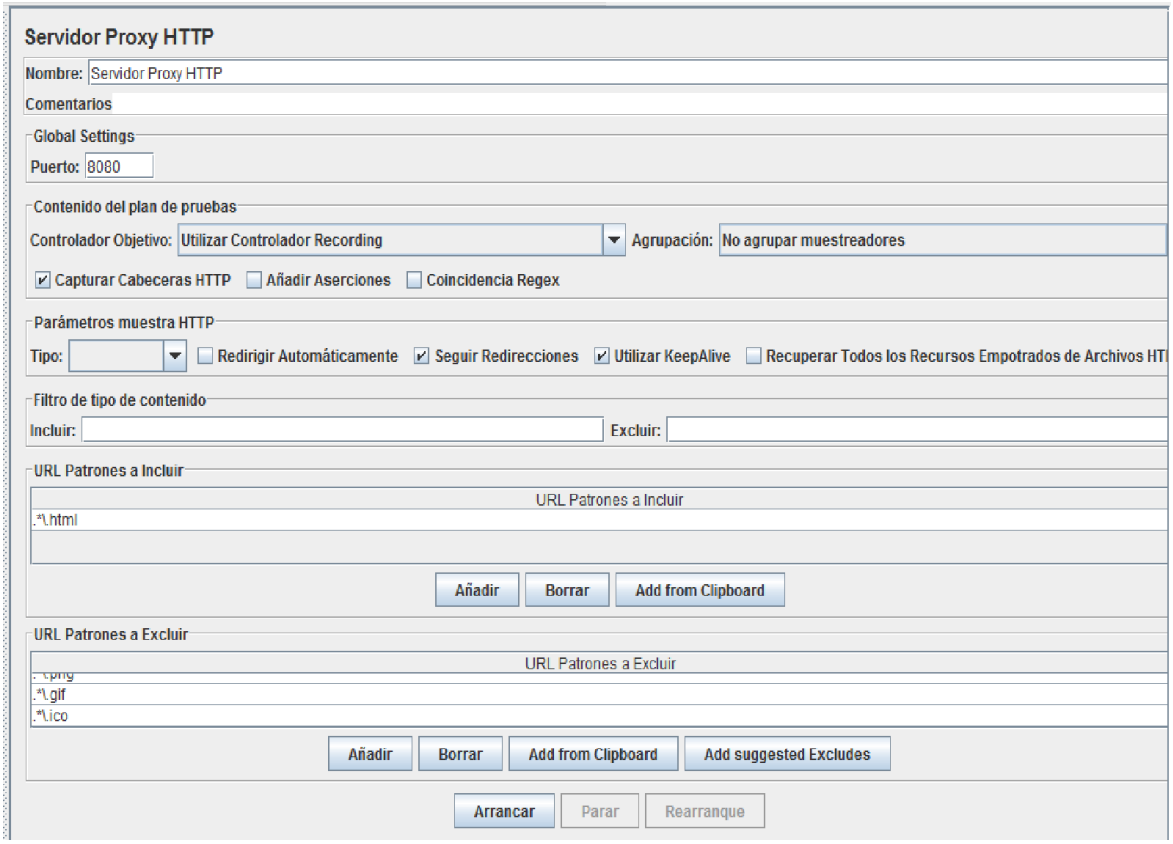

Figure 7: Proxy configuration in JMeter

3.2.2 TIMER CONFIGURATION IN JMETER

The more accurately users are modeled, the more reliable performance test results would be. One frequent aspect of accurate user modeling is the modeling of user delays. This part explains how to configure user delay using a JMeter tool. To use timer in JMeter, it was necessary to include in the workbench of JMeter a random uniform timer and introduce a value for the timer.

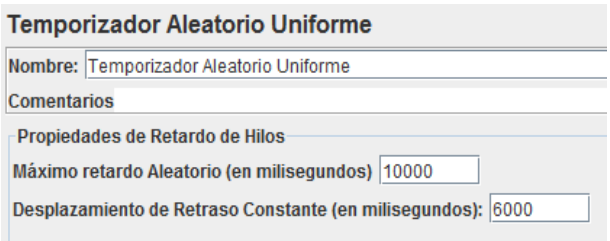

Figure 8. Jmeter timer configuration

This timer pauses each thread request for a random amount of time, with each time interval having the same probability of occurring. The total delay is the sum of the random value and the offset value.

The values used were:

- Random delay maximum: 10000ms
- Constant delay offset : 6000ms

3.3 TESTS AND RESULTS

LOAD TEST

The user model was defined and configuration of the records of the session in the way that this session had the most important elements of the user experience.

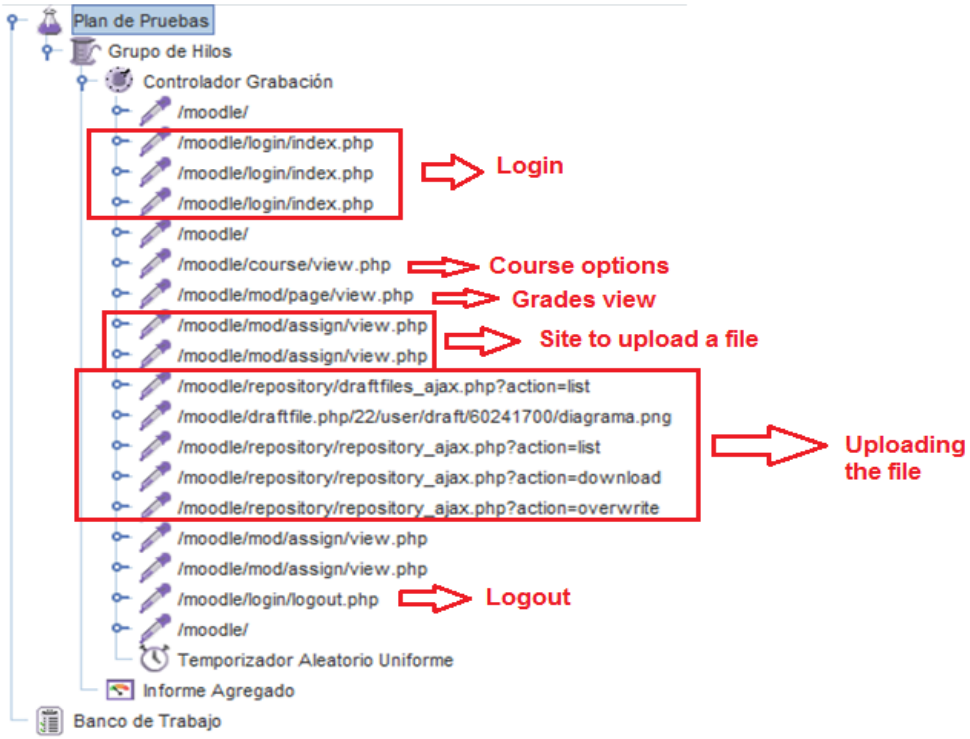

Figure 9: User modelling implied URL's

The load test was developed using a load of 20 simultaneous (and delayed) requests.

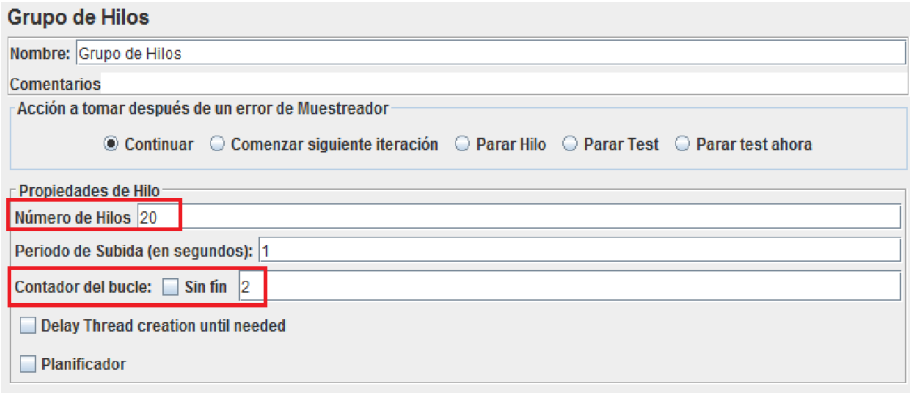

Figure 7: Configuration of Jmeter users

Once the elements were defined for the user session, the number of concurrent users and the loop counter was configured, the configurations were made followed by the experiment using the button play or run. The most important thing about the load testing was to verify that the application, system or service conforms to service level agreement (SLA).

For this experiment, the defined response time and percentage of error as a requirements of the SLA was set. These parameters are based on subjective perceptions depending on the type of web page that was requested. The targeted limits for the test will be:

- Response time per page: 3 seconds
- Percentage of error: 1%

3.3.1 LOAD TEST

The results realised in the case for 20 concurrent connections are in the table 2 below. The following values correspond to the average value for the elements involved in all the user session. The results showed that the system is almost capable of handling 20 simultaneous requests. The response time obtained was around 3 seconds and the percentage (%) of error was 0.

Table 2: Results Load Test

Concurrency	Response time (ms)	Throughput (Requests/s)	Throughput (Kb/s)	% Error
20	3086	1.5	161.4	0%

To be more specific, an analysis of each web page request in the user session was performed. The table 3 below shows the results obtained from this experiment.

Table 3. Individual results of load test

Elements	Response time (ms)	Throughput (Requests/min)	Throughput (Kb/s)	% Error
moddle/	2062	14.5	35.5	0%
…/login/index.php	3323	25.1	59.2	0%
…/course/view.php	3047	9.1	21.4	0%
…/page/view.php	3071	8.9	20.9	0%
…/assign/view.php	3142	25.3	59.4	0%
…/draftfiles_ajax	1410	9.0	0.1	0%
…/user/draftfiles	2812	8.9	20.9	0%
…/repository_ajax	1428	9.0	0.1	0%
…/repository_ajax	1430	8.9	0.1	0%
…/repository_ajax	1480	9.0	0.1	0%
…/login/logout.php	3097	8.5	21.0	0%

From the analysis, it can be seen that the login page does not comply with the predefined parameter. The login web page took 3.323 seconds to load, a value which exceeded the 3 seconds defined in the SLA. Again, the web page where the grades of the controls (tests) can be seen took 3.142 seconds also exceeding the pre-established value. Other web pages, like the page where one can select between the courses or log-out from the moodle also exceeded with (71 and 97 milliseconds respectively) to the pre-established value. However other web pages, in this case and according to the results gotten, took less than 3 seconds to load like the case of the page where files can be uploaded. This page took just 1.4 seconds a value that complies with the established SLA. In terms of error percentage the web pages complied with the maximum value permitted of 1%, because none of them exceeded this value, all of them have been served with a 0% of error by the server.

3.3.2 SERVER SIDE RESULTS

The results for the load test with 20 concurrent users in terms of CPU consumption, RAM consumption and Network I/O transactions are shown below in table 4.

Table 4. Server side results

Test	Concurrent users	Time (seconds)	CPU (%)	RAM(MB)	Network	
					I (Mb)	O (Kb)
Load	20	8 min 30 s	47.66	154.5	23.5	41.1

The result shows that, the CPU usage is only 47.66%, which means the system could support more concurrent users trying to connect to the platform.

3.3.3 CAPACITY TEST

Capacity test is performed to determine how many users and/or transactions a given system will support and still meet performance goals. This test compared the results of the load test for 20 concurrent users and it was repeated with 25, 30, 35 and 45 concurrent users. For these values there was no errors, just an increment in time of response. There was also no errors with 100 concurrent connections, however with 125 concurrent users, there was an error. The results from the capacity test is shown below in table 5.

Table 5: Results Capacity Test

Concurrency	Response time (ms)	Throughput (Requests/s)	Throughput (Kb/s)
20	3086	1.5	161.4
25	8542	1.5	168.0
30	14115	1.6	174.9
35	15955	1.7	183.7
45	25582	1.7	190.4
125	27056	4.6	504.8

It can be seen that, the capacity tests exceeded the target set in the SLA. The response time for all the request exceeded 3 seconds. This is represented graphically in figure 8 below.

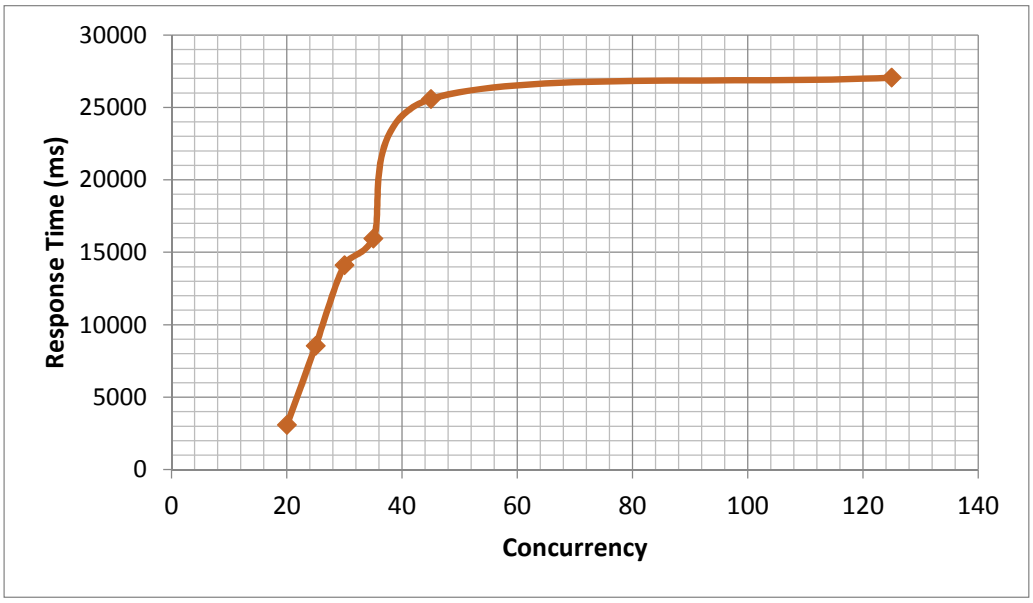

Figure 8: Capacity Test: Response Time vs Concurrency

After running a number of tests, some error was encountered between 100 and 125 concurrent requests. This is shown in the table 6 below with a graphical representation in figure 9.

Table 2: Error percentage - Capacity Test

Concurrency	% Error
20	0
25	0
30	0
35	0
45	0
60	0
100	0
125	1.44

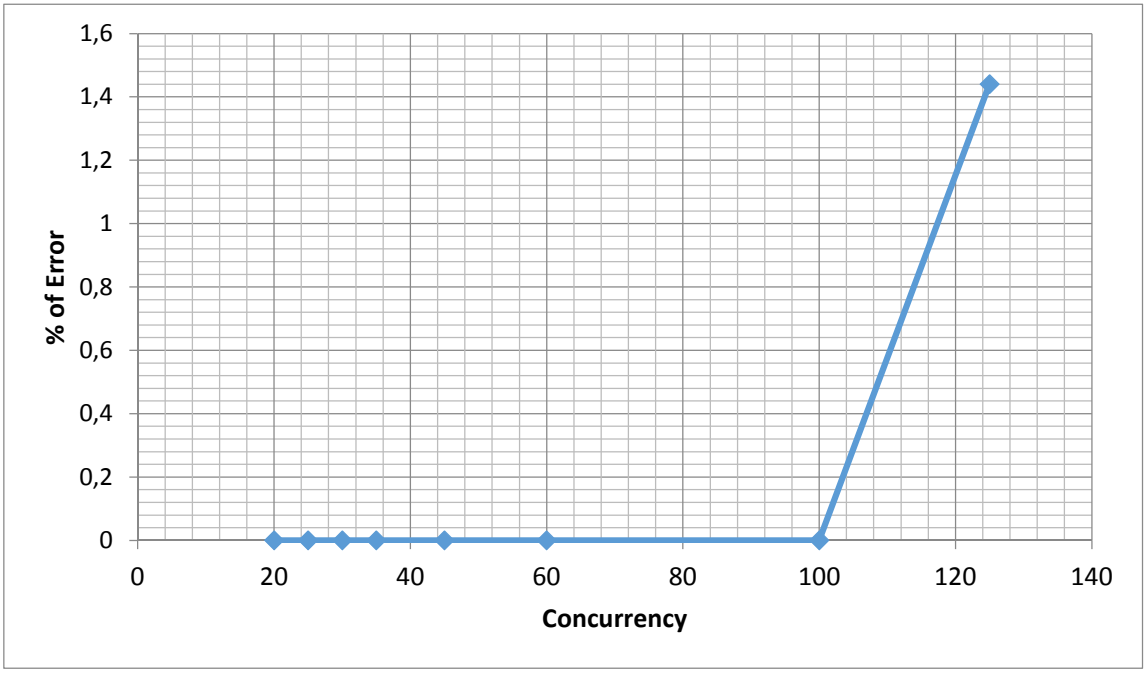

Figure 8. % error

By observing the performance at the server side, it can be interpreted that, there was a moment where the server was "overloaded" and does not possess enough resources to attend to this number of simultaneous requests. This therefore resulted in the error.

3.3.4 SERVER SIDE RESULTS

Complementing the load test with 20 concurrent users, the environment as tested using 25, 30, 35 and 45 concurrent users. The results in terms of CPU consumption, RAM consumption and Network I/O transactions are shown in the table 7 below.

Table 7. Server side results

Test	Concurrent connections	Time(seg)	CPU (%)	RAM(MB)	Network	
					I (Mb)	O (Kb)
Load	20	8 min 30 s	47.66	154.5	23.5	41.1
Capacity	25	11 min 33 s	75.87	250.1	59	126.3
	30	12 min 35 s	76.34	245.9	88.5	192.5
	35	13 min 48 s	77.19	284.8	122.7	267.3
	45	17 min 34 s	76.05	429.9	164.3	358.2

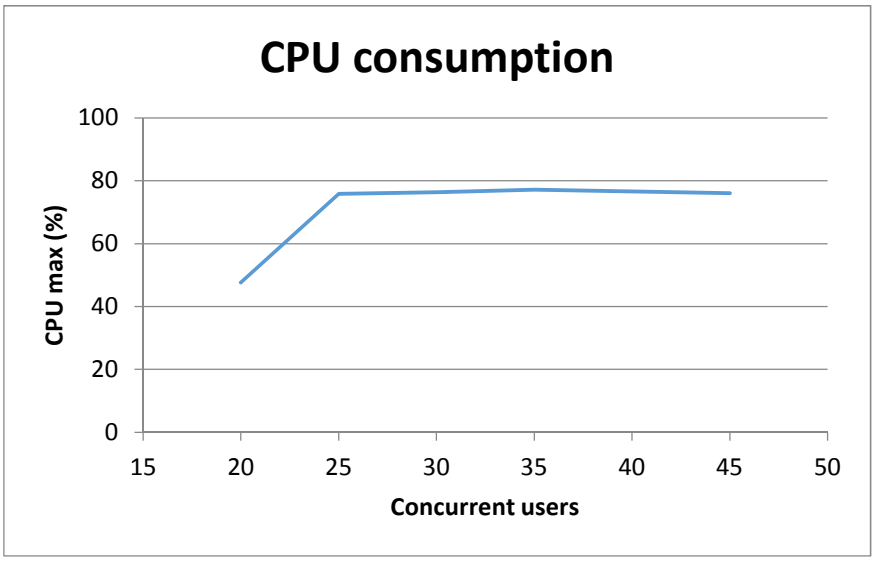

Figure 9. CPU consumption

These results of the table 7 and the graphics above show that the CPU consumption breakpoint is around 25 concurrent connections when the linearity was lost. The CPU consumption was around 76% for more than 25 concurrent connections until 45.

The CPU usage has not increased in a remarkable way, the response time however increased. This occurred because the CPU does not have more resources to dedicate to this process and has to take more time to respond to the entire requests because the rate of request per second exceeded the rate of response. These requests were not lost because they were stored in a queue to be served.

Figure 10 below shows the time response evolution of the server. We can see that the time increases with the increase of the concurrent connections.

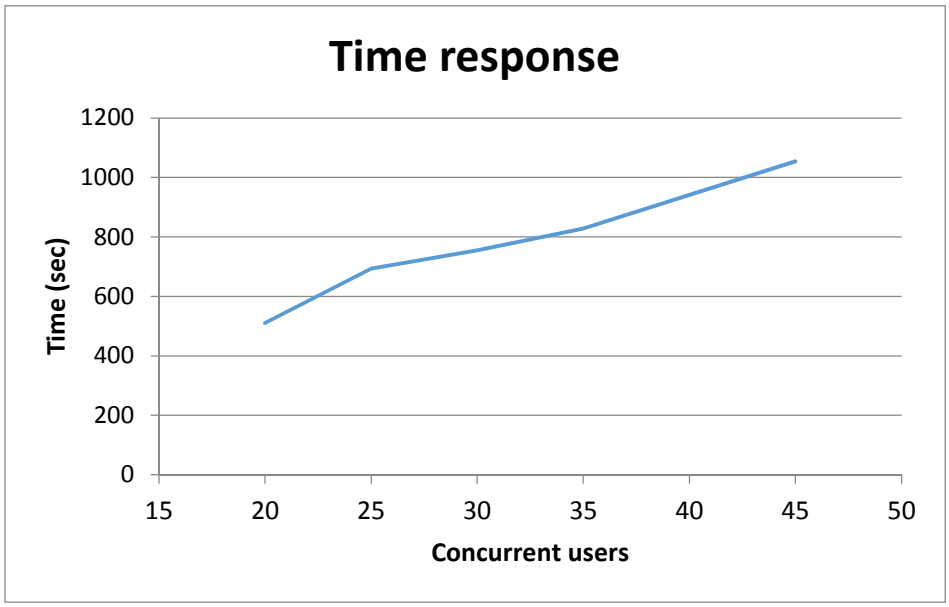

Figure 10. Time Response Evolution of the Server

For these test, there was no errors until the number of 125 concurrent users where the systems started failing and the CPU usage had increased over 100%. The figure 11 shows a behavior of the system CPU usage for this number of concurrent connections. It had been observed that a lot of peak over 99% of usage was reached. When the experiment finished, the CPU usage decreased to 4%.

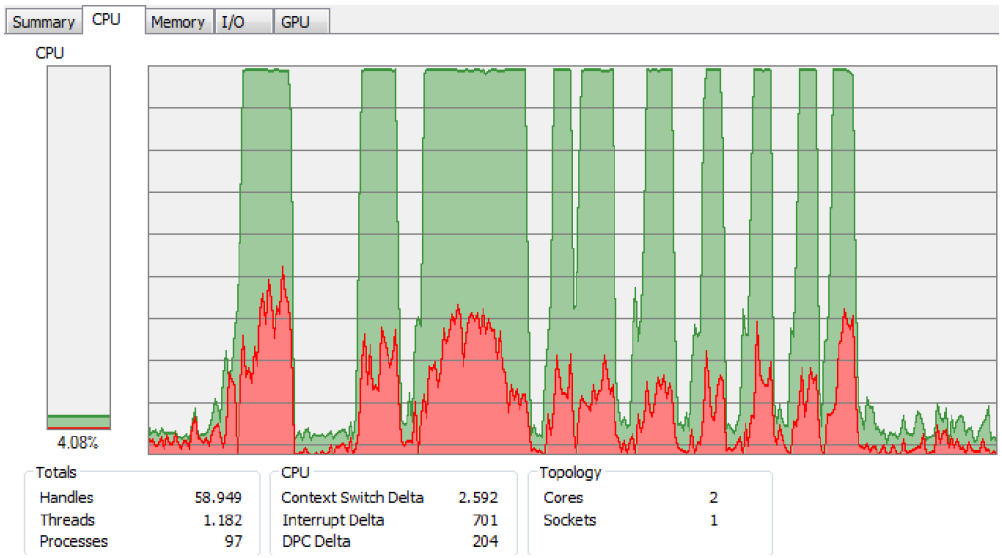

Figure 11: CPU performance

We concluded that our systems can support less than 125 concurrent connections without errors.

Other results that can be shown graphically are related with the RAM consumption. The following graphics shows these results.

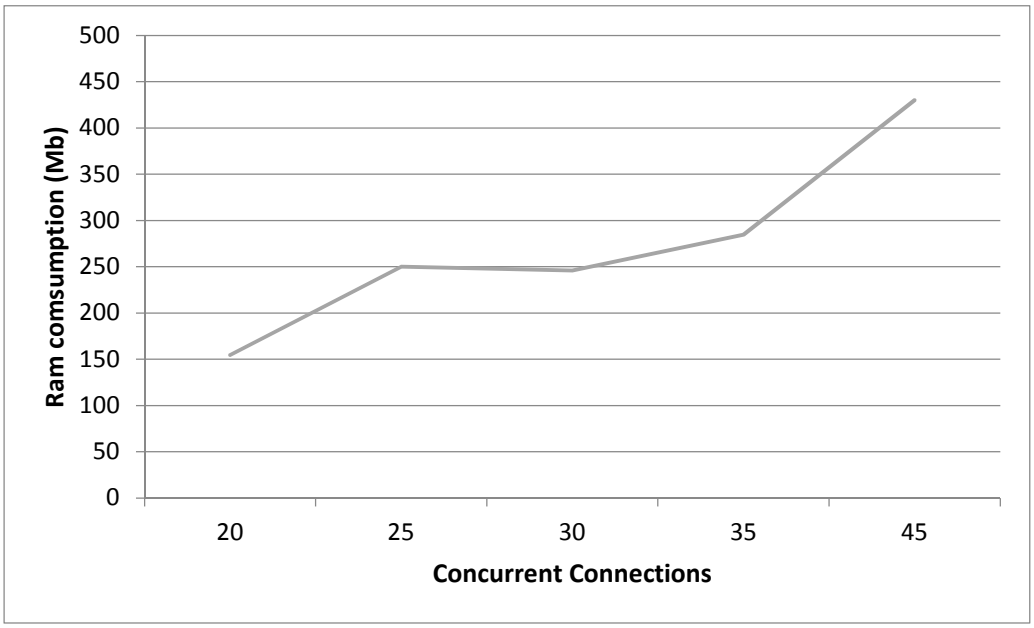

Figure 12: RAM consumption

This showed that with the increase of the concurrent users the RAM consumption had increased linearly. The value presented at 30 concurrent connections could be a measurement error at the time of conducting the experiment. However the RAM is not the limitation for this experiment. Actually at 125 concurrent connections the RAM consumption was around 1.2 GB but the server machine had enough RAM (8 Gb) to serve that amount of concurrent users.

Other experiments that had useful graphics to understand that the problem in this case was the CPU, was the results of I/O Network transactions.

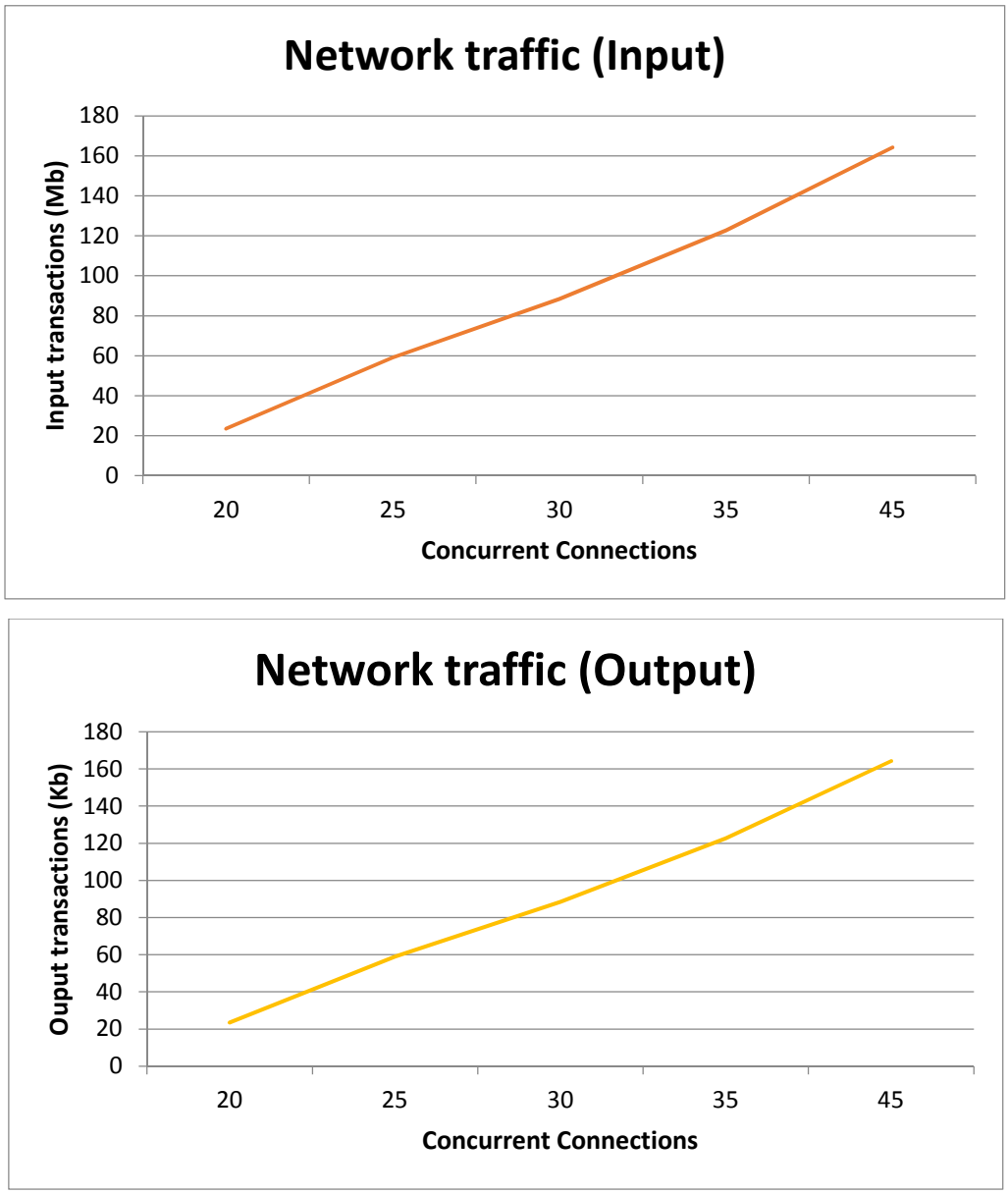

Figure 13. Network I/O

The result showed in a clear way that, the Network Interface Card (NIC) was not the problem due to the increase of traffic between server and client in both input and output transactions was linear for more than 25 concurrent connections that was the point where the system reached the CPU usage limit.

3.3.5 BOTTLENECK OF THE SYSTEM

In this experiment, the bottleneck of the system was the CPU. This was shown in table 7 where the maximum resources dedicated to respond to all the request was around 77%. This occurred at 25 concurrent connections where the linearity of the consumed resources was lost with the increase of the concurrent connections. The request was stored in a queue to be attended to, however it took more time. Another bottleneck was the maximum concurrent users that the Apache web server can support. To check this, the “httpd.mpm” of the Apache web server was checked with the result displayed below.

```
# worker MPM
# StartServers: initial number of server processes to start
# MaxClients: maximum number of simultaneous client connections
# MinSpareThreads: minimum number of worker threads which are
kept spare
# MaxSpareThreads: maximum number of worker threads which are
kept spare
# ThreadsPerChild: constant number of worker threads in each
server process
# MaxRequestsPerChild: maximum number of requests a server
process serves
<IfModule mpm_worker_module>
    StartServers          2
    MaxClients          150
    MinSpareThreads      25
    MaxSpareThreads      75
    ThreadsPerChild      25
    MaxRequestsPerChild   0
</IfModule>
```

This file shows that the maximum concurrent clients that could be supported by the Apache web server are 150. However, in this case the first limitation of the test was the CPU, the second one would be the Apache maximum number of concurrent connections permitted, and after that the RAM and possibly the NIC resources could be a problem, but not in this case.

In this experiment with 125 concurrent connections the system started having errors, this was due to multiple opened TCP connections.

4 CONCLUSIONS

Some options showed possible areas where there can be improvements for the system performance. These options can either be Hardware or Software improvements. For the hardware, the more clear, easy and obvious way to improve the performance would be by adding hardware resources to the machine. In this case changing the CPU of the server with one that has higher performance characteristics would improve the performance of the system. Furthermore, other solutions that would enhance the performance of the system would be to add more RAM and or update the NIC interface (taking into account that in this scenario the limitation is the client machine).

For the software, the options that need to be modified to enhance the system performance are;

- To increase the number of sockets in the server to increase the number of requests/responses.
- To reconfigure the httpd.mpm file of the Apache web server to permit more concurrent users.
- To improve the TCP buffer to transmit more efficiently through the NIC interface.
- To load just the necessary extensions to apply in the Apache server.
- To disable all non-essential processes of the server.

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Profil épidémiologique des enfants victimes d'accidents de la vie courante, hospitalisés à l'hôpital d'enfants de Rabat, Maroc

[Epidemiological profile of child victims of home related injuries, hospitalized in children's hospital of Rabat, Morocco]

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ABSTRACT: To determine the prevalence of related-home injuries among children who were admitted for at least 24 hours in the surgical pediatric emergencies department, in the Children's hospital of Rabat, Morocco. *Methods:* a transversal retrospective study about children with home-related injuries carried out between January 1 and June 30, 2014. Indicators included: age, gender, cause, month, lesions, duration and location of hospital staying, surgery and evolution. The data entered on Excel and analyzed by SPSS 13. *Results:* 761 files from 900 hospitalizations were studied. Male were 75% and the median of age was 8 years [3years; 13 years]. The leading causes of non-fatal injuries were falls, cut or piercing and burns. The lesions were head injuries (154 cases), fractures (433 cases), gate fingers (61 patients), burns (52 cases) and bipolar trauma (28 patients). Length of stay is 24 hours in 74.8%. The majority of patients was hospitalized in the emergency department and received nonoperative treatment with a simple evolution (respectively 96.1%, 73.1% and 90.6%). *Conclusion:* home related injuries deserve to be taken seriously.

KEYWORDS: home related injuries, Child, trauma, hospitalization, public health, Morocco.

RESUME: Les accidents de la vie courante constituent un problème de santé publique dans certains pays. Au Maroc, ce phénomène n'est toujours pas exploré. Objectif : déterminer la prévalence des patients hospitalisés pour des traumatismes liés aux accidents de la vie courante. *Matériels et méthodes :* Nous avons réalisé une étude transversale rétrospective concernant les enfants hospitalisés au moins 24 heures au service des urgences chirurgicales pédiatriques de l'hôpital d'enfants de Rabat, Maroc, suite à des accidents de la vie courante, entre 1 Janvier 2014 et 30 Juin 2014. Les variables concernées sont l'âge, le sexe, les mois de l'année, les circonstances, les lésions, la durée et le lieu d'hospitalisation, la notion d'intervention chirurgicale ainsi que l'évolution. Les données étaient saisies sur Excel et analysées par SPSS13. *Résultats :* 900 hospitalisations pour accidents de la vie courante ont été retrouvées, 761 dossiers ont été retenus. Il existe une prédominance masculine (75%), avec une médiane d'âge de 8 ans [3ans; 13 ans]. Les étiologies étaient dominées par les chutes, les pincements et les brûlures. Les lésions causées étaient les traumatismes crâniens (154 cas), de fractures (433 cas), de doigts de porte (61 patients), de brûlures (52 cas) et de traumatismes bipolaires (28 patients). La durée d'hospitalisation est de 24 heures dans 74,8%. La majorité des patients a été hospitalisée au service des urgences et a bénéficié d'un

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traitement non opératoire avec une évolution simple (Respectivement 96,1%, 73,1% et 90,6%). *Conclusion:* Les accidents de la vie courante méritent d'être pris au sérieux.

MOTS-CLEFS: accident de la vie courante, enfant, traumatisme, hospitalisation, santé publique, Maroc.

1 INTRODUCTION

Les accidents de la vie courante (AcVC) se définissent habituellement comme des traumatismes non intentionnels se produisant à domicile ou dans ses abords, à l'école, dans les aires de jeu ou au cours du sport. Ils constituent un problème de santé publique dans divers pays [1, 2,3].Selon l'OMS, 950000 adolescents de moins de 18 ans meurent chaque année dans le monde [4]. En France, ils sont à l'origine d'environ 20000 décès par an soit 3 fois plus que les accidents de la circulation et 20 fois plus que les accidents de travail [5], et une hospitalisation sur huit est en rapport avec un AcVC [6]. Les étiologies sont dominées par les chutes, les pincements les brûlures [1, 2, 3, 7, 8]. D'autres étiologies sont moins fréquentes et sont spécifiques d'une tranche d'âge donnée. Ces accidents sont responsables de traumatismes crâniens, de fractures et de brûlures, de doigts de porte ainsi que d'autres lésions [2,8]. Au Maroc, les accidents de la vie courante ne font pas l'objet d'étude et sont encore méconnus. Les statistiques marocaines restent ainsi quasi inexistantes.

Dans ce sens, nous avons réalisé une étude descriptive et analytique sur le profil épidémiologique des enfants victimes d'accidents de la vie courante qui ont motivé une hospitalisation d'au moins de 24 heures au service des urgences chirurgicales pédiatriques de l'hôpital d'enfants de Rabat, Maroc.

2 PATIENTS ET MÉTHODES

Il s'agit d'une étude transversale, descriptive rétrospective des accidents de la vie courante qui ont motivé une hospitalisation d'au moins de 24 heures au service des urgences chirurgicales pédiatriques de l'hôpital d'enfants de Rabat, sur une période de 6 mois, du 1 Janvier 2014 au 30 Juin 2014. Les données ont été récoltées à partir des registres de consultations et les fiches de staffs journaliers du service, remplis par les externes, internes et résidents de gardes et complétés par les séniors (Professeurs agrégés). Cet hôpital couvre la région de Rabat Salé Zemmour Zaer, qui couvre une superficie de 9580 Km², soit 1,3 % de la superficie du Royaume, abritant 1.985.602 habitants, d'après le recensement Général de la Population et de l'Habitat (2004) (Haut Commissariat au Plan, 2004).

Les traumatismes en rapport avec des accidents de la voie publique, les intoxications et les noyades, ainsi que ceux en rapport avec un accident de la vie courante traités en ambulatoire ont été exclus de notre étude.

Les données ont été saisies sur Excel et analysées par un logiciel de statistique (SPSS 13). Les variables quantitatives ont été exprimées en médiane et quartiles et les variables qualitatives ont été exprimées en nombre et pourcentage. Le test khi 2 à 5% était utilisé pour savoir si la différence entre certaines variables est significative.

3 RÉSULTATS

Durant les 6 premiers mois de l'année 2014, 12180 patients ont consulté au service des urgences chirurgicales pédiatriques de l'hôpital d'enfants de Rabat, Maroc. 1505 d'entre eux ont été hospitalisés pour diverses pathologies dont 900 étaient en rapport avec des accidents de la vie courante. Seulement 761 dossiers ont pu être exploités. Il existe une prédominance masculine avec un sex-ratio de 3 (571 garçons pour 190 filles). La médiane d'âge était de 8 ans [3ans; 13 ans]. La médiane d'âge chez les garçons est de 9 ans, alors qu'elle est de 5 ans chez les filles. Cette différence est statistiquement significative (p <0,001). Nous avons également reparti les patients par tranches d'âge: tranche des nouveau-nés et nourrissons (0 à 2 ans), tranche des enfants en préscolaire (2 à 6 ans) et celle avec un âge supérieur à 6 ans.

La répartition des patients en fonction des mois est représentée sur la figure 1.

Les accidents de la vie courante étaient responsables de traumatismes crâniens (154 cas), de fractures (433 cas), de doigts de porte (61 patients), de brûlures (52 cas) et de traumatismes bipolaires (28 patients) (Figure 3). D'autres lésions étaient également retrouvées (Figure 5). La durée d'hospitalisation est de 24 heures dans 74,8%. La majorité des patients a été hospitalisée au service des urgences et a bénéficié d'un traitement non opératoire avec une évolution simple (Respectivement 96,1%, 73,1% et 90,6%) (Tableau 1). Ces lésions se répartissaient de façon différente selon les mois de l'année (Tableau 2), et cette différence était statistiquement significative (p< 0,001).

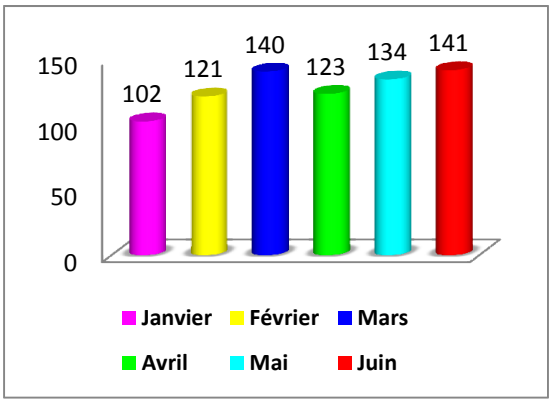

Figure 1 : Répartition des patients victimes d'accidents de la vie courane hospitalisés à l'hôpital d'enfant de Rabat, Maroc selon les mois de l'année.

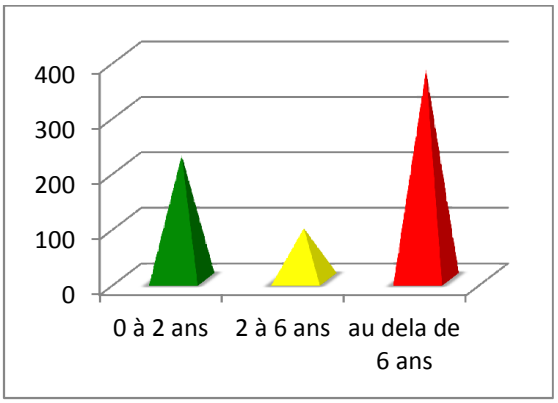

Figure 2 : Répartition des patients victimes d'accidents de la vie courane hospitalisés à l'hôpital d'enfant de Rabat, Maroc en fonction des tranches d'âge

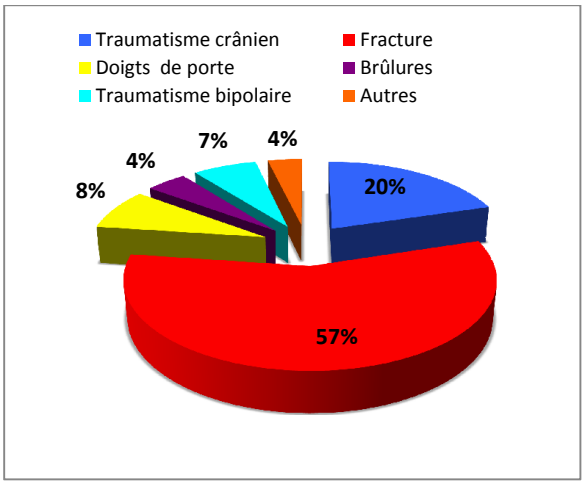

Figure 3 : Répartition des patients victimes d'accident de la vie courante hospitalisés à l'hôpital d'enfants de Rabat selon les lésions

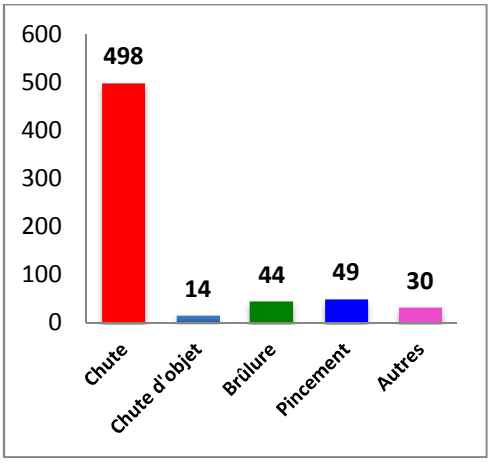

Figure 4 : Répartition des patients d'accidents de la vie courane hospitalisés à l'hôpital d'enfant de Rabat, Maroc en fonction des circonstances

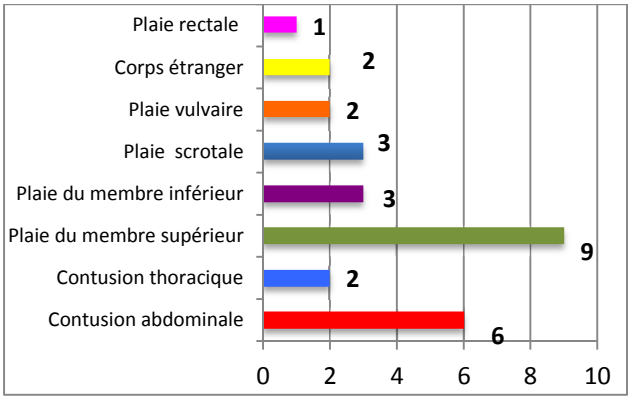

Figure 5: Répartition des patients victimes d'accidents de la vie courante hospitalisés à l'hôpital d'enfant de Rabat, Maroc en fonction des autres lésions

Tableau 1 : Caractéristiques des enfants admis pour Accidents de la vie courante à l'hôpital d'enfants de Rabat durant les 6 premiers mois de l'année 2014

Caractéristiques	Effectifs	Pourcentage
Lésion		
TC*	154	20,2
Fracture	433	56,9
Doigts de porte	61	8,0
Brulure	33	4,3
Traum bip	52	6,8
Autres	28	3,7
Durée d'hospitalisation		
24 heures	569	74,8
48-72 heures	176	23,1
Autres	16	2,1
Lieu d'hospitalisation		
Service	731	96,1
Réanimation	30	3,9
Intervention chirurgicale		
Non	556	73,1
Oui	205	26,9
Evolution		
Simple	617	90,6
Complication	56	8,2
Décès	8	1,2
Total	761	

**TC : traumatisme crânien, Traum Bip : traumatisme bipolaire*

Tableau 2 : Répartition des lésions en fonction des mois chez les enfants admis pour Accidents de la vie courante, à l'hôpital d'enfants de Rabat durant les 6 premiers mois de l'année 2014.

		Lésions					
Mois		**TC***	**Fracture**	**Doigts porte**	**Brûlure**	**Traum Bip***	**Autres**
Janvier	**n**	19	60	4	4	12	3
	%	18,6	58,8	3,9	3,9	11,8	2,9
Février	**n**	27	66	7	6	10	5
	%	22,3	54,5	5,8	5	8,3	4,1
Mars	**n**	32	81	6	6	11	4
	%	22,9	57,9	4,3	4,3	8,9	2,9
Avril	**n**	26	69	8	5	11	4
	%	21,1	56,1	6,5	4,1	8,9	3,3
Mai	**n**	31	86	5	7	3	2
	%	23,1	64,2	3,7	5,2	2,2	1,5
Juin	**n**	19	71	31	5	5	10
	%	13,5	50,4	22	3,5	3,5	7,1

**TC : traumatisme crânien, Traum Bip : traumatisme bipolaire*

L'analyse statistique avait également révélé qu'il existe une différence statistiquement significative entre garçons et filles en ce qui concerne la répartition en fonction des groupes d'âge, des lésions et des circonstances ($p<0,001$) alors qu'elle est non significative pour l'évolution (Tableau 5).

L'évolution était simple dans 90,6% des cas, émaillée de complications dans 8,2% et le décès était survenu chez 8 patients (1,2%). Toutefois, cette évolution était différente de façon significative ($p<0,001$) en fonctions des groupes d'âge et des lésions (Tableau 6).

Tableau 3: Comparaison des variables en fonction du sexe chez les enfants admis pour accidents de la vie courante, à l'hôpital d'enfants de Rabat durant les 6 premiers mois de l'année 2014

Caractéristiques	Masculin		Féminin		p
	n	%	n	%	%
Groupe d'âge					< 0,001
0 à 2 ans	141	27,4	82	46,1	
2 à 6 ans	62	12	30	16,9	
> 6 ans	312	60,6	66	37,1	
Lésions					< 0,001
Traumatisme crânien	103	18	51	26,8	
Fracture	360	63	73	38,4	
Doigts de porte	32	5,6	29	15,3	
Brûlure	21	3,7	12	6,3	
Traumatisme bipolaire	34	6	18	9,5	
Autres	21	3,7	7	3,7	
Circonstances					< 0,001
Chute	338	81,7	110	68,8	
Chute d'objets	9	1,9	5	3,1	
Pincement	26	5,5	18	11,3	
Brûlure	26	5,5	23	14,4	
Autres	26	5,5	4	2,5	
Evolution					0,199
Simple	458	89,8	159	93	
Complication	44	8,6	12	7	
Décès	8	1,6	0	0	

Tableau 4: Comparaison de l'évolution en fonction des groupes d'âge et des lésions chez les enfants admis pour Accidents de la vie courante, à l'hôpital d'enfants de Rabat durant les 6 premiers mois de l'année 2014.

	Simple		Complications		Décès		
	n	%	n	%	n	%	p
Groupe d'âge							<0,001
0 à 2 ans	200	97,1	4	1,9	2	1	
2 à 6 ans	72	88,9	6	7,4	3	3,7	
> de 6 ans	294	87,5	40	11,9	2	0,6	
Lésions							<0,001
TC*	140	95,9	0	0	6	4,1	
Fracture	334	88,8	42	11,2	0	0	
Doigts porte	56	91,8	5	8,2	0	0	
Brûlure	24	82,8	4	13,8	1	3,4	
Traum bip*	40	90,9	3	6,8	1	2,3	
Autres	23	90,6	2	8	0	0	

**TC : traumatisme crânien, Traum Bip : traumatisme bipolaire*

4 DISCUSSION

Les accidents de la vie courante constituent un problème de santé publique dans la majorité des pays développés [1-4,6]. La gravité et l'ampleur sont difficiles à établir du fait de l'absence de données dans notre pays. Les résultats de notre étude donne une idée approximative des accidents de la vie courante, puisqu'ils intéressent uniquement les traumatisés venant de la région de Rabat Salé Zemmour Zaer, ayant été hospitalisés au service des urgences chirurgicales pédiatriques de l'hôpital d'enfant de Rabat pour une durée d'au moins de 24 heures. Ces traumatismes surviennent à tous les âges. Pour HU et all, les patients se répartissaient entre deux tranches d'âge : 5 à 9 ans (45 %) et 10 à 14 ans (55%) [1]. Dans une autre étude comprenant les enfants de tout âge, 68,3% des patients avaient moins de 4 ans (47,6% entre 1 et 4 ans). Il est de 16,6% pour les 5 à 9 ans et 15% entre 10 et 14 ans. [9]. Ormandy [10] constata que le décès était maximal avant l'âge de 5 ans.

Notre médiane d'âge était de 8 ans [3ans; 13 ans], avec 32,2 % pour la tranche d'âge inférieure à 2 ans, de 13,3% entre 2 et 6 ans et 54,5% supérieure à 6 ans. Cette différence dans les pourcentages peut être expliquée par le fait que nous n'avons pas adopté la même classification des tranches d'âge. Les filles sont plus touchées dans la tranche d'âge « nourrissons » (46,1%) et les garçons au delà 6 ans (60,6%).

Nous avons également noté une distribution différente de façon statistiquement significative des accidents en fonction des mois de l'année avec cependant deux pics au mois de Mars et de Juin, et ceci peut être expliqué par l'amélioration des conditions climatiques permettant aux enfants de sortir davantage et par la période des vacances scolaires.

Il existe une prédominance masculine [1, 2, 5, 8, 11,13]. Le sex-ratio dans notre série était de 3 garçons pour une fille, il est de 1,4 chez Thélot [2] et de 1,3 pour Mack [12]. Ceci peut être expliqué par la turbulence des garçons et leurs caractéristiques propres (Activité physique plus intense, plus prolongée et plus violente, vive curiosité et intrépidité, désir d'indépendance et d'autonomie. Pour d'autres, il s'agit d'une différence d'expositions aux risques [11].

Les étiologies sont dominées par les chutes, les pincements et les brûlures [1, 2, 3, 8, 9, 12,13]. Ainsi, les chutes représentent 55% des étiologies tout âge confondu et 73% chez les moins de 1 an [4]. Dans d'autres séries, ce pourcentage avoisine les 32% et 50% chez les moins de 1 an [11]. Elles ont entrainé le décès chez 33,9% des patients [12]. Cependant, d'autres séries ne rapportent que 22% des traumatismes qui sont en rapport avec les chutes [14]. Les pincements viennent en deuxième lieu avec des pourcentages variables de 9,3 à 12,6% [2, 14], par rapport à 8% dans notre série, et cela est dû au fait que les patients qui ont bénéficié d'un traitement ambulatoire sont écartés de notre étude. Les brûlures sont retrouvées dans les séries avec des pourcentages très variés: 9,3 % [14], 10% [11], 18,8% [9] et 29% [8]. 9,3% des décès chez Mack ont été en rapport avec des brûlures [12].

Les lésions causées dans notre série sont les fractures, les traumatismes crâniens, les doigts de porte, les plaies et les brûlures, ce qui concorde avec les données de la littérature [2, 9, 11,13].

Les traumatismes crâniens ne représentent que 20,2% de nos cas, ce qui concorde avec la littérature [2, 8]. Ce pourcentage atteint les 73% dans une série Nantaise [11], qui a regroupé toutes les lésions du pôle céphalique, et non seulement des traumatismes crâniens.

Les fractures représentent dans notre série 56,9% alors qu'elles sont de 10% et 14% [2, 8]. Ceci peut être expliqué par le fait que toutes les fractures nécessitant une réduction sous anesthésie générale sont hospitalisées au service pendant 24 heures.

Les plaies représentent dans notre série 2,23% de toutes les lésions, alors que d'autres séries rapportent des chiffres plus importants (30% [8], 23% [2]), et ceci est dû au fait que nous n'avons répertorié dans notre série que les cas ayant nécessité une hospitalisation.

Les limites de cette étude résident dans deux points : la méthode utilisée, à savoir la collecte des informations, faite à partir des fiches générales d'admission qui ne sont pas propres aux accidents de la vie courante. En effet, plusieurs dossiers ont été écartés car ne contenaient pas toutes les informations nécessaires ou étaient incomplètement remplis. Une étude prospective avec des fiches d'exploitations spécifiques apporteraient plus de renseignements et seraient plus fiables. Le deuxième point est représenté par notre choix de ne répertorier que les traumatismes ayant motivé une hospitalisation, ce qui ne renseigne pas sur les autres traumatismes qui ont bénéficié d'un traitement en ambulatoire et qui sont de loin plus fréquents.

Les résultats de notre étude ne reflètent pas l'ampleur des accidents de la vie courante au Maroc, mais ont l'avantage d'attirer l'attention sur ce phénomène qui ne cesse de croitre de par le monde et entraine de jour en jour des décès et des handicaps non négligeables.

5 CONCLUSION

Les accidents de la vie courante ont la réputation d'être bénins mais peuvent entrainer des décès et des séquelles graves. La prise de conscience de tout un chacun de la gravité que peuvent revêtir ces traumatismes doit justifier des études structurées qui rendront compte de façon objective de leur ampleur, et de leur enjeu, et doit aboutir à des actions préventives. Une bonne connaissance du problème, tant sur le plan épidémiologique, sanitaire et aussi économique permettrait d'impliquer tous les acteurs afin d'avoir une vue plus globale des accidents de la vie courante dépassant la classique notion d'« accident inévitable».

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Trends and Differentials of Teenage Birth in Ethiopia

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ABSTRACT: Globally, each year around 16 million girls aged 15-19 give birth, accounting for around 11 percent of all births. The main objectives of this study were to identify predictors of teenage birth and examine the trend of teenage birth based on data from three Ethiopian Demographic Surveys (EDHS) conducted in 2000, 2005, and 2011. Discrete-time hazard modeling was used to estimate the hazard of first birth before age 20 after controlling for the effects of socio-economic factors. The results suggested that the overall likelihood of first birth before age 20 among Ethiopia women decreased slightly over time in the three DH surveys. At individual level, women's education, especially secondary and higher, had a strong effect to delay first birth during adolescence in all three surveys. Residing in urban areas was inversely associated with teenage birth. Exposure to mass media has a significant delaying influence in the 2000 (28.6%) compared to 17.1% and 15.8% for the 2005 and 2011 EDHS, respectively.

KEYWORDS: Discrete-time, First birth, Hazard model, Person-Period Data, Teenage birth.

1 INTRODUCTION

Globally, each year around 16 million girls aged 15-19 give birth, accounting for around 11 percent of all births (WHO, 2008). Almost 95% of these births occur in developing countries. They range from about 2% in China to 18% in Latin America and the Caribbean. Half of all adolescent births occur in just seven countries: Bangladesh, Brazil, the Democratic Republic of Congo, Ethiopia, Nigeria, India and the United States (WHO 2008).

Countries of Latin America and the Caribbean and Sub-Saharan Africa have the highest proportion of adolescent births (UNICEF, 2012 report). Approximately 95 percent of adolescent births occur in low and middle-income countries (United Nations Department of Economic and Social Affairs, 2011). Bangladesh, India, and Nigeria alone account for one in every three of the world's adolescent births and the only industrialized country among the top 10 countries with the highest number of adolescent births is the United States (UNICEF, 2012).

Early childbearing is recognized worldwide to have a profound impact on the well-being and reproductive health of young women, as well as the overall pace and direction of a country's development (AGI, 1998). Early childbearing can derail a young woman's educational prospects, reduce her long-term social and economic autonomy, and endanger both her health and that of her newborn.

Compared to adult mothers, adolescent mothers are more likely to experience maternal mortality, anemia, and obstetric complications. In addition, their infants are at higher risk for preterm birth, low birth weight, poor nutritional status and fetal death. In poor countries, the health of women and children is also influenced by a range of social and economic factors such as the mother's education, access to health care services, decision-making power, acceptance of contraceptives, and employment opportunities (Gill, Pande and Malhotra 2007; Taffa and Obare 2004).

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The major objectives of the study were to analyze trend and identify predictors of teenage birth in Ethiopia. Accordingly, we found it appropriate and relevant to assess the trends and characteristics of teenage birth from three nationally representative datasets based on the three 2000, 2005, and 2011 Ethiopian Demographic and Health Survey. It is hoped that such a study would inform policy related to maternal health issues and population, with special emphasis on teenage women.

2 DATA AND METHODOLOGY

DATA SOURCE

In this study data from the 2000, 2005, and 2011 Ethiopian Demographic and Health Survey (EDHS) have been used. The three surveys were conducted by the Central Statistical Agency (CSA) under the auspices of the Ministry of Health with the worldwide MEASURE DEMOGRAPHIC HEALTH SURVEY (DHS) project, a USAID-funded project providing support and technical assistance in the implementation of population and health surveys in countries worldwide. The primary objectives of the EDHS were to provide up-to-date information for planning, policy formulation, monitoring, and evaluation of population and health programs in the country.

The 2000 EDHS was the first of its kind to be conducted in the country. In that survey a nationally representative data set was obtained through interviews with 15,367 women aged 15-49 years. Among these 6,428 were aged 15-24. In the 2005 EDHS a total of 14,070 women were interviewed including 5,869 women aged 15-24. The 2011 DHS included 16, 515 women aged 15-49 of whom 6,857 were of age 15-24. Since the primary objective of this study is about the fertility behavior of the youngest cohort, we focused on female respondents aged 15-24 at the time of each of the surveys.

STUDY VARIABLES

The response variable of this study is "age at first birth before age 20" in completed years. We define y_{it} as a binary response (yes, no) to the event that woman *i* giving first birth at age *t* (*t*=15-19, in completed years). By convention y_{it} is set to 1 if the women has her first child at age *t*, and set it 0, otherwise. The phrases "age at first birth" and "time at first birth" are used interchangeably throughout this study.

The predictors (variables/factors) included in the model that are assumed to determine teenage fertility were:

a. Woman's religion: coded as Coptic Orthodox, Protestant, Muslim, and "Others". The last group included Catholics and followers of traditional beliefs.
b. Frequent media exposure: measured by asking respondents whether they watched television, listened to radio broadcast or read newspapers on weekly basis.
c. Woman's educational attainment: no education, primary, secondary and above.
d. Place of residence: urban, rural
e. Occupation refers to working status of women and or the type of job a woman was engaged in at the time of the survey. It is classified as: Not working (includes not paid work), agricultural worker, nonagricultural worker.
f. Region refers to the nine regional administrations and two city administrations of Ethiopia in which a woman was living at the time of the survey.

METHODS OF DATA ANALYSIS

DISCRETE-TIME HAZARD ANALYSIS

Births occur in the reproductive age 15-49 years, and in some exceptional cases outside this age. Thus, for the analysis of birth histories it is appropriate to use continuous-time models such as the Cox model. However, data about birth histories are typically collected via retrospective surveys in which a DHS is an example. In such surveys it is common practice to record dates in large grouped-time intervals such as months or years. The application of continuous-time models to grouped-time survival data is not recommended because of the problem of the possible large number of ties (i.e., more than one individual experiences an event at the same time). To overcome difficulties that continuous-time methods have with these grouped time data, alternative methods have been developed (Allison, 1982). A popular alternative is the discrete-time approach, where time is treated as though it were truly discrete (Myer, Hankey and Mantel, 1973; Brown, 1975).

Discrete time hazard modeling allows considerable flexibility in handling time-varying covariates (in particular, a woman's age) (Allison, 1982). Another advantage of discrete-time hazard modeling is that it allows fitting censored observations (that is, teenagers aged 15-19 who had not yet completed adolescence at the time of a survey), as well as women aged 20-24. The model is essentially a logistic regression model with the response variable being the log-odds of a women having had a first birth at age *t* (*t* = 15, 16, 17, 18, 19).

The discrete-time hazard probability is the conditional probability that an individual *i* will experience the event of interest at time t given that the individual has not experienced the event of interest in any earlier time intervals (Singer and Willett, 1993). That is:

$$h_i(t) = P(T_i = t | T \geq T_i) \quad (1)$$

In this setting of age at first birth, $h_i(t)$ is the probability that a teenager *i* gave first birth in year *t* given that she had not given birth before time *t*.

Inference methods for survival analysis allow for right censoring. A teenager is right censored at age *t* if the observation period ends before experiencing the event of interest (first birth in this case). Thus the observation period for this subject is not $T_i = t$, but rather $T_i > t$. The end of the observation period may be determined by the design of the survey. In this study since EDHS is a retrospective (a single interview) survey the observation period is ended by design at the day of the interview.

With right censoring, the observation about subject *i* is represented with an ordered pair (t_i, y_{it}), where t_i is the time recorded and y_{it} is an indicator of the occurrence of the event of interest. Thus y_{it} =1 means that t_i is uncensored ($T_i = t$), while y_{it} = 0 means that t_i is censored ($T_i > t$). The standard estimation methods for survival models use censored times under the assumption of non-informative censoring. Informally, censoring is non-informative when, conditionally on the observed covariates, the end of the observation period does not depend on the hazard.

We next include a set of *q* predictors to equation (1) that characterize individuals in the population. We denote the *q* predictors in time period *t* for the *i*th individual by the vector $X_{it} = (x_{1it}, x_{2it}, ...x_{qit})'$. The discrete-time hazard function for individual *i* in time period *t* with *q* predictors is given (see Singer and Willett, 1993) by:

$$h_i(t \mid x_{it}) = P(T_i = t \mid T_i > t, X_{1it} = x_{1it}, X_{2it} = x_{2it}, ...X_{qit} = x_{qit}) \quad (2)$$

The covariates can be time-invariant or time-varying. Time-varying covariates are extremely useful in building a proper model for the hazard, but they are rarely available in practice because of the difficulty to measure them accurately, especially in retrospective surveys. So, only time-invariant covariates were considered in this study.

STATISTICAL MODEL FOR DISCRETE-TIME HAZARD

Although equation (2) shows that the hazard depends on the vector of predictors, it does not specify the functional form of dependence. This section provides a description of a formal model of a hypothesized relationship between the population hazard probabilities and predictors.

The most popular choice to specify how hazard depends on time and the predictor variables is the logistic regression model (Cox, 1972; Myers, Hankey, and Mantel, 1973; Byar and Mantel, 1975; Brown, 1975; Thompson, 1977; Mantel and

Hankey, 1978; Allison, 1982; Singer and Willett, 1993). The model represents the log-odds of event occurrence as a function of predictors and also has the attributed of baseline profile risk and a shift parameter that captures the effect of the predictors on the baseline profile (Singer and Willett, 1993). Therefore our proposed population discrete-time hazard model is:

$$h_i(t) = \frac{1}{1+\exp[-\{(\alpha_1 A_{1it} + \alpha_2 A_{2it} + ... + \alpha_T A_{Tit}) + (\beta_1 X_{1it} + \beta_2 X_{2it} + ...\beta_q X_{qit})\}]} \quad (3)$$

Here A_{1it} , A_{2it} , …, A_{Tit} are a sequence of dummy variable, with values $(a_{1it}, a_{2it}, ..a_{Tit})$ indexing time period. α_1 , α_2 ,…, α_T are intercept parameters that capture the baseline level of hazard in each time period. The slope parameters β_1 , β_2 ,…, β_q describe the effects of the predictors on the baseline hazard function, albeit on a logistic scale (Singer and Willett, 1993). *T* refers to the last time period observed for anyone in the sample. If t_i represents the last time period when individual *i* was observed (and at which time she was either censored or experienced the target event), then *T*=sup $\{t_i\}$. Taking the logit transformation of both sides of (3) we obtain

$$\ln\left(\frac{h_i(t)}{1-h_i(t)}\right) = (\alpha_1 A_{1it} + \alpha_2 A_{2it} + ... + \alpha_T A_{Tit}) + (\beta_1 X_{1it} + \beta_2 X_{2it} + ... + \beta_q X_{qit}) \ . \quad (4)$$

This form assumes that the predictors are linearly associated with the logistic transformation of hazard (logit-hazard), not with the hazard themselves, nor with the natural logarithm of the hazard probabilities.

We also notice that the discrete-time hazard model contains no single intercept, instead the alpha parameters act as multiple intercepts, one per time period. When the values of all the predictors X_1 , X_2 ,…, X_T are set zero, the population discrete-time hazard model depends only on α_1 , α_2 ,… α_T and represent the population baseline logit-hazard function because it captures the time-period by time-period conditioning log-odds that individuals whose covariate values are all zero (baseline group) will experience the event in each time period, given that they have not already experienced the event (Singer and Willett,1993).

ESTIMATION TECHNIQUE

Let y_{it} be a dichotomous indicator variable that female teenager *i* gave birth at time t. The coding here is that y_{it} is 0 if teenager *i* did not experience the event of interest at time *t* and y_{it} is 1, otherwise. There will also be instances when an individual does not experience the event of interest before the observation time ends, and those individuals must be censored. Let C_i be a dichotomous indicator variable that describes if an individual was censored or not with the coding c_i = 0 if individual *i* has not been censored and c_i = 1 if individual *i* has been censored.

The maximum likelihood method is used to estimate the parameters α_1 , α_2 ,…, α_T and β_1 , β_2 ,…, β_q in equations (3) and (4) thereby giving an estimate for $h_i(t)$. The likelihood function must be constructed in two parts because of censoring. The two parts of the likelihood function deal with first the uncensored individuals, that is, the probability that the individual experienced the event of interest at time t_i , and the censored individuals, that is, the probability that the individual experienced the event of interest after time period t_i .

That is the contribution of subject *i* to the likelihood is different if the time is uncensored or censored:

For uncensored ($y_i = 1$): $P(T_i = t_i) = \prod_{u=1}^{t_i - 1}[1 - h_i(u)]x h_i(t_i)$ (5)

For censored $(y_i = 0)$: $P(T_i > t_i) = \prod_{u=1}^{t_i}[1 - h_i(u)]$. (6)

Here t_i represents the last time period when individual i was observed.

Assuming that individuals in the sample are independent (given their x_{1it} , x_{2it} ,.., x_{qit} values), the likelihood function is simply the product of the probabilities of observing the sample data, $P(T_i = t_i)$ in the case of uncensored individuals (c_i = 0) and $P(T_i > t_i)$ in the case the uncensored individuals (c_i = 1) we have the likelihood function:

$$L = \prod_{i=1}^{n} [P\{T_i = t_i\}]^{1-c_i} [P\{T_i > t_i\}]^{c_i} \tag{7}$$

Substituting (5) and (6) into (7), and taking logarithm we have

$$l = \sum_{i=1}^{n} \left[(1-c_i) \ln\left(\frac{h_i(t_i)}{1-h_i(t_i)} \right) + \sum_{t=1}^{t_i} \ln(1-h_i(t)) \right] \tag{8}$$

The event-history indicator Y_{it} can be used with equation (8), and we get:

$$\sum_{t=1}^{t_i} y_{it} \ln\left(\frac{h_i(t)}{1-h_i(t)} \right) = \left\{ \begin{matrix} \ln\left(\frac{h_i(t_i)}{1-h_i(t_i)} \right) when, c_i = 0 \\ 0, when, c_i = 1 \end{matrix} \right\}$$

$$= (1-c_i) \ln\left(\frac{h_i(t_i)}{1-h_i(t_i)} \right) . \tag{9}$$

Substitute (9) into the first term inside the bracket of equation (8) eliminates the censoring indicator c_i from the log-likelihood function. Replacing it by the dichotomous realization of the event-history process y_{it} we have obtain:

$$l = \sum_{i=1}^{n} \left[\sum_{t=1}^{t_i} y_{it} \ln\left(\frac{h_i(t_i)}{1-h_i(t_i)} \right) + \sum_{t=1}^{t_i} \ln(1-h_i(t)) \right].$$

This can be rewritten as:

$$l = \sum_{i=1}^{n} \sum_{t=1}^{t_i} \left[\ln\left(\frac{h_i(t_i)}{1-h_i(t_i)} \right)^{y_{it}} + \ln(1-h_i(t)) \right]$$

Combining like terms and take the antilog we have:

$$L = \prod_{i=1}^{n} \prod_{t=1}^{t_i} h_i(t)^{y_{it}} (1-h_{it})^{(1-y_{it})} \tag{10}$$

Equation (10) is the likelihood function for the discrete-time hazard process in terms of the data, y_{it} , and the hazard probability parameters, $h_i(t)$.

Following Allison (1982), Brown (1975), and Laird and Oliver (1981), the equivalence of the likelihood functions of the discrete-time hazard model in (10) and independent Bernoulli trials model allows us to treat the N dichotomous observed values y_{it} as a collection of independent dichotomous variables with a hypothesized logistic dependence on predictors. They can be regarded as the values of the outcome variable in a logistic regression analysis of the time-period indicators and

covariates X. This provides a simple method of obtaining maximum likelihood estimates of $\alpha_1, \alpha_2, ..., \alpha_T$, $\beta_1, \beta_2, ..., \beta_q$ and hence $h_i(t)$ using standard logistic regression analysis software (Singer and Willet 1993). Because computer software for conducting logistic regression analysis is so widely available, we will illustrate the fitting of hazard models via standard logistic regression approach, rather than via direct maximization of the likelihood in (10).

CONSTRUCTING THE PERSON-PERIOD DATA

In a typical data set, each person (case) has one record of data. Discrete-time survival analysis model (DTSAM) requires a person-period format; that is, each person may have a different number of records depending on the duration of observation. So, the first step to conduct DTSAM is to convert the data into a person-period data format. In the converted person-period data set, different cases may have a different number of records depending on how long it takes to experience the event (time to first birth). Therefore before we conduct discrete-time survival analysis we transform the standard one-person, one-record data set (the person-period data set) as shown in Table 1.

Table 1.Conversion of a person-level data set into a person-period data set

Person-level data set

ID	DURATION	CENSOR	Education
3686	18	0	0
5440	17	0	2
5560	19	1	1

Person-period data set

ID	PERIOD	A1	A2	A3	A4	A5	Education	y_{it}
3686	15	1	0	0	0	0	0	0
3686	16	0	1	0	0	0	0	0
3686	17	0	0	1	0	0	0	0
3686	18	0	0	0	1	0	0	1
5440	15	1	0	0	0	0	2	0
5440	16	0	1	0	0	0	2	0
5440	17	0	0	1	0	0	2	1
5560	15	1	0	0	0	0	1	0
5560	16	0	1	0	0	0	1	0
5560	17	0	0	1	0	0	1	0
5560	18	0	0	0	1	0	1	0
5560	19	0	0	0	0	1	1	0

BASELINE HAZARD MODELS

We begin by estimating a simple discrete-time hazard model using a standard logistic regression model that includes only a set of age dummy variables (A1 through A5, see Table 1) and no intercept model (Model 1, represented by equation (11)) as follows:

$$\psi_{it} = \ln\left(\frac{h_{it}}{1-h_{it}}\right) = \sum \alpha_t (AGE_{it}) \qquad (11)$$

where h_{it} is the hazard of giving first birth for person *i* at year *t*, and AGE_{it} is a dummy variable for age *t* for person *i*. The estimated coefficients of the α_i 's give the shape of the baseline logit-hazard curve (Reardon et al., 2002).

DISCRETE-TIME HAZARD MODEL WITH PREDICTORS

In the next model we add demographic covariates to model 1 in equation (11). Model 2 is represented by the following equation:

$$\psi_{it} = \sum \alpha_t (AGE_{it}) + \beta X_i \qquad (12)$$

where X_i, is a vector of time-invariant covariates for teenager female *i*. Model 2 is used to estimate the effects of the demographic covariates on the logit-hazard curve (Reardon et al., 2002). We used this model to determine the effect of the demographic covariates on the hazard of first birth.

3 RESULTS

Descriptive Results. The life table (Table 2) illustrated the key components of the population hazard functions amongst the sample of women in the three surveys. The first column gives the age of women at first birth. The next three columns tally the number of women who did not give first birth at the beginning of each full year, the number who gave first birth at the age and the censored numbers. According to 2000 EDHS, 1,435 women had their first birth before age 20. Similarly, for 2005 and 2011 EDHS the figures were 1,361 and 1,466 respectively. For the same periods 4,248(77.16%), 4,281(75.88%) and 5,136(77.80%) were censored (did not give birth at the time of the interview).

The fifth column of Table 2 presented another summary – the proportion of women who gave first birth by the end of each full year. We note that among the 6,283 women, 2.94 % had their first birth at age 15 in 2000 survey and increased to 4% in 2005 and dropped down to 3.68% in the 2011 survey. Of the 2,453 women who did not give first birth by age 18, 11.25% gave their first birth at age 19 in the 2011 survey.

Table 2. Life table describing the distribution of event occurrence over time (age)

	Number of									**Proportion**					
	Women with no first birth at the beginning of each age (b)			Women who gave first birth during the age (a)			Were censored at age			Values in column (2) divided by the corr. values in column (1)			All women with no first birth at the end of each age		
Age	00	05	11	00	05	11	00	05	11	00	05	11	00	05	11
15	6283	5632	6602	185	226	243	826	683	879	0.0294	0.0401	0.0368	0.9706	0.9600	0.9632
16	5272	4723	5480	293	301	296	718	615	733	0.0556	0.0637	0.0540	0.9166	0.8987	0.9112
17	4261	3807	4451	350	316	339	567	516	603	0.0821	0.0830	0.0762	0.8413	0.8241	0.8418
18	3344	2975	3509	321	278	312	656	675	744	0.0960	0.0934	0.0890	0.7605	0.7471	0.7670
19	2367	2022	2453	286	230	276	2081	1792	2177	0.1208	0.1137	0.1125	0.6687	0.6621	0.6806

00, 05 and 11 stand for years 2000, 2005 and 2011, respectively.

Under the assumption of independent censoring we can use the sample hazard function to estimate the sample survival function at those ages when censoring precludes direct computation. For example, an estimate of the survival probability at the end of age 18 is 0.8418×(1-0.0890). In other words, the sample survival probability in any year is simply one minus the hazard probability for that year multiplied by the sample survival probability from the previous year. Accordingly, the sixth column of Table 2 presents the proportion of women who did not give first birth at the end of each full age. Examining this sample survival function showed that 97% of the women did not give first birth at age 15 in the 2000 survey. For the same age, 96% of the women did not give first birth in 2005. This figure has slightly increased in 2011 to 96.32%.

The plot of the population hazard function shows the hazard experienced by women in each time period (Figure 1). According to the left panel of the Figure 1, there was no clear difference of first birth probability at age 17 in the 2000 and 2005 surveys. We also note that there was no visible difference in the probability of not giving first birth at age 17 in the 2000 and 2011 surveys (right panel). But in the 2011 survey the probability was higher than in the two previous surveys after age 17. We also note that the probability in the 2005 survey was lower than in the other two surveys for all in the 15-19 years bracket.

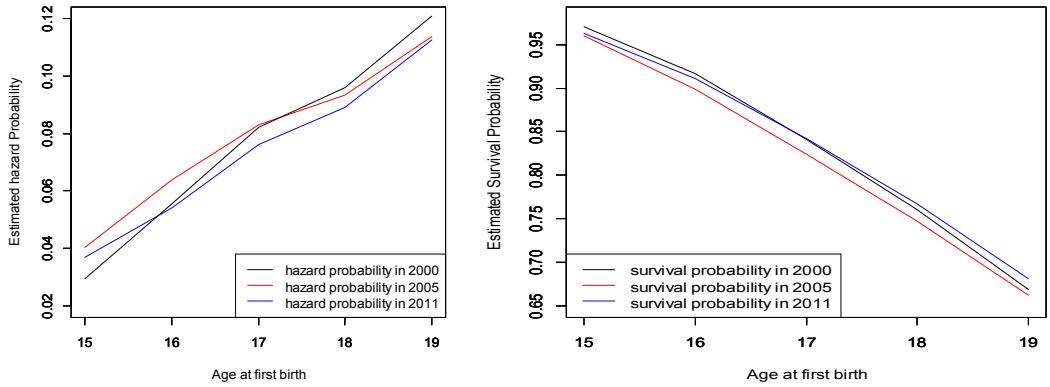

Figure 1. Estimates of survivor (did not give first birth before age 20) and hazard (did give first birth before age 20) probabilities for all women aged 15-24 at the time of interviews in each of the threeDHS

Results Of Discrete-Time Hazard Models. In order to fit the model, we need to restructure our data set, from what we refer to as a person-level data set, which contains one record for each person in the study, to a person-period data set, which contains one record for each time period that an individual is at risk of a giving first birth before age 20. Table 1 illustrates the conversion from a person-oriented data set to a person-period data set using three individuals as a illustration for the sample data from 2011 survey. A similar procedure was followed for 2000 and 2005 survey. The first two individuals have known age at first birth - the first woman gave first birth at age 18, and the second woman gave first birth at age 17. The third woman (ID5560) had not yet given birth; so she was censored at the end of age 19. The person-oriented data set describes a woman's event history using two variables: an event time (here DURATION, the period in which the individual experienced a first birth or was censored) and a censoring indicator (CENSOR = 0 for individuals who gave first birth and 1 for individuals who did not) and one time-invariant covariate, educational attainment of women (variable name: Education). The person-period data set includes a period variable, PERIOD, which specifies the time period *t* that the record describes. The particular time period described in the record is also identified through the set of time (age-at-first-birth) indicator variables (A1 through A5).

The person-period data set includes an event indicator, y_{it}, which indicates whether a first birth occurred at time *t* (0 = no, 1 = yes). For each person, the event indicator must be 0 in every record except the last. Non-censored individuals (like individual 3686) experience the event in their last period, whereas censored individuals never experience a first birth, so y_{it} remains 0 for all of their records (like in individual 5560).

Results Of Discrete-Time Hazard Model without predictors. Using equation (11), the first model to be fitted is a simple discrete-time hazard model with without any predictor and only a set age dummy variable (A1 through A5 as described in Table 1). That is a baseline model. Using dummy variables A1 to A5 equation (11) becomes:

$$\psi_{it} = \sum_{t=15}^{19} \alpha_t (AGE_{it}) = \alpha_1 A1 + \alpha_2 A2 + \alpha_3 A3 + \alpha_4 A4 + \alpha_5 A5$$

where $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ stand for $\alpha_{15}, \alpha_{16}, \alpha_{17}, \alpha_{18}, \alpha_{19}$, respectively.

Table 3 gives estimates for Model 1 in equation (11).

Table 3. Parameter Estimates with standard errors and Fitted Hazard Probabilities from baseline discrete-time hazard model fitted to the 2000, 2005, and 2011 EDHS data

Parameter		Estimate ($\hat{\alpha}$) and the respective standard error in brackets			fitted hazard		
Period	predictor	2000	2005	2011	2000	2005	2011
15	A1	-3.4952***	-3.1747***	-3.2645***	0.0294	0.0401	0.0368
		(0.0746)	(0.0679)	(0.0654)			
16	A2	-2.8328***	-2.6872***	-2.8630***	0.0556	0.0637	0.0540
		(0.0601)	(0.0596)	(0.0598)			
17	A3	-2.4136***	-2.4022***	-2.4957***	0.0821	0.0830	0.0762
		(0.0587)	(0.0587)	(0.0565)			
18	A4	-2.2426***	-2.2723***	-2.3270***	0.0960	0.0934	0.0889
		0.0889	(0.0630)	(0.0593)			
19	A5	-1.9846***	-2.0530***	-2.0653***	0.1208	0.1137	0.1125
		(0.0681)	(0.0700)	(0.0639)			

** * * p-value <0.001*

The parameter estimates for the time-indicator variables (A1 through A5) allow for the estimation of the risk of event at each year (from 15 to 19 year). Accordingly, the estimates $\hat{\alpha}_1$ through $\hat{\alpha}_5$ describe the shape of the overall fitted logit-hazard profile. That is, if the risk of event occurrence are unrelated to time, the hazard function would be flat and meaning that the $\hat{\alpha}s$ are approximately equal. If event risks increase over time, values of the $\hat{\alpha}s$ for later periods will be greater than for earlier periods which is identical to estimated hazard in Table 3. For example, in the 2000 EDHS (column 3), at age 15 we have $\hat{\alpha}_1 = -3.4952$ (s.e. = 0.0746) and the estimate of α_1 give an estimate of hazard $\hat{h}_1 = 0.0294$ (column 6). The interpretation is that a woman in the age group 15-24 has a risk of 2.94 percent of giving first birth at age 15 in 2000, which increased to 4.01 percent in 2005, and then decreased to 3.68 percent in 2011. For age 16, $\hat{\alpha}_2 = -2.8328$, $\hat{\alpha}_2 = -2.6872$, $\hat{\alpha}_2 = -2.8630$, in 2000, 2005 and 2011, respectively. Therefore, risks of giving first birth at age sixteen in 2000, 2005 and 2011, respectively, were 5.56, 6.37, and 5.4 percent showing the trend of first birth before age 20 in the three survey periods.

Results Of Discrete-Time Hazard Model with Covariates. The second model in this study was a discrete-time hazard model with demographic covariates (model 2 given in equation (12)). But before fitting this model a univariate discrete-time hazard model fit of each predictor variable was performed to select significant candidate predictor variables that would qualify for the multivariate discrete-time hazard model at a stringent 5% level. The results show that all predictors qualify for inclusion in the multivariate discrete-time hazard model.

A multivariable discrete-time hazard model containing region, religion, education, place of residence, occupation, and exposure to media information in addition to the age dummy variable A1, …, A5, was fitted for each of the three surveys.

The above consideration gives rise two to the full model

$$\psi_{it} = \alpha_1 A1 + \alpha_2 A2 + \alpha_3 A3 + \alpha_4 A4 + \alpha_5 A5 + \beta_1 REG_i + \beta_2 EDU_i + \beta PLR_{3i} + \beta_4 MED_i + \beta_5 REL_i + \beta_6 OCC_i$$

The statistical analysis, however, showed that religion and occupation were not significant predictors at 5%. Hence model that excludes these two, namely

$$\psi_{it} = \alpha_1 A1 + \alpha_2 A2 + \alpha_3 A3 + \alpha_4 A4 + \alpha_5 A5 + \beta_1 REG_i + \beta_2 EDU_i + \beta_3 PLR_i + \beta_4 MED_i$$

had to be considered. Further analysis showed that this reduced model provided a good fit at 5% level. Accordingly, model 2 (given by equation (12)) becomes:

$$\psi_{it} = \sum_{t=15}^{19} \alpha_t (AGE_{it}) + \beta X_i \quad (13)$$
$$= \alpha_1 A1 + \alpha_2 A2 + \alpha_3 A3 + \alpha_4 A4 + \alpha_5 A5 + \beta_1 REG + \beta_2 EDU + \beta_3 PLR + \beta_4 MED$$

Having achieved that we look for alternative re-parameterization of $\alpha_1 A1 + \alpha_2 A2 + \alpha_3 A3 + \alpha_4 A4 + \alpha_5 A5$ in the above model. The reason for doing so is that the parameterization of the hazard profile using time indicators (A1 through A5, in this case) lacks parsimony and representation of the main effect of time requires the inclusion of many parameters in the discrete-time hazard model. Therefore, we need to adopt a particular algebraic form for the shape of the logit-hazard profile ($\alpha_1 A1 + \alpha_2 A2 + \alpha_3 A3 + \alpha_4 A4 + \alpha_5 A5$).

We note that the estimates of the parameter α_1 to α_5 in Table 3 which represents the population hazard probability in each time period under consideration showed that the hazard of first birth before age 20 was an increasing function of time.

A linear, quadratic, and cubic function of time (age at first birth or the indicator PERIOD in Table 1) were fitted. The plots of all functions are shown in Figure 2 below for the 2011 survey data. The same procedure was followed for 2000 and 2005 survey.

Using the difference in log likelihood value (-2 Log Likelihood) between the cubic and quadratic, linear and quadratic, we found that the quadratic function was a better fit than the cubic and linear.

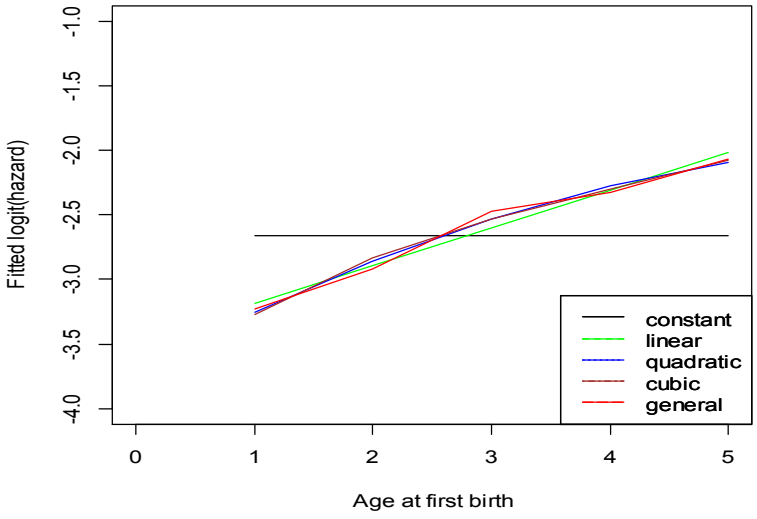

Figure 2: Fitted functions for the baseline model

As a result we have a the following model with a quadratic function of age at first birth:

$$\psi_{it} = Age + Age\_squared + \beta_1 REG_i + \beta_2 EDU_i + \beta_3 PLR_i + \beta_4 MED_i \quad (14)$$

where Age = age at first birth of woman, and Age_squared = square of age at first birth.

Further comparison of equations (13) and (14) revealed that the model (in equation (14)) provided appropriate fit to the data in all the three survey, meaning that it becomes our final model.

The results (estimated coefficient, standard error, and hazard of timing of first birth before age 20 among women age 15-24 years) in Table 4 are based on the final model above.

Table 4. Summary results of the discrete-time hazard model for women aged 15-24 for the three surveys

Variables	2000		2005		2011	
	Coeff.(SE)	HR	Coeff.(SE)	HR	Coeff.(SE)	HR
Intercept	-4.5122(0.1966)	-	-3.6123(0.1905)	-	-3.2360(0.1862)	-
Region						
Tigray	0.2279(0.1015)	1.256*	0.3421(0.1136)	1.408**	0.1722(0.1080)	1.188
Affar	0.0820(0.1240)	1.085	-0.1682(0.1452)	0.845	-0.2458(0.1188)	0.782*
Amhara	0.5032(0.0863)	1.654***	0.2030(0.0990)	1.225*	-0.2165(0.1077)	0.805*
Oromiya (ref.)	-	1.00	-	1.00	-	1.00
Somali	-0.3396(0.1393)	0.712*	0.0612(0.1519)	1.063	0.0459(0.1336)	1.047
Benishangul -Gumuz	0.1638(0.1121)	1.178	0.3613(0.1209)	1.435**	0.2450(0.1160)	1.278*
Gambel	-0.6721(0.1063)	0.511***	-0.2541(0.1053)	0.776*	-0.4389(0.1143)	0.645***
SNNP	0.1701(0.1241)	1.185	0.6089(0.1345)	1.838***	0.4466(0.1205)	1.563***
Harari	-0.1534(0.1290)	0.858	0.4408(0.1373)	1.554**	0.1898(0.1331)	1.209
Addis Ababa	-1.1047(0.1477)	0.331***	-0.4864(0.1528)	0.615**	-1.1653(0.1901)	0.312***
Dire Dawa	-0.9291(0.1560)	0.395***	0.2223(0.1528)	1.249	-0.1990(0.1456)	0.820
Woman's educational attainment						
No education (ref.)	-	1.00	-	1.00	-	1.00
Primary	-0.2941(0.0784)	0.745***	-0.5225(0.0747)	0.593***	-0.7456(0.0638)	0.474***
Secondary and above	-0.8820(0.1175)	0.414***	-1.3037(0.1156)	0.272***	-1.9242(0.1286)	0.146***
Woman's place of Residence						
Urban (ref.)	-	1.00	-	1.00	-	1.00
Rural	0.3429(0.0865)	1.409***	0.4273(0.1020)	1.533***	0.3351(0.0861)	1.398***
Exposure to media						
Yes	-0.3365(0.0693)	0.714***	-0.1879(0.0704)	0.829**	-0.1717(0.0626)	0.842**
No (ref.)	-	1.00	-	1.00	-	1.00

*p<=0.05;**p<=0.01;***p<=0.001; SE: standard error; HR: hazard ratio; ref.: reference

According to Table 4, the effect of region on the hazard of timing of teenage birth was not consistent across regions and over time. For example, a 15-20 year old woman who lived in Tigray in 2000 and 2005 had, respectively, 25.6 % (HR=1.256) and 40.8% (HR = 1.408) higher risk of having a first birth before 20 years of age compared to her counterpart in Oromiya region, controlling the effect of other variables in the model. On the other hand, the hazard of timing of first birth before age 20 was significantly lower in the three survey for Amhara region compared to Oromiya when the effect of other factors in the model were controlled.

Women with secondary and above level of education had the lowest chance of having a teenage first birth compared to women who had no education and the decrease was more pronounced in 2011. Similarly, women who had exposure to media information were less likely to have early birth compared to those who had no exposure to media news/information.

4 DISCUSSION

The result of this study regarding the impact of education on early first birth agrees with the findings of others as discussed next. Findings of studies done in Brazil (Gupta and Leite, 1999) and in other eight sub-Saharan African countries (Gupta and Mahy, 2003) showed that high level of education was found to be strongly associated with delayed childbearing among adolescents. More specifically, Gupta and Mahy (2003) found that education (grade 8 and above) consistently and significantly helped to reduce the risk of having first birth before age 20. Kamal (2012) showed that secondary and higher level of education was an important determinant in delaying birth among women in Bangladesh. Another study in Bangladesh by Nahar and Min (2008) showed that higher education was inversely related to have first birth before age 20. A study in Sweden by Olausson et al. (2001) also revealed that teenage birth was positively associated with low educational attainment. According to Elisa and Nunez (2001) education showed a strong negative effect on teenage birth, especially up to 11-13 years of education in the six Latin American countries under study (Bolivia, Brazil, Colombia, Guatemala, Dominican Republic and Peru). The risk of having first birth before age 20 among 11-13 years of education was lower than the risk observed among those with 0-3 years of education.

In the 2000, 2005, and 2011 EDH the risk of having first birth before age 20 among for women exposed to media were 28.6%, 17.1% and 15.8%, respectively. These percentages show that the changes, especially for 2005 and 2011, are not dramatic. Perhaps, this could be because the increase in mass media exposure is a recent phenomenon, and that it takes time for media exposure to bring about increase in knowledge about teenage birth. A study by Gupta and Mahy (2003) conducted in eight sub-Sahara African countries agrees with the result of the current study. They found that regular listening to radio broadcast habit was inversely associated with the probability of an adolescence first birth in Cote de Voire and Zimbabwe.

The current study identified place of residence as a characteristic that is associated with adolescent motherhood. Urban women had a lower proportion of teenage birth than rural women of the age group 15-19. The studies by Gupta and Mahy (2003), Katherine et al. (2009), Chandrasekhars (2010), and Kamal (2012) came up with similar conclusions. A reason for that could be that women in urban areas had better access to health services than those living in rural places (World Bank, 2004). On the other hand, results from studies from Brazil and Colombia contradict our finding indicating that place of residence had no significant effect or loses its effect when the disparity in socio-economic levels was controlled (Gupta and Leite, 1999; Cesare and Rodriguez, 2006).

5 CONCLUSION

In this study, we were not only interested in 'whether' a woman had first birth before age 20, but also in 'when' they had first birth (age at first birth). The result of baseline model revealed that the chance of having first birth at age 15, 16, 17, 18, and 19 was increasing in all three surveys (Table 2). The study also revealed that residing in urban areas and having secondary and above level of education were inversely associated with teenage birth in all three surveys. Exposure to media did not show a considerable effect towards reducing teenage birth over time. Hence, more should be done to effectively use media information about early birth.

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La contamination bactérienne des pigeons: une des contraintes du développement de la colombiculture au Maroc

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ABSTRACT: In the framework of a general program to develop the production of the pigeon flesh in Morocco, we carried out in our laboratory a specific study on the bacterial risk contaminations of two local pigeon races called Beldi and Mgandi; in addition to a spanish race named Sevillanos. In fact, as the most poultry species, pigeons are characterized by their small size, an ease in manipulation on the farm and slaughtering, necessitating simpler devices for experiments. The latter has for objectives the genetic selection and the comparison of food systems of farm breeding methods.
The results of the various analysis and the comparison of the averages show an important contamination of the visceral organs by different germs.
This study shows that the local races are characterized by their resistance to colliforms, staphylococcus and streptococus. If the months with high temperature remain a favourable periode for the developpement of the faecal germs, the wintry months, however, are characterized by a high rate of mortality among pigeons.
Besides, the female pigeons remain more exposed to the contaminations by most of the studied germs.

KEYWORDS: pigeon, races, contamination, bacteria.

RÉSUMÉ: Dans le cadre d'un programme général de développement de la production du pigeon de chair au Maroc, une étude précise a été entrepris sur les risques de contamination bactérienne de deux races locales appelées *Beldi* et *Mgandi* et une race espagnole dite *sevillanos*. En effet, comme la plupart des espèces avicoles, le pigeon est caractérisé par sa petite taille, une grande facilité dans la manipulation pour l'élevage et l'abattage, permettant à l'éleveur de mettre aisément des dispositifs expérimentaux ayant pour objectifs, la sélection génétique, la comparaison des régimes alimentaires ou encore des modes d'élevage du pigeon.
Les résultats des analyses de variance et la comparaison des moyennes montrent une importante contamination des organes viscéraux par les différents germes (les coliformes totaux et fécaux, les streptocoques totaux et fécaux et les staphylocoques)
Si les mois chauds restent évidemment la période favorable au développement des germes fécaux, les mois hivernaux sont des mois de mue des pigeons coïncidant avec une période de mortalité importante.
Par ailleurs les femelles restent les plus exposées aux contaminations par la plupart des germes étudiés. Enfin, Cette étude montre également que les races autochtones se caractérisent par leur forte résistance aux germes étudiés.

MOTS-CLEFS: pigeon, races, contamination, bactérie.

1 INTRODUCTION

L'élevage semi industriel du pigeon domestique a débuté aux USA vers 1930 et s'y est développé rapidement, porté par une demande soutenue des consommateurs américains. Ce n'est que vers 1963 que les premiers élevages ont vu le jour en France. Cet élevage connaît aujourd'hui une industrie fleurissante dans ces pays et dans la plupart des pays occidentaux.

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Au Maroc, malgré les conditions favorables et malgré la diversité des races élevées, les tentatives de production intensive du pigeon de chair ont généralement tendance à échouer par ce qu'ils ne sont assurés que dans des élevages familiaux.

Parmi les contraintes liées au développement de la colombiculture, les croisements consanguins, sans aucun choix préalable des couples et des races des reproducteurs. A ces facteurs s'ajoutent les conditions d'élevage, et les contaminations par différents parasites.

En présence de toutes ces contraintes. Le rendement annuel des élevages reste très faible et son amélioration s'avère indispensable afin de résorber le déficit de la production de viande colombicole au Maroc.

Dans le cadre d'un suivi de la contamination bactérienne réalisé au laboratoire, les résultats ont montré que les staphylocoques, les streptocoques, et les coliformes restent des bactéries secondaires (1, 2, 3,4); Leur présence a pour conséquence l'affaiblissent des pigeons, les rendant surtout vulnérables aux salmonelles qui provoquent une forte mortalité chez les pigeonneaux (1, 2, 3, 4).

La présente étude à pour but la caractérisation quantitative et qualitative de la flore de contamination pour trois races de pigeons, deux locales standardisées au Maroc, dites *Beldi* et *Mgandi* et une race d'origine espagnole appelée *Sevillanos*. L'analyse de la charge microbienne a été réalisée sur les organes les plus infestés (foie, gésier, intestin, chair, cœur, Poumon et rate), ainsi que sur la période de prolifération intensive de chaque type de bactérie.

La connaissance de ce phénomène de contamination par ces différents types de bactéries, permettra aux éleveurs d'essayer de se prémunir contre les dégâts qui peuvent être causés au niveau des élevages par l'établissement d'un programme prophylactique.

2 MATÉRIEL ET MÉTHODES

2.1 RACES DE PIGEONS

Trois races de pigeon ont été utilisées dans cette étude :

- deux races locales mgandi et beldi (figure 1et 2) ont étés sélectionnées et standardisées par le laboratoire de Génétique et Biométrie de la faculté des sciences de kénitra durant plusieurs années (5). Celles ci sont les plus représentées et les mieux commercialisées dans le marché marocain.

Figure 1 : Couple de race mgandi
(Photo Soulaymani)

Figure 2 : photo de race beldi
(Photo Soulaymani)

- une race européenne (figure 3) : sevillanos est d'origine espagnole (6). Le choix de cette dernière est basé sur le fait qu'elle occupe la deuxième place après les deux races locales sur le marché Marocain.

Figure 3 : Couple de race sevillanos
(Photo Soulaymani)

2.2 CONDITIONS D'ÉLEVAGE

L'étude à été effectuée sur 30 couples de pigeon, 10 couples pour chaque race. L'élevage est réalisé en claustration complète dans des parquets identiques et indépendants composés chacun de six pondoirs à double case disposés en damier. La présence d'un pondoir supplémentaire évitera la compétition pour les nids (7,8,9,10 ,11, 12), tout en respectant la convention de l'union européenne , qui prévoie que tout animal bénéficie d'un hébergement adapté, d'une alimentation adéquate à tout moment et de soins appropriés à ses besoins physiologiques et comportementaux en accord avec l'expérience acquise et les connaissances scientifiques (13) . Il faut souligner que l'élevage en claustration diminue les risques de contamination microbienne, en réduisant le contact avec les animaux sauvages et les autres animaux domestiques

L'alimentation des pigeons est composée de céréales à raison de 40% de mais, 30 % de blé et 30%de légumineuse, auxquels sont ajoutés du calcium de 7%, du chlorure de sodium de 3% et des vitamines avec 13% (14).

2.3 ANALYSE BACTÉRIENNE

Les pigeons apportés au laboratoire sont soit malades ou morts avec une période post mortem ne dépassant pas 30 minutes seuls les pigeons qui ont été morts sous surveillance ont fait l'objet de notre étude. En effet, après la mort ou

pendant la période agonique, le cadavre est envahi par les germes en provenance de la masse intestinale. Dans ces conditions, les résultats obtenus ne peuvent être interprétés. Par ailleurs, il est nécessaire que les animaux agonisants (ou cadavres) apportés au laboratoire n'aient pas reçu de traitement aux antibiotiques (1, 2,3). Les carcasses sont mises dans des sacs stériles en plastique, puis sont rapidement acheminées au laboratoire ou elles sont conservées à 4°C jusqu'au moment de l'analyse. L'analyse bactérienne réalisée sur 13 pigeons de notre élevage est basée sur la méthode dite destructive (15).

Les abats prélevés (foie, gésier…) sont placés dans des flacons stériles. Après macération, 5 grammes de l'homogénat est placé dans 20 ml d'eau peptonée tamponnée qui constitue la solution mère et qui va servir à la préparation de la dilution 10^{-1}. Les dilutions successives sont effectuées dans l'eau physiologique stérile jusqu'à 10^{-6}.

2.4 CARACTÈRES ÉTUDIÉS ET MÉTHODE D'ANALYSE

2.4.1 CARACTÈRES BACTÉRIENNES

L'étude a porté sur le dénombrement de la charge bactérienne (en coliformes, streptocoques, et staphylocoques) de plusieurs organes (foie, gésier, intestin, cœur, poumon et chair) en fonction de la race, du sexe et du mois de la mort de chaque pigeon.

- Dénombrement des coliformes : Ces bactéries ont été dénombrées sur gélose au désoxycholate lactose (DCL). Les boites ont été ensemencées en profondeur et par la méthode de la double couche. L'incubation est réalisée pendant 24 à 48 heures à 37°C pour les coliformes totaux et à 44°C pour les coliformes fécaux. Après incubation et dans les deux cas, les colonies apparaissent rouge rosâtre avec un halo de précipitation d'acide biliaire.
- Dénombrement des streptocoques : Le dénombrement de ces germes a été effectué sur milieu Slanetz et Bartley, ensemencé en surface. L'incubation est réalisée pendant 48 heures à 37°C pour les streptocoques totaux et à 44°C pour les streptocoques fécaux. Seules les colonies roses à marrons sont dénombrées.
- Dénombrement des staphylocoques : ce dénombrement est réalisé sur l'agar sélectif d'après chapman. L'ensemencement se fait en surface et l'incubation est faite à 37°C pendant 48 heures. Seules les colonies présentant un halo jaune sont dénombrées.

2.4.2 CARACTÈRES STATISTIQUES

L'analyse statistique est effectuée par le logiciel statistica, la variabilité du nombre de bactérie exprimé en UFC/gramme d'organe, est analysée selon un modèle à effets fixés comprenant les effets des facteurs race, organe, sexe, et mois de prélèvement pour chaque échantillon. La comparaison multiple des moyennes est réalisée par le test Tukey's chaque fois que l'analyse de la variance révèle des différences significatives

3 RÉSULTATS

3.1 CARACTÉRISTIQUES DE LA CHARGE BACTÉRIENNE AU NIVEAU DE LA POPULATION ÉTUDIÉES

Les résultats de la charge bactérienne globale de notre population toutes races, tous sexes, tous mois et tous organes confondus sont consignés sur le tableau I.

Tableau I: charge bactérienne globale des différents germes étudiés

Groupe microbien	N (nombre de répétition de chaque analyse)	Moyenne	Ecart -type
Coliformes totaux	273	5,92	0,63
Coliformes fécaux	273	4,54	0,57
Streptocoques totaux	273	5,95	2,46
Streptocoques fécaux	273	4,43	0,59
Staphylocoques	273	5,81	0,49

Les résultats montrent que les germes totaux que ce soit pour les Coliformes, les Streptocoques ou les Staphylocoques présentent les moyennes de contaminations les plus élevées. En effet cette microflore est d'origine fécale colonisant ainsi tous les organes de l'animal.

3.2 ANALYSE DE VARIANCE

Afin de déceler l'influence des facteurs organes, mois, races et sexe, une analyse de variance à 1seul facteur est effectuée, cette analyse est résumée dans le tableau II.

Tableau II : l'analyse de variance a une seule variable à P< 0.05 pour les différents types de germes en fonction des facteurs étudiés

	Groupe microbien (log10UFC)	F	P	Différence
	Coliformes totaux	2,55	0,020	*
	Coliformes fécaux	3,35	0,003	**
Organes	Streptocoques totaux	1,27	0,266	---
ddl=6	Streptocoques fécaux	4,62	0,000	***
	Staphylocoques	5,75	0,000	***
	Coliformes totaux	51,84	0,000	***
	Coliformes fécaux	58,87	0,000	***
Mois	Streptocoques totaux	1,48	0,205	---
ddl=4	Streptocoques fécaux	4,15	0,002	**
	Staphylocoques	2,29	0,059	---
	Coliformes totaux	0,95	0,387	---
	Coliformes fécaux	3,69	0,026	*
Races	Streptocoques totaux	2,09	0,124	---
ddl=2	Streptocoques fécaux	5,38	0,005	**
	Staphylocoques	1,08	0,338	---
	Coliformes totaux	5,77	0,016	*
	Coliformes fécaux	15,94	0,000	***
Sexe	Streptocoques totaux	2,15	0,143	---
ddl=1	Streptocoques fécaux	1,55	0,213	---
	Staphylocoques	5,00	0,025	*

** différence significative ; ** très significative ; *** hautement significative, --- pas de différence*

Le facteur organe présente un rapport F hautement significatif pour les streptocoques fécaux, les staphylocoques totaux et fécaux et une variance significative pour les coliformes totaux et fécaux.

En général, pour le facteur mois, le rapport F est hautement significatif pour les coliformes totaux et fécaux ainsi que les staphylocoques fécaux et significatifs pour les streptocoques fécaux.

Cependant l'analyse de variance en fonction des races n'est significative que pour les coliformes fécaux et les streptocoques fécaux.

3.3 COMPARAISON MULTIPLE DES MOYENNES

La comparaison multiple des moyennes est effectuée chaque fois que l'analyse de variance s'avère significative. (Les groupes affectés de la même lettre ne présentent pas de différence significative)

- Effet d'organe:

Tableau III : la moyenne et écart type de chaque type de germes (log 10 UFC/g) en fonction des organes

Organes	Coliformes totaux	Coliformes fécaux	Streptocoques fécaux	staphylocoques
Foie	5,92±3,49ab	4,49±0,16ab	4,52±0,32ab	5,68±0,51bc
Cœur	5,66±0,66b	4,28±0,59b	4,17±0,58b	5,60±0,46c
Chair	5,98±0,57ab	4,62±0,30ab	4,52±0,48ab	5,95±0,29ab
Intestin	6,16±0,50a	4,77±0,54a	4,33±0,66b	5,70±0,35bc
Rein	5,98±0,61ab	4,61±0,56ab	4,50±0,53ab	5,73±0,68bc
Poumon	5,79±0,70ab	4,36±0,65ab	4,23±0,69b	5,91±0,59bc
Gésier	5,97±070ab	4,60±0,62ab	4,76±0,63a	6,11±0,23a

Les groupes affectés de la même lettre ne présentent pas de différences significatives.

L'intestin constitue l'organe le plus infesté que ce soit pour les coliformes totaux ou les coliformes fécaux, alors que pour les autres germes, cet organe se classe en second lieu. Notant aussi que, le gésier présente le taux le plus élevé que soit pour les streptocoques totaux et fécaux que pour les staphylocoques totaux.

Cependant, les organes cœur et poumon se caractérisent par leur faible teneur par les différents germes étudiés. En effet le système digestif contient déjà ces germes mais à des faibles taux, le déséquilibre sanitaire observé à un certain stade de vie de l'animal favorisera l'apparition de ces bactéries, et prendront le dessus sur les germes dits de barrière. Ainsi les organes qui seront les plus infestés appartiennent à l'appareil digestif à savoir l'intestin et le gésier.

- Effet de Mois:

Tableau IV : la moyenne et écart type de chaque type de germes (log 10 UFC/g) en fonction des mois

Mois	Coliformes totaux	Coliformes fécaux	Streptocoques totaux	Streptocoques fécaux	staphylocoques
Janvier	5,71±0,61c	4,53±0,56ab	5,70±0,77	4,28±0,63b	4,57±0,44a
Février	4,53±0,78d	3,23±0,59c	5,80±0,51	4,31±0,41ab	4,15±0,68b
Mars	5,78±0,31bc	4,34±0,30b	5,83±0,26	4,50±0,25ab	4,34±0,42ab
Juillet	6,07±0,25ab	4,64±0,56a	5,60±0,92	4,30±0,77b	4,37±0,57b
Août	6,12±0,25a	4,74±0,24a	6,40±3,81	4,60±0,38a	4,58±0,24a

Les groupes affectés de la même lettre ne présentent pas de différences significatives.

En général, c'est durant les mois chauds (août et juillet) que le taux de contamination est le plus élevé par les différents germes. En effet, la chaleur d'été et l'humidité favorisent la prolifération de la plupart des germes. Cependant, malgré le faible taux de contamination pour les germes cités ci-dessus, en période hivernale (froide), Soulaymani et al(16) ont observé une forte mortalité. Ces observations s'expliquent par le fait que cette période froide coïncide avec celle de mue des pigeons.

- Effet de race:

La comparaison multiple des moyennes montrent que les trois races de pigeons ne différent significativement que pour les coliformes fécaux et les streptocoques fécaux, les résultats de ces comparaisons sont consignées sur le tableau V.

Tableau V : la moyenne et écart type de chaque type de germes (log 10 UFC/g) en fonction des races

Races	Coliformes fécaux	Streptocoques fécaux
Mgandi	4,98±0,41ab	4,31±0,66b
Sevillanos	4,45±0,72b	4,52±0,53a
Beldi	4,77±0,76a	4,63±0,16a

Les groupes affectés de la même lettre ne présentent pas de différences significatives.

Il est à noter que les races locales présentent la plus forte contamination pour les coliformes fécaux, et les races beldi et sevillanos sont les plus infesté par les streptocoques fécaux. Malgré que la race beldi présente une forte contamination les travaux antérieurs (16) ont montré une meilleure adaptation de cette race.

- Effet de sexe:

Les femelles restent les plus exposées aux infections bactériennes que les males, à savoir les coliformes totaux et fécaux, les staphylocoques totaux, cependant les streptocoques totaux et fécaux s'attaquent d'une façon similaire aussi bien aux femelles qu'aux males.

4 DISCUSSION

Depuis plusieurs années, l'étude de la sélection génétique du pigeon d'élevage occupe une place de choix dans la thématique générale de notre laboratoire (16, 17,18,). Ce projet d'amélioration génétique des races de pigeon producteur de chair ne peut aboutir que si les études de sélection génétique sont accompagnées d'une bonne connaissance de la qualité microbiologique du produit destiné à la consommation et l'élaboration d'un plan prophylactique. Or, il se trouve que lors de notre recherche bibliographique, aucune étude bactériologique n'aurait été relevée sur le pigeon. En effet, les études microbiologiques dans la littérature sont essentiellement axées sur le poulet et la dinde (19).

Les résultats de cette étude microbiologique sur trois races de pigeons : deux locales mgandi et beldi et une espagnole sevillanos montrent que la race mgandi présente le taux de contamination le plus bas pour les différents germes étudiés. Alors que les races beldi et sevillanos présentent une charge bactérienne plus importante par rapport à celle trouvé sur la race mgandi. Cependant, une différence persiste entre la race beldi et sevillanos au sujet du taux de mortalité. En effet, le taux de mortalité chez la race beldi est inférieur à celui de la race sevillanos, même si les deux races présentent la même charge bactérienne. Ces résultats peuvent s'expliquer par le fait que les races locales n'ont pas subi une forte sélection et reste très proche de la race sauvage caractérisé par une résistance aux maladies.

Par ailleurs, l'analyse de la contamination en fonction des mois ne présente pas de différence, sauf pour les germes d'origine fécaux qui prennent de l'ampleur au mois de juillet et août. Ces mois coïncident avec l'augmentation de la température estivale. Les germes les plus présents sont les streptocoques et les coliformes qui sont des archétypes bactériens signant une contamination d'origine fécale et signalant la présence éventuelle d'autres bactéries pathogènes (20). Cependant, il est important de noter que la mortalité des pigeons s'observe également durant la période hivernale qui coincide avec la période des mues et où les pigeons sont affaiblis.

Quant à la contamination des différents germes en fonction des organes, elle est différente, avec un taux de contamination plus élevé pour les organes viscéraux tels que le foie, les intestins et le gésier. Cela concorde avec les résultats obtenus par (19). Dans le même contexte (21) précisent que ces germes sont responsables de pertes économiques majeurs dans les élevages avicoles. Enfin, Notons que les organes cœur et poumon présentent le taux le plus bas de contamination.

Pour ce qui est de la contamination en fonction du sexe, les femelles restent les plus exposées aux contaminations aussi bien aux coliformes qu'aux Staphylocoques. Cela s'explique par le fait que ces germes vivent normalement sur la peau, dans les cavités nasales et au niveau des premières voies respiratoires chez la plupart des volailles soumise à un élevage intensif (22). Toute fois, ils peuvent devenir pathogènes et envahir les tissus à la suite d'une blessure ou d'une plaie ou à la suite de la pente excessive (23). Cette pathogenicité s'exprime par une production intense d'entérostomies et par conséquent une nuisance de la santé de l'animal (24).

5 CONCLUSION

La production de pigeon de chair nécessite d'une part une sélection génétique des pigeons capables de se reproduire facilement en évitant les croisements consanguins et d'autre part, des conditions d'élevage contrôlées aussi bien de point de vue alimentation équilibrée, que du point de vue hygiène des locaux d'élevage et d'abattage. Sans oublier, l'élaboration d'un plan prophylactique contre les germes et les parasites qui provoquent des ravages dans les élevages de volaille de manière générale.

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Behavior of *Xanthomonas fragariae* in an inorganic medium enriched with N, P, or K

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ABSTRACT: In this study, the behavior of *Xanthomonas fragariae*, angular leaf spot of strawberry agent, was followed in the AB medium, enriched with nitrogen, phosphorus or with potassium, and in the soil of the Mamora forest with 14% to 28% of humidity in function of these fertilizer elements. The obtained results have shown that Na_2HPO_4 and NH_4Cl, used, 0.01 and 0.05 mol/L, respectively as a phosphorus and nitrogen source, have a significant effect on the survival of *Xanthomonas fragariae.* By contrast, KCl, used as a source of Potassium, has no significant effect on the number of culturable cells.
The three sources used NPK, 14% and 28% showed a great influence on the number of culturable cells of *Xanthomonas fragariae*, either increasing or decreasing. Potassium, at 28 to 14% of humidity, inhibited the rate growth of Xanthomonas, while the phosphorus and nitrogen stimulated its growth, greater than 28% of humidity than 14%. Similarly the bacterial growth was not affected during the incorporation of NPK at different concentrations in the soil of Mamora.

KEYWORDS: *Xanthomonas fragariae*, growth, fertilization, Nitrogen-Phosphorus-Potassium, soil, humidity.

1 INTRODUCTION

Angular leafspot, caused by *Xanthomonas fragariae* (Kennedy et King, 1962), was described in New Zealand, Australia, Asia and in Africa and in the majority of the European countries where the strawberry is cultivable (CABI/EPPO, 2013). In Morocco, angular leaf spot of strawberry, is responsible for considerable yield losses, it was reported first on strawberry in the region of Loukkous (Mdarhri, 2005). It causes the browning of sepals that dry, affecting the aesthetic quality of fruits. *Xanthomonas fragariae* attacks the leaves and migrates to the crown and roots of plants; they spread from the diseased plants to healthy plants in strawberry fields through irrigation, splashing rain, wet equipment, etc. The conditions for the disease are medium or cool temperatures during the day, night low temperatures and high humidity (Fisher, 2004).

In order to limit the damages induced by plants, several control methods are developed, mineral nutrition, for example, is much in demand as a means of prevention against many diseases (El Youssfi *et al.,* 2014; Wienhold *et al.,* 2009**)**. In this sense, despite the nitrogen is used to improve crop yields (Christiane *et al.,* 1999; Dossa *et al.,* 1991), but at the same time increases the sensitivity and susceptibility of plants to leaf diseases (Develash et Sugha, 1997; Doshi et Thakore, 1995; Vilain, 1993 ; Nacro *et al.,* 1997). Phosphorus has variable effects on performance. Repeated applications of phosphorus affect the useful microbial diversity over time and cause a drop in crop yields (Gyaneshwar *et al.,* 2002). As for potassium, it is able to reduce several plant diseases (Anderson, 2002).

The present study aims to investigate 1 / the relationship between fertilization and *in vitro* behavior of *Xanthomonas fragariae* in the AB media nitrogen-enriched, phosphorus or potassium and 2 / and its behavior depending on the humidity, 14% and 28% in soil amended nitrogen, phosphorus or potassium.

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2 MATERIALS AND METHODS

2.1 PREPARATION OF THE BACTERIAL SUSPENSION

The used strain of *Xanthomonas fragariae* in this study is from the collection of the microbiology laboratory of the Faculty of Applied Sciences in Kenitra. It was isolated from strawberry leaves of the variety "Camarosa" grown in greenhouses of M'nasra (Gharb) (Djassinra *et al.,* 2012).

A preculture of the strain was carried out at 26 ° C on medium LPG, 24 hours later, a suspension of bacterial CFU / mL (OD = 0.1) at 620 nm was prepared (Turechek et Peres, 2009).

2.2 PREPARATION AND SOIL INOCULATION

Soil samples from Soil Mamora were taken, after eliminating the top 5 cm of the surface (15 to 25 cm of the vertical depth). The pH of the various soil samples was 7.4.

After screening, 20 g of soil are left in screw vials. They are sterilized at 121 ° C for 15 min. After cooling, the moisture content of the soil sterile tubes is adjusted to 28% or to 14% (P / V).

Each vial of soil supplemented with different concentrations of nitrogen source (NH4Cl), phosphorus (Na_2HPO_4) or potassium (KCl), was inoculated with 1 mL of the bacterial suspension of *Xanthomonas fragariae,* ajusted to 10^8UFC/mL corresponding to the exponential growth phase. Pots are then incubated in the dark at 26 ° C for 32 days.

2.3 COMPORTEMENT DE *XANTHOMONAS FRAGARIAE*

2.3.1 IN MINERAL AB MEDIUM ENRICHED WITH NITROGEN, POTASSIUM OR PHOSPHORUS

250 ml flasks containing 40 ml of AB mineral solution (1 g/L of NH_4Cl, 0.3 g/L de$MgSO_4$, 0.15 g /L of KCl, 0.01 g/L of CaCl2, 2.5 mg/L of $FeSO_4$) modified and supplemented of 1g/L of glucose (Emily Alexander *et al.,* 1999). They are complemented by different concentrations of Na2HPO4, KCl or NH4Cl, while the control is performed without these elements. They are then inoculated with a bacterial suspension of 108 CFU / mL and incubated at 26 ° C.

2.3.2 BACTERIAL COUNT

In order to achieve bacterial count of each sample, a series of successive dilution of 1/10 is carried out. After stirring, 0.1 of each dilution was cultivable on Petri dishes containing medium YPGA (Van Den Mooter *et al.,* 1990), the incubation is carried out in the dark and at 26 ° C for 24 days.

The bacterial concentration was expressed as CFU / mL using the following formula.

UFC/ml = NC / 0.1mL x Fd

CFU: colony forming units, NC: number of colonies, Fd: dilution factor. The results are expressed as log10 CFU / mL.

2.3.3 ANALYSES STATISTICS

All analyzes were performed with the software Statistics for Social Sciences (SPSS, version 21.0) and the Excel spreadsheet program (version 2013). Data were represented as mean ± standard deviation (SD) or median (interquartile range from 25 to 75).

The normality of distribution was tested by the Kolmogorov-Smirnov test. In the case of abnormal distribution, Mann-Whitney test was used to compare median between two independent samples. In the case of normal distribution and if the variances are homogeneous, the ANOVA, a factor between two or more independent samples, was used. Post hoc tests were used for multiple comparisons. P values <0.05 were considered significant.

3 RESULTS

3.1 BEHAVIOR OF *XANTHOMONAS FRAGARIAE* IN THE AB MINERAL MEDIUM ENRICHED N, P OR K

The evolution of the growth of *Xanthomonas fragariae* in the AB mineral medium, supplemented with different concentrations of Na2HPO4, KCl or NH4Cl, (0.01, 0.05 and 0.15 mol / l) is followed by counting the number of culturable cells in CFU / mL (Table I and Figure 1).**Table I: Evolution of the number of cultirable cells of *Xanthomonas fragariae* in the mineral AB medium supplemented with different concentrations of N, P, or K over time without moisture .The results are expressed as log10 CFU / mL.**

mol/L / Days	Control	KCl			Na_2HPO_4			NH_4Cl		
		0.01	0.05	0.15	0.01	0.05	0.15	0.01	0.05	0.15
T1	6,32	6.34	6.88	7.2	6.39	6.4	6.72	6.82	6.51	6.89
T2	6,9	6.42	6.51	6.5	6.4	6.45	7.91	7.26	7.5	7.72
T3	7	6.45	6.98	6.55	6.45	6.52	8.52	7.98	8.52	8.63
T4	7,8	7.81	7.1	7.56	6.51	6.71	8.77	8.77	9.2	9.44
T16	8,25	8.2	9	7.82	6.58	6.86	8.98	9.53	9.73	9.84
T24	9,11	8.88	9.6	9.98	6.66	6.98	8.92	9.61	9.88	9.98

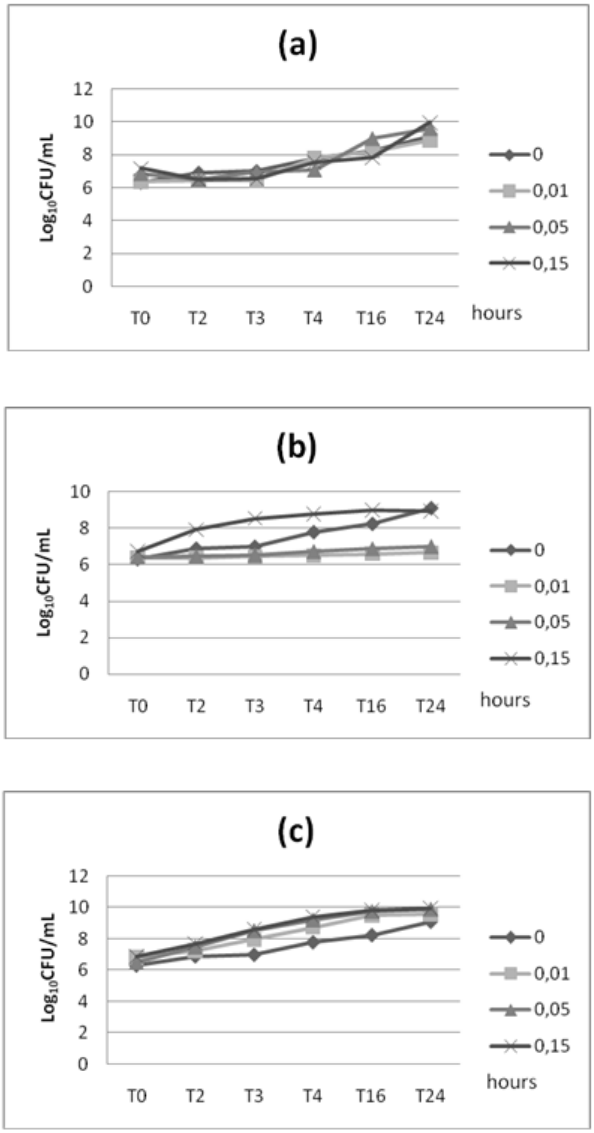


Figure 1: Growth of Xanthomonas fragariae in the AB mineral medium enriched N, P, or K; (a): KCl; (b): Na2HPO4; (c): NH4Cl.

The results in Table N° I show that the number of culturable cells of *Xanthomonas fragariae,* in the AB mineral medium modified and enriched with KCl, increases identically, both the control in media containing different concentrations of KCl (0.01 ; 0.05 ; and 0,15mol/l). As for Na2HPO4, there is a maximum increase in the number of culturable cells for concentration 0.15 mol / L and reaches a high level compared to the control, whereas the level of the increase is less than the control at concentrations 0.01 and 0.05 mol / L.

However, for the NH4Cl, there is an increase in the number of cultivable cells with a maximum of 9.61, 9.88 and 9.98 Log10UFC / ml after 24th days respectively for concentrations 0.01; 0.05 0,15mol / L (Figure 1 (c)).

3.1.1 EFFECT OF AB MINERAL MEDIUM ENRICHED WITH N, P AND K ON THE BEHAVIOR OF *XANTHOMONAS FRGARIAE.*

According to a multiple comparison by the Games-Howell test, the variance of the analysis to a single classification factor, shows that the survival of *Xanthomonas fragariae* is maximal at the concentrations of 0.01 to 0.05 mol / L of Na2HPO4 and NH4Cl. This analysis shows that these concentrations have a highly significant effect of 5% error on the survival of *X. fragariae* while the medium supplemented with different concentrations of KCl has no significant effect on the survival of this bacteria.

Table 1: Effect of different concentrations of potassium, nitrogen or phosphorus on the behavior of Xanthomonas fragariae

concentrations	solutions	signification	Std. Deviation	95% of the average confidence interval		Probability (P)
				minimum	Maximum	
0 (n=6)	**Na2HPO4**	7.56	1.02	6.49	8.64	1.000
	KCL	7.56	1.02	6.49	8.64	
	NH4CL	7.56	1.02	6.49	8.64	
0.01 (n=6)	**Na2HPO4**	6.50	0.11	6.39	6.61	0.015
	KCL	7.35	1.09	6.20	8.50	
	NH4CL	8.33	1.17	7.10	9.55	
0.05 (n=6)	**Na2HPO4**	6.65	0.23	6.41	6.90	0.021
	KCL	7.68	1.29	6.33	9.03	
	NH4CL	8.56	1.33	7.16	9.95	
0.15 (n=6)	**Na2HPO4**	8.30	0.87	7.39	9.21	0.248
	KCL	7.60	1.28	6.26	8.94	
	NH4CL	8.75	1.24	7.45	10.05	

ANOVA with one factor correction Welch.

Table 2: Comparison of multiple concentrations 0.01 and 0.05 mol /L potassium, nitrogen or phosphorus on the behavior of Xanthomonas fragariae.

Variable	I	J	significant difference (I-J)	Std. Error	Probability (p)	95% confidence interval	
						minimum	maximum
0.01	Na_2HPO_4	KCL	-0.85	0.45	0.231	-2.30	0.60
		NH_4CL	-1.83000*	0.48	0.027	-3.38	-0.28
	KCL	Na_2HPO_4	0.85	0.45	0.231	-0.60	2.30
		NH_4CL	-0.98	0.65	0.333	-2.77	0.81
	NH_4CL	Na_2HPO_4	1.83000*	0.48	0.027	0.28	3.38
		KCL	0.98	0.65	0.333	-0.81	2.77
0.05	Na_2HPO_4	KCL	-1.03	0.53	0.222	-2.72	0.67
		NH_4CL	-1.90333*	0.55	0.037	-3.66	-0.15
	KCL	Na_2HPO_4	1.03	0.53	0.222	-0.67	2.72
		NH_4CL	-0.88	0.76	0.500	-2.95	1.19
	NH_4CL	Na_2HPO_4	1.90333*	0.55	0.037	0.15	3.66
		KCL	0.88	0.76	0.500	-1.19	2.95

Both sources have a significant effect on *Xanthomonas fragariae* survival are Na2HPO4 and NH4Cl concentrations 0.01 and 0.05 mol / L.

3.2 BEHAVIOR OF *XANTHOMONAS FRAGARIAE* IN THE SOIL WITH 14% AND 28% OF HUMIDITY IN FUNCTION OF THE POTASSIUM SOURCE

In order to study the survival of *Xanthomonas fragariae* 14% and 28% humidity and the different concentrations of KCl, a comparison of the number of cultivable cells (log_{10}UFC / ml) is performed. The results are reported in Table II and Figure 2.

Table II: Evolution of the number of cultirable cells of Xanthomonas fragariae, in the soil of Mamora at 14% and at 28% of humidity and in function of different concentrations of potassium (KCl). Results are expressed in log_{10} CFU/ml.

	Numbre of cultirable cells (log_{10} CFU mL-1)							
Humidity	**14%**				**28%**			
mol/L / **days**	**0**	**0.01**	**0.05**	**0.15**	**0**	**0.01**	**0.05**	**0.15**
T0	1.18	1.3	1.44	1.64	1.26	1.5	1.62	1.73
T4	6.81	6.3	6.57	6.26	6.26	7.11	7.3	7.49
T8	6.94	8.32	8.5	8.76	7.06	8.46	8.61	8.95
T12	7.33	6.79	6.92	7.09	7.73	6.64	6.84	6.97
T21	7.64	6.24	6.46	6.52	7.90	6.57	6.53	6.6
T32	9.18	6.04	6.11	6.34	9.66	6.24	6.32	6.51

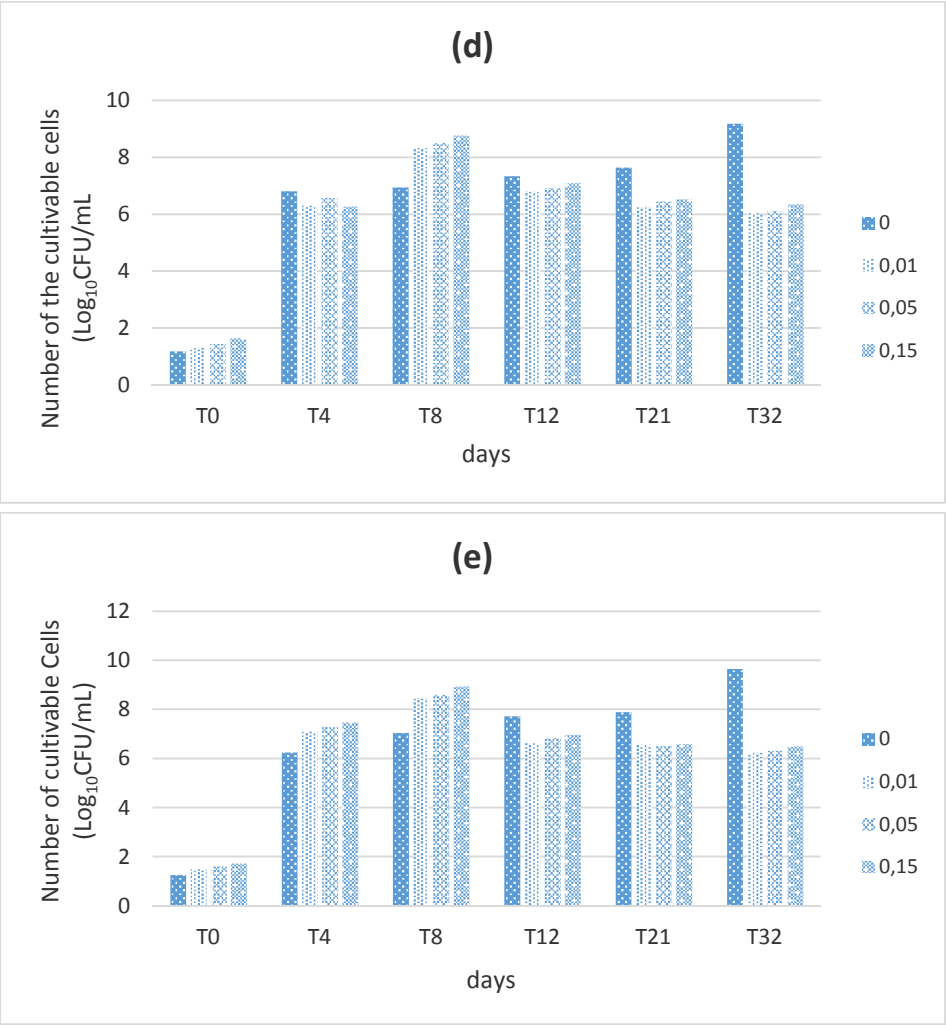


Figure 2 : Bahavior of Xanthomonas fragariae in the soil of the forest of Mamora enriched with potassium ; (d) : 14% Humidity, (e) : 28% Humidity

The evaluation of the survival of cultirable cells of *Xanthomonas fragariae*, in the presence of different concentrations of KCl, at 14% of humidity, passes through two phases during 32 days of incubation. For 0.01; 0.05 and 0.15 mol / L of KCl, there is a phase of growth where the number of cultirable cells increases for all three concentrations, with significant growth from 6.3 to 8,32$\log_{10}$UFC / mL and 6.57 to 8.5 $\log_{10}$UFC / mL and 6.26 to 8,76$\log_{10}$UFC / mL respectively for the above concentrations, followed by a regression phase where culturability *Xanthomonas fragariae* decreases from 8.32 to 6,04$\log_{10}$UFC / mL, from 8.5 to 6.11 $\log_{10}$UFC / ml and from 8.76 to 6,52$\log_{10}$UFC / ml for all three concentrations.

The same remark is observed at 28% of humidity, we note an increasement of the *Xanthomonas fragariae* growth during 8 days, this growth reached a level of the order of 8.46; 8.61 and 8,95log10UFC / mL, followed by a decrease in number of cultivable cells.

• Average Analysis

In order to study the behavior of *Xanthomonas fragariae* in the mineral AB medium in function of humidity, a comparison of the average is carried out, the results are shown in Figure 3.

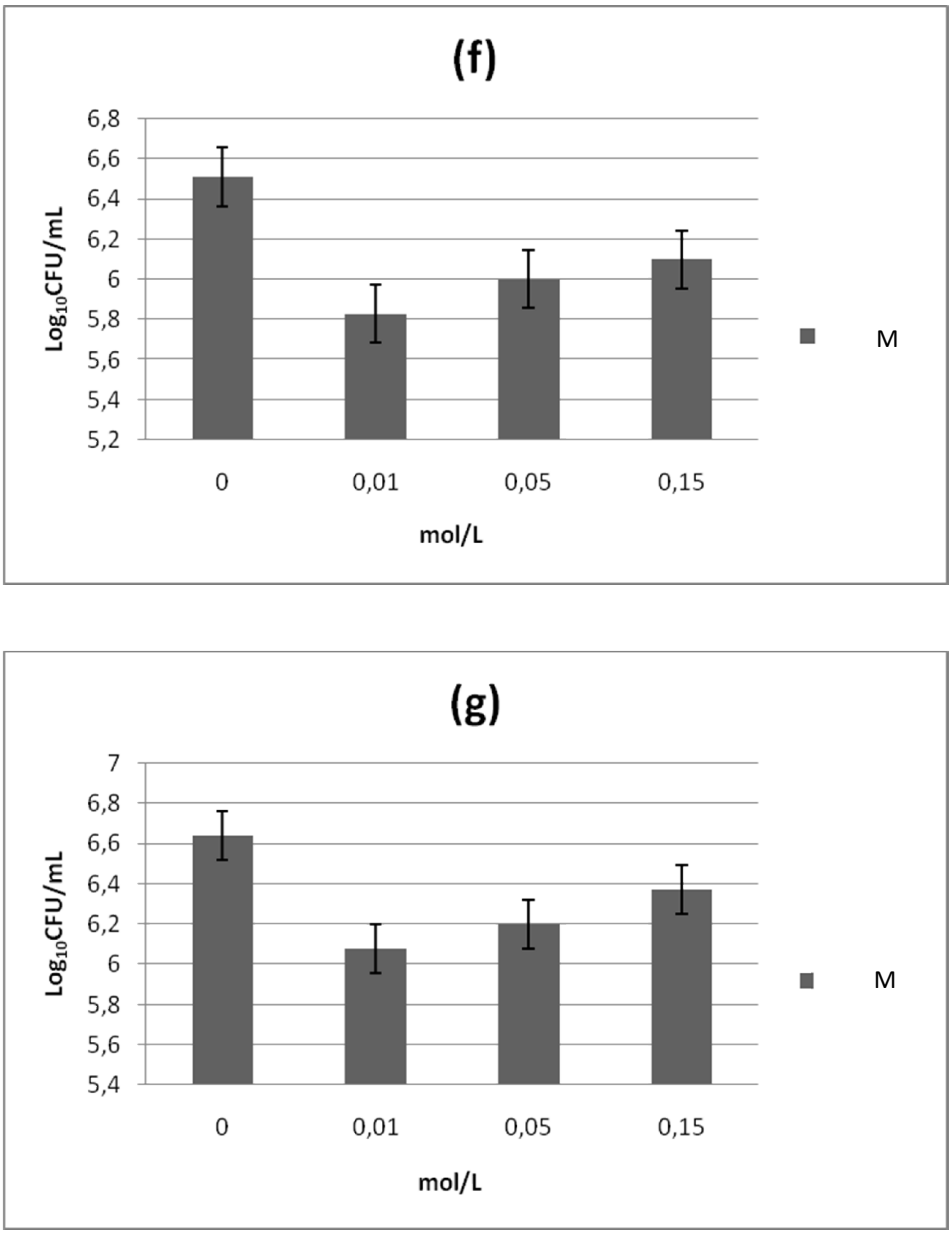


Figure 3 : Average of cultivable cells of Xanthomonas fragariae to the concentartions 0.01 ; 0.05 ; 0.15mol/L of KCl ; at 14% (f) and 28% of humidity (g).

The analysis of the average surviving cells of *Xanthomonas fragariae* in function of the concentrations of KCl, shows that the growth of the bacteria depends on the effect of the KCl concentration in combination with humidity. Indeed, at 14% of humidity, we observe a slight decrease in the average number of culturable cells compared to control that number is less important to 0,01mol / L, while it is important to 0.05 and 0.15 mol / L, but remains lower for the control.

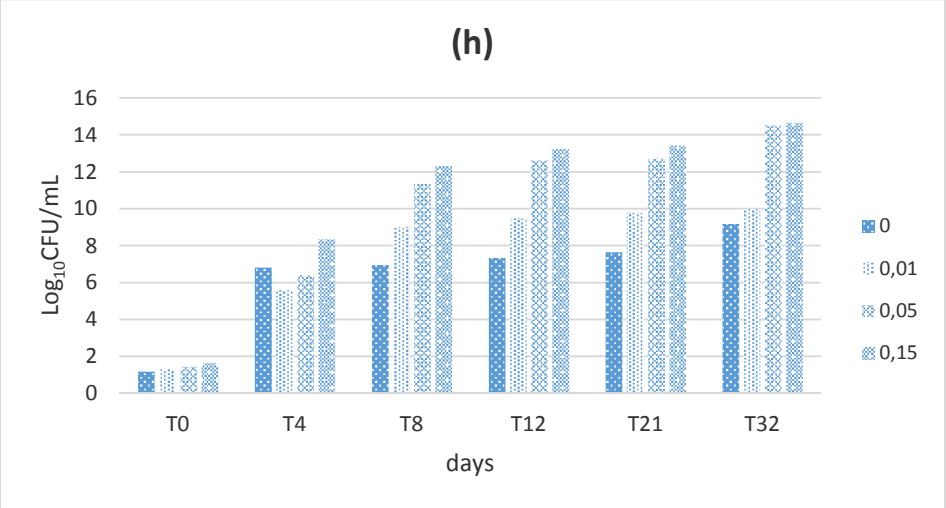
The same remark was observed in 28% of humidity, there is a decrease in the cells number of the bacteria to the concentrations 0.01 compared to control, while the maximum number of cultirable cells was noted for concentration of 0.05 and 0.15mol / L.

3.3 BEHAVIOR OF *XANTHOMONAS FRAGARIAE* IN THE SOIL AT 14% AND 28% OF HUMIDITY IN FUNCTION OF THE NITROGEN SOURCE

The results of the *Xanthomonas fragariae* survival, in the soil of Mamora at 28% and at 14% of humidity in function of different concentrations of NH4Cl are reported in Table III and Figure 4.

Table III: Evolution of the cultirable cells number of Xanthomonas fragariae, in the soil of Mamora at 14% and at 28% of humidity in function of different concentrations of nitrogen. The results are expressed in log_{10} CFU / mL.

	Number of cultivable cells (log_{10} CFU ml-1)							
Humidity	**14%**				**28%**			
mol/L / days	0	0.01	0.05	0.15	0	0.01	0.05	0.15
T0	1.18	1.3	1.44	1.64	1.26	1.5	1.76	1.9
T4	6.81	5.6	6.4	8.34	6.26	8	10.5	12
T8	6.94	9	11.34	12.3	7.06	12.01	11.78	13.2
T12	7.33	9.5	12.62	13.22	7.73	12.46	12	12.9
T21	7.64	9.79	12.71	13.41	7.9	13.8	13.8	14.7
T32	9.18	9.98	14.5	14.65	9.66	13.9	14.45	15



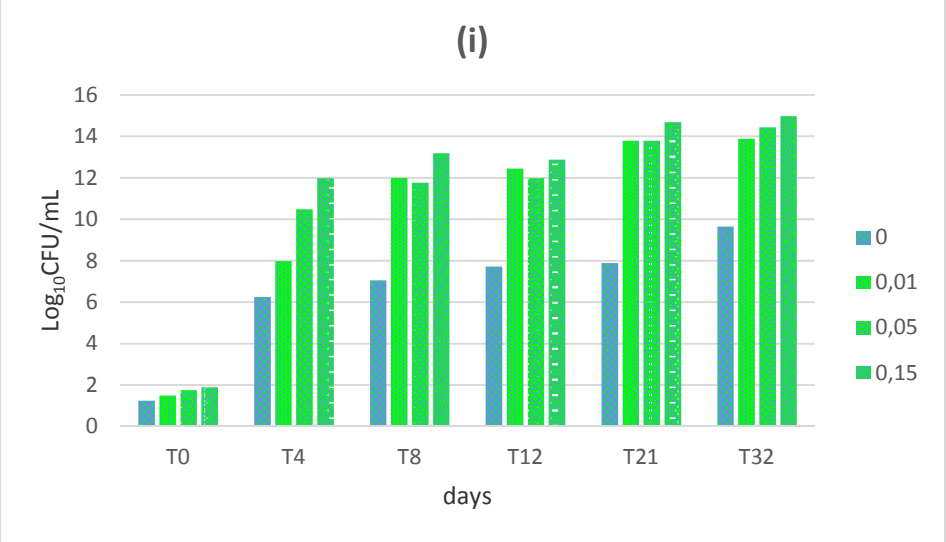


Figure 4 : Behavior of Xanthomonas fragariae in the the soil of Mamora floor enriched with nitrogen; (h) : 14% Humidity, (i) : 28% Humidity.

In general, we observe that the used three concentrations of NH_4CL in function of 14 and 28% of humidity constitute a favorable media to the cellular survival of *Xanthomonas fragariae*. In fact, the cultirable cellular number after 32 days of incubation vary from 14.5 to 14.65 log10 CFU/mL at 14% of humidity for the concentrations 0.05 and 0.15 mol/L and from 14.45 to 15 mol/L at 28% of humidity for the same concentrations. By cons, at the concentration 0.01 mol/L, the bacterial survival is totally different in function of humidity, at 28% of humidity, the number of the cultirable cellular number has known a maximal increase and attains a level in the order of 13.9; 14.45 and 15log10 CFU/mL respectively 0.01; 0.05; 0.15mol/L of NH_4CL that is not comparable with those of 14% that stays less important.

- **Means analyzes**

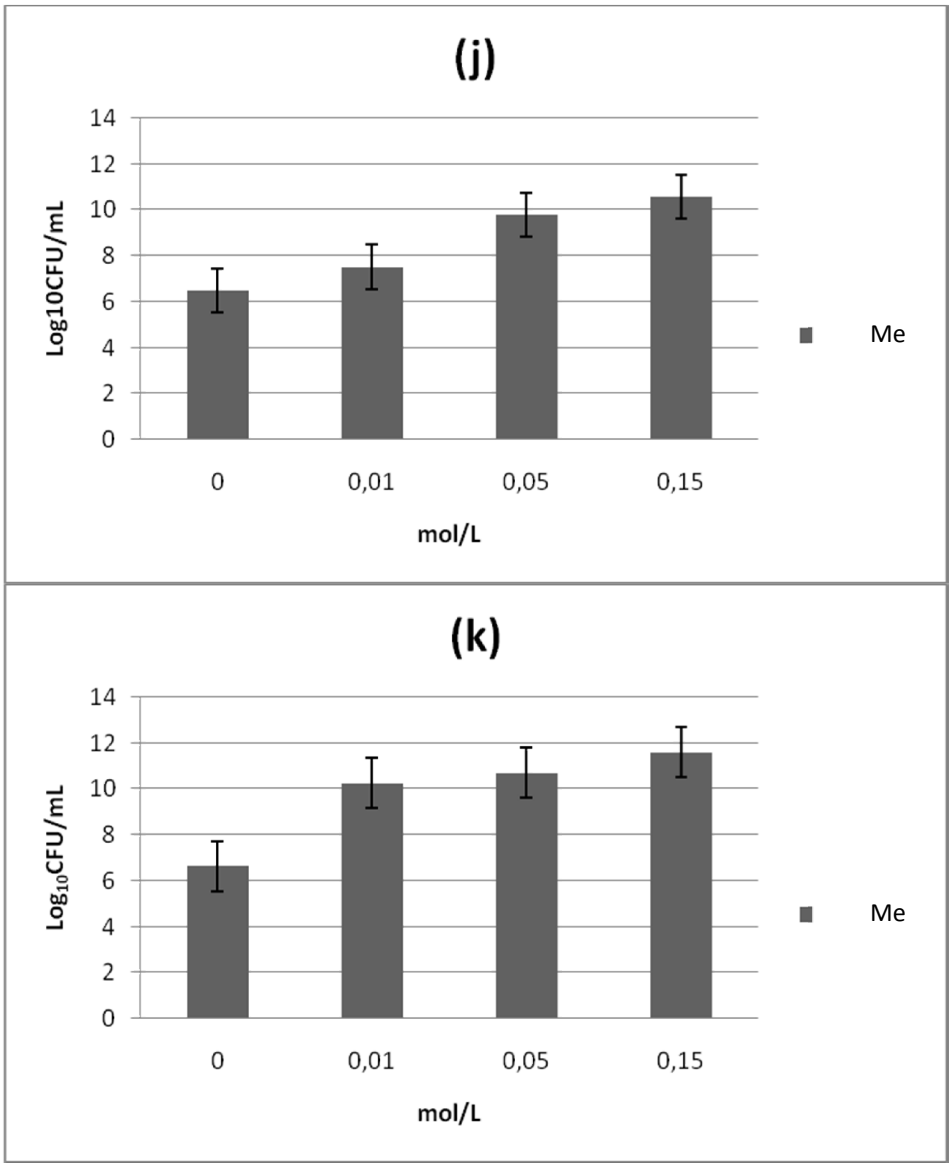


Figure 5 : Means number of the cultirable cells Xanthomonas fragariae at the concentrations of 0.01 ; 0.05 ; 0.15mol/L of NH_4Cl ; at 14% of humidity(j) et at 28% of Humidity (k) .

The analyzes of the cultirable cells in function of the NH_4Cl, shows that the growth of the *Xanthomonas fragariae* bacteria, in function of the humidity, depends of the NH_4Cl concentrations. In fact, about the figure number 5 ((j) and (k)) we notice an increase of the mean cultivable cells relative to the control, thus more the concentration of NH_4Cl increases more the mean of the cultirable cells increases.

3.4 BEHAVIOR OF *XANTHOMONAS FRAGARIAE* IN THE SOIL AT 14% AND AT 28% OF HUMIDITY IN FUNCTION OF THE PHOSPHATE SOURCE.

The survival of *Xanthomonas fragariae* is monitored during time, in different concentrations of phosphorus at 14% and 28% of humidity. The results of these experiences are consigned in the table IV and in the figure 6.

Table IV: Evolution of the cultirable cells of Xanthomonas fragariae, in the soil of Mamora at 14% and at 28% of humidity and in function of different concentration of phosphorus concentration. The results are expressed in log_{10} CFU/mL.

	Number of the cultirable cells (log_{10} CFU mL-1)							
Humidity	**14%**				**28%**			
mol/L / Days	**0**	**0.01**	**0.05**	**0.15**	**0**	**0.01**	**0.05**	**0.15**
T0	1.18	1.59	1.64	1,8	1.26	1.24	1.37	1.30
T4	6.81	4.45	5.11	6.45	6.26	5.45	6.81	8.14
T8	6.94	6.22	6.24	8.8	7.06	6.6	7.22	9.42
T12	7.33	7.35	7.86	9.3	7.73	7.36	8.65	9.8
T21	7.64	8.53	9.11	10.22	7.9	8.85	9.95	11.2
T32	9.18	9.32	10	12	9.66	9.11	11	13.13

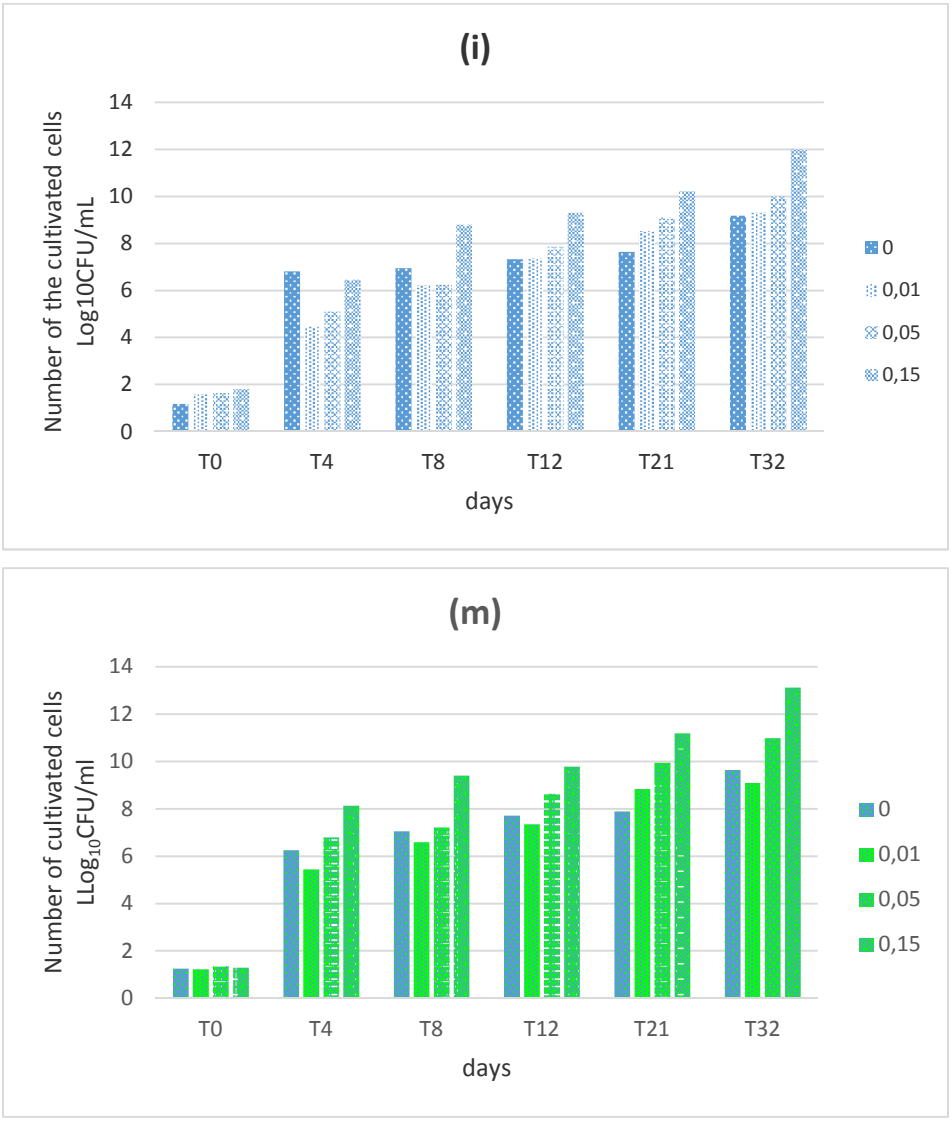


Figure 6: Behavior of Xanthomonas fragariae in the soil of the Mamora forest enriched with phosphorus; at 14% (l) and at 28% of humidity (m).

The analyzes of the table IV shows that the mean number of the cultivable cells has varied according to the tested concentrations of Na_2HPO_4 in function of humidity.

At 14% of humidity, during the first days of incubation, the number of *Xanthomonas fragariae* cells knows an increase of the cultirable cells number that attains a maximum in the 32th days. By cons, for the concentrations 0.01 and 0.05mol/L, the growth of *Xanthomonas fragariae* stays less important relative to the control (figure 6 (i)).

At 28% of humidity, we note that the cultirable cells number increases in function of the Na_2HPO_4 concentration incorporated in the medium, this increase seems that it depends on the concentration de Na_2HPO_4 in the modified AB mineral medium,: more the concentration increases more the rate of the growth increases.

- **Means analyzes**

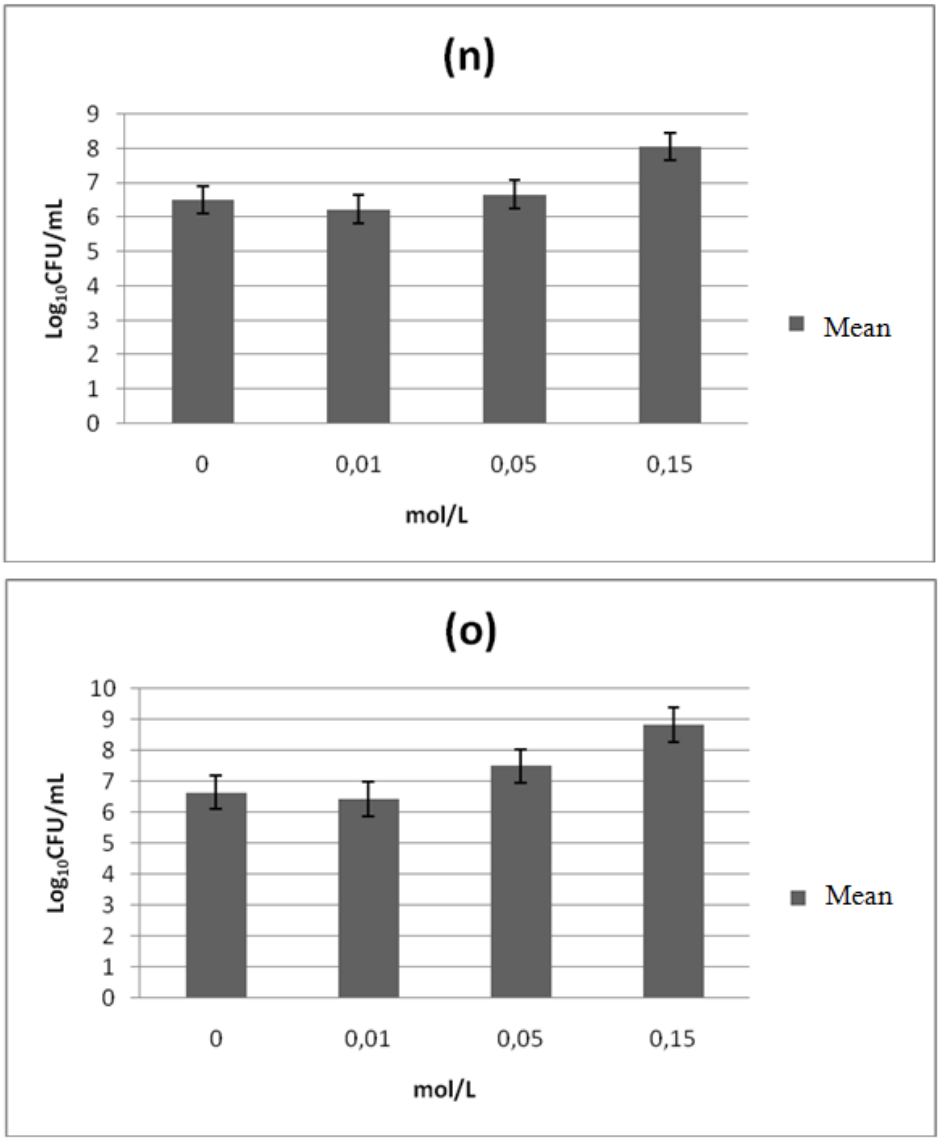


Figure 7 : Means of the cultirable cells of Xanthomonas fragariae in the concentrations 0.01; 0.05; 0.15mol/L of Na_2HPO_4; at 14% (n) and at 28% (o) of humidity.

The analysis of the cultirable cells at 14% of humidity, in function of different concentrations of Na_2HPO_4, revealed a decrease of the cells number of *Xanthomonas fragariae* in the concentration 0.01 relative to the control, but this number increases for the concentrations of 0.05 and 0.15mol/L.

At 28% of humidity, and at a concentration 0.01 of Na_2HPO_4, we note an accentuated decrease of the mean number of the cultirable cells of *Xanthomonas fragariae* relative to the control. By cons, in the case of the concentration 0.05 and 0.15 mol/L, the mean number of the cultivable cells is higher than the control.

3.5 EFFECT OF AZOTE, PHOSPHORUS, OR OF POTASSIUM COMBINED AT HUMIDITY OF 14% AND/OR 28% ON THE BEHAVIOR *XANTHOMONAS FRAGARIAE*

Table3 : Effect of different concentrations of azote, potassium or phosphorus combined with humidity.

solutions	Concentrations	14%	28%	Probability (p)
Na2HPO4	0	7.14(5.40, 8.03)	7.40(5.01, 8.34)	0.631
	0.01	6.24±2.86	6.44±2.89	0.910
	0.05	6.66±3.05	7.50±3.40	0.662
	0.15	8.10±3.58	8.86±4.10	0.738
KCL	0	7.14(5.40, 8.03)	7.40(5.01, 8.34)	0.631
	0.01	5.83±2.37	6.09±2.38	0.856
	0.05	6.00±2.38	6.20±2.39	0.886
	0.15	6.10±2.38	6.38±2.44	0.848
NH4CL	0	7.14(5.40, 8.03)	7.40(5.01, 8.34)	0.631
	0.01	7.53±3.46	10.28±4.81	0.282
	0.05	9.84±4.95	10.72±4.62	0.757
	0.15	10.59±4.89	11.62±4.89	0.725

The results of the analysis of variance in a single classification factor between the various concentrations of Na2HPO4, KCl or NH4Cl according to humidity.

4 DISCUSSION

The mineral or organic fertilization, pesticide application and useful microbial inoculations, aim to increase the productivity and economic performance (Shaharoona *et al.,* 2006). However, the side effects of these factors on bacterial organisms are often overlooked.

In our work we tested in one hand, the effect of different concentrations of nitrogen, potassium or phosphorus on the behavior of *Xanthomonas fragariae* and secondly the same combined effect humidity 14% and 28%.

Xanthomonas fragariae is able to survive in the soil sterile of the Mamora forest at 0.15 mol/L of Na_2HPO_4, and of NH_4Cl so this growth is inhibited in the concentrations 0.01, 0.05mol/l. We can suggest that 0.15mol / L concentration that gives cells a greater protective effect. The analysis of variance for a single classification factor shows that the concentrations 0.01 and 0.05mol / L causes an inhibition of *Xanthomonas fragariae* growth so that the growth is stimulated at 0,15mol/L. These results are similar to those reported par Shaharoona *et al*. (2006) that mentioned which specifically referred to the efficacy of *Pseudomonas* sp. with a significant increase in maize yields when plants receive adequate amounts of nitrogen. Martyniuk *et al.* (2009) have shown that the fertilized soil with mineral fertilizers improve microbiological activity of bacteria (number and respiratory activity of bacteria) and the biochemical properties of the soil. Furthermore, Meysam Beigzade *et al*. (2013) showed that there was a significant interaction between the application of phosphate fertilizer and bacterial growth. By cons, potassium has no significant effect on the growth of many bacteria of *Xanthomonas fragariae*.

Numerous studies have shown that potassium application is able to reduce the incidence of several pathogen genera of plants, case *Verticillium, Rhizoctonia, Fusarium, Plasmopa* (Anderson, 2002; Develash and Sugha, 1997; Angadi and Vijayakumar, 2000). Kelman (1953) noted that its application reduces high levels of glutamine and glutamic acid in tobacco plants sensitive to *Alternaria*, *Cercospora*, and *Sclerotinia*, which makes them less susceptible to these pathogens plants. The survival of several pathogenic bacteria in plant debris and soil has been studied by various authors. In many studies, survival varies with the pathogen in question and it is influenced by environmental factors such as pH, soil humidity, temperature, aeration and the interactions between them and between the microorganisms. Our study examined the survival of *Xanthomonas fragariae* in soil humidified to 14% or 28%.

The results showed that *Xanthomonas fragariae* is able to survive in different tested experimental conditions. Indeed, factors such as temperature, time, the sterility of the ground, do not affect the growth of these bacteria in the forest floor of Mamora (Kenza *et al*., 2014). Generally, the cells of *Xanthomonas fragariae* persist more time in the conditions of high humidity the in the conditions of low humidity of soil. The effect of humidity on the survival of *Xanthomonas fragariae* was not significant*;* this can be explained by the type of the used soil by a partial loss of soil organic matter for sterilization. However, the characteristic of a ground which seems to have more impact on the survival of the bacteria and water

retention, which is related to particle size distribution, organic matter content, which is confirmed by a study by Sinisa *et al*. (2007) that compared mortality *E. coli* in two soil types. In this case, bacterial mortality was mainly influenced by soil type (sterile and non sterile). They also noted that the improvement of moisture retention depends on the size of soil particles which may therefore increase bacterial survival due to increased water capacity. Tate, in 1978, also reported that the survival of *E. coli* in an organic soil over a period of 8 days after application of manure was larger than in sandy soil (soil Mamora). This was attributed in part to the richness in organic matter in the soil containing manure and greater ability to retain humidity.

However, other authors have reported a reduction in the severity and bacterial decay of *Ralstonia solanacearum* after application of a high dose of nitrogen in sandy soil fertilized with ammonia compounds was more effective (Kelman, 1953; Michel and Mew, 1998)**.** Beringer and Kay (1993) have made long-term studies on the survival of *Bradyrhizium japonicum* in Italian clay soil type and they found that the humidity in the soil is the most obvious factor affecting the level of population. The flooding leads to a dramatic decrease in population in the soil. In addition, fertilized soils with sufficient usable nitrogen maintain survival of Rhizobium in soil (Lochead and Thexton, 1953).

5 CONCLUSION

At the end of this work, we deduce that nitrogen and phosphorus stimulates growth rate of *Xanthomonas fragariae*. These are necessary for growing strawberries, but we must reason with the nature of nitrogen and phosphorus to be used to control the growth of this bacterium in greenhouses. This reasoning also embracing the potassium which has an inhibitory effect of the growth of *Xanthomonas fragariae,* and this with a view for improving performance. It is also interesting to know the effect of fertilizing elements on the growth of the bacteria and the development of the disease in order to consider ways to control much more adequate.

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The Method of decomposition domain for the numerical modeling of a jet by the particle-mesh method

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ABSTRACT: This work concerns to the digital treatment of the problems with strong not linearities during the resolution of the equations of Navier-Stokes in particular those due to the recirculation strong in turbulent regime. The idea developed is to use the method of subdomains: The domain in which took place the flow is decomposed several subdomains separated by imaginary boundary. In each of these subdomains, we use the best adapted digital method. The passage in all the domain is made by digital connecting. This connecting is made by covering of domain. The results are presented in the case of a jet of rejection emitted by the bottom in a rectangular canal. In this application, we divided the domain of study into two parts: Near the boundary layer, we use the finished difference method and in the outside zone the resolution is made by the method Particular. The fictitious interface between these two subdomains is processed by the method particles - meshing. A validation of this approach is made by a comparison with a direct calculation in all the domain.

KEYWORDS: Equations of Navier-Stokes, numerical methods, particulars Methods, Method of finished differences, Decomposition of the domain, Scheme T.S.C of projection interpolation.

1 INTRODUCTION

In this work we present a complete numerical solution of flow plan generated by a jet emitted from the bottom in an open canal. The fluid is considered incompressible viscous. The direct resolution of such a problem by the methods of differences finished puts number difficulties for the large numbers of Reynolds. Indeed, numerical instabilities due to the treatment of the not linear terms in zones with strong variations of speed appear what require refining the meshing. But this type of methods used to carefully consider the boundary conditions on solid walls. For high Reynolds numbers, other methods are better suited to handle viscous fluid flows in the case of strong recirculation of velocity vectors, mention particle methods. But they have other types of drawbacks on treatment of the boundary conditions at the wall. We present a numerical approach which combines the advantages offered by each of both methods quoted previously. For that purpose, the domain of the flow is divided into two subdomains in each of which is used the most appropriate method: in the neighborhood of walls, we use a method of the finished differences and somewhere else the method particular. But there raises the problem of connecting both subdomains, that is of the transmission of the information enter a method which uses a meshing (the method of the finished differences) and another one without meshing (the method particular). To solve this problem, we used the following technique: It makes the emission of particles after a test on the sign of the normal speed at the interface between the two subdomains. The particles which by effect of recirculation enter the first one subdomain close to the solid wall are distributed on the meshing of differences finished by a technique particles-meshings and new particles are created in exchange [1][2].

2 PRESENTATION OF METHOD

The application of the decomposition method of the domain for a numerical solution of the Navier-Stokes equations is done in several steps:

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STEP 1: GEOMETRIC DECOMPOSITION OF THE DOMAIN:

The domain resolution is decomposed into several subdomains. This decomposition is based on physical and numerical considerations: Nature of the flow regime, ease of writing the conditions in the limits and treatment of nonlinearities in the equations of movement.

For connected domain, the decomposition is based on the partitioning of the domain Ω into n (n ≥ 2) subdomain Ωi :

$$\Omega = \bigcup_{1 \le i \le n} \Omega_i$$

The intersection between the subdomain is limited to the interfaces (Figure 1):

$$1 \le i < j \le n, \Omega_i \cap \Omega_j = \partial\Omega_i \cap \partial\Omega_j$$

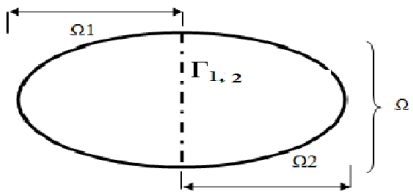

Figure 1: Partition into two subdomains Ω1 et Ω2

STEP 2: CHOICE OF METHOD FOR SOLVING IN THE SUBDOMAIN:

The choice of the method of resolution in every subdomain is made on the basis of the capacity of the digital method in treated the equations of the movement. In particular, we consider the calculation time, the adaptation to the treatments of non-linearity and to the geometrical configuration.

STEP 3: WRITING CONDITIONS INTERFACES:

It is a question of writing conditions of continuity of variables between both under geometrical domains. In particular it is necessary to assure the implicit character of the resolution of the equations of movements.

3 APPLICATION

We tried to solve the equations of Navier-Stokes and the equation of transport of mass of a jet at the bottom of a canal. In terms of vortex function , function of current ψ , and concentration C, these equations are [3]:

$$\frac{\partial\omega}{\partial t} + (\vec{U}.\vec{\nabla})\omega = \frac{1}{\mathcal{R}e}\Delta\omega + \frac{1}{\mathcal{F}r^2}\left[\vec{\nabla}C \wedge \frac{\vec{g}}{\|\vec{g}\|}\right].\vec{k} \quad (1)$$

$$\Delta\psi = -\omega \quad (2)$$

$$\vec{U} = \vec{\nabla} \wedge (-\psi\vec{k}) \quad (3)$$

$$\frac{\partial C}{\partial t} + (\vec{U}.\vec{\nabla})C = \frac{1}{\mathcal{R}eSc}\Delta C \quad (4)$$

With the following notations:

- $\vec{\nabla}$ and Δ are respectively the gradient operator and the Laplacian operator.
- t is the time variable.
- $\vec{k}$ is c the directly perpendicular vector in the plan of the flow.
- $\vec{U}$ is the velocity Victor.

$\Omega = \bigcup \Omega_i.$

- ψ is the function of current
- ω is the vortex function , such a $\vec{\omega} = \omega\vec{k} = \vec{\nabla} \wedge \vec{U}$
- C is the concentration of the pollutant.
- $\vec{g}$ acceleration of gravity.
- $\mathcal{R}e$, Sc, Fr Represent respectively the numbers of: Reynolds, Schmidt and Froude.

The connected rectangular domain Ω is decomposed into two subdomains Ω1 and Ω2 separated by a border Γ (figure 2):

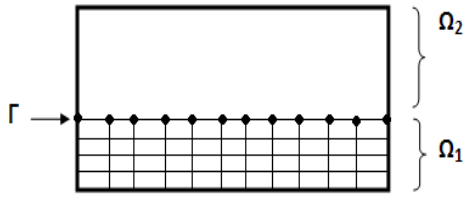

Figure 2: Subdivision of the domain Ω.

The jet is the bottom (Domain Ω1) and the flow is dominated by the effect of the walls. The resolution method selected in this subdomain is the method of finished differences [2]. It is the method Eulerienne which possesses the advantage to facilitate the writing of the conditions in the limits on the solid walls. Far from walls (Domain Ω 2), the flow is external in large number of Reynolds and in big recirculation of speed. In this domain, we use the particular method [5], It is the lagrangienne method which consists to discretize the transportable variables by means of a number of particles which will be followed in their movement.

Between both subdomains the interface is the place of transmission the results of resolution by a method which uses a meshing (the method differences finis on Ω 1) and a method without meshing (the particular method on Ω 2), requires special treatment.

A first algorithm is to transmit information according to the sign of the velocity normal to the boundary between the two sub domains Ω1, Ω2. If some particles of Ω2 come in Ω1, their intensities (vorticity and concentration) are distributed on the nodes of the mesh used for the method of finished differences, one using the particle mesh method.

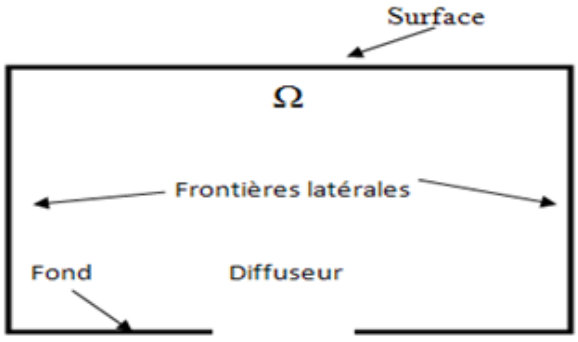

Figure 3: Domain of study Ω.

4 RESULTS

Geometric Data: Length 6 m and 4 m high. The fictitious interface between the two domains Ω1 and Ω2 under fixed at

y = 1.6.

The results will be presented in terms of the iso-values tourbillon w, function, the concentration C, the lines of current, in all the domain of study Ω.

Given physical: Fr = 18, Sc = 1.5.

A direct calculation was made in all the domain of study by the finished difference method. Figures 4a, 4b, 4c and the results are presented for a Reynolds number Re = 100.

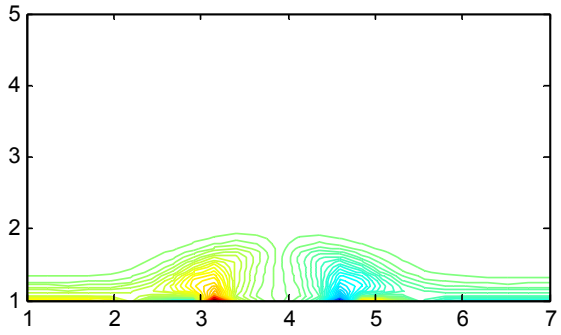

Figure 4a : Iso-vortices by direct calculation at t = 1.

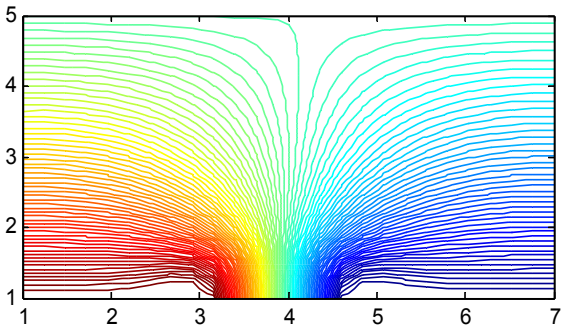

Figure 4b : The current lines by direct calculation at t = 1.

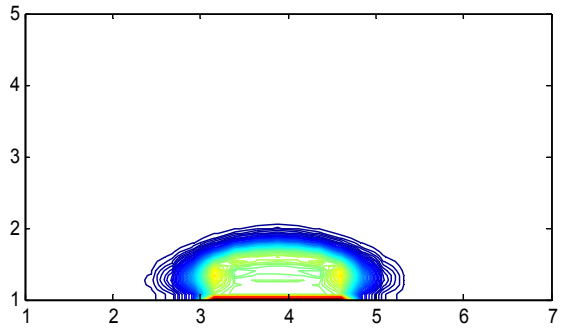

Figure 4c : Iso-concentrations by direct calculation at t = 1.

Direct calculation becomes unstable from Re = 1000. In the same geometrical configuration, it solved the complete Navier-Stokes equations by the method of the subdomains.

The fictitious interface separating the two subdomain Ω1 and Ω2 is set at y = 1.6. It is from this interface that are emitted particles representing the flow of the jet in the subdomain Ω2 between y = 1.6 and y = 5. We present on the figure 5a calculation for the number of Reynolds Re=100, and on the figure 5b a calculation for the number of Reynolds Re=1000.

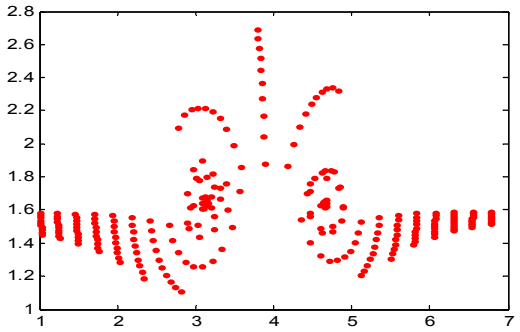

Figure 5a : Movement of fluid particles in the subdomain Ω2 at t = 1.

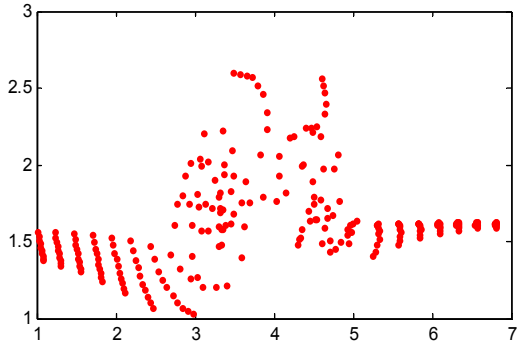

Figure 5b : Movement of fluid particles in the subdomain Ω2 at t = 1.

The particles that pass from the subdomain Ω2 to Ω1 will project their information carried (vortex and concentration) on the nodes of the closest mesh with the projection Scheme TSC.

On the figure 6a and 6b, we present the results for a number of Reynolds Re 100.

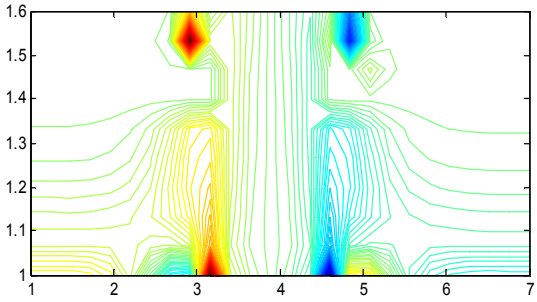

Figure 6a : Iso-vortices in the sub domain Ω1 at t = 1.

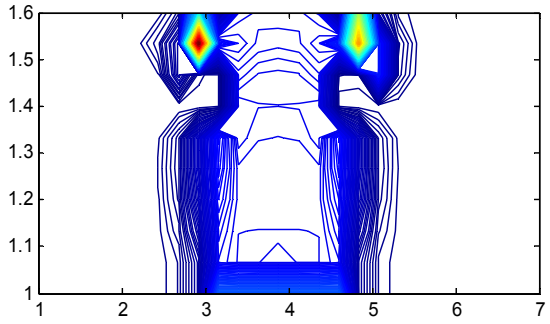

Figure 6b : Iso-concentration in the subdomain Ω1 at t = 1.

5 CONCLUSION

From the results presented, we can conclude that the method of multi-domain has removed the difficulties posed by the finite difference method and are related to numerical instabilities associated with high Reynolds numbers. Based on the combination of several methods.

Multi domain method allows the advantages of a numerical method given in the region where it is most effective.

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Detecting Innovation Signals with Technology-Enhanced Social Media Analysis - Experiences with a hybrid approach in three branches

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ABSTRACT: Online communities are seen as valuable knowledge source about customers' needs and interests. Innovation research also tries to analyze content from online communities to detect signals for future innovations. Within this contribution the theory of signals for future developments, existing approaches are introduced.
Building upon this introduction, we describe the Austrian research project "Innovation Signals" that aims to develop and implement a technology-enhanced analysis of signals for future developments by analyzing user-generated content from selected online communities. Besides automatic data extraction and statistics the approach tries to make sense through structured content analysis. Therefore, the approach combined so-called qualitative research with quantitative research, as well as automatic monitoring and analysis with manual social research.
Part of this research project was the identification of innovation signals for three companies from different fields/branches (sport, energy, and mobility). Within this contribution we describe and reflect on our experiences within these settings and on additional findings based on the project. These are guidelines for social media mining and a comparison of existing approaches of technology-usages for weak signal detection. The authors also discuss practical implications derived from their experiences, as well as future opportunities for further research.

KEYWORDS: weak signals, innovation, foresight, future, enterprises, social media mining, approach.

1 INTRODUCTION

From the perspective of enterprises as well as from the perspective of innovation research, user generated content within the Social Web can be a valuable source for detecting ideas for future innovations. To arrive at a deeper understanding of customer needs, of their opinions about products or new trends, several theories and approaches have been put forth by now. Nevertheless, the potential of Social Media for strategic innovation purposes is still at its beginnings: The understanding of social media content and its transformation into business opportunities, innovation chances and novel products and services are still in their infancy (cf. [1], [2], [3]). In addition, futurologists do currently not consider content from weblogs and Internet forums as being among the top ten sources for detecting weak signals (see [4]).

The research project "Innovation Signals" at Salzburg Research (Austria) focuses on the idea of detecting weak signals as potential early signs of innovations. In this context, the developed technologies and methods have been combined to provide three enterprises with a full social media analysis and consulting phase. Within this contribution, the state of the art, the project and our specific approach called "innovation signals" as well the respective lessons-learned are described and

discussed critically. The paper builds upon contributions that describe first experiences with this new approach (see [5], [6]) and provide a final summary of the research project and its results.

2 THE THEORY OF (WEAK) SIGNALS FOR FUTURE DEVELOPMENT

According to Ansoff weak signals are "imprecise early indications about impending impactful events" [7]. All that is known, he proceeds, "is that some threats and opportunities will undoubtedly arise, but their shape and nature and source are not yet known" (ibid.). Compared with other levels of knowledge about the future, weak signals are among the vaguest, especially compared with "drivers" or even "trends" (see [8] and Table 1). It is either totally surprising (positively or negatively) or gives you the feeling of change (ibid.).

Table 1. Future signals sense-making framework (see Kuosa [8], p. 45)

The levels of future knowledge	The fundamental nature of information	
	Disrupters / non-linear	**Promoters / linear**
A. Weak Signals	Any observation that is totally surprising, amusing, ridiculous, or annoying to you.	Any observation that tells about change and makes sense to you.
B. Drivers	Your understanding of potential seeds of change.	Your understanding of demands of change.
C. Trends	Your understanding of blockers and change.	Your understanding of inevitable large change processes.

The collection and detection of weak signals could "be a key to anticipating changes in advance and avoid letting them cause surprise" [9]. The challenge in detecting weak signals is that they normally are hidden in the "noise of the daily produced data" [10], see also Figure 1.

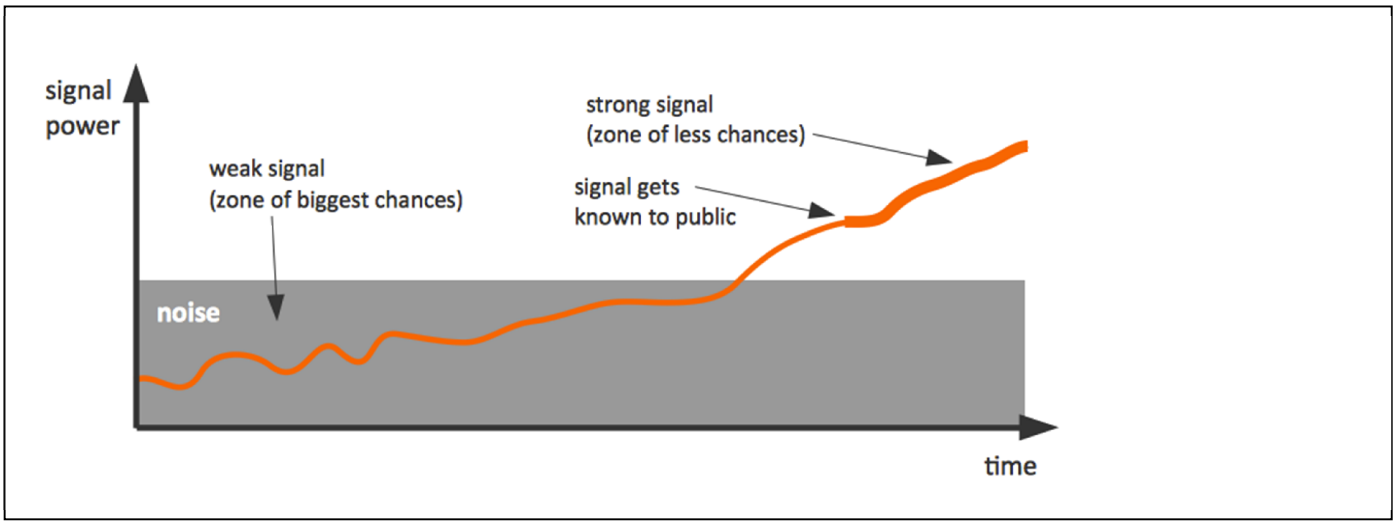

Fig. 1. Evolution of a weak signal, building upon Coffman [11] and Steinmüller [12]

Additionally, it is unclear if weak signals are detectable at any point in time, even if literature sometimes gives the feeling "that they lie 'out there' almost as a commodity" [13, p. 379]. To get a better idea what properties "weak signals" might have or what they can be, it is suggested to use hindsight to detect and identify weak signals for current trends to get better information on how they might be detected in the future [9]. However, it is not only complicated to detect such weak signals inbetween the noise, but it is also a challenge to filter out the "wrong" signals and to keep the "right" ones for further evaluation and discussion. Already Coffman described the issue of "people who 'know'" that scoffed at weak signals [11]. "Cognitive filters" influence the final detection of what is coined as "weak signals" and which weak signals might be overseen. Ansoff [7] named mental filters that influence the realization of weak signals within enterprises: The "surveillance

filter" focuses on specific information in the environment and the "mentality filter" is responsible for the selection that is strongly influenced by a companies' culture. The third filter, the "power filter" might be the influence of managers who neglect or even surpress information. As described and empirically shown in [14] such mental filters can be influenced by contextual factors. Filters can be decreased by "virtual process, open question and anonymity" (ibid., p. 919). Filters can be strengthened through "focused scope, close to the current strategy, strong requirement for plausibility and probability in the social interaction process" and others (ibid., p. 919).

Besides these challenges, weak signal detection continues to attract attention from futurologists as well as enterprises, because this concept provides one of the few frameworks of how future developments might be recognized at a very early stage. Concrete approaches and applications are part of strategic foresight activities in enterprises as well as in research, and are still under development. Of course, technologies play a growing role within such approaches.

3 APPROACHES TO DETECT WEAK SIGNALS

Even if the concept of weak signals might be clear, the variety of approaches to detect them is broad: Sources, detection and evaluation methods vary.

First of all, the variety of sources for weak signals is broad: In a survey experts should rank their favorite sources for detecting weak signals [4]: In some of the branches, for example economics as well as society and culture, (interviews with) futurologists are the preferred source for weak signals detection. In politics, these are politicians; in technology and science, these are scientists/ researchers. Besides individuals, who are always at the first ranks of preferred sources, marginal/underground press (environment) or blogs (society and culture) also belong to the ten most preferred sources.

The variety of detection methods of (potential) weak signals and their evaluation (i.e. if they are weak signals or just noise) is broad. In an earlier study we looked for current usage of technologies for weak signals detection [15]. We collected examples for the usage of technologies for weak signals detection in the literature from the last five years. Our final set of applications of IT within the process of weak signals detection was diverse: To start with, we found a naive application of text mining to identify emerging terms within conference abstracts in the field of technology-enhanced learning [16]. A completely different approach is the application of a tool designed for scouting (collecting data from scouts, edited by an expert round) as part of an integrated insight and response system at Deutsche Telekom Innovation Laboratories [17]. In another application a quantitative model for detecting weak signals (emerging trends) with the help of an inference model and a Bayesian network at a "weak signals tracking board" are part of the "New and Emerging Signals of Trends model", dealing with future sciences and technologies [18]. Finally, in the field of life sciences a set of monitoring and data-mining approaches is integrated to deliver a "technology radar" with the help of a technology watch team [19].

As we will show, our developed approach in the project is yet another variation of how to detect weak signals.

4 PROJECT GOALS AND GUIDING RESEARCH QUESTIONS

Within the research project "Innovation Signals" we set out to develop and implement a new methodology that combines two common analytical approaches: a) using user-generated content for innovation purposes and b) a unique methodological design that utilizes a software tool. The goals of the project are:

- Development of technology for early identification of innovation signals within the Social Web.
- Development of the methodology to combine innovation signals with statistics and trends.
- Tailored reports on innovation signals including ideas, innovation chances and visions for single industry partners.

Within this paper we will describe the project results as a whole, addressing the following research questions:

- How does the Innovation Signals approach look like?
- How does the approach work within concrete settings with industry partners?
- What are lessons learned for future applications and/or adaptions of the approach?
- What additional insights, results and conclusions can be drawn from the project?

In the following, we will describe the research design of the project.

5 RESEARCH AND PROJECT DESIGN

The project called "Innovation Signals" is a research project funded by the Austrian research program "Research Studios Austria" (Austrian Federal Ministry of Science, Research and Economy, BMWFJ, and The Austrian Research Promotion Agency, FFG). Following the midterm evaluation, further funding depended on the project's ability to find paying customers for the developed service. The project and development builds on academic research and literature and integrates these with concrete requirements from practice. The following illustration (figure 1) gives an overview over the general project plan.

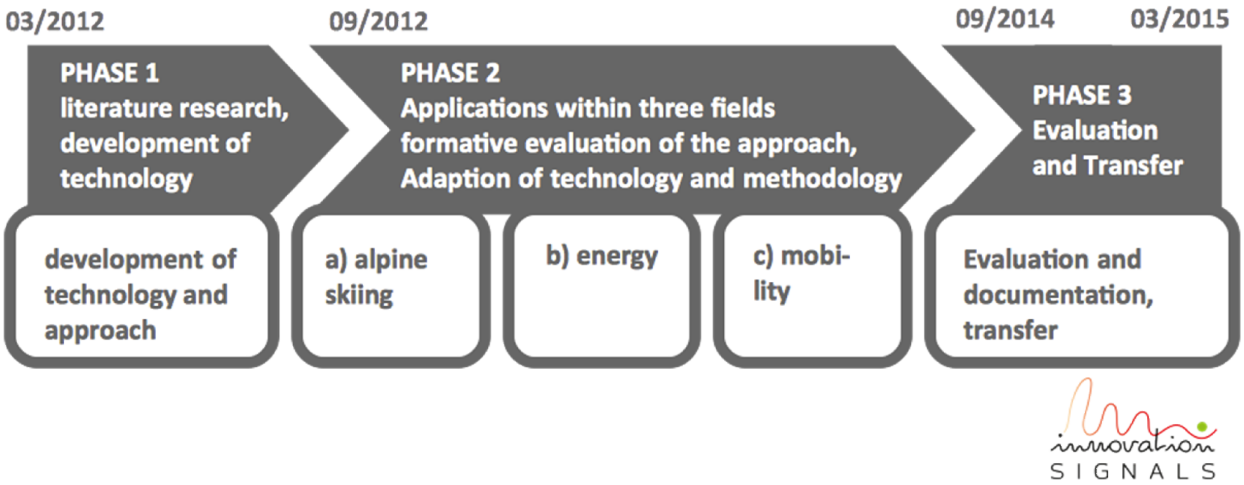

Fig. 1. Innovation Signals project plan

The formative development as well as the evaluation of the innovation signal methodology and the used technologies are the reason that the three examples used are neither identical nor directly comparable.

6 THE "INNOVATION SIGNALS" APPROACH

Our concept called "Innovation Signals" uses a combination of social science methods as well as data mining tools to identify common topics and potential weak signals in a certain field using user-generated content from the Web (esp. from discussion forums). Comparing the findings with the state of the art in the industry and the current product or service portfolio of the client, the researchers focus on and present their data about topics that are currently not or only marginally addressed by the client's portfolio. Additionally, the approach includes the contextualization and translation of information into business opportunities. The subsequent diagram depicts the different phases and the overall structure of the Innovation Signals research process that will be described in more detail below. As you can see in the illustration, the process usually has more than one iteration.

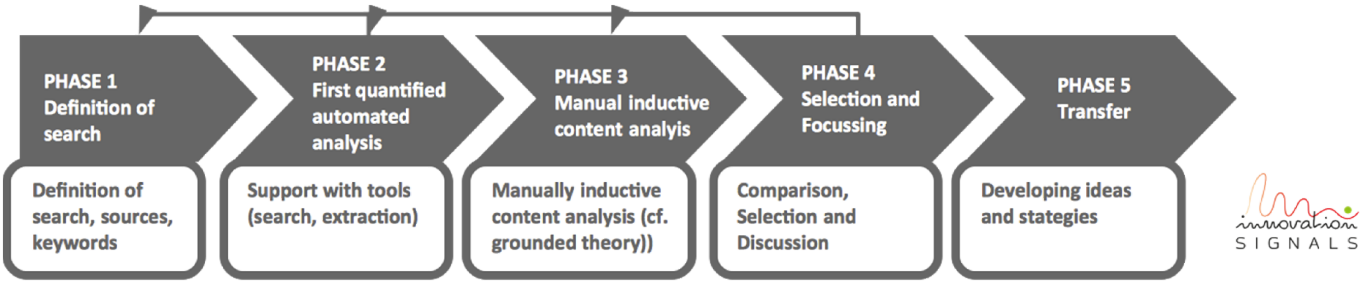

Fig. 2. Innovation Signals research process

Phase 1: Definition of search fields. The main goal of this first phase is to define small and concrete search fields or, even better, hypotheses. An example for such a hypotheses might be, "From the perspective of the consumer, photovoltaics are predominantly an issue of technology and commercial viability, but not so much of ecology". Then a keyword list and a list of forums, websites or discussion lists is collected that fit to the defined search field or hypotheses. We both used our tool or extracted data manually. Within all cases presented, it was easy to find communities discussing the topics of interest, but we developed a list of quality criteria on which communities were selected. Examples of quality criteria are the level of activity in the forum (e.g. the number of new threads per month), the number of members of the community, the number of views on threads, the number of replies in most threads (also that there should not be any posts containing questions that remain unanswered etc.) or a well elaborated structure of contents of the forum (with maybe also sub-forums).

Phase 2: First quantified and automated content analysis - exploration, mining, analysis: In analyzing the sources, we used both a top-down approach, searching for pre-defined keywords and a bottom-up approach, identifying new topics that are frequently discussed by users in the communities. Therefore, we used a simple search tool as well as our enhanced and adapted data extraction tool to detect relevant content in the Social Web. Our own tool is the innovation signals prototype software, using a framework developed by Salzburg Research as part of several Apache projects (see figure 3). Nevertheless, for each client, we developed our own keyword lists and adaptations to address the special requirements of every search field.

In Figure 3, the Innovation Signals Framework is illustrated. Technically, we used several tools and framework technologies developed in-house or within other Apache projects. For example, the Apache Tomcat Server is in use as application container for the full framework; such as Apache Marmotta and the KiWi triplestore to provide storage backend and Apache Stanbol for content analysis. Additionally, extractors for every case (and search field), transformers, sentiment analysis, upload and search indices were developed or adapted and implemented within the Innovation Signals project.

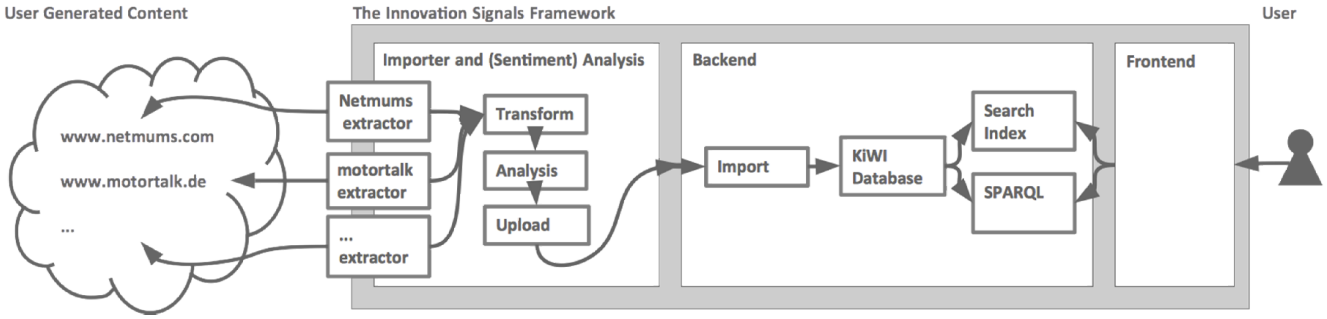

Fig. 3. Innovation Signals Tool Framework

Phase 3 – Manual inductive Content Analysis: The automated analysis of textual content enables an efficient information processing, but the machine-processed information still remains ambiguous. In order to enable effective research, the interactions in the social web must be additionally structured and analyzed with social scientific methods. This means to associate user-generated content with relevant statistics, trends and theories to amplify the meaning of the information and to understand the consumers' conversations better and in a broader context. Therefore postings to one defined (and special) topic had been selected with a criteria list (minimal length, originality of content, not only short statements as "me too"). Using the grounded theory of approach of content analysis and theory development, we developed a coding scheme toward a certain aspect of interest. In a first round and with broader search fields the goals of this analysis was on a more general level, e.g. we analyzed the main topics discussed by users. In second round (after phase 4, selection and focusing), this analysis was normally even more focused. Exemplarily, we looked for other aspect that were aspects of users' argumentation dealing with costs of a special product and service.

Phase 4 – Selection and Focusing: Typically, our list of topics discussed was a very long one and the majority of findings were trivia to any expert in the field: Some aspects of discussion are very well known, already some years old and therefore not an "innovation signal" or a "weak signal". Although we obtained a very good overview over the field, we were (of course) not able to decide which topics are "common" and which could be seen as weak signals. Our way to reduce the amount of relevant topics concerning the search fields in the social web was to research the "state of the art" within the respective field. Within our three approaches we (a) read relevant basic information and standard literature, especially for educational purposes, and (b) we analyzed all services and information material from our client. In addition, verifying the selection with

the client was an important step as well. After confirming the search fields, we started to go into deeper analysis within our selected topics, search fields and hypotheses.

Phase 5 – Transfer: Within the last phase we worked on potential translations of our findings into business opportunities. This phase of the research process utilizes user generated content (in close co-operation with customers/companies) as an additional information source for strategic decision making with regard to the kind of innovation (product, process, business models, strategic innovation fields) to be pursued in order to determine the focus of the product innovation and market strategies and/or to detect new markets and new ideas.

7 EXPERIENCES IN THE FIELD

The described process is the result of our (learning) experiences from three different client projects. As requirement of the project, applications of the innovations methodology were needed and several potential industrial partners were courted. Finally, we had the chance to support three customers with our analyses and approaches and to take further project effort to work, tuning and adapting the methodology as well as technology. The following field experiences took place in three very diverse settings (alpine skiing, mobility, and energy) and are reported chronically.

7.1 EXPERIENCES WITHIN THE SEARCH FIELD OF ALPINE SKIING

In our first case, a ski manufacturer commissioned us to support their early innovation phase. Part of the mission was to identify possible areas of innovation and new customer needs in the social web. In a kick-off workshop with the company, we identified the relevant search fields, i.e. the areas in which to look for innovative customer needs and solutions. We selected 24 specific ski forums derived from the objectives of the ski manufacturer, from which we extracted a total of 170,000 posts.

From earlier projects with the company, we knew about current innovation projects, the general product portfolio and were aware of the state of the art. Accordingly, we were able to very well define the search field and come up with hypotheses relatively easily.

In total, we selected over 300 authentic user posts that provided valuable ideas and information to specific product improvements and other innovations. We translated these posts into customer need statements (Ulwick, 2005), which we reviewed and prioritized in a customer survey. Among the top ten customer needs were joint-friendly skis, eco-friendly ski manufacturing, more grip on ice and simple handling, etc.

7.2 EXPERIENCES WITHIN THE SEARCH FIELD OF MOBILITY

After the first successful application, we wanted to prove the method in a second field: mobility. Within the first workshops and discussions the industry partner showed a broad interest on “everything from the field”. This had several consequences for our work: As we had 12 different search fields with a relatively long list of subtopics each. As a first step, we searched for forums in which the relevant search fields might be discussed. Astonishingly, interesting statements were not only found in automobility-related forums but in very general ones, for example bravo.de (a Website of a journal for teenagers) und Moms.org (a community platform for mothers). The range of search fields delivered a long list of potential interesting aspects and topics that might be weak signals. To verify if a topic was new or “trending” we also used Google Insights for Search.

In our first presentation of results we presented a large amount of new items, potential signals, interesting things. Nevertheless we had the impression that this was “too much”: Some aspects were not “new”, some were “uninteresting”, some were “overemphasized”. On the other side, this long presentation also made our customer aware, that we had to limit and therefore focus the search fields and questions. Reflecting why our work within the second field was much more difficult as compared with the first one, we found some additional reasons: Of course we also found that this process might be easier if we had a profound knowledge on the topic before we started the development of the keyword lists and first analysis, helping us to define the search fields. Additionally, we did not have a clear idea on how to filter all the potential innovation signals –mainly because filtering means to prioritize some information over others, something that we couldn’t do without knowing what qualified as interesting information and what didn’t. After the presentation we re-defined and sharpened the search fields together with our industry partner, for example we focused on “changing the means of transportation” instead of multi- and intermodal mobility. .

The following work and presentation of results was more focused. A good driver was the decision on “what is relevant from customers’ perspective”. Additionally, we did an analysis of the current working fields of our partner to see where and if

the new topics might be influencers. Nevertheless, the preparation of the presentation itself and the concrete way to present the data took approximately half of our time within the project and was done in close communication with the partner. As a result and sign of approval, the final presentation was presented at a management board meeting (by our industry partner).

Within this second case we frequently utilized sentiment analysis. For example we analyzed the sentiments along our client's product portfolio. Sentiment analysis is an analysis of the affective tone of the posts. For this purpose we use word lists that assign sentiment values to common words in a certain language, which acts as foundation for the sentiment values of a post. This analysis provides e.g. a comparison, representing the number of positive and negative sentiments associated with competing enterprises. In addition, customer associations with a brand, for example with words such as 'fun' or 'performance' can be compared. As a result, the company gains a much broader view over potential innovation fields that are prioritized and put into the context of larger societal trends. We used automated sentiment analysis implementation within our tool and some cases, but did this in combination with a manual analysis. This comparison led us to the decision, that manual analysis produces much higher quality outcomes (we typically had 100 to 1,000 posts for such analyses).

Of course we tried to conduct automatic sentiment analyses with our tool, but as the number of relevant text parts was small (in the described case 288) we also analyzed them manually. This and some other attempts to deal with an automatic sentiment analysis resulted in the conclusion that the manual analysis was much better and was always needed for control.

7.3 Experiences within the Search Field of Renewable Energy

In our third case we worked with an energy provider interested in what users say about renewable energy. In preparation for our first workshop we did a relatively intense analysis of the current state of the art within the field. We wanted to be well prepared and be able to offer recommendations for search fields and possible hypotheses in the first workshop.

Nevertheless, we had similar experiences in our first workshop as in our second case: Building on our experiences from case two we insisted on just five search fields, one of them being renewable energy. This restriction resulted in the client's wish to have very broad search fields. Our client had the impression that focusing on just five narrow search fields might result in missing some interesting weak signals.

Technically, the online discussion of "solar energy" was pretty well covered in five specialized discussion forums that made it worth to develop extractors for these forums. Compared with a simple text search our tool enabled us to search and count the appearances of words including all synonyms in one single step.

Within our third case we developed a new idea on how the results might be presented: The "customer journey" illustration. Building on our analysis of the existing offers and services of our partner, we developed a plan of the typical steps or customer journey, from the first idea of purchase to recycling. Each step in the survey was supported by a (manual) sentiment analysis, resulting in values showing whether customers overall experienced this phase as positive or not.

As a result, we could pinpoint all the current touchpoints that were described as negative by customers. In turn, we could describe and sketch a complete new business model for our client that would allow customers to only experience the positive steps in the customer journey and thereby changing the entire experience from mainly negative to mainly positive.

7.4 Overview of the three settings

In the following we give an overview about facts and figures as well as experiences from the three settings.

Languages were always English and German

Table 2. Overview over the three settings

	Sports (Leisure)	Mobility	Energy
Field Description	Potential trends and ideas for alpine skiing	New emerging customer needs with regards to mobility	Alternative energy from customers' perspective
Definition of Search Fields and Questions	One clearly defined search field	12 search fields (to many)	Five fields (but too broad)
Usage of Tools	Building own Extractor, Analysis with own Tools	Google Insights for Trends, Usage of sentiment analysis with own tool	Building own Extractor, analysis with own tool
Description of Sources	(Very) specialized discussion forums of alpine skiers and alpine winter sports.	Customers' needs were found in very general forums.	Specialized forums of providers and end-consumers.
Presentation of Results	Presentation was not only, but also a long list of ideas from skiers.	Presentation builds on long discussion with client to match their existing categorization; focus on customers' needs.	We developed a "customer journey" illustration to reveal points for improvement.

8 REFLECTIONS OF THE EXPERIENCES IN THE FIELD

Reflecting all experiences with the innovation signals methodology and looking forward on future adaptions of our approach, we considered four aspects as relevant lessons-learned: (a) researchers should be well prepared in the field, (b) defining the search is crucial and requires a set of helpful methods, (c) the potential of technological support depends on search fields, (d) the potential of surprise is small, and (e) the presentation of data is the key.

8.1 RESEARCHERS AS FIELD EXPERTS AND COMMUNICATION IS IMPORTANT

In order to use social media mining to the benefit of third parties, e.g. clients, an excellent knowledge of the field decreases the time needed to define search fields and derive plausible hypotheses. This is not always the case for consulting in innovation management. However, within our innovation signals approach we experienced that certain level of expertise can help set boundaries early and facilitate the generation of own ideas to develop good (focused) search fields or even small research questions or hypotheses within the workshops with the client. For future work, we would suggest to e.g. deal with the service description of the customer to understand them and to read and analyze basic literature from the field. One of the authors of this paper describes this as "our key competence in this project is to become experts in an entirely new field in beeline".

8.2 NEED TO DEVELOP METHODS FOR THE DEVELOPMENT OF SEARCH FIELDS, QUESTIONS AND HYPOTHESES

One of the difficulties we encountered was that in the first phase of defining the search fields it was not easy to arrive at clear and "small" foci? We identified the following reasons: Potentially our client got the impression of losing certain aspects by focusing. Another aspect is that the approach itself, at least the approach description, leads to the impression that it delivers data without input, i.e. "the data speaks itself". Another challenge we confronted was the fact that clients' often perceived our findings as being trivial, even though they would address main challenges in the field. An example is that discussion on global oil supplies and trade were seen as irrelevant – or at least well known - to our mobility client. After our three projects, we are pretty aware, that there is a need to design the first phase more effectively, to increase communication and narrower search field definitions. The challenge is finding a good balance between defining the search fields and the consequent search concepts in a way sufficiently focused to avoid fuzzy results and providing a definition broad enough to include important yet silent innovation signals – with the support of the client. Thus, one conclusion here is that "data doesn't talk". We have to come up with relevant hypotheses that we can test and therefore support or reject with the help of the data. Focusing the search is the way to get a better understanding of the data.

8.3 THE POTENTIAL OF TECHNOLOGICAL SUPPORT DEPENDS ON SEARCH FIELDS

The role of technology in any project was central for the start phase, but within our projects we more and more see, at least within part of the cases, that the "manual work" for collection, indexing and also analysis itself was often faster, better

and more efficient than the automated analysis (and the additional work needed). The analysis of sentiment for instance was far more reliable and efficient when done manually, especially considering that our typical set of user posts amounted to some hundred text parts. Writing an extractor is worthwhile writing when the material comes from specialized and focused discussion forums such as forums on solar energy. Of course the tools might be helpful in social media mining, for example monitoring user feedback. For usage in analyzing posts in order to find weak signals with relatively few relevant posts, manual analysis proved to be superior to the automatic analysis currently available.

8.4 POTENTIAL TO SURPRISE IS SMALL (IF ANY)

The general feedback in all three settings was that our customers said that the results do not surprise them, but rather support their hypotheses. This is a little bit concerning, as such hypothesis were not clearly described within the first contacts and workshops with our partners. For instance, the social media mining project for a large mobility provider showed that drivers are increasingly dissatisfied with the costs of mobility. However, this observation did not qualify as groundbreaking news to our client. The analysis in the energy sector could after major contextualization deliver at least some food for thought as we could show that the customer journey towards a solar panel on the roof was paved with negative experiences for which an energy provider could possible offer a remedy for. Finally, the analysis conducted in the realm of the skiing industry was able to identify some features that users would look for when reviewing new skiing products. However, even though this last analysis was by far the most specific, the results failed to surprise our client. Building on the impression, that no big surprises were developed for our customers, we tried to validate these experiences. Therefore we discussed the role of surprise within weak signals theory and similar experiences within the extant literature. The paper [20] may be seen as a first discussion of the topic, which should be a first step to validate researchers' experiences and to initiate future discussion.

8.5 PRESENTATION OF THE DATA IS THE KEY

Even if our clients asked us (more or less literally) to "let the data talk", the presentation of this data in meaningful and digestible form is possibly the most challenging part of each project. We developed and used several approaches to "fill" the data with meaning and tried to avoid presenting a long list of findings. One example is the sorting by services provided to our mobility client, another was the development of a (typical) "customer journey" and what might influence or innovate it. Another lesson concerning the presentation of results can be summarized as follows: Finding out and showing unknown innovation potentials are key, while the presentation of previously known facts should be kept to a minimum. A careful researcher should not only be aware of a senseful presentation and good story for his/her issues, but should additionally address future potentials of change within the partner's enterprise.

9 ADDITIONAL INSIGHTS AND RESULTS OF THE PROJECT

Whereas the key project work was the development of new technologies, the implementation and adaption of the approach and the work with our three clients, additional work was necessary. As described within the introduction of this article, we looked for and analyzed existing experiences and approaches of technology usages for weak signals detection [15]. And as referred to in the reflection part, we wrote a short paper on our impressions concerning the limited surprise potential of weak signals detection [20].

Additionally, we discussed and reflected our experiences within this and similar projects related to a first set of guidelines concerning social media mining for innovation purposes in general [21]. Social media in general and user-generated content are seen as potential sources for trend detection and innovation. Nevertheless, there are quite a variety of approaches and experiences. Within this contribution, we wanted to collect and discuss existing recommendations from the literature and our own experience. Building on lessons-learned from the literature and an expert discussion, we present guidelines for social media mining for innovation purposes. These guidelines especially build on experiences with an approach called innovation signals, which combines social media mining technology with an interpretative methodology. We explain guidelines, as "No tool will do your work automatically" or "Narrow your search", and discuss our methodology of guidelines' development as well as the results critically.

10 DISCUSSION

Technology was the basis of our project idea. However, we were always aware that social science methods and consulting competences will play an important role. Looking back, we gained a lot of experience with the possibilities of social media

mining technologies, but also with the effort this implies: Developing one extractor translates into the need of one good developer from our research institution for at least one day – and usually, 4-6 extractors for one topic are needed. This is not affordable in a non-co-funded working situation. Additionally, the results leads to a smoother way to obtain results, but especially the quality of the sentiment analysis did not convince us.

Interestingly, our experiences seem to be shared within research institutions and consultant agencies in our field, but the experiences are seldom shared openly. Perhaps this is also related to potential customers and funding agencies that focus on technologies and a certain magic that might occur with its help. From our perspective in the field of innovation signals, technology of course plays a major role, but current tools are already help enough to support our social science analysis and consulting services for the detection and communication of innovation signals.

Nevertheless our report shows that the approach itself, even if successful, i.e. satisfying our clients, has potential for optimization and adaption.

11 OUTLOOK

After finishing the "innovation signals" project, an important future project is called "Innovation Lens". Within our projects we saw that internal innovation processes in firms are crucial for the realization of innovation. Therefore, many companies have introduced dedicated structures how to decide about innovation processes internally. This may be advantageous, e.g. regarding the focus on markets or product categories. At the same time, the increasing dynamics of most markets require not only incremental, but also disruptive innovations. Yet, traditional patterns of innovation are an impeding factor, in this respect. The new project "Innovation Lens" tries to develop and pilot an innovative technology-enabled methodology to detect blind spots in a company's innovation management at a very early stage. Companies shall question and analyze their traditional patterns of thinking, in order not to miss changes in the company's environment and in customer needs. The new methodology shall be based on IT-supported aggregation of a company's internal and external sources of data, visualized in the form of so-called innovation concept maps.

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Validation of Balloon Burst Method in Measurement of Reverberation Time in a Classroom

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ABSTRACT: This paper aimed to validate the experimental result of reverberation time using balloon burst method with the model (sabine equation) using AcMus software. The experimental procedure utilized dynamic microphone as the receiver, balloon as the sound source and AUDACITY software to record and analyze the impulse created upon popping the balloon. Balloon Burst method has a reverberation time value of 1.28s while the AcMus software gave a reverberation time value of 1.33s. The percent error was calculated and showed a 3.76% error. Hence, the balloon burst method can be used to determine the reverberation time of a classroom also, it can be utilized as instructional materials in science classes.

KEYWORDS: Balloon burst method, reverberation time, Audacity, AcMus and dynamic microphone.

1 INTRODUCTION

Reverberation time measurement is very vital in improving the acoustics not only of classrooms but any other rooms. It can strongly affect the learning of the students since it can interfere to the student and teacher interaction [1]. For auditoria, it served as the basis whether it is for music playing or for speech. In theaters or opera houses, the rooms must be designed in such a manner that every sit receives the acoustic quality that includes reverberation time. And in cinemas, to obtain an outstanding quality of acoustics the reverberation time linear to the frequency must be aimed [2].

There are many methods that can be utilized to determine reverberation time this includes integrated impulse response method, interrupted noise methods, filtered burst method implemented by Bruel & Kjaer and method of recording the room response to an impulsive source. The first three methods mentioned in the latter statement utilized omni-directional speakers which makes it expensive. The method of recording the room response to an impulsive source was preferred since inexpensive sound source like balloon can be used. In addition, balloon is an omni-directional source and has a good spectral content than other inexpensive impulsive sound source [3],[4]. Room response to an impulsive source was applied in the study elsewhere using dynamic microphone, amplifier and speaker. Results showed good agreement with the conventional sound level meter [5].

In this work, the balloon burst method was the preferred method. This method is a specific kind of method of recording the room response to an impulsive source. Based on its name, the sound source used in this method is a balloon. Rusiana et al. (2012) utilizes balloon burst method to determine the reverberation time for 3 classrooms. Same materials were used with the current study applying sabine equation as the model. However, the reliability of the balloon burst method was not tested. In this work, the reverberation time values were determined using the balloon burst method and compared with the model sabine equation using AcMus software to avoid manual calculations.

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2 MATERIALS AND METHODS

2.1 MATERIALS

This paper made use of SLR MC-502 Sharp dynamic microphone as the sound receiver and balloon with a circumference of 80cm as the sound source. The free software AcMus was utilized and set applying the sabine equation to theoretically calculate the reverberation time of a classroom. The experimental set up made use of Audacity software to record and analyze the sound impulses created upon popping the balloon. In addition, an HTC-1 temperature with humidity meter was used to monitor the temperature and relative humidity of the room. Furthermore, 4-Edison classroom having a volume of 148.78 m^3 located at the third floor of Capitol University Basic Education Department (CUBED) was utilized as the testing room.

2.1.1 MEASUREMENT SETUP

The sound source which was the balloon was positioned in front of the black board (represented by star) where the teacher usually stays most of the time. The microphone was positioned in 5 different places inside the classroom (represented by cross marks). Figure 1 shows the various positions of the microphone and the sound source.

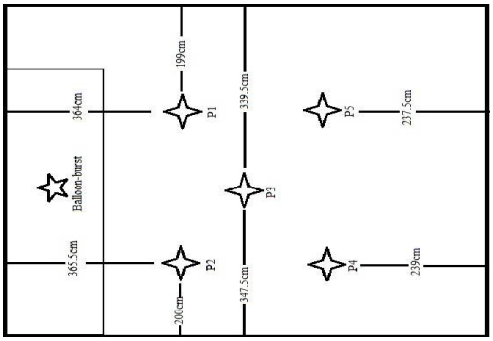

Figure 1 The Position of the Sound Source and the Microphone inside the Classroom.

During the testing process, the doors were closed as well as the windows. The things inside the room were removed like the lockers, tables and the chairs living the classroom almost totally empty. Figure 2 shows the interior of the classroom and the experimental set up.

Figure 2. The Interior of the Classroom and the Experimental Setup

2.2 METHODS

The balloon was popped using pin in front of the blackboard and the impulse was recorded using the dynamic microphone and Audacity. The latter procedure was repeated for the remaining 4 positions. The files were saved and analyzed using the same software.

The recorded data were opened using the Audacity software. An impulse that looks like a white noise with an exponential decay was seen. The unnecessary periods or junks (the blank portion) were deleted and the impulse was analyzed. The impulse was highlighted and normalized by going to the "effect" feature and clicking the "normalize". The highlighted impulse was normalized to zero. The feature "audio track" was selected and the impulse was transformed in waveform (dB). Figure 3 show the sample impulse loaded to the Audacity and the waveform (dB).

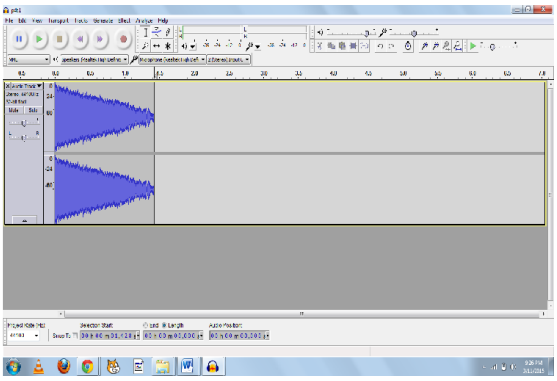

Figure 3. The Sample Recorded Sound Impulse of the Classroom in CUBED.

In figure above, the impulse has a linear pattern staring from 0 dB down to -60 dB. The period that the impulse decayed from 0dB up to -60dB was determined through observation and by clicking the part where the impulse decayed to -60dB. The period served as the reverberation time of the room at a certain position. Same process had been done to other positions in that room and the average result was computed and reported as the reverberation time (Rusiana et al., 2012).

2.3 REVERBERATION TIME MEASUREMENT USING ACMUS SOFTWARE

Every aspect of the interior of the classroom was sketched like the ceiling, walls and the floor. In addition, the area of the materials that composed the classroom was noted and measured. Figure 4 shows an example of our sketch and measurements.

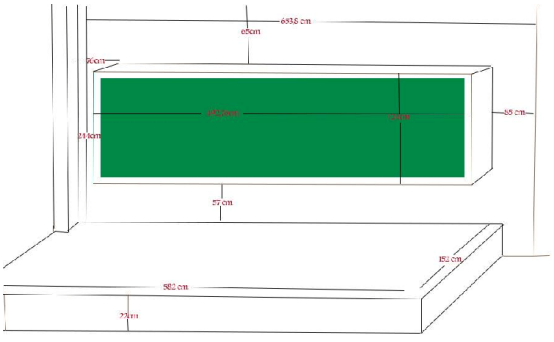

Figure 4. A sample from our sketches.

On the process of running AcMus, the software asks for the location of the saved file of your workspace. After finding a location, the interface will show lots of buttons and windows. The reverberation option was clicked from the drop-down box. Text boxes will be available from there.

The condition of the room was plugged in the AcMus like the temperature, humidity, room volume and pressure. The sabine equation was chosen as the model based on the research problem of this paper. The AcMus has a Portuguese default language hence the researchers translated this with the help of the internet. Figure 5 shows the sample AcMus page in computing the reverberation time.

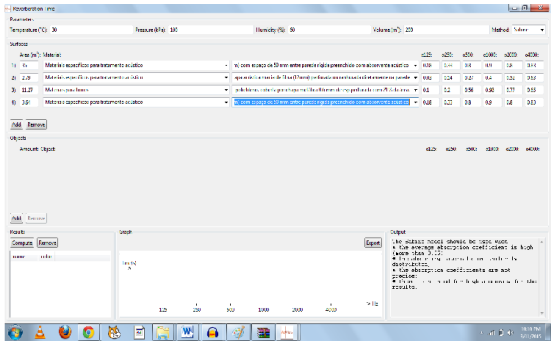

Figure 5. Sample AcMus page

3 RESULTS AND DISCUSSION

Table 1 shows the average reverberation time values every position using the balloon burst method and the AcMus software. The classroom's temperature and humidity were 30.2 +/- 1˚C and 67 +/- 5% respectively during the duration of the experiment. The same conditions were plugged-in the AcMus software while assuming a standard pressure since the location is sea level. Experimental result has an average value of 1.28s while AcMus gives a value of 1.33s.

The calculated percent error was low having a value of 3.76%. This error might be due to the assumption made that the pressure is at standard having a value of 101.33kPa. Despite of having such error, it did not go beyond the limit which is 5%. In addition, these results have a good agreement with the work of Gollmer that a dynamic microphone can be utilized as a sound receiver even if it is inexpensive.

Table 1. Reverberation Time Values from balloon burst method and AcMus Software and the Percent Error

Position	Reverberation Time		Percent error (%)
	Experimental Results (s)	AcMus Result (s)	
1	1.33	1.33	3.76
2	1.32		
3	1.27		
4	1.26		
5	1.24		
average	1.28		

4 CONCLUSION

The primary goal of this research was to determine the reliability of using balloon burst method in determining reverberation time. The experimental result was compared with the model sabine equation using the AcMus software. Results revealed that balloon burst method can be a reliable method to determine the reverberation of a room due to an acceptable percent error which is 3.76% despite of being inexpensive.

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THE EXTENT OF USING INDIVIDUALIZED EDUCATIONAL PLAN ON ACADEMIC PERFORMANCE IN SCIENCES BY DEAF LEARNERS: A CASE OF REV. MUHORO SECONDARY SCHOOL FOR THE DEAF; NYERI COUNTY, KENYA

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ABSTRACT: The main aim of the study was to analyze the extent to which teachers were incorporating Individual Education Program (IEP) in teaching science subjects. The study was guided by Felder Silverman Dimension Model theory to science learning. Descriptive Case study design was used. The study was conducted at Rev. Muhoro Secondary School for the Deaf inMukurwe-ini Sub-County, Nyeri County, Kenya. The target population of study comprised of; Principal, teachers and students of Rev. Muhoro Secondary School for the Deaf. The Principal, teachers who took part in the study were sampled purposively while students were sampled along stratus. The sample size of the study involved one principal, seven science teachers and forty eight students. Data collection was done by use of questionnaires, interview and lesson observation. It was then analyzed both qualitatively and quantitatively. The study revealed that, even though most teachers maintained high academic aspirations in class many of them had little understanding on the planning and implementation of IEP in class. It was therefore commended that, there was need for re-training of teachers on how to plan and use IEP in class. It was further stressed that, only teachers who had trained in Special Needs Education recruited to teach in schools for the deaf and that inspectorate services should be enhanced to ensure that teachers were using IEP in their teaching.

KEYWORDS: Deaf learners, Individual Education Program, Special Needs Education.

BACKGROUND TO THE STUDY

Roles of teachers of the deaf students are changing rapidly, as the classroom settings and demographic factors of teachingscience becomes more demanding. Science subjects are increasingly viewed as subjects of life-long utility among students, society and the country at a large. This is reiterated by McIntosh, (1994) who state that, scientific literacy has become a necessity for everyone as the need to use scientific information to make choices that a rise in everyday life increases.

Early educators such as Dewey, (1964) Montessori, (1968) and Froebel, (1974) believed that, effectiveness of teaching and learning are determined by the type of teaching strategies applied in classroom. National Research Council (2005) echoes the same sentiments when it asserts that, pedagogical practices that address students' initial understandings and preconceptions about topics, provides a foundation of factual knowledge and conceptual understanding. While achievement of these objectives remains important, the use of Individual Education Programas part of this achievement can't be ignored.According to Jodi, (1996) Individualized Education Program (IEP) is a developmentally appropriate curriculum that is based on each learner's needs. Developmentally appropriate, means that each child's unique progress and growth are used to determine what he or she can accomplish.

Gibbs, (1992) noted that, individualized learning gives students greater autonomy and control over choices of subject matter, learning methods and pace of the study. Keefe, (2007) agrees when he acknowledges that every learner has unique experiential background and unique set of talents and personal interest which must be taken into consideration during

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learning in class. There are no two individual learners who exhibit the same behaviour patterns or posses the same goals or aspiration in class (Njeri, 2012).

Rittenhouse, (2004) while evaluating newly trained teachers of the deaf, on the use of IEP in teaching noted that, while they were typically energetic and willing to attempt to tackle new ideas, they often lacked the skills necessary for successful maintenance and development of Individualized Educational Program (IEP). Similar study conducted at theInstitute of Science in America, establishes that Individual Education Program was key to students' improvement in class.

El-zraigat, (2012) conducted a study in Jordan on challenges of educating students who were deaf and hard of hearing. He surveyed 30 teachers and four Principals drawn from four schools. In his survey, he found out that many teachers lacked necessary expertise in planning Individualized Education Program (IEP). Ndurumo (1993) in Kenya established almost the same findings. He noted that, students who are deaf benefited more on IEP as their needs and interests were catered for in class based on their learning pace. He further noted that, failure of deaf students to master academics subjects was as a result of failure by teachers of the deaf learners to cater for their individual differences. Ndurumo, (1993) study highlighted urgent need to introduce Individualized Educational Program (IEP) in curriculum to address the prevailing poor performance. The present study sought to find out if teachers at Rev. Muhoro School were incorporating IEP in their teaching during learning of science subjects in class and how this was contributing on performance in sciences.

STATEMENT OF THE PROBLEM

In spite critical role played by science education in promoting scientific and technological development in the country, the performance in national examination in these subjects had been generally poor. MoEST (2005) laments that the performance in Mathematics and science subjects at secondary education level had been characterized by poor performance in national examinations. According to Aduda, (2009), the most recent outcry was made by the then Minister of Education Prof. Ongeri, who noted that, there had been a drastic drop in performance in sciences in 2008 KCSE

Even of more concern is that, this poor performance has even been poorer in secondary schools for the deaf in Kenya. The trend has been observed for some years now and is quite disturbing. A five year period 2009-2013 had shown that, the performance at Rev. Muhoro Secondary School for the Deaf had been oscillating at mean score of 2.0 and below (Rev. Muhoro KCSE Performance Index). While we appreciate that, there had been some research to correct the trend in hearing schools; the same in deaf schools largely remains. It is likely reiterating that achievement of scientific goals remain difficult if this trend is not checked (Eshiwani, 1998). This issue becomes even more urgent as research a study (McIntosh, Sulzen, Reeder, and Kidd 1994; Molander, Pedersen and Norell, 2001 and Moores and Martin 2006) indicates that science subjects had been greatly neglected in the Curriculum for deaf learners. These findings prompted the present study whose aim was to analyze extent to which teachers' were incorporating Individual Education Program in teaching science subjects and how this was contributing on performance in science in KCSE

PURPOSE OF THE STUDY

The purpose of the study was to analyze theextent to which teachers were incorporating Individual Education Program in teaching science subjects at Rev. Muhoro Secondary School for the Deaf and evaluates itscontribution on performance in KCSE. Findings revealed that, there was positive correlation between the use of IEP and performance in sciences

OBJECTIVES OF THE STUDY

- To find out how teachers incorporate IEP in teaching science subjects to deaf learners
- To establish if students have an IEP to monitor their performance in sciences
- To find out frequency of IEP discussion between the teacher and the student

THEORETICAL FRAMEWORK

The study was guided by Felder and Silverman (1998) Dimension Model Theory to Sciences Learning. According to Felder and Silverman (1998), there are four Dimensions of learning styles related to each students preferred mode of receiving information in class. The four Dimensions are based on the type of information students receive in class (sensory or intuitive) modality in which they receive it (visual or verbal) process by which they receive it (actively or reflectively) and the order in which they receive it (sequentially or globally).

The theory stresses that in any learning, all learners are unique and therefore, there is need to adopt teaching strategies that effectively takes into account their learning styles. The fact that, students who are deaf requires extended services such as the use of IEP makes the theory an effective preposition for this study. Felder and Silverman (1998), noted that, the use of pedagogical strategies that provides students with time to think and reflect in class and strategies that structure student-student and teacher-student interaction should be emphasized as a way to learning

CONCEPTUAL FRAMEWORK

The conceptual framework shows the interrelationship between the variables of the study and the main focus of Felder Silverman Dimension Model Theory to Science Learning. In this conceptual framework, IEP is the main variable in learning science subjects. If the learners are to occupy an active role in science class, then the teacher in class will have to adopt an IEP in teaching. This teaching strategy is in line with Felder Silverman Dimension Model to science learning which advocates for learning that is based on the learning needs of each learner. The resultant effect of this is increased accommodation and assimilation leading to improved performance in sciences at KCSE

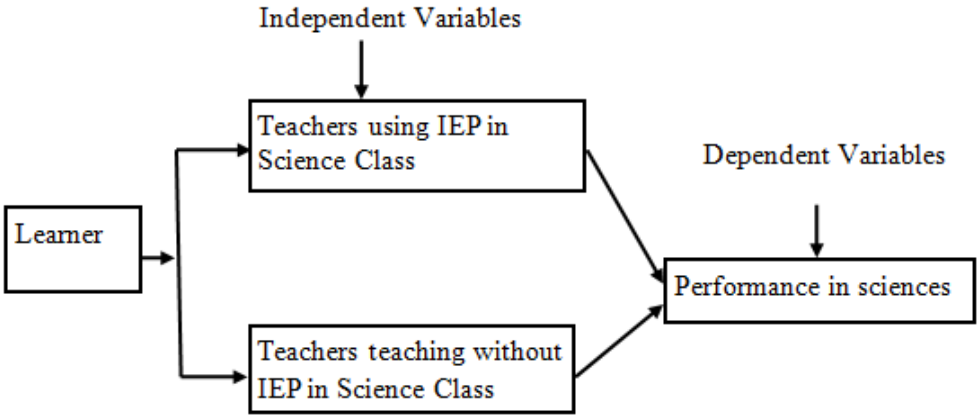


Figure 1: The Conceptual Framework Model on Effective Teaching Strategies in Classroom

Source: Adopted from researcher study;

RESEARCH DESIGN

The study used descriptive Case study design. According to Nachmias and Nachmias, (1981) there are virtually no specific requirements guiding Case research. They assume a holistic view of the process under the study (Gummesson, 1988) and hence the approach was useful in responding to how and why questions about poor performance in sciences at Rev. Muhoro Secondary Schools for the Deaf. The study used both qualitative and quantitative data collection strategies even though most of the Case studies emphasize qualitative approach. This was meant to minimize limitations of each method

TARGET POPULATION

The target population comprised of; 1 Principal, 23 Teachers, and 210 Students of Rev. Muhoro. The Principal provided data on how science subjects had been performed by deaf students for years, while teachers and students gave their views on the level of IEP use in classroom, and how this was contributing on performance in sciences.

SAMPLING TECHNIQUE

The researcher used purposive sampling technique when sampling Teachers and Principals to take part in research. This was due to the fact that, participants to take part in the study were few based on the research design adopted. The school had three streams with a population of 210 students with 23 teaching staff. Out of this population of 210 students, 140 were deaf students while 70 were hearing students. The classes of deaf students were double streamed with hearing students

occupying the third stream. Stratified random sampling techniques were used to select a sample size of 48 deaf students from Form Two to Form Four with each Form producing 8 participants to ensure equal representation. Form one students did not participate owing to the fact that they were yet to settle and would not have had reliable information touching on this study. On the other hand, out of 23 teachers, there were 7 science subjects teachers- Chemistry, Biology and Physics who took part in this research. The school principal also took part in the study by informing the researcher on how teachers were utilizing IEP in class to improve performance of deaf learners in sciences. This formed a sample of 56 participants. The result of the study were then generalised to the whole population.

SAMPLE SIZE

The sample size consisted of 48 Students, 7 Science Teachers and 1 Principal making a total sample of 56 respondents as shown in the table below;

Table1:-Sample size

School	No. of students	No. of teachers	No. of head teacher	Total
Rev. Muhoro Sec	48	7	1	56

RESEARCH INSTRUMENTS

The study used questionnaires, interview and lesson observation schedules as instruments for data collection. There were two sets of questionnaires meant for science teachers and students respectively, then interview schedule for Principal. The questionnaires included questions related to the extentat which teachers were incorporating IEP in teaching and how this was contributing on performance in sciences in class. In addition, the questionnaires were used in finding out some of the measures to be put in place to sort out any gap identified. Interview schedule on the other hand were used in finding out if the school was using IEP in teaching science subjects and any relationship on performance. Further, the researcher recorded aspects of teaching strategies being used by teachers in classroom with the aim of finding out if IEP was being incorporated in learning or not. This was done by use of video recorder and later analyzed according to major themes.

PILOT STUDY

Before the actual study, the researcher carried out pilot study at Murang'a Secondary School for the Deaf. This was quite essential as it helped the researcher in estimating reliability and validity of the researcher instruments. Only Biology subject was used in the pilot study. The number of the respondents who were interviewed using questionnaire were; 3 biology teachers and 6 students. The researcher scored on the questionnaire manually. After a period of two weeks, the researcher again administered the same questionnaire to the same group of subjects. The responses were again scored manually. The findings of the study were then compared to determine the reliability of the questionnaire.

RELIABILITY AND VALIDITY

According to Mugenda, (2008) validity is the accuracy, trust, worthfulness and meaningfulness of inferences that are based on the data obtained from the use of a tool or a scale for each construct or variable in the data. In this study, validity of research instruments was determined through professional judgment by the supervisors. On the other hand, reliability is the degree to which a research instrument yields the same results or data after repeated trials. This was achieved through test-re-test method where research instruments were piloted twice at Murang'a Secondary School for the Deaf.

DATA COLLECTION TECHNIQUES

Teachers teaching sciences subjects were given a questionnaire in the staffroom to fill. They were also observed in their respective classes and both qualitative and quantitative data collected following observation guide prepared. Each class was observed twice a week for a period of one month. Brief discussions were also conducted by science teachers to exhaust all the information required for this study. Interviews with the head teacher was held at her own discretion and the venue decided by her within the period of the study. The researcher noted down important points of interview. Lastly students were given questionnaires to fill under the support of the researcher assistance in their classes. They were also observed in

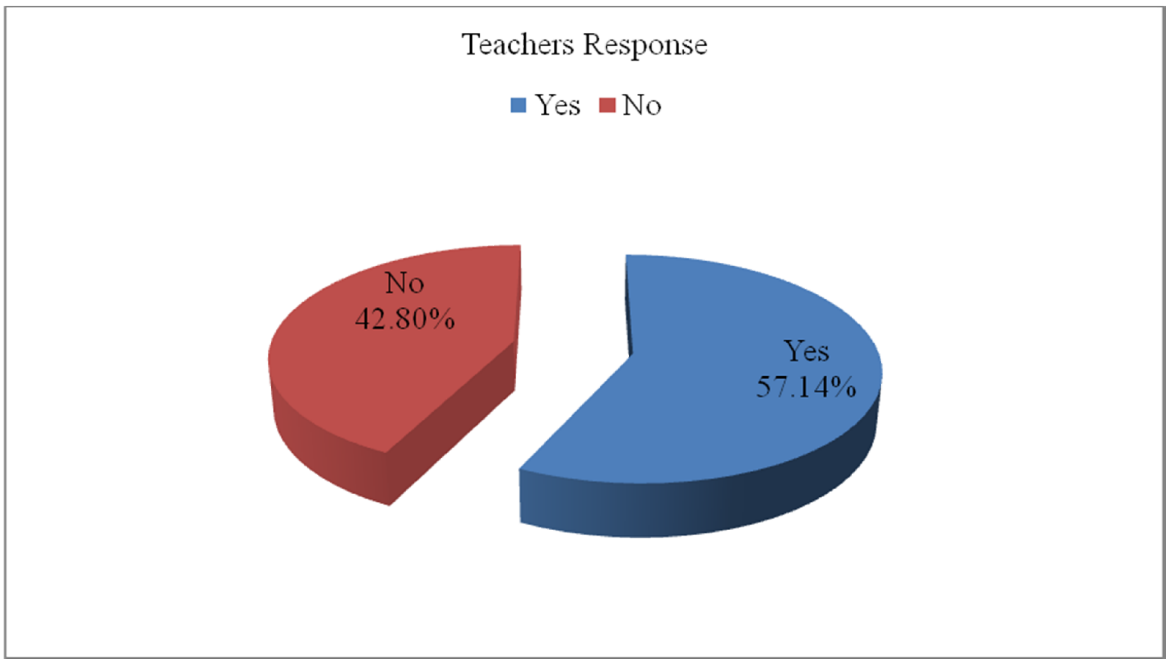
their respective classes on how they were participating in the learning process when different teaching strategies were being used.

DATA ANALYSIS

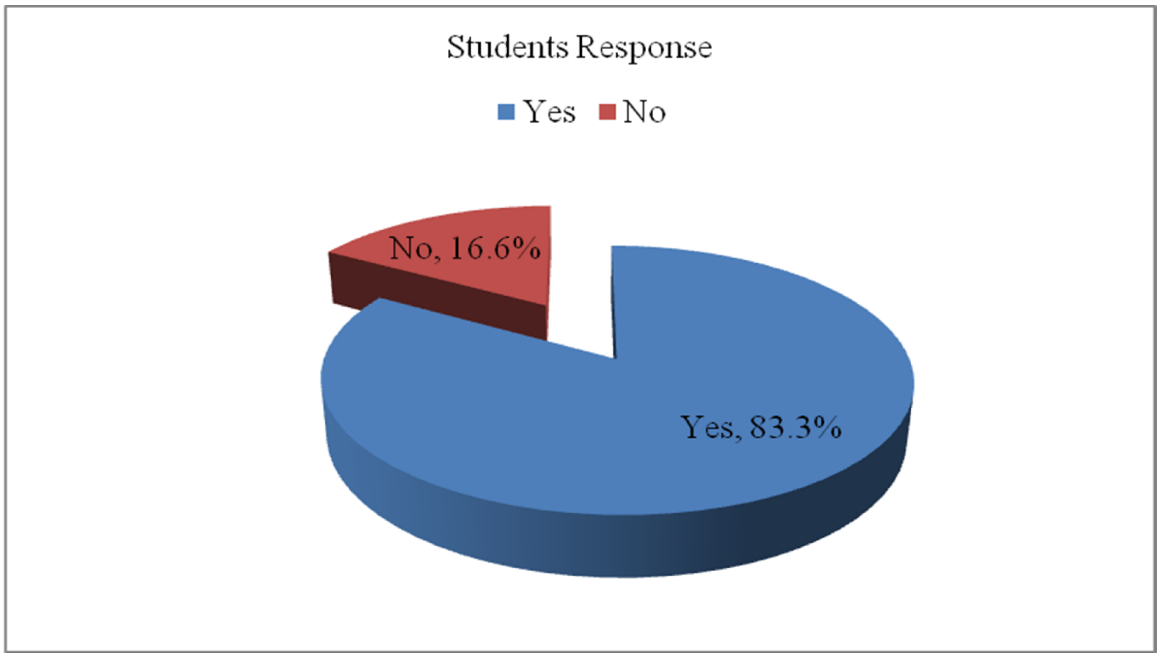
Data collected by the researcher was analyzed both quantitatively and qualitatively. Quantitative data from closed, open ended questionnaires and lessons observations schedules were analyzed and presented by descriptive statistics while qualitative data were analyzed based on major themes and then reported in narrative form.

DATA ANALYSIS AND DISCUSSION

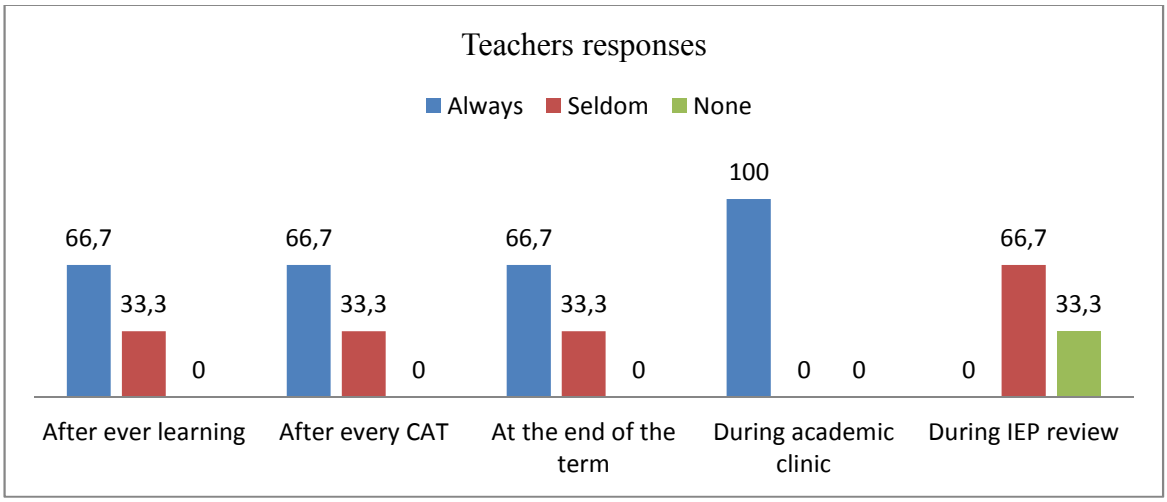
During data collection, teachers were asked to state if they were incorporating IEP in science class to monitor learners' performance or not. Their responses were as shown below;



Findings revealed 57.14% of teachers were incorporating IEP in their teaching to monitor learners' performance in sciences while 42.80% were not. Students were equally asked to state if they had an IEP or not. Their responses were as shown below;



From the findings, majority of the students (83.3%) reported having an IEP while 16.6% reported they did not have. Teachers were also asked to give frequency at which they discussed IEP with their students. Their responses were as shown below;



Sixty six point seven percent- 66.7% of teachers reported to have discussed IEP with their students after every learning, 33.3% did this seldom while 0% none. 66.7% reported to have discussed after every CAT, 33.3% seldom while 0% none. Sixty six point seven percent- 66.7% discussed at the end of the term, 33.3% did it seldom while 0% none. 100% discussed during academic Clinics, 0% did it seldom while, 0% none. Zero percent-0% discussed during IEP review 66.7% did it seldom while 33.3% none. Interview with the principal reported the school was using IEP in monitoring students' academic performance; though this was being used to a lesser extent.

Analysis of teachers' responses revealed majority of them (66.7%) discussed their IEP with their students after learning, CAT, at the end of the term and during academic Clinics. This higher percentage may have been attributed to normal routine procedures in school as marking of exercise books, follow up on students corrections in class work and doing revisions of continuous assessment tests which the teacher equated to IEP as there was no evidence to support their responses.

One hundred percent (100%), of teachers reported to have discussed their IEP with their students during academic Clinic. This may be true as it involved the parents. Interview with the Principal indicated teachers were using IEP in monitoring learners performance though this was being done to a less extend.

Observation in learning trend revealed that, though teachers maintained higher standards of academic learning which were not limited to academic Clinic and revision of continuous assessment tests, there was no documentary evidence to support existence of IEP in school. Most of them existed as brief case IEP which did not seem to follow IEP format expected of such learners. These findings supports Rittenhouse (2004), study on newly trained teacherswho establishes that, while they were typically energetic and willing to attempt to tackle new ideas, they often lacked the skills necessary for successful maintenance and development of individualized education program.

Students' responses were not utilised in this section since from the beginning, their responses seemed to address their personal convenient. Most of them seemed not to comprehend exactly what IEP meant even after being assisted by the research assistant. They equated it to continuous revision, academic Clinic which was being done in school as a parcel of addressing general inefficiencies in academics hence their inclusion here would have simply watered down the recommendations to be made.

CONCLUSION

The study found out that, even though most teachers maintained higher standards of academic learning, most of them were not using IEP in their teaching as there was no file in school to support its existence. It was noted that most teachers did not comprehend the meaning of IEP and the format of writing it. Observation in teaching trends showed that most teachers equated IEP on normal routine class procedures as marking of exercise books, follow-up on students' corrections in class and doing revision of continuous assessment tests. This lack of understanding on planning and using of IEP had made students who required IEP to lag behind in sciences. Equally students seemed not to comprehend it. This was a clear indication that IEP was not being used in school,

RECOMMENDATIONS OF THE STUDY

The study recommends that:

1. There is need for intensive immersion of teachers on IEP preparation which may include; organizing in-servicing teachers training Courses for teachers on IEP. This should be facilitated by MoEST in conjunction with KISE and any University offering Special Needs Education
2. There is need to review Policy on teacher recruitment where by only those trained to teach deaf learners are recruited to teach in deaf schools. Most of these teachers usually undergo intensive preparation where they are taught on how to plan and implement IEP in class. This puts them in a better position as teachers of the deaf students.
3. Quality Assurance and Standard Officers in Ministry of Education Science and Technology (MoEST) should intensify inspection of schools for the deaf to ensure teachers were using Individual Education Program in their teaching.

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CLASSROOM ENVIRONMENT AND ITS SUPPORT TO EFFECTIVE CLASSROOM COMMUNICATION FOR DEAF LEARNERS

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ABSTRACT: The purpose of the study was to determine the impact of classroom communication on academic performance of learners with hearing impairment. A case of Kambui School for the Deaf, Kiambu County-Kenya. The specific objective was to establish whether the classroom environment was supportive to effective classroom communication for learners with hearing impairment. The study was guided by the Holcomb's 1967 Total Communication Theory. It adopted descriptive case study design. The respondents were the head teacher, ten teachers and sixty learners, giving a total sample of 71 participants (n – 71). Data was corrected by the use of interviews, questionnaires and observations. A combination of content analysis and thematic approach was used to analyze qualitative data. Research findings indicated that, classroom environment was not supportive to effective classroom communication. To support improved academic outcomes of learners with hearing impairment, it is important that their direct experiences in the classroom is understood. The school had large class sizes which affected teacher learner interaction. It was noted that, there was inadequate teaching and learning materials. In order to improve academic performance accommodations such as small class sizes, spacious classroom, well ventilation, a good lighting and noise management need to be observed.

KEYWORDS: Classroom, communication modes, learning, academic performance, environment.

BACKGROUND TO THE STUDY

The classroom environment and activities are what learners experience directly and they are the mechanism through which educational interventions are most likely to produce desired improvements in learner's performance. Peters (2004) in a study titled inclusive education, and education for all strategy for all children; reveled that, environment played a significant role in disabling majority learners. Ademokoya (2008) in a study titled classroom communication and placement of learners with hearing impairment in an inclusive class carried out in Nigeria found that, to support improved outcomes of learners with hearing impairment, it was important that, their direct experiences in the classroom were understood.

A study carried out in Zambia by Malunga (2007) titled an investigation on the use of sign language and language by regular teachers teaching learners with hearing impairment showed that in relation to the learning environment, the best possible conditions were a quiet place and good lightening. This allowed learners with hearing impairment to concentrate and follow what was being lip-read. A study by Liwakala (2003) carried out in Mpika, Zambia, reported that, learners with hearing impairment were visual learners. As a result, an attractive classroom with talking walls such as interesting notice boards and charts around the room, visual teaching aids such as pictures, diagrams and word maps assisted the learners to learn. In relation to seating arrangement, Liwakala (2003) found that it was very cardinal that learners with hearing impairment sat on chairs so that they could see both the teachers and their peers as much as possible. This was attributed to the fact that, the learners are able to see the various signs, lip-read and interpret body language as they were in full view of all participants in the classroom.

A study carried out by Ekwama (2003) in Nigeria, found that, in order to accommodate learners with hearing impairment who used hearing aids, it was vital to minimize noise. If there was noise from outside, doors needed to be shut and in certain instances, windows were shut. These measures were put in place in order to reduce background noise. It was highlighted

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that background noise, reverberation and distance from the speaker were real issues for learners with hearing impairment, even those with mild or unilateral hearing loss who were able to hear in the classroom.

PURPOSE OF THE STUDY

The study sought to establish whether classroom environment was supportive to effective classroom communication for learners with hearing impairment.

STATEMENT OF THE PROBLEM

Classroom environment and activities are what learners experience directly and they are the mechanism through which educational interventions are most likely to produce desired improvements in learner's academic performance. Environment can disable learner'sperformance; therefore their direct experiences in the classroom should be understood. If classroom environment is to play a positive role in the academic performance of learners with hearing impairment, certain accommodations need to be made in the classroom.Accommodations such as, small class sizes, spacious classroom, well ventilation, a good lighting, attractive classrooms with talking walls and well managed background noise.

OBJECTIVE OF THE STUDY

The study sought to establish whether classroom environment was supportive to effective classroom communication for deaf learners.

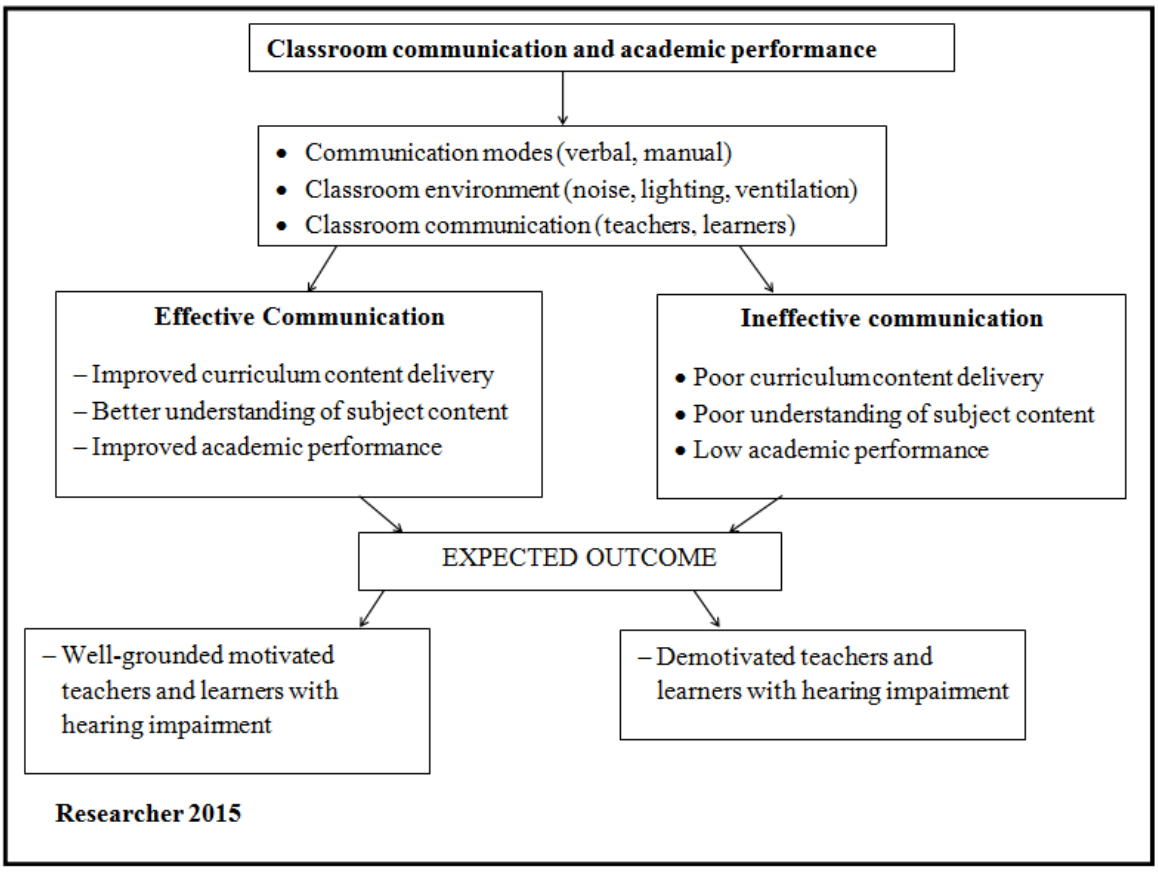
THEORETICAL FRAMEWORK

The study was guided by Holcomb's (1967), Total Communication Theory (Scouten, 1984). Total communication advocates the use of one or several communication mode(s) that is, manual, oral and writing. Teachers may use the communication mode(s) appropriate for a particular child at a particular stage of development (Reed, 2009). One limitation is that, while the Theory may be sound, it may not be put into practice accurately enough in some situations. Although the idea of individualization is at the heart of Total Communication, teachers are limited to how many different communication modes they can use at one time.

CONCEPTUAL FRAMEWORK

The major concepts undelaying the study were: classroom communication, communication modes and academic performance of learners with Hearing Impairment.

Table 1: Classroom communication and academic performance



RESEARCH METHODOLOGY

The study adopted descriptive case study design. A mixed method procedure was used in which observation; interview and questionnaires were employed throughout the study. The questionnaires were important to find out learners perceptions relating to classroom communication and its necessity and importance for academic performance. Classroom observations were necessary to investigate the classroom communication practices of teachers and learners with hearing Impairment.

TARGET POPULATION

The total target population comprised of 276 respondents (N-276). It consisted all the 251 learners (129boys and 122girls) (2013 enrolment) and twenty five teachers (12 male and 13female).

SAMPLING TECHNIQUE AND SAMPLE SIZE

The study used purposive sampling to select the school and the headteacher. Simple random sampling was used to select a sample size of ten teachers (5male and 5 female) and sixty learners (30boys and 30girls) giving a sample total of 71 respondents (n-71).

RESEARCH INSTRUMENTS

The study utilized both primary and secondary data. Primary data was generated using questionnaire interviews and observations. Secondary data was generated from institutions records such as school enrollment, academic records and teacher's qualifications.

PILOT STUDY

A pilot study was conducted at Kerugoya School for the Deaf which had similar characteristic as the actual study school. The study sample had a total of 27 respondents (n – 27) (seven teachers and 20 learners with Hearing Impairment).

VALIDITY AND RELIABILITY

For the purpose of validity, opinions from expert were considered. The data collected was certified using triangulation. Reliability of the instruments was determined by test-retest method on the pilot study sample after two weeks.

DATA COLLECTION

The researcher obtained permission from relevant authorities such as Kenyatta University, the National Council for Science and Technology (NCST) Kiambu County Commissioner, Kiambu County Director of Education and lastly the head teacher of the school. Informal appointments were made with the respondents. The researcher visited the school for four days to create rapport, conduct interviews and then collect questionnaires. Two teachers from the school helped in organizing the learners and collecting the questionnaires. Kenyan sign language was used all through the data collection period.

DATA ANALYSIS

The data collected was analyzed using the thematic framework. The study focused on identifying and describing both implicit and explicit ideas within the themes as stipulated in the research objectives. Coding was used to represent themes and linked to raw data for analysis. The results were in line with the obtained study themes.

FINDINGS

The study sought to find out if classroom environment was supportive to classroom communication for learners with hearing impairment. The findings reviewed that, the model of the classrooms was made in such a way that it accommodate a maximum of twelve learners at any given time. This prescribed classroom enabled enough ventilation, good lighting and one-on-one teaching interaction with the learners. However, the classrooms were compromised by large class sizes of over twenty learners, therefore making it difficult for the teacher to communicate effectively. It was also difficult for the teachers to address individual needs of the learners.

Similarly any seating arrangement should not isolate the learner. Moreover some learners with hearing impairments also had visual impairments. These learners needed to have a very clear view of the teacher, peers and teaching and learning materials of which without the learners were more handicapped. This is supported by Liwakala, (2003), who found that, it was very cardinal that learners with hearing impairment sat on chairs so that they could see both the teachers and their peers as much as possible. This was attributed to the fact that, the learners are able to see the various signs, lip-read and interpret body language as they were in full view of all participants in the classroom.

Findings showed that background noise was not well managed. Ventilation and lighting was another problem for all classes, windows were covered with newspaper which prevented good lighting and ventilations. There were few old hanging charts in some classes. Most classrooms lacked attractive talking walls; I support findings by Malunga, (2007), in his study titled an investigation on the regular teachers teaching learners with hearing impairmentin Zambia which revealed that the best possible learning environment for learners with hearing impairment would be a quiet place with good lighting. This would allow learners with hearing impairment to concentrate and follow what is being lip-read and signed. Since learners with hearing impairment are visual learners, they needed attractive interesting notice boards and charts around the room, visual teaching aids such as pictures and diagrams will assist the learners to learn. It was also revealed that background noise and reverberation were real issues for learners with mild hearing impairment. Ekwama, (2003), in his study in Nigeria found that, in order to accommodate learners with hearing impairment who used hearing aids, it was vital to minimize noise. He suggested that, if there was noise from outside doors needed to be shut and in certain instances, windows were shut. Those measures need to be put in place in order to reduce background noise. Findings showed that classroom environment was not supportive to effective classroom communication which could have contributed to the learner's dismal academic performance.Ainscow, (2007), highlighted that, without communication there would be no education, no matter how

qualified a teacher and relevant of the adaptation of content. In order to support improved outcomes of learners with hearing impairment, it is important that their direct experiences in the classroom are understood.

DISCUSSION

The study focused on learners with hearing impairment, their communication, classroom environment and academic performance. The analysis of the study showed that, the classroom environment in the school was not supportive to effective classroom communication which could have contributed to learner's decimal academic performance. According to Heward, (2006), most learning occurs through interacting with other people, such learning is possible only when individuals are able to communicate with understanding. Likewise, the quality of the relationship between a learner with hearing impairment and his/her teachers is dependent on the quality of communication existing between them. Just like communication modes play vital role in enhancing academic performance, classroom environments is vital in enhancing classroom communication. If classroom environment is to play a positive role in the academic performance of learners with hearing impairment, accommodations such as, small class sizes, specious classrooms, good lighting and ventilation, noise management and provision of adequate teaching and learning materials need to be made in the classrooms.

RECOMMENDATIONS

The study sought to determine the impact of classroom communication on academic performance of learners with hearing impairment of interest was whether classroom environment was supportive to effective classroom communication. Basing on the study findings the researcher recommends the following:

- The government of Kenya in conjunction with the Ministry of Education Science and Technology (Special Education Section) needs to provide more funds in Special Education Institutions to cater for the infrastructure. This will allow the school to accommodate more learners.
- The government of Kenya should to establish more schools for learners with hearing impairment in the counties. This would help to accommodate the growing number of such learners. The current environment in the school is too high and just to mention the waiting list for admission is equally long.
- The Government of Kenya to allocate more funds for purchasing teaching and learning materials, as learners with hearing impairment are visual learners.

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A framework of data warehouse and data mining technique to evaluate teachers performance in University of Agriculture, Faisalabad

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ABSTRACT: Data is a vital asset of an organization and every organization tries its best to store large amount of data. Important decisions are made on the base of stored data. University of Agriculture, Faisalabad is the popular university of the Pakistan. UAF is using Oracle database to store the university employees and students record. This database can store data upto Gbs. Data in this database cannot be analyzed to find hidden information or patterns mean ad hoc queries are not supported. Only few tens of records can be accessed at the same time. Data warehouse stores very large amount of historical data. It stores data up to Tbs. Millions of records can be accessed at the same time. Different data mining techniques explore data warehouse to find hidden patterns and determines what was happening, what is happening and what will happen. Data warehouse supports ad hoc queries. Organizations can make proactive and knowledge driven decisions for more profit and improvements in business. We proposed a framework of Data warehouse for the University of Agriculture, Faisalabad, Pakistan. This Data warehouse stores the large data of teachers of UAF. This data is analyzed for evaluating the teachers performance. This data is used by data warehouse to make prediction about teachers. This warehouse helps not only to administration but also to teachers about their performance and weaknesses.

KEYWORDS: Data warehouse with data mining, Performance evaluation with Data warehouse, Decision making with data warehouse, uses of Data mining.

1 INTRODUCTION

The life of an organization depends on its data. The organization will succeed as much as strong data it has .The progress of an organization can be measured as it gets information from stored data. In decision making this stored data can be used. Trends are determined by using this stored data as history.

University of Agriculture, Faisalabad is not only the famous university of Pakistan but also famous at international level. This university has six faculties: faculty of Agriculture, faculty of veterinary science, faculty of sciences, faculty of animal husbandry, faculty of agricultural engineering and technology and faculty of social sciences. Then each faculty is subdivided into many departments. University has more than 500 teachers and half of them are p.hds. University also hires many visiting staff for improving education standard.

University database stores only bio data of teachers like name father name address qualification. This data cannot be used as history to take important decision and to evaluate teacher performance. University is using Oracle database to store the teachers data. This database is only used for record keeping. Database has many limitations. This database can store data upto Gbs. But university should store data of many years as history. This database stores daily operational data but does not

store long term informational requirement data. University cannot use this database to determine which teacher is performing best and to whom university should hire for next semester. This Database stores simple and short transactions. In database user can view data only as flat file. User can access few tens of records at a time. Indexing and hashing on primary key takes a lot of time. Data in database cannot be analyzed.

In this research a new approach is used to store teachers data in a way that it can be used in decision making or evaluation can be made on this data. For this purpose the concept of data warehousing is used in this research. We proposed a framework of Data warehouse and data mining technique for this university. Data warehouse is used to store large amount of historical data. Data of years can be stored in this database. Decisions can be made on the basis of stored data. Organizations use data warehouse to promote their business. From this stored historical data organization can take important decision.

An insatiable need of the companies in this brutally competitive marketplace is Information. The key to maintain competitive advantage is to understanding the customers's requirements, and the approach in which they want to accept your products or services. Well-known queries and analysis tools can be used to grasp competitive edges, to access crucial data in an appropriate, well-organized manner is significant. Touching and distribution of data all over an organization, between all departments, offices and business followers has equal value [1].

1.1 DATA WAREHOUSE

Data warehouse stores data for years. A relational catalog more willingly than for transaction processing designed for query and investigation is known as data warehouse. Historical data resultant from transaction data is usually stored in this database, but data from additional springs can also be included. Analysis workload is separated from transaction workload and consolidate data from several sources can be gained by organization.

It is analyzed that an immense pact of time spending is concerned in data warehouse system and in its assembling process and daily operation problems often occur, one major concern takes place in the effort of taking out, making over and putting together data in data warehouse from business database. This is because data is received from different types of sources and business applications varieties. A variety of data extraction curriculum supports the functions of purifying the data, processing of the data and usual procedures, and multiple data sources can be handled. In sort to grasp valuable preservation and supervision to data quality Automatic data extraction is demanded through this we let the data warehouse to precisely, securely and constantly mine data from the database and managerial staff can use this for analysis, when it is renovated into the regular data [2].

An extraction, transportation, transformation, and loading (ETL) solutions are included in a data warehouse, adding together to a relational database. And other applications to gather the data and make it available to uses such as an online analytical processing (OLAP) engine, client analysis tools, are provided.

It is presented that in the joining process by reinstating subject-oriented data mutually from data sources data warehouse is measured useful. The job of bringing back data from equipped information system side to data warehouse side throughout data warehousing is carried out by ETL tool. ETL tool performs many key functions including: (1) the classification and withdrawal of data from associated data sources, (2) the enhancement of data on the derivation of business rules, (3) the adaptation of the data into an incorporated format, and (4) the collection of the data to the data warehouse and data mart [3].

This data can be analyzed by the use of different techniques of data mining to predict the future based on the stored historical data. User can perform ad hoc queries on the data stored in data warehouse. Major difference of Data warehouse over Database is that data in data warehouse meets the four characteristics (i) subject oriented (ii) time variant (iii) integrated (iv) non volatile

1.1.1 SUBJECT ORIENTED

To help analyze data in efficient way data warehouses are designed. Data warehouse can be designed to focus on a single subject. For illustration, for discovering further about organization's sales data, a warehouse can be built that concentrates only on sales. Through this warehouse, useful information about sale can be query like "Who was the top customer last year for specific item? Mean a data warehouse by subject issue can be defined, sales in mentioned scenario, the data warehouse is made subject oriented.

1.1.2 INTEGRATED

An intimately associated issue to subject orientation is integration. Data comes in data warehouses from different sources or data marts. In these sources data may be stored in different way or format. Data is taken from these different sources in different formats and put into central data warehouse by resolving different tribulations as identification divergence and contradictions among components of measure. When these conflicts are resolves mean consistency is achieved, that data is said to be integrated.

1.1.3 NONVOLATILE

As it is shown from the word nonvolatile, it means that, once entry of data into the warehouse is made, it is supposed to not be change. Because data warehouse has to store large amount of historical data this is commonsense and the rationale to a warehouse, analysis is allowed to determine what has occurred and why has occur and when has occur.

1.1.4 TIME VARIANT

In industry with the intention of discovering inclinations a bulky amount of data is looked-for. Data warehouse stores data over a long period of time so that important decision can be taken based on this stored data. As match up to **online transaction processing** systems this is very much unusual, historical data demands to be moved in annals for recital necessities. Intended by the term time variant is that change over time is the focus of data warehouse.

1.2 INTRODUCTION TO DATA MINING TECHNIQUES

The technique with reference to dealing out data and categorizing patterns and trends in that information is data mining so that decision or judgment can be made. To detection relevant patterns in a database, to predict future trends analysis is made by defined approaches and algorithms on current and historical data. Data mining reads databases for hidden patterns and to make prediction about future trends and behavior. Proactive, knowledge-driven decisions can be made by organizations by using these tools and organization can answer to the questions that were previously too time sustained to steadfastness.

Data Mining can be described as a technique for taking out the "sense" holded in information to let the understanding needed by a user to formulate a "right" choice. Another definition could be providing the exact information, in the precise structure, at the accurate time, so as to allow the manager to proficiently and successfully perform his duties. Data Mining allows a computer to absorb the stable flow of data produced by the computerized sensors and monitors of the stand, and then extract meaningful information from these contents [4].

1.2.1 DATA

Any facts, truth, numbers, or text that can be practiced by a computer are data. Today, enormous and budding amounts of data are accumulated by organizations in diverse formats and different databases.

1.2.2 INFORMATION

Information is provided by the prototype, associations, or relationships among all this *data*. For example, Information on which products are selling and when can be yielded as a result of analysis of trade point of sale transaction data.

1.2.3 KNOWLEDGE

Knowledge is gained from historical patterns and future trends by converting the information into accurate blueprint. For example, in illumination of promotional labors to supply knowledge of consumer buying manners review information on retail supermarket sales can be examined. Thus, it could be determined by manufacturer or retailer that which items are most vulnerable to promotional efforts.

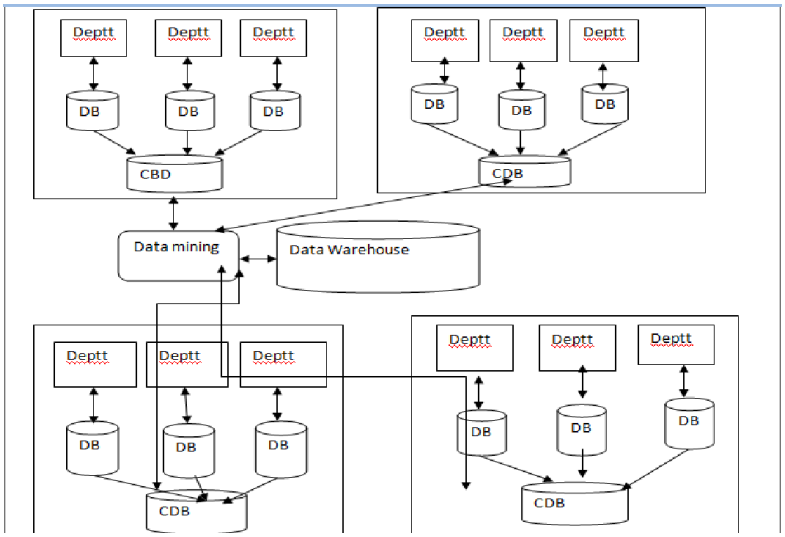
It is stated that the information and knowledge turns into the most precious resources of electric power companies due to the changeable market. The Use of advanced information technology to assimilate presented software and hardware assets, permit the recruits and tools in most excellent operation status, perfectly understanding existing production position

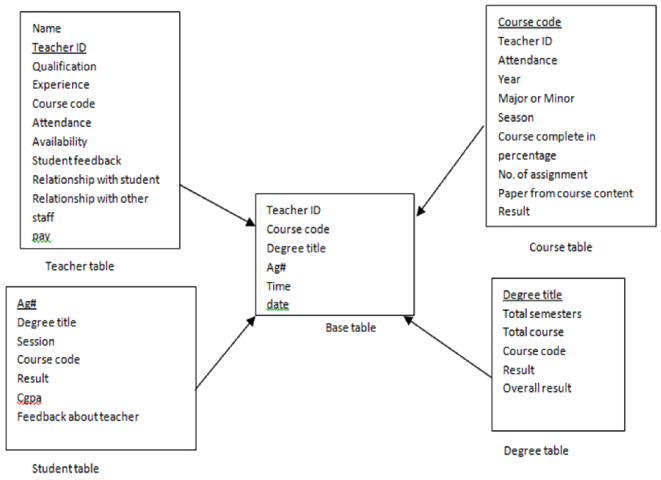
and the predict market stipulate, has become a imperative technique for the electric power enterprise to improve the industry rivalry [5].

It is explained that to take out hidden or masked information from bulky databases a set of robotic procedures are used called data mining. The phrase data mining in large databases withdraws nontrivial of convincing, unstated, potentially serviceable and eventually logical information and the use of the current computing devices is carried out for achieving significant data. From diverse sectors successful appliances in data mining have been accounted in the preceding few decades. Invaluable knowledge that was unknown before can be exposed in the existing database using these mining techniques. For example date profiles of the customers and their procure are kept up to date, a list of available products is maintained with quantities and prices [6].

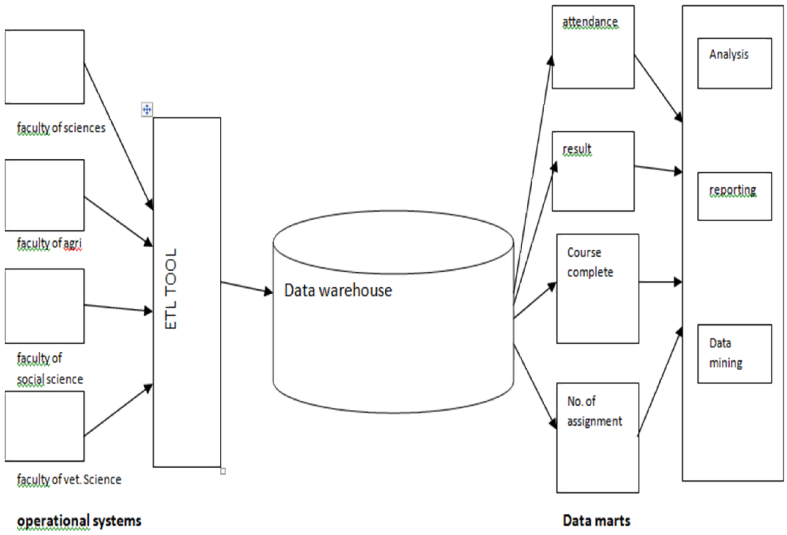
2 PROPOSED FRAMEWORK

We proposed a framework of data warehouse and data mining technique for this university. According to this framework each department stores data of its teachers mean every department has a database. Then the data of these departments is stored in concerned faculty. Mean the data of computer science department, Botany department and chemistry department is stored in the centralized database of faculty of sciences. And the data of anatomy department and pathology department is centralized in the faculty of veterinary sciences database. Then this centralized data of all faculties again centralized at data center. Mean all these faculties then stores data in data warehouse of data center.





Structure of DW tables



3 METHOD

A deep study of data warehouse and data mining technique is conducted. The current system of university of Agriculture Faisalabad is studied and expectations from the new system are analyzed. SPSS is used to evaluate the result. Questionnaire of 20 questions is prepared. A survey is conducted in three main universities of Faisalabad National textile university Faisalabad, GC university Faisalabad and Agriculture university, Faisalabad. Questionnaires are filled by the lecturers of computer departments of these universities. Following attributes are used as parameters to evaluate teacher performance: Attendance, percentage of course, no of assignments, availability besides lectures, result, relationship with students, relationship with other staff, student feedback, no of jobs done.

Using the information on websites, a larger and extra knotty data warehouse is built origination the standpoint of modification on data warehouse. Each site on the Web can be used as data source and every data establishment is diverse reason is that different formats are used to develop these websites and these websites use different types of data, and every site has different information and tissue. From the perspective of multidimensional database, A Web data environment has immense and mixed data warehouse background, based on two-dimensional flat face data cooperatively time dimension and link dimension use to comprise this. The center of attention on conventional data warehouse is data mining which is much more easier than the Web data mining technology. Consequently, the amalgamation of miscellaneous data by the side of with the sites should be premeditated. At these sites only the data are integrated, and an uniform view is provided to users, to accomplish what it is compulsory from the massive data possessions is possible [7].

4 RESULTS AND DISCUSSION

Mean, weighted score and rank is calculated for each question.

Data is consolidated from heterogeneous sources in Data warehouse (DW) of all enterprise to support enterprise wide decision support system (DSS) which consists of dashboard, reporting, and analyzing. At the presentation layer the high level overview of the data warehouse together with the DSS is shown. To support dynamic load allocation based on demand, the DW is implemented in the Cloud Infrastructure. Their respective standalone applications are used to obtain these data sources which are not deployed in the cloud infrastructure. In addition, presentation layer is supported in both client-server platform as well as web-based platform for reporting and analysis. Various selected format such as pie chart and other format in the interactive dashboard are used to present OLAP. A large number of data has been accumulated from heterogeneous data sources from multiple applications, in the healthcare sector in which we are building the data warehouse. Through the ETL process, these data needs to be populated into DW. To support the needs of presenting in both ad-hoc reports and statistical reports we have also implemented the data model and OLAP [8].

From this stat some parameters got high rank these parameters are as follow:

The use of data warehouse and data mining technique can improve teachers performance got 16 rank.

The use of data warehouse with data mining technique is sufficient for performance evaluation got 14 rank.

Data warehouse and data mining technique in this scenario can improve the level of education got 15 rank.

Collectively by these three factor we got 31% success.

Reliability between questions is calculated and .642 reliability is found between questions which shows questions are highly reliable.

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.642	20

And if regression is calculated for these questions good results are obtained which are shown in diagram below.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.922[a]	.850	.593	.54780

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COMPARATIVE ANALYSIS INTO THE GEOMAGNETIC INDICES (ap, AE, DST, Bz) DURING DISTURBED PERIOD AND QUIET CONDITIONS OF SOLAR MAXIMUM YEAR (2001)

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ABSTRACT: Geomagnetic indices are used to measure the intensity of geomagnetic storms. In the study of solar terrestrial relationship the use of indices of geo magnetic activity plays an important role. The aim of this work is to compare the linear relationship between geomagnetic indices at quiet and disturbed period when ap <26nTand ap > 26nT for solar maximum in the year (2001). Auroral indices obtained from the omni-web are compared for the geomagnetic disturbance of different intensities. Three hourly average values of the Dst, ap, AE and Bz indices have been studied for one year of high solar activity (2001) during quiet and disturbed period. Thus, the correlations of geomagnetic indices were determined by plotting graphs of the indices against one another. The study reveals that the annual correlation coefficient of AE×ap is 72.3% for quiet period, which is the highest correlation. Also, the coefficient of Dst ×Bz is 7.94% for quiet period, which is the least correlation. For the monthly correlation, the correlation coefficient of AE× Bz in the month of May is 84.9% for disturbed period, which is the highest correlation. Also, the correlation coefficient of ap× Dst in the month of January is 1% for disturbed period, which is the least correlation. For both annual and monthly coefficient, the correlation coefficient of AE × ap (3-hourly values) for quiet period is in general the highest of all, followed by AE × Bz for disturbed and quiet period. Thus, ap is strongly influenced by AE activity or ap is the major factor that determines the auroral activity. It is observed that when Bz has values within -10nT and lower the auroral activities (AE) increases and gives a better correlation relatively to other geomagnetic indices. Also, it is observed that there was intense (or strong) storm in the months of April and October for both disturbed and quiet period. Thus, these months (April and October) could be seen as a critical months which must be given a special attention for consideration in the further studies.

KEYWORDS: Geomagnetic storms, geomagnetic indices, magnetic field, Auroral Electrojets, Solar wind.

1 INTRODUCTION

Geo-magnetic storms generally occur due to abnormal conditions in the Interplanetary Magnetic Field (IMF) and solar wind plasma emissions caused by various solar phenomena. The study of these worldwide disturbances of Earth's magnetic field are important in understanding the dynamics of solar-terrestrial environment and furthermore because such storms can cause life threatening power outages, satellite damage, communication failure and navigational problems. As a result of their unique temporal and spatial coverage, these remarkable data series allow for instance statistical studies over long time periods (more than 125 years) of the solar wind - magnetosphere coupling. It is then possible to characterise the physical processes. Indices of geomagnetic activity (ap, AE, Dst, Bz, kp, k) were introduced over half a century ago. They reflected the prevailing pre satellite era view about generation of the external magnetic field activity. Many researchers have studied the relationship between solar terrestrial and geomagnetic activities; the main reason of this project is to suggest further investigation on the solar terrestrial relationship. Geomagnetic storm generally occurred due to abnormal conditions in the interplanetary magnetic field (IMF) and solar wind plasma caused by various solar phenomena such storm can cause satellite

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damage, communication failure and navigation problem [2]. When an intense and long lasting interplanetary convective electric field leads through substantial energization in the magnetosphere-ionosphere system to an intense ring current which is stronger than the threshold of the quantifying storm time Dst (disturbance storm time) index, the time interval is defined as a geomagnetic storm (GMS). GMSs are usually classified by the Dst indices as intense storms (peak Dst ≤ −100 nT), moderate storms (−100 nT < peak Dst < −50 nT) and weak storms (peak Dst > −50 nT). In the study of solar-terrestrial relationships, the use of indices of geomagnetic activity plays an important role. The five most commonly used indices are AE, Dst, Bz and the linear counterpart of the letter (National atmospheric and oceanographic Administration), ap. Available since 1932, the Kp index represents the intensity of planetary magnetic activity as seen at subauroral latitudes and is given for each 3-h interval. The individual K indices for each of the contributing mid-latitude observatories reflect the maximum range of any component of the field over the 3-h interval at each station. The Kp index is the average of the K values from all contributing observatories. A conversion scale transforms the quasi-logarithmic Kp to a linear index named ap. AE was defined to measure primarily the variations in the auroral electrojets. It is based on 1-min values of the H- component trace from auroral-zone observatories located around the world. The data of these observatories are plotted as a function of universal time. The upper and lower envelopes are defined as AU and AL indices, respectively, and are believed to represent the maximum eastward and westward electrojet currents. The sum of the absolute values of AL and AU is called AE. The ring-current index Dst. Was introduced to measures primarily the ring-current magnetic field [3]. It is based on hourly averages of the H component recorded at four low-latitude observatories, subtracting the average and the permanent field from the disturbed magnetic [4]. Although these five indices have been calculated for many years, only a few studies on their interrelationships have been published [1],[5].

The purpose of this study is to understand better the possible relationships between the geomagnetic indices. This will be done for two different epochs of the same solar cycle. During the descending phase of the solar cycle, near solar minimum (1974), it is known that stable coronal holes on the sun lead to the existence of recurrent high-speed streams that are observed at earth during every solar rotation. On the other hand, at solar maximum (2001), when large-scale coronal holes retract back to higher latitudes, what produces the observed high-speed streams responsible for the storms are transient solar phenomena generally known as coronal mass ejections (involving the presence of flares or filament eruptions).

1.1 AE (Auroras Electrojets) index is defined primarily as the measurement of variation in the auroral electrojets. It is based on 1 min values of the H component trace from auroras zone observatories located around the world. It measures geomagnetic activity at high latitude. The data of these observatories are plotted as a function of universal time. The upper and lower enveloped are defined as AU and AL indices respectively and are believed to represent the maximum eastward and westward electrojets current. The sum of absolute values of AL and AU is called AE.

1.2 DST (Disturbance Storm Time) index was introduced in 1964 and is defined as the hourly average of the deviation of H (Horizontal) component of magnetic field measured by several ground status and represents the degree of equatorial magnetic field deviation specifying the magnitude of Geomagnetic storms (GMS) measured in nanotesla (nT). It measures geomagnetic activity at low latitude. It is also a measure of in the context of space weather. It gives information about the strength of ring current around earth caused by solar protons and electrons.

1.3 ap index is a measure of the general level of geomagnetic activity over the globe for a given day. It is derived from measurements made at a number of stations world-wide of the variation of the geomagnetic field due to currents flowing in the earth's ionosphere and to a lesser extent in the earth's magnetosphere. To get the ap values we convert the 3-hour Kp values to ap values. It measures geomagnetic activity at mid latitude.

1.4 Bz index. It is generally believed that the basic parameter leading to geomagnetic disturbances is the southward component of interplanetary magnetic field. The Bz value is perpendicular to the elliptic and is created by waves and other disturbances in the solar wind. The strongest connection with the most dramatic effects occurs when the Bz component is tilted heavily southward. The direction of Interplanetary Magnetic field (Bz) is the most important ingredient if we want to see the auroras.

In this paper the linear relationship between geomagnetic indices at quiet and disturbed period when ap < 26 nT and ap > 26nT for solar maximum in the year (2001) has been compared also the annual and monthly correlations between the geomagnetic indices has been investigated.

2 METHODS OF DATA ANALYSIS

In this research, ap index was used instead of Kp since it is based on linear scale and ap is a 3 hourly average index, Dst, Bz and AE were averaged for the same interval for the purpose of comparison. This implies that the result of this study is limited

to 3 hourly intervals. The solar wind plasma and field measurements with 1hr time were obtained from the OMNI website [6].

In order to understand how these indices respond to interplanetary sources of activity during different periods of the solar cycle, annual and monthly averages were studied for 2001. A physical relationship between two different indices can be estimated by calculating the linear correlation coefficient 'r' which indicate whether the indices are related or not.

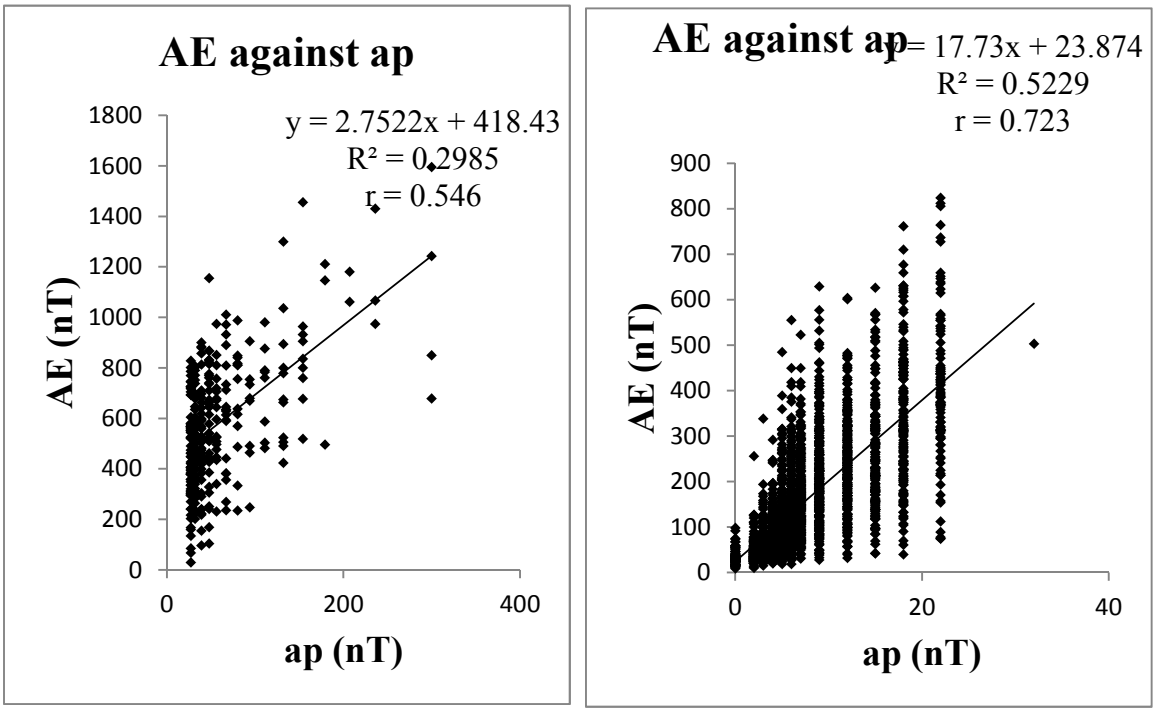
The Julian day calendar was used in getting the corresponding month from the data's of 365 days. Three hour average interval of each geomagnetic indices was calculated and graph for the annual and monthly correlation was drawn for a year of high solar activity (2001) during quiet period when ap is < 26 nT and disturbed period when ap > 26 nT in the format 'ap × AE','ap × Dst', 'ap × Bz', 'AE × Dst', 'AE ×Bz', 'Dst × Bz

3 RESULTS AND DISCUSSION

3.1 ANNUAL CORRELATION

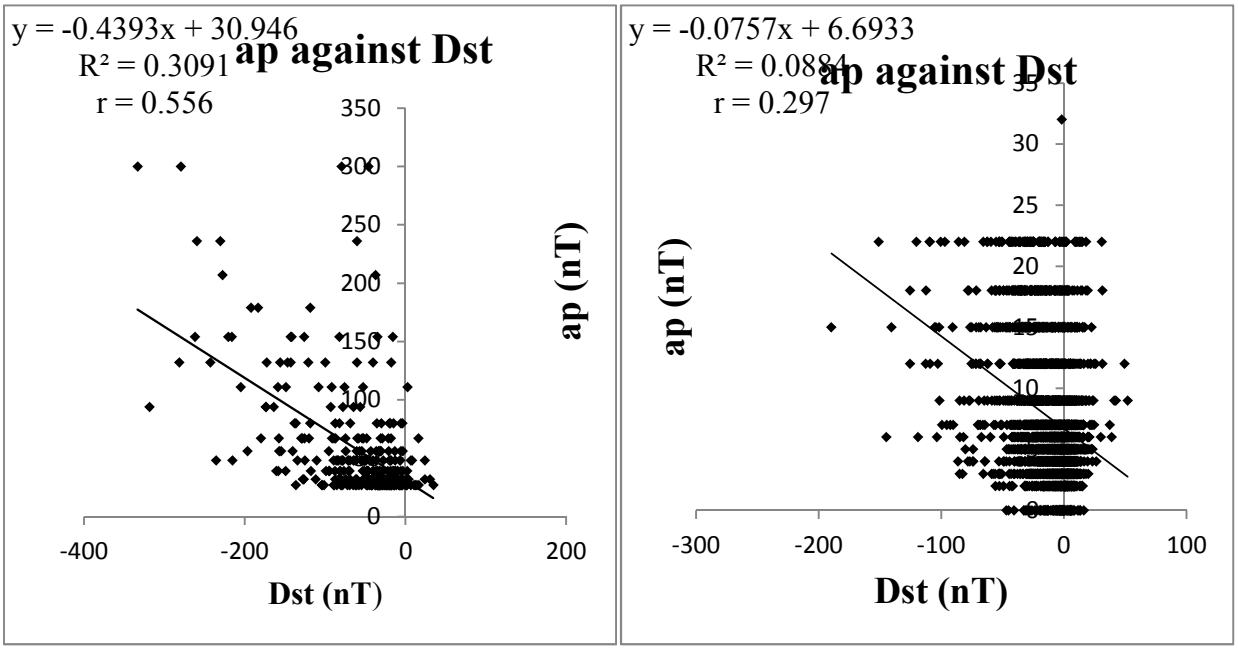
Fig 4.1- 4.6 shows the six possible annual correlation between the geomagnetic indices ap, AE, Dst, Bz during solar maximum (2001), One can see that AE × ap for both quiet and disturbed period, AE × Bz for both quiet period and disturbed period and ap × Dst (disturbed period) has correlation above 0.5 (50%), Thus, they can be classified under high correlation. However, AE × ap for quiet period with 72.3% correlation is the highest among all of them.

Also ap × Dst (Quiet period), ap ×Bz (Quiet and disturbed period), AE ×Dst (Quiet and disturbed period) and Dst × Bz (Quiet and disturbed) has correlation below 0.5 (50%), Thus, they can be classified under low correlation. However, Dst × Bz for quiet period with 7.94% correlation is the lowest among all of them. Further, the correlation between ap and AE is the highest of all, as they both have their geomagnetic stations fairly close. Not so well correlated are Dst and Bz, since Dst monitors mainly the ring current, whereas Bz is the basic parameter leading to geomagnetic disturbances is the southward component of interplanetary magnetic field.



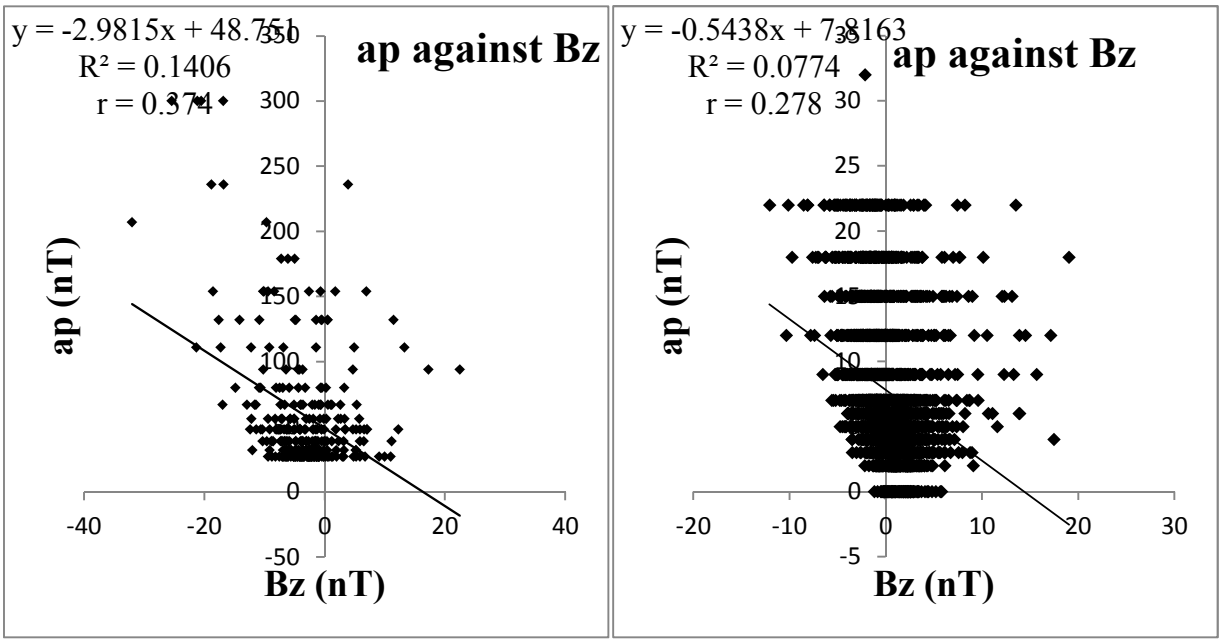
Disturbed Quiet

Fig 4.1: Annual correlation plot of AE against ap for Disturbed & Quiet period for year 2001



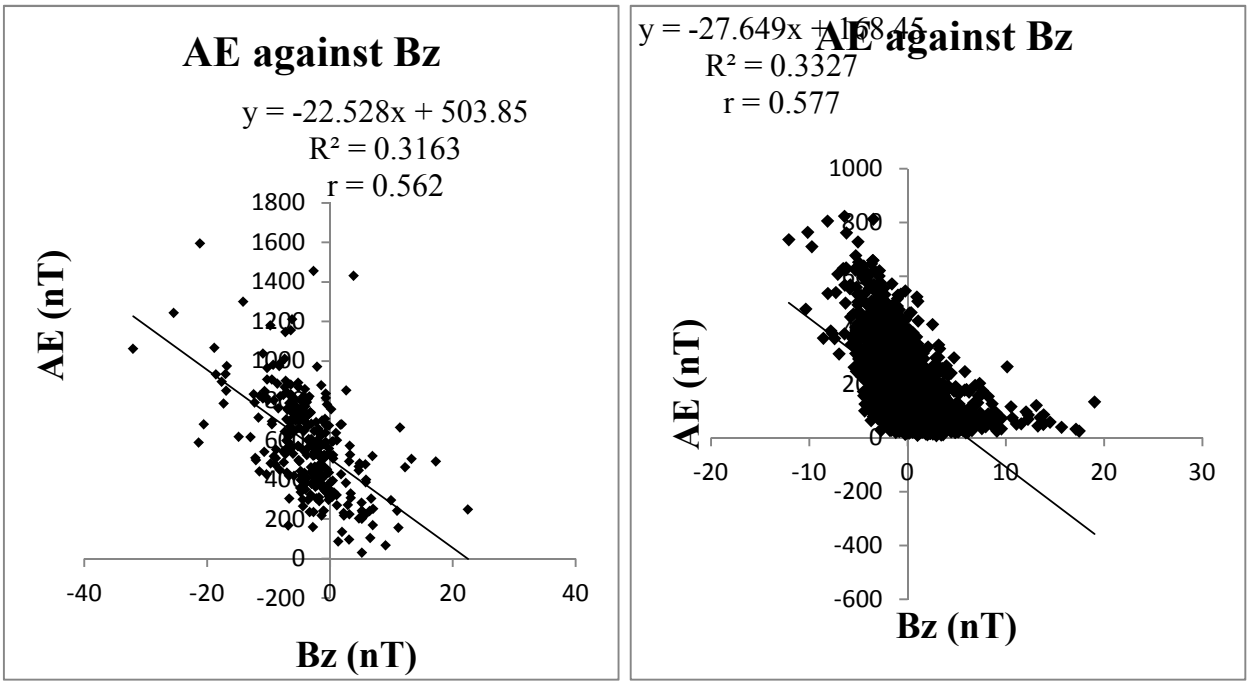
Disturbed Quiet

Fig. 4.2: Annual correlation plot of ap against Dst for Disturbed & Quiet period for year 2001



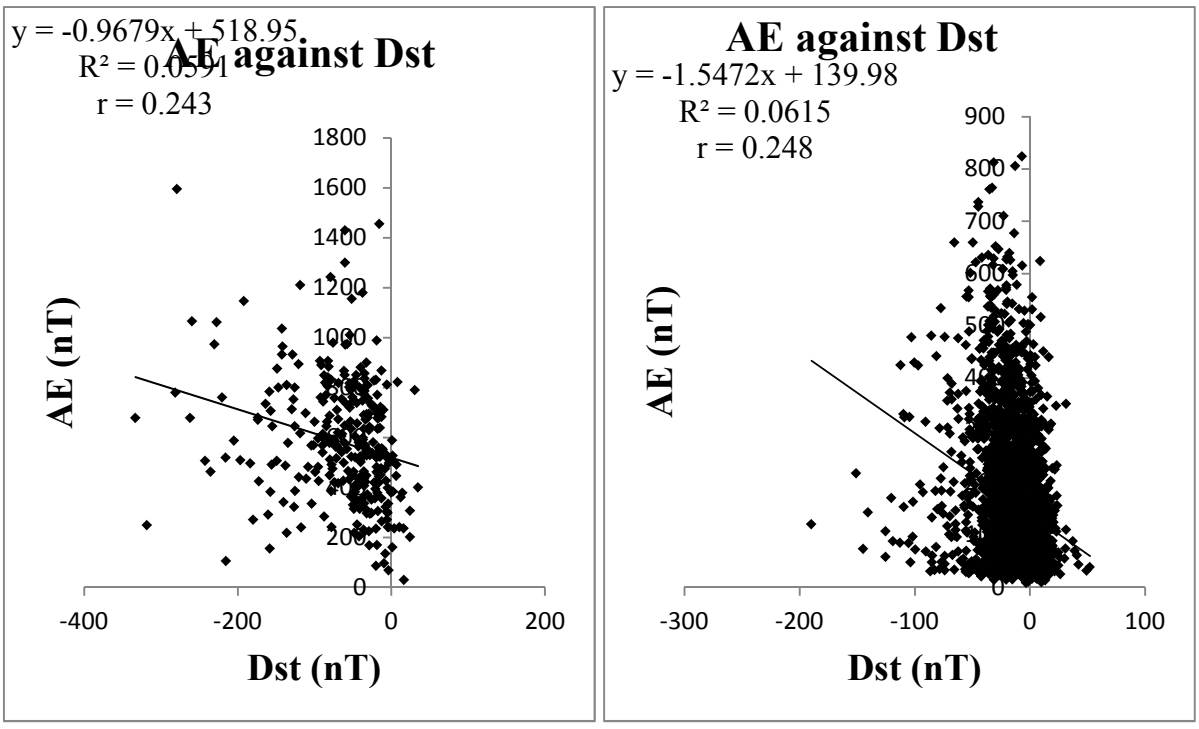
Disturbed Quiet

Fig. 4.3: Annual correlation plot of ap against Bz for Disturbed & Quiet period for year 2001



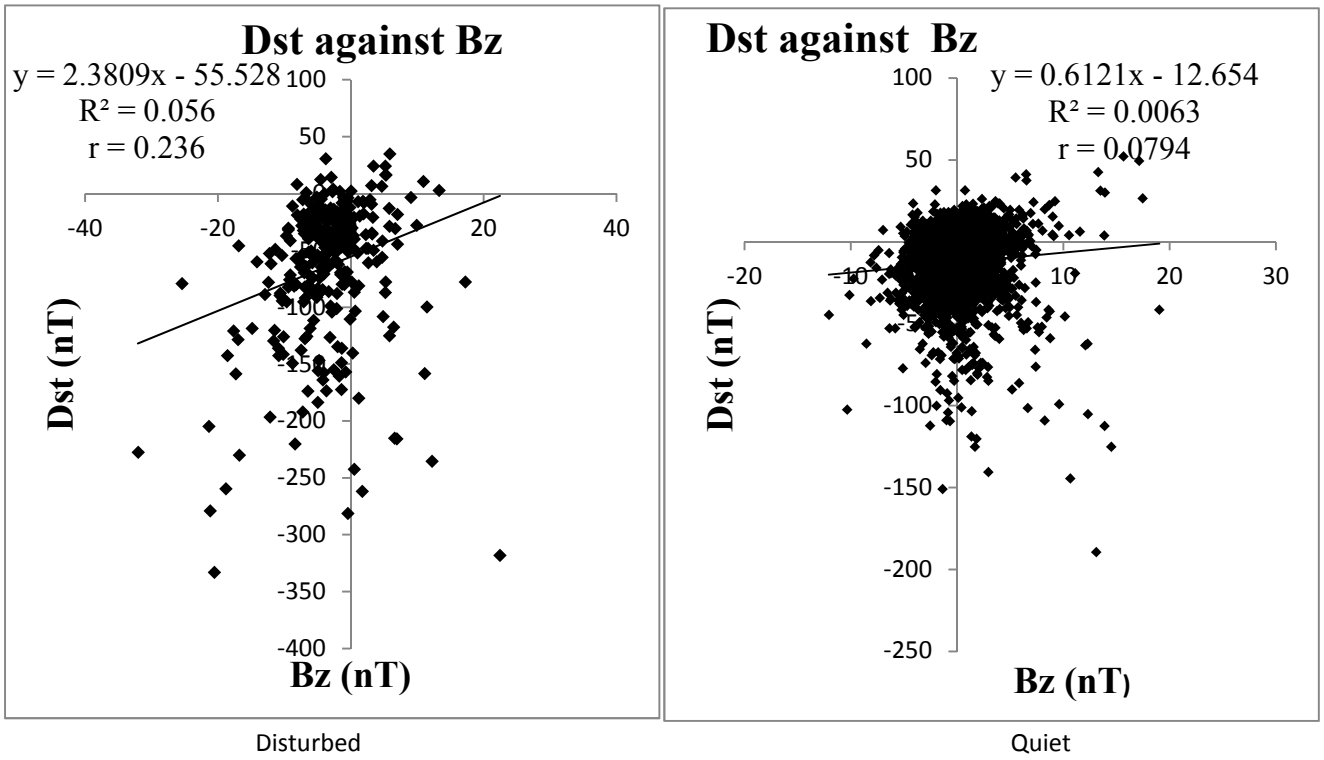
Disturbed Quiet

Fig. 4.4: Annual correlation plot of AE against Bz for Disturbed & Quiet period for year 2001



Disturbed Quiet

Fig. 4.5: Annual correlation plot of AE against Dst for Disturbed & Quiet period for year 2001



Disturbed Quiet

Fig. 4.6: Annual correlation plot of Dst against Bz for Disturbed & Quiet period for year 2001

3.2 MONTHLY CORRELATIONS

For all months of 2001 the correlations were calculated and the plot was drawn in the same format as seen in figure 4.1-4.6.

In the month of January, AE × ap (Quiet period), AE ×Dst (Disturbed period) and AE ×Bz(Quiet and disturbed period) has correlation above 0.5 (50%), Thus, they can be classified under high correlation. However, AE × ap for quiet period with 78.5% correlation is the highest among all of them.

Also AE × ap (Disturbed period), ap × Dst (Quiet and disturbed period), ap×Bz (Quiet and disturbed period), AE × Dst (Quiet period) and Dst × Bz (Quiet and disturbed period) has correlation below 0.5 (50%), Thus, they can be classified under low correlation. However, ap × Dst for disturbed period with 1% correlation is the lowest among all of them.

In the month of February AE ×ap (Quiet period), ap × Dst (Quiet period), AE × Dst (Quiet and disturbed period) and AE ×Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus, they can be classified under high correlation. However,AE × ap for quiet period with 82.5% correlation is the highest among all of them.

Also AE × ap (Disturbed period), ap × Dst (Disturbed period) ap × Bz (Quiet and disturbed period) and Dst ×Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus, they can be classified under low correlation.However,AE× ap for disturbed period with 15.6% correlation is the lowest among all of them.

In the month of March AE× ap (Quiet and disturbed period), ap × Dst (Disturbed period) and AE × Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus, they can be classified under high correlation. However,AE× ap for quiet period with 76.1% correlation is the highest among all of them.

Also ap × Dst (Quiet period) ap × Bz (Quiet and disturbed period), AE × Dst (Quiet and disturbed period) and Dst × Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However,Dst × Bz for Quiet period with 13.2% correlation is the lowest among all of them.

In the month of April AE × ap (Quiet and disturbed period) and AE × Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE× ap for Quiet period with 68.9% correlation is the lowest among all of them.

Also ap × Dst (Quiet and disturbed period) ap × Bz (Quiet and disturbed period), AE × Dst (Quiet and disturbed period) and Dst × Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, AE× Dst for disturbed period with 14.6% correlation is the lowest among all of them.

In the month of May AE× ap (Quiet period), ap × Bz (Quiet period), AE × Bz(Quiet and disturbed period) and Dst ×Bz (Quiet and Disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE × Bz for disturbed period with 84.9% correlation is the highest among all of them.

Also AE× ap (Disturbed period), ap ×Dst (Quiet and disturbed period) ap × Bz (Disturbed period) and AE × Dst (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However ap × Bz for disturbed period with 19% correlation is the lowest among all of them.

In the month of June AE× ap (Quiet period) and AE × Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, Bz ×AE for disturbed period with 77.8% correlation is the highest among all of them.

Also AE × ap (Disturbed period) ap × Dst (Quiet and disturbed period) ap × Bz(Quiet and disturbed period), AE ×Dst (Quiet and disturbed period) and Dst× Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However AE× Dst for disturbed period with 16% correlation is the lowest among all of them.

In the month of July AE × ap (Quiet period) and AE × Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE× ap for quiet period with 71% correlation is the highest among all of them.

Also AE × ap (Disturbed period) ap × Dst (Quiet and disturbed period) ap × Bz (Quiet and disturbed period), AE × Dst (Quiet and disturbed period) and Dst× Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, Dst× Bz for quiet period with 20.8% correlation is the lowest among all of them.

In the month of august AE × ap (Quiet and disturbed period), ap × Dst (Disturbed period) and AE × Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, ap × Dst for disturbed period with 69.2% correlation is the highest among all of them.

Also ap× Dst (Quiet period) ap × Bz (Quiet and disturbed period), AE × Dst (Quiet and disturbed period) and Dst × Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, Bz × Dst for quiet period with 1.7% correlation is the lowest among all of them.

In the month of September AE× ap (Quiet and disturbed period) and AE ×Bz (Quiet and disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE × ap for disturbed period with 73% correlation is the highest among all of them.

Also ap× Dst (Quiet and disturbed period) ap × Bz (Quiet and disturbed period), AE × Dst (Quiet and disturbed period) and Dst× Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, ap × Dst for disturbed period with 2.6% correlation is the lowest among all of them.

In the month of October AE × ap (Quiet period) and AE × Bz(Quiet and disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE × ap for quiet period with 72.6% correlation is the highest among all of them.

Also AE × ap (Disturbed period), ap × Dst (Quiet and disturbed period), ap × Bz (Quiet and disturbed period), AE × Dst (Quiet and disturbed period) and Dst × Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, Dst × Bz for quiet period with 8.8% correlation is the lowest among all of them.

In the month of November AE × ap (Quiet and disturbed period) and Dst × Bz (Quiet period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE ×ap Disturbed period with 83.2% correlation is the highest among all of them.

Also ap × Dst (Quiet and disturbed period), ap × Bz (Quiet and disturbed period), AE ×Dst (Quiet and disturbed period), AE ×Bz (Quiet and disturbed period) and Dst ×Bz (Disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, AE× Dst for quiet period with 15.1% correlation is the lowest among all of them.

In the month of December AE × ap (Quiet period) and AE × Dst(Disturbed period) has correlation above 0.5(50%), Thus they can be classified under high correlation. However, AE × Dst for disturbed period and AE × Bz for disturbed period with 78.5% correlation is the highest among all of them.

Also AE× ap (Disturbed period),ap × Dst (Quiet and disturbed period), ap × Bz (Quiet and disturbed period), AE × Dst (Quiet period), AE ×Bz (Quiet and disturbed period) and Dst × Bz (Quiet and disturbed period) has correlation below 0.5(50%), Thus they can be classified under low correlation. However, ap× Dst for disturbed period with 15.3% correlation is the lowest among all of them.

Table 3.3: Categorization of results using the Dst index for disturbed period

Classification	Months
Normal/Minor	Nil
Moderate	January, February, May, June, July, August, September
Intense/ Strong storm	April, October, December
Super storm	March, November

During the disturbed period, it is observed that there is intense (strong) storm in the month of April, October and December and super storm in the months of March and November. All other months fall under moderate storm.

Table 3.4: Categorization of results using the Dst index for quiet period

Classification	Months
Normal/Minor	March
Moderate	January, February, May, June, July, August, September, December
Intense/ Strong storm	April, October, November
Super storm	Nil

During the quiet period, it is observed that there is no month with super storm. However, there is intense (strong) storm in the months of April, October and November. There is normal (minor) storm in the month of March while there is moderate storm in the other months. A glance at the categorisation, it will be observed that there is intense (or strong) storm in the months of April and October for both disturbed and quiet period. Thus, these months (April and October) could be seen as a critical months which must be given a special attention for consideration in the further studies.

4 CONCLUSIONS

During geomagnetic disturbance the auroral indices AE, ap, Bz, Dst have been compared. Effort has been made to achieve a better understanding of the indices and comparing them at disturbed and quiet period during high solar activity by calculating their 3-hourly averages and correlations. Dst index was used to measure the intensity of the geomagnetic storm for each day of year (2001) which shows occurrence of super storm for two month (March and November) which makes (2001) a year of high solar activities. The main conclusions are as follows:

For the annual correlation, the coefficient of AE ×ap (r =72.3%) for quiet period has the highest correlation. This implies that during quiet storm, measure of the level of geomagnetic activity determines the intensity of auroral activity. Also, the coefficient of Dst ×Bz (r =7.94%) for quiet period has the lowest correlation. This implies that for larger positive values of Bz during quiet storm, the direction of the interplanetary magnetic field does not determine the intensity/strength of geomagnetic storm.

For the monthly correlation, the coefficient of AE× ap (quiet period) has high correlation for all the 12 months, AE× ap (disturbed period) has high correlation for 5 months and low correlation for 7 months, ap × Dst (disturbed period) has high correlation for 2 months and low correlation for 10 months, ap× Dst (quiet period), has high correlation for 1 month and low correlation for 11 months, ap × Bz (disturbed and quiet period) has low correlation for all the 12 months, AE× Dst (disturbed period) has high correlation for 4 months and low correlation for 8 months, AE× Dst (quiet period) has high correlation for 2 months and low correlation for 10 months, Bz ×AE (quiet and disturbed period) has high correlation for 11 months and low correlation for 1 month, Dst × Bz(disturbed period) has low correlation for all the 12 months and Dst × Bz (quiet period) has high correlation for 1month and low correlation for 11 months. For the monthly correlation, the correlation coefficient of AE× Bz in the month of May is 84.9% for disturbed period, which is the highest correlation. Also, the correlation coefficient of

ap× Dst in the month of January is 1% for disturbed period, which is the least correlation For both annual and monthly coefficient, the correlation coefficient of AE ×ap (3-hourly values) for quiet period is in general the highest of all, being followed by AE × Bz for disturbed and quiet period. Thus, during quiet storm, ap is strongly influenced by AE activity or ap determines the auroral activity. It is observed that when Bz has values within -10nT and lower the auroral activities (AE) increases and gives a better correlation relatively to other geomagnetic indices.

Also from Table 3.3- 3.4, it is observed that there was intense (or strong) storm in the months of April and October for both disturbed and quiet period. Thus, these months (April and October) could be seen as a critical months which must be given a special attention for consideration in the further studies.

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Environmental and Social challenges of oil and gas exploration in Kenya

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ABSTRACT: The discovery of oil reserves in the Turkana Rift basin, could possibly multiply government revenue. These findings signify a major possible change in the country's position considering the fact that it is one of the low incomes, aid dependent countries in the Sub Saharan region. However, the commercial exploitation of this resource also presents the country with formidable environmental and social challenges due to weak institutions, lack of public participation, poor communication, unskilled labor in the oil industry, absence of crucial policies, poor organizational structures and governance system, indicators that continue to affect all activities leading to unsustainable actions at both the national and community levels. This could give birth to more disastrous results like civil strife, sabotage of oil dealing and the resource curse phenomenon. The paper focuses on aspects of long term sustainable actions which require engagement of all actors, dissemination of information among others driven by all the four sustainability domains (political, economic, ecological and cultural pillars) to prevent potential negative impacts on the country's socio-economic development. This involves comprehensive environmental and social baseline and impact assessment studies, best practice in environment management for effective impact reduction and mitigation, effective environment monitoring, intensive coordination with County government and socialization to local communities to obtain legal and public approval, acceptance, and support for the operation from the very beginning phase of the operations of planning until after the completion of the operations.

KEYWORDS: Oil exploration, Social and environmental challenges, Kenya.

1 INTRODUCTION

The global economy relies heavily on oil and gas to fulfill majority of its energy demands, and it is a key indicator of the economic wellbeing of both developed and developing nations. The international Energy Agency (IEA) predicts that global oil demand will reach 90 million barrels/day in 2020 (World Energy Outlook, 2009). The continued increase in the world's energy demand is due, I parts, to robust economic growth in China and India and an uncertain political climate in the Middle East (Mane, 2005; BP, 2008).

Until the last few years the East Africa region has been a sleepy backwater for the upstream industry, but the discovery of significant quantities of oil in Uganda in 2006 has ushered in a bonanza (Deloitte, 2013). Onshore oil discoveries in Uganda have been followed by discoveries in Kenya. Offshore world-class discoveries of gas have also been seen in Tanzania and Mozambique. Potential hydrocarbon basin across East Africa is the subject of intensive interest. There has also been an influx of majors, super-majors and big independents. Indeed so rapid has the industry's progress been over the last few years (Deloitte, 2013).

In mid-2012 oil was discovered in Kenya. This came after a long time of disappointing exploration activities in Kenya. The reserves became commercially viable after it was confirmed that there were around 300 million barrels worth of reserves. As of January 2014, Tullow said Kenya's Northern Basin could have an excess of 1 billion barrels of oil. Kenya's petroleum potential is best depicted by the four large sedimentary basins that straddle the country (sedimentary basins and exploration blocks map). These are Lamu, Anza, Mandera and Tertiary Rift basins. The sedimentary basins are divided into blocks as shown below.

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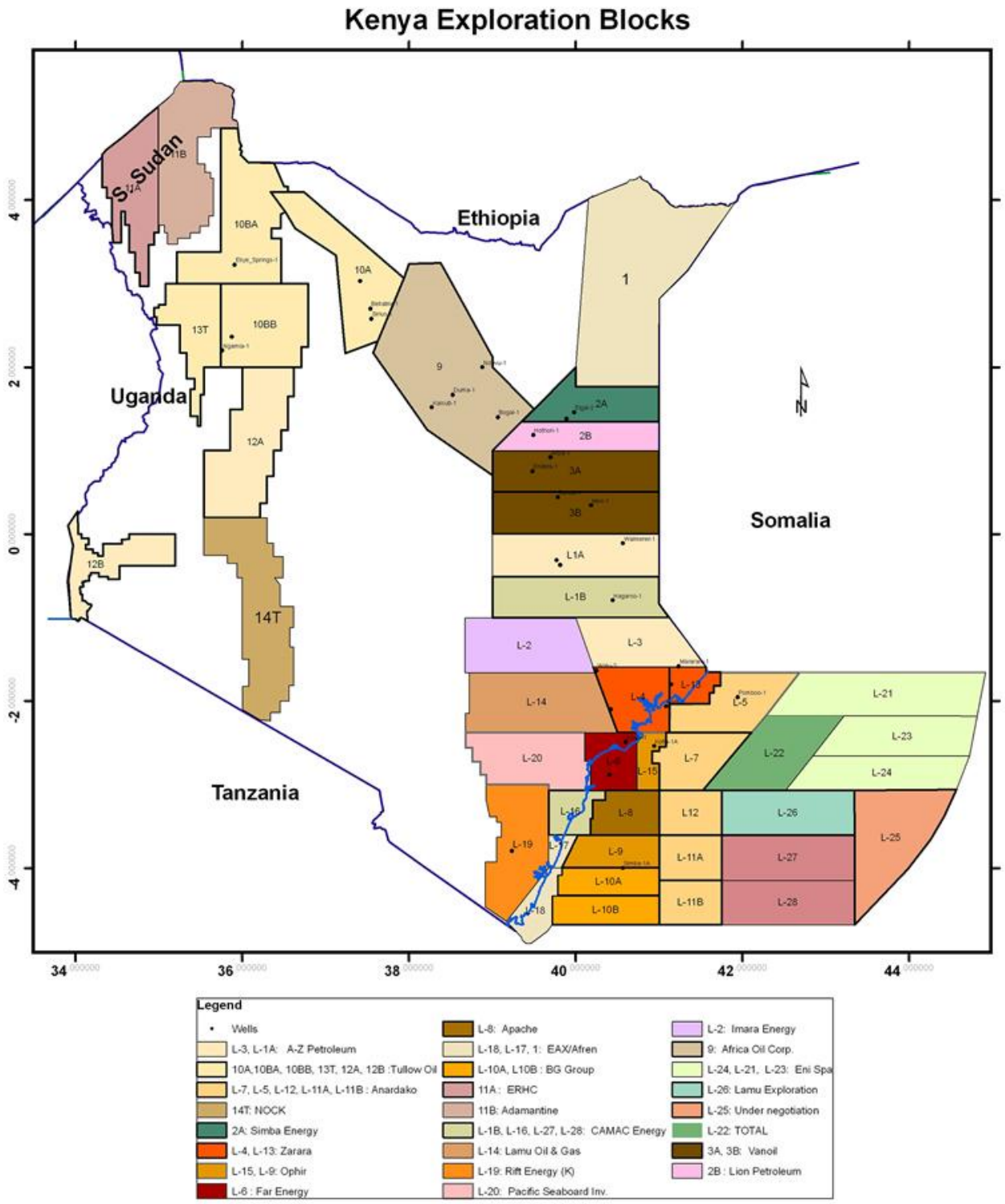

Exploration Block Map of Kenya: Government of Kenya Revised Edition 2013

Since the discovery of the oil and gas, there have been huge expectations as to how Kenya is going to be transformed as a result of the discovery of the oil and gas in commercial quantities. If managed well, the revenue generated from the natural resources, particularly oil and gas, could bring huge foreign earnings into a country. The wealth from natural resource is a strong base for income creation and sustained economy. Conceptually, the abundance of natural resources is a double-edged sword. While oil and gas discovery, for example, presents considerable opportunities for low income countries (like Kenya) to

deepen domestic revenues and grow, resource abundance carries important challenges. Inspite of the socio-economic benefits that oil and gas production can bring to the nation, oil and gas exploration and production involve several activities that can have detrimental impact, either directly or indirectly, on the environment and society and therefore require special attention in striking a good balance. This paper seeks to identify these important challenges and the readiness of the Government of Kenya to deal with the challenges.

1.1 OIL AND GAS DEVELOPMENT ACTIVITIES

The oil and gas industry has three main sectors, namely the upstream, midstream and downstream. The upstream involves the exploration and production; the midstream covers the transportation of oil and gas, and the downstream deals with refining and processing of crude oil and gas products, as well as the distribution and marketing of the products (E&P Forum/UNEP, 1997).The major stages of the upstream oil activities are briefly described below (E&PForum/UNEP, 1997; Kloff & Wicks, 2004).

1. Aerial and seismic surveys are carried out to identify favorable geological structures such as faults and anticlines in the subsurface. 2. Exploration drilling and appraisal involve drilling of oil wells to confirm the presence or otherwise of hydrocarbon and the internal pressure of such a reserve, all aimed at evaluating the nature, size and extent of the hydrocarbon reservoir to enable confirmation of its economic viability. 3. Development and production wells are drilled into hydrocarbon reservoir to extract the produced fluids, comprising oil, gas and water. 4. Decommissioning and rehabilitation involve the closure and removal of production installations and other structures at the end of the commercial life span of an oil reserve, followed by the restoration of the site to environmentally sound conditions.

2 MAJOR CHALLENGES OF OIL AND GAS DISCOVERY

It is an undeniable fact that exploration and exploitation of oil and gas resources has economic implications for a country but it also comes with major challenges. This section presents some major challenges of oil and gas discovery.

2.1 POTENTIAL ENVIRONMENTAL IMPACT ARISING FROM OIL AND GAS DISCOVERY

The exploration and production industry in any country is accompanied by many environmental challenges. Major activities in upstream operations which result in environmental challenges include seismic acquisition, drilling, development; production and transportation pose great challenges to the environment.

2.1.1 SEISMIC ACQUISITION

According to Marful-Sau (2009), seismic acquisition leads to acoustic emission and accidental spills of chemicals that pollute the sea. Research conducted in the Norwegian seas has also proven that seismic shooting could cause fish to travel tens of kilometres, and some may not return unless after a few weeks. In onshore data acquisition, vast areas of vegetation need to be cleared to improve accessibility to Vibroesis and other seismic acquisition equipment. The destruction to vegetation is made more pronounced in mangroves and forests. This activity affects the aquatic life.

2.1.2 DRILLING

During drilling, a large volume of fluids are circulated through the well and into open, partially enclosed or completely enclosed systems at elevated temperatures (Broni-Bediako and Amorin, 2010). When these drilling fluids are agitated during circulating process there is significant potential of the drilling fluid being discharged to the environment. Drilling discharge affects marine environment, thereby affecting fishing activities which is the major occupation among the coastal communities (Anon., 2010a)

2.1.3 DEVELOPMENT AND PRODUCTION

Particulates which are generated from other burning sources such as well testing contribute enormously to atmospheric pollution. Apart from the emission of carbon dioxide and carbon monoxide, nitrogen oxides and hydrogen sulphide gases are introduced into the atmosphere in quantities which depend on the nitrogen and sulphur content in the oil. In production, the major waste produced is water containing inorganic salts, heavy metals, solids, production chemicals, hydrocarbons and

occasionally Naturally Occurring Radioactive Material (NORM). These have minimal effect on the environment. Nonetheless the release of the waste water into freshwater bodies requires special care (Sam-Okyere, 2010).

2.1.4 TRANSPORTATION AND STORAGE

Oil transportation has been a major source of pollution through oil spills and leakages. Oil spills occur as a result of mechanical failure processes that are involved in oil transportation and storage.

2.2 As may be the case elsewhere, oil and gas exploration and production in the field involve the various stages that could be accompanied by intrinsic environmental challenges. The environmental impacts arising from oil and gas production activities can be broadly grouped into two, namely (i) ecosystems, and (ii) human, socio-economic and cultural (E&P Forum/UNEP, 1997).

2.2.1 NOISE

During oil and gas development, noise disturbances associated with aircraft, bulk vessels and drilling operational activities are likely to impact negatively on the ecosystem. This may arise from prospecting and survey activities already mentioned above. At certain levels, noise affects the functions of marine organisms. Fish and marine mammals, including whales and dolphins, are particularly affected mostly by sound elevation because of their dependence on sound for reproduction, feeding, and avoiding hazards such as predators and navigation (McCauley, 1994; Tyack & Miller, 2002; Popper, 2003). There have also been reported death, reduced growth, impaired hearing and stress, as some of the possible impact of noise from oil and gas operation (Fernandez *et al.*, 2005).

2.2.2 ATMOSPHERIC EMISSIONS

Atmospheric emissions are increasingly becoming the subject of concern to both industry and national governments due to its negative effect on climate. Sources of emissions associated with oil development activities, can be grouped as follows (E&P Forum/UNEP, 1997): (i) Flaring, venting and purging of gases; (ii) Combustion processes from diesel engines and gas turbines; (iii) Fugitive gases from loading operations and losses from process equipment; (iv) Airborne particulate from burning sources, such as well testing and soil disturbance during construction and vehicular traffic. Of these gas emissions, flaring is the most alarming, and has been a source of major conflict in Nigeria and elsewhere (Sala-i-Martin &Subramanian, 2003; ERA/CJP, 2005).

The principal emissions accompanying flared gas contain toxic by products such as methane and benzene, and also generate carbon dioxide, carbon monoxide, volatile organic carbons, sulphur dioxide, nitrogen sulphide and nitrogen oxide. Some of these gases (e.g. carbon dioxide), contribute to global warming, whereas the sulphur gases and carbon dioxide contribute to the formation of acid rain, which is detrimental to soil Consequently, gas flaring has the potential to damage the Forest Reserve and the surrounding vegetation and farmlands located offshore the oil field.

2.2.3 AQUATIC POLLUTION

Discharges from oils and gas installations include produced water, process water, sewerage, sanitary and domestic wastes, and spills and leakages (E&P Forum/UNEP, 1997). These discharges arise from the drilling of exploration wells and, subsequently, the production of crude oil. Produced water is a combination of formation water from the reservoir and injection water, containing a complex mixture of inorganic and organic compounds, trace and heavy metals, drilling fluids and drill cuttings, and well treatment chemicals (E&P Forum, 1994; Sadiq *et al.*, 2002). The composition of produced water makes it potentially toxic to marine waters. Organic compounds in discharged waste water, when released into marine waters, rivers or lakes, react with and consume dissolved oxygen, thereby, depleting the water of oxygen and rendering it uninhabitable for aquatic organisms (Harremoës, 1998). Similarly, excess supply of nutrients to water bodies also stimulates excessive plant growth and causes reduction in water quality and a decrease in the population of fish and other aquatic organisms (Harremoës, 1998; WHO/EC, 2002). Anti-fouling paints on ships also contain potent biocide such as tributyltin (TBT), which causes reproduction failure of female marine snails and a decline in population (Kloff & Wicks, 2004). Oil tankers, underwater pipelines, offshore oil drilling rigs and coastal storage facilities can accidentally release crude oil into the ocean, and a significant portion of the ecosystem, both offshore and onshore. The negative effects of oil spillage on marine organisms include damage to digestion tract of marine species through digestion, absorption of oil in contaminated food, contamination of eggs leading to poor hatchery, and trapping of turtles and birds leading to death. Over the years, the petroleum industry has witnessed oil spills that have caused considerable ecological damage. Notable among these spills

were the Amoco Cadiz, which spilled about 227,000 tonnes of oil in 1978 (Patin, 1999) and the Exxon Valdez, which spilled 40,000 tonnes of oil in 1989, resulting in the death of about 250,000 seabirds, nearly 3,000 sea otters, 300 harbour seals, 250 bald eagles and up to 22 killer whales (BBC, 1989). Similarly, in 1999, the Erika oil vessel spilled about 20,000 metric tonnes of oil that affected 400 km of coastline, and killed over 100,000 birds (BBC, 2000). The explosion, in 2010, of the Deepwater Horizon, owed by British Petroleum (BP) in the Gulf of Mexico killed 11 people, and resulted in the spillage of 4.9 million barrels of oil, polluting hundreds of miles of coastline and killing 491 birds, turtles and 27 mammals within the first 40 days after the spill (Reuters, 2010; BBC, 2011).

2.2.4 TERRESTRIAL POLLUTION

During oil and gas exploration and production, potential impacts on soils arise from physical disturbances due to construction, deforestation and contamination, resulting from spillage and leakage or solid waste disposal. These activities result in land degradation, transformation and fragmentation of natural habitats, and can disable the vital ecosystem processes that support growth (Barnard & Newby, 2009). In the Niger Delta region of Nigeria, three main sources of oil pollution have been identified, namely oil spills, gas flares and waste discharges (Pyagbara, 2007). Rivers, streams and ponds have been the receiving bodies for oil spills and waste discharges, with their accompanying negative environmental impacts. Available data show that between 9 and 13 million barrels of oil have been spilt in the Niger Delta region in the past 50 years (NCF/WWF/IUCN, 2006). These spills, which occurred on land and destroyed crops, damaged the quality and productivity of soil that the communities use for farming (UNEP, 2011). The spills have also caused the death of birds and mammals, damaged fisheries and contaminated water that the inhabitants use for drinking and other domestic purposes (Amnesty International, 2009). Oil spills and other oil-related pollution have also seriously damaged the Niger Delta's mangroves, which are an important fish breeding area. The damage has resulted in a severely impaired coastal ecosystem, and compromised the livelihoods and health of the region's impoverished residents (NCF/WWF/IUCN, 2006; Amnesty International 2009), thus, negatively affecting economic activities. The reasons assigned to the frequent oil spills in the Niger Delta include corrosion of oil pipes, poor maintenance of infrastructure, spills or leaks during processing at refineries (World Bank, 1995), human error and the consequence of deliberate vandalism or theft of oil (Steiner, 2008). The damage to the ecosystem has caused the Ogoni people, who think their lives are intrinsically bound up with the survival of the environment, to stand up against the denigration of their environment (UNEP, 2011).

2.3 ILLEGAL OIL BUNKERING CHALLENGE

Illegal oil bunkering is the art of stealing oil, i.e., the dangerous practice of siphoning and transporting stolen fuel. The high level of illegal oil bunkering result when there is either high unemployment or ready market for the stolen oil.

2.4 UNEMPLOYMENT

The high expectations that oil companies will offer employment to many Kenyans could result in people moving from the rural areas in Kenya to oil fields in search of jobs in the oil companies. These expectations, if not met, could result in the youth engaging in illegal oil bunkering and other social vices for their livelihood. Political parties could take advantage of the frustrations of the people (especially the youth) to advance their own agenda.

2.5 INTERNATIONAL MARKET FOR STOLEN OIL

Over the past two decades, Kenya has been experiencing many challenges as a result of the smuggling of its natural resources across its borders. Some of these resources include ivory, timber, gold and oil. This has made the government to spend huge sums of money in combating this illegal practice.

2.6 NATIONAL CHALLENGE OF THE USE OF THE OIL'S REVENUE

A lot of views have been expressed by both Kenyans as to how best Kenya can utilize the revenue that will accrue from the oil and gas to ensure net benefit and to avoid the so called *resource curse* as seen in countries like Chad and Nigeria (Broni-Bediako and Addei, 2010). A school of thought puts it that Kenya's oil and gas revenue would be used to build industries such as petrochemical and fertilizer industries to enhance the agriculture sector. Others are also of the view that the oil revenue should be put into a consolidated fund. These are some of the challenges that the Government of Kenya will have to address. Some other challenges include:

i. Ensuring proper accountability and transparency for the oil revenues else it, could result in the so called resource curse.
ii. Ensuring equal distribution of the oil and gas revenue. The question is, will the major part of the revenue be used to develop Nairobi and other areas and neglect communities in the area where the oil is produced, as in Nigeria where people believe that the major part of the money is used to develop Abuja while the neighboring communities remain undeveloped.
iii. Though Kenya has advanced greatly in her democratic path, the challenge of abandoning democracy and resorting to military should not be overlooked. Chad had one of the best policies on how to use its oil revenue but later resorted in using its revenue in purchasing arms (Gary, 2010).
iv. The challenge of the gradual decline of citizens' duties and obligations such as payment of tax. Citizens will be expecting government to finance public services.
v. Meeting of the huge expectations of the leaders of the host communities is another big challenge. Reports by Addei *et al.* (2010) reveal the expectations of the people in the host communities on the oil and gas industry.
vi. Spatial utilization conflicts
vii. Population and settlement pressure
viii. Weak institution and management
ix. Challenges in implementation, compliance, enforcement and monitoring.

Even though Kenya has well-formulated national policies and legal frameworks that regulate the operations of mining companies, most of the legislations on environment are not strictly enforced, and this has been attributed to several factors. Among these are weak institutional capacity to manage the environment, inadequate resources, and lack of political will, all of which have resulted in the lack of proper mechanisms for coordination, monitoring and enforcement. Furthermore, economic concerns, absence of effective sanctions to serve as deterrent to potential polluters, community dissatisfaction, and duplication and overlapping of institutional functions add up to the other foreseeable challenges (UNEP, 2002). Finally, inadequate remuneration and lack of commitment on the part of staff members of the regulatory and enforcing agencies, often serve as good grounds for bribery and corruption. Consequently, mining companies find it cheaper to pollute than to prevent environmental degradation, and the consequence is the documented mining related pollution and land degradation in the mining communities.

3 Kenya is likely to suffer from the above mentioned social Challenges and potential sources of pollution and their accompanying negative environmental impacts, if they are not well managed. Since some Oil fields are located offshore, the ecosystems of concern in these areas are the ocean, beaches, and the atmosphere. The inhabitants of towns and communities dotted along the coast traditionally engage in fishing, as their means of livelihood. Consequently, protecting the sea from any potential environmental damage is very paramount.

3.1 Historically, many new oil-exporting countries failed to give adequate attention to the environmental and social aspects of the petroleum sector in its early development stages. At a later point, it was precisely the overlooked environmental and social impacts of petroleum production that had the greatest negative political and economic ramifications for the government, the oil industry, and society as a whole. Many developing country governments have enacted laws and policies for environmental and social standards. However, the government institutions and agencies for their regulatory oversight and compliance have often been under-funded and ineffectual. Laws and policies alone are insufficient to manage environmental and social standards. Environmental and social issues touched by the oil sector are best addressed through joint collaboration by the oil industry and government, based on respect, mutually agreed objectives and a clear delineation of roles and responsibilities. It is in the best business interests of reputable international oil companies to achieve this level of collaboration. Environmental and social issues should not be compartmentalized into separate functions, but should be recognized as overlapping and interlinked domains that are best addressed holistically.

Over the past 10-15 years, governments and international oil companies (IOCs) have given increasing attention to the environmental and social aspects of oil operations. They have recognized that the reputation and credibility of both governments and private companies are jeopardized if these issues are not handled well. At the risk of over-simplification, this growing awareness of environmental and social issues grew out of initial attention to health, safety and environment (HSE) by oil companies for internal operational practices and technical processes. Over time, greater and greater attention was given to external factors affecting company performance, including explicit concern about social issues and the importance attached to corporate social responsibility (CSR). International media attention to oil spills and pollution, adverse social impacts on local communities and displaced peoples, and inequitable economic growth associated with oil revenues prompted private companies and governments alike to reconsider where their responsibilities to environmental and social concerns begin and end as well as the wider context in which they must act.

4 MANAGEMENT FRAMEWORKS FOR MINIMIZING OIL AND GAS INDUSTRY RELATED RISK

4.1 LEGISLATIONS, CONVENTIONS AND REGULATORY FRAMEWORKS

Major environmental issues related to oil and gas development have been addressed through countless global and regional treaties, national laws and a number of administrative regulations and management frameworks, promulgated by individual countries and multinational organizations such as UN agencies, the World Bank, and International Finance Corporation (IFC) (Gao, 1998) to promote natural resource conservation and pollution control. Kenya is signatory to a number of United Nations and Regional Cooperation Conventions and multi-lateral agreements, which will help in managing environmental impacts. These international conventions are binding on national governments and serve as a baseline or guide in drafting national policies, legislations and regulations. Notable among these treaties and conventions, that have been ratified by Kenya and of particular importance to the environment and oil and gas operations, includes (e.g. Kloff & Wicks, 2004). 1. International Convention for the Prevention of Pollution of the Sea by Oil, 1962; 2. International Convention on the Establishment of an International Fund for Compensation of Oil Pollution Damage, 1971 ;); 3. International Convention on Civil Liability for Oil Pollution Damage, 1969; 4. Convention on Wetlands of International Importance, especially as Waterfowl Habitats, 1971; 5. Convention on the Conservation of Migratory Species of Wild Animals, 1979; 6. International Convention for the Conservation of Atlantic Tunas, 1966; 7. Montreal Protocol on Substances that Deplete the Ozone Layer, 1989; 8. Convention on Biological Diversity, 1992; 9. International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties; 10. United Nation Convention on the Laws of the Sea, 1982; 11. International Convention for the Prevention of Pollution from Ships (MARPOL Convention 73/78); 12. International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990; 13. The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention); 14. Convention on the Ban of the Import into Africa and the Control of Transboundary Movement of Hazardous Wastes within Africa (Bamako Convention).

Nationally, Kenya has no comprehensive environmental legislation targeting the oil and gas industry. Existing legislation for ecosystem protection include, The Constitution of Kenya, Wildlife Conservation and Management Act (Cap 376), Forest Act, 2005, Penal Code Cap 63, Public Health Act (Cap 242), The Factories and other places of work Act Cap 514, Water Act, 2002, Mining Act (Cap 306) The Agriculture Act (Cap 318), The Lakes and Rivers Act, Cap 409, Laws of Kenya, Environmental Management and Coordination Act (EMCA, 1999), EMCA (Environmental Impact Assessment (EIA) and Audit (EA) Regulations, 2003, EMCA (Waste Management) Regulations, 2006, EMCA (Water Quality) Regulations, 2006 EMCA (Air Quality) Regulations, 2008, EMCA (Fossil Fuel Emission Control) Regulations, 2006, EMCA (Noise and Excessive Vibration) Regulations, 2009, EMCA (Wetlands, River Bank, Lake shore and Sea shore Management) Regulations, 2009, EMCA (Conservation of Biodiversity and Resources, Access to Genetic resources and Benefit sharing) Regulations, 2006. Other legal frameworks that target the oil and gas industry are Petroleum (Exploration and production) Act 1986, and Energy Act, 2006. Some of these legislations were formulated for both the mining and oil and gas industries, and are, therefore, more generalized. Consequently, they have not been effective in the mining industry, and are, therefore, destined to face a number of challenges in the oil sector.

4.2 RECOMMENDED MEASURES TO ADDRESS ENVIRONMENTAL CONCERNS IN THE OIL AND GAS INDUSTRY

Guided by the various international treaties and conventions, there is the urgent need for the Government of Kenya to formulate an all-inclusive oil and gas development policy with environmental issues at the center stage. The policy framework should integrate environmental legislations and management systems, and also mandate stakeholders to develop an environmental value culture at every stage of their business processes to supplement government's efforts in a cost effective manner. Consequently, the policy should be tailored along two main approaches to regulating the environmental performance of an industry, namely the 'prescriptive' and 'performance based' approaches (Technical Meeting Document, 1998).

4.2.1 THE PRESCRIPTIVE APPROACH

The prescriptive or "command and control" approach is based on legislations indicating specific requirements made by government, to be met by operators. The regulations clearly spell out structural, technical, and procedural requirements to address environmental, health and safety hazards. This makes it relatively easy for government to determine, via an inspection procedure, whether an operator is meeting the requirements. Thus, it is convenient for the Government of Kenya to adopt this approach by setting mandatory environmental codes and standards to regulate and monitor the activities of companies in the oil and gas industry. These standards must include general guidelines for the preparation of an

environmental impact assessment and detailed guidelines for the preparation of an environmental action/management plan to be submitted by firms before the commencement of operations. It is very important that environmental impact assessment be undertaken prior to the commencement of oil exploration and development, and, when discovered that it can potentially impact the environment negatively, the companies involved would be required to indicate what mitigation measures would be employed to contain the situation. The standards must also include acceptable limits of concentrations of compounds and chemicals in effluent discharges generated through the operations of the various companies. Equally importantly should be the application of the "polluter pays" principle to ensure that producers of wastes that cause environmental damage are made to pay compensation and the cost of remediation.

4.2.2 PERFORMANCE-BASED APPROACH

In the performance-based or "self-regulation" approach, which is based on agreements made between government and operators, greater emphasis, is placed on setting environmental goals or standards to be met by operators in the industry. This requires the operators to define strategies and plans in order to achieve the overall objectives and criteria set by the regulator. Accordingly, the operators are responsible for providing evidence, assuring that they are complying with the agreements. An example is a legally binding Environment Action Plan (EAP) that is formulated by the op requirements (Technical Meeting Document, 1998). The self-regulation approach focuses on self-inspection (internal audits) by company experts, in consultations with skilled external auditors, in order to check compliance and report to the regulator. It, thus, removes some of the burden of auditing and inspection from government, while allowing the operator flexibility in choosing practical measures to meet the environmental objectives (Technical Meeting Document, 1998). This approach could, therefore, be adopted by opportunity to find other ways of meeting the goals or targets set by government. Thus, the oil companies could be mandated by government to develop Environmental Management Plan (EMP) or Environmental Management System (EMS) to ensure that they operate within the environmental standards for the industry. EMS is a tool which involves continual cycle of planning, implementing, reviewing and improving the processes and actions that will effectively and efficiently enable an organization meet its business and environmental goals (Five Wind International, 2004). This means that there is a review of the system after each cycle to identify areas for further improvement to meet the national environmental standards for the industry.

The EMS, if well implemented, offers a lot of benefits including improved environmental performance, enhanced compliance, and pollution prevention, reduction in emissions, resource conservation and reduction in environmental pollution. As part of operational measures, oil companies should develop innovative environmental technologies to be employed in their operations, and develop a proper disposal of generated solid waste. The two types of approach could be achieved through the collaborative efforts of the Ministry of Environment, Water and Natural Resource, the National Environmental Management Authority (NEMA), the Kenya Bureau of Standards (KEBS), the oil and gas companies, and other stakeholders in the industry. The EMS, if well implemented, offers a lot of benefits including improved environmental performance, enhanced compliance, and pollution prevention, reduction in emissions, resource conservation and reduction in environmental pollution. As part of operational technologies to be employed in their operations, oil companies should develop innovative environmental technologies to be employed in their operations, and develop a proper disposal of generated solid waste.

4.3 RECOMMENDED ADMINISTRATIVE AND INSTITUTIONAL SUPPORT

A perfect blend of both prescriptive and performance-based approaches could serve a good purpose in pursuing environmental management in the oil and gas industry. In many countries, performance-based approaches are increasingly being adopted to complement existing prescriptive regulations. Classical examples exist in Norway, the Netherlands and Australia, where the offshore oil industry has been moving to a regime based on goal-setting approach, supplemented by the prescriptive system of regulation (Technical Meeting Document, 1998). However, the mere prescription of environmental codes and setting of standards, as well as the development of EMS, cannot provide the much needed panacea for pollution emanating from the oil and gas industry. Guided by the drawbacks encountered in mining industry, it is important that an improved and sustainable strategy be put in place to ensure that oil companies strictly adhere to regulations guiding their activities in the industry, and are not spared any documented punishment if they violate any of the legislations.

Accordingly, it is recommended that the following be considered by government in its quest to safeguard the ecosystem whilst exploiting the oil and gas resources: 1. Government should ensure strict control and enforcement of environmental policies; 2. Strengthening existing regulatory framework for environmental protection; 3. Regular and effective monitoring of oil development activities; 4. Periodic update of environmental guidelines; 5. Periodic upward review of fines/penalties to deter potential polluters; 6. Periodic review of the effectiveness of local environmental agencies; 7. Availability of resources

for staff development in the regulatory and enforcing agencies; 8. Improved remuneration to prevent violations of legislation by companies and discourage bribery; 9. Tax and duty exemptions on the importation of technologies related to environmental control to encourage firms in both industries to transfer pollution control technology to their establishments; 10. Regular inspection and maintenance of oil installations.

In addition, Kenyans should be equipped with the necessary knowledge, skills, attitude and motivation for the prevention of pollution and resource deterioration. Furthermore, establishment of conservation pressure groups, with requisite expertise should be encouraged to serve as an appropriate watch dog, providing public education and making sure that the environment is conserved. Environmental education, both formal and informal, should be embarked on to inculcate environmental values and the habits of preservation and conservation among the entire citizenry.

4.4 INTEGRATED APPROACH FOR MANAGING SOCIETAL ISSUES

4.4.1 INTENSIVE COORDINATION AND SOCIALIZATION WITH LOCAL AUTHORITIES AND OTHER STAKEHOLDERS

Engaging potentially affected stakeholders in consultation and participation in decision making is essential to smooth project execution in sensitive environments. Transparency in dealing with governments and local communities has been effective to obtain both legal and public approval, acceptance and support. Local communities' involvement is not only at the beginning phase of E&P operations but also extended to the implementation phase and continued until the completion of the operations. Due to this direct involvement, the local communities have better knowledge about the oil and gas operations. The other advantage from their participation is the improvement of communication between oil and Gas Company with the local communities which aids into smooth operations of oil and gas activity.

4.4.2 CONTRIBUTING IN SUSTAINABLE SOCIAL AND ECONOMIC DEVELOPMENT OF LOCAL COMMUNITIES

As part of commitment for sustainable development, corporate social responsibility (CSR) programs should be performed with 5 main focuses: 1. Education and research, 2. Health and Nutrition, 3. Community economic empowerment and capacity building, 4. Environment and alternative energy, 5. Foundation for preservation of local culture. In implementing CSR programs, integrated approach of partnership between Government, Company, Academic and public sector is necessary to meet the objective of community self-sufficiency and sustainability. Collaboration and clear delineation of roles and responsibilities between the County government, community and its oil company partners is required to achieve optimal environmental and social programmes with cost-effective use of available resources. This trend is evident in the growing complexity and scope of CSR and the accompanying demands placed on oil companies and the CSR oversight function of government

4.4.3 CLAIMS AND DISPUTES MANAGEMENT

Societal claims and disputes are managed with government involvement as a mediator through intensive coordination and discussion process, supported with involvement of conflict resolution experts when necessary. This approach has shown positive results in managing and solving societal claims and disputes.

5 CONCLUSION

Proactively addressing environmental and social issues at the very early stages in the development of the oil sector can help avoid later unforeseen problems. Recognizing the different social and environmental requirements that must be addressed at each stage in the lifecycle of an oil project – from screen/negotiate through the dispose phase is essential. There is also growing convergence and inter-linkage between environmental and social issues, requiring their holistic treatment. Successful oil and gas exploration and production operations in environmentally and socially sensitive area require careful and intensive approach to minimize impacts to surrounding environment as well as to surrounding communities. The actions taken to control and minimize aspect of oil and gas exploration and production operations to environment and to manage societal issues have shown positive results in minimizing the 'footprint' of exploration and production operations and to make a positive contribution in environmental and social areas.

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ASSESSMENT OF HEAVY METAL DISTRIBUTION IN ROCKS FROM ENYIGBA PB-ZN DISTRICT, SOUTH EASTERN NIGERIA

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ABSTRACT: The environmental and geochemical studies at Enyigba Pb-Zn mining district near Abakaliki South eastern Nigeria were undertaken to characterize the distribution of mobile heavy metals in rocks. A total of twenty-one (21) samples were collected from rock samples in the area. The distribution and determination of total concentration were estimated. The geochemical studies include sampling, partial leach test and chemical analysis for As, Cd, Ca, Co, Cu, Mn, Ni, Pb and Zn using UV-Spectrophotometer. The result revealed high concentration of some of the metals in the sampled media with decreasing concentrations with distance from known Pb/Zn mining sites for mostly Cd, Pb, As, and Ni. Their potential distribution and environmental risk were evaluated using enrichment and contamination factor. Indices of geoaccumulation, contamination and metal enrichment showed generally high values for Cd, As, Pb and Cu. compared with permissible limits and standard. Generally the concentration is in order: Cd > Pb > Cu > As > Co > Zn > Zn; for rock samples. Compared to permissible limits, the degree of enrichment is very high for Cd and moderate for Pb, and Cu in the rocks samples. Also the calculated contamination factor shows low to very high contamination status. These levels of contamination and values indicate that under the prevailing conditions and environmental regulations in Nigeria, the mining district would face major and hazardous discharges of these metals to soil and water sources.

KEYWORDS: Heavy Metal Distribution, Rocks, Nigeria.

1 INTRODUCTION

The study area (Figure 1), 14 km southeast of Abakaliki, covered the Pb-Zn mining district of Enyigba and its surrounding villages of Ameka, Ameri and Ohankwu all in Ebonyi State, southeastern Nigeria. The major occupation of the people living in the area is farming and mining activities. The deposit of Pb-Zn sulphides (galena and sphalerite) in Nigeria have been known for a long time but have only been exploited in the past on a very small scale. The lead-zinc field covers over 48,000/sqkm in extent with lead-zinc mineralization at many centres. Deposits are localized in the Cretaceous sediments along 600/km long belt within the Benue Trough, a sediment filled intracratonic basin extending from Ishiagu (South of Abakaliki) North-eastward to Gombe (Farrington 1952, Olade, 1976, Orazulike 1994). The occurrence of lead–zinc in the Benue valley has attracted a lot of attention. Mining of the ore has been carried out for a long time by both the natives, for local uses as cosmetics, and foreign companies, for export. Production of the ore started in the year 1925 (Offodile, 1989) but commercial production started in 1947 (Kogbe, 1989).

Since the discovery of and mining of Pb-Zn deposits in Abakaliki and its environs in the early 1900s, not much data exist on the impact of their mining on the environment.

Metal contamination that occurs as a result of mining characterized by elevated toxic metal concentrations and acid rock and mine drainage, continue several years after the cessation of mining activities. Heavy metal effluents from the weathering of the mineral deposits and mine dumps affect both the surface and underground water quality and soil. These level of contamination in the area may lead to low agricultural production, and other biological communities if present at anomalously high level. This study is to assess the levels of heavy metals distribution in rocks as may have resulted from lead-zinc mining in the area.

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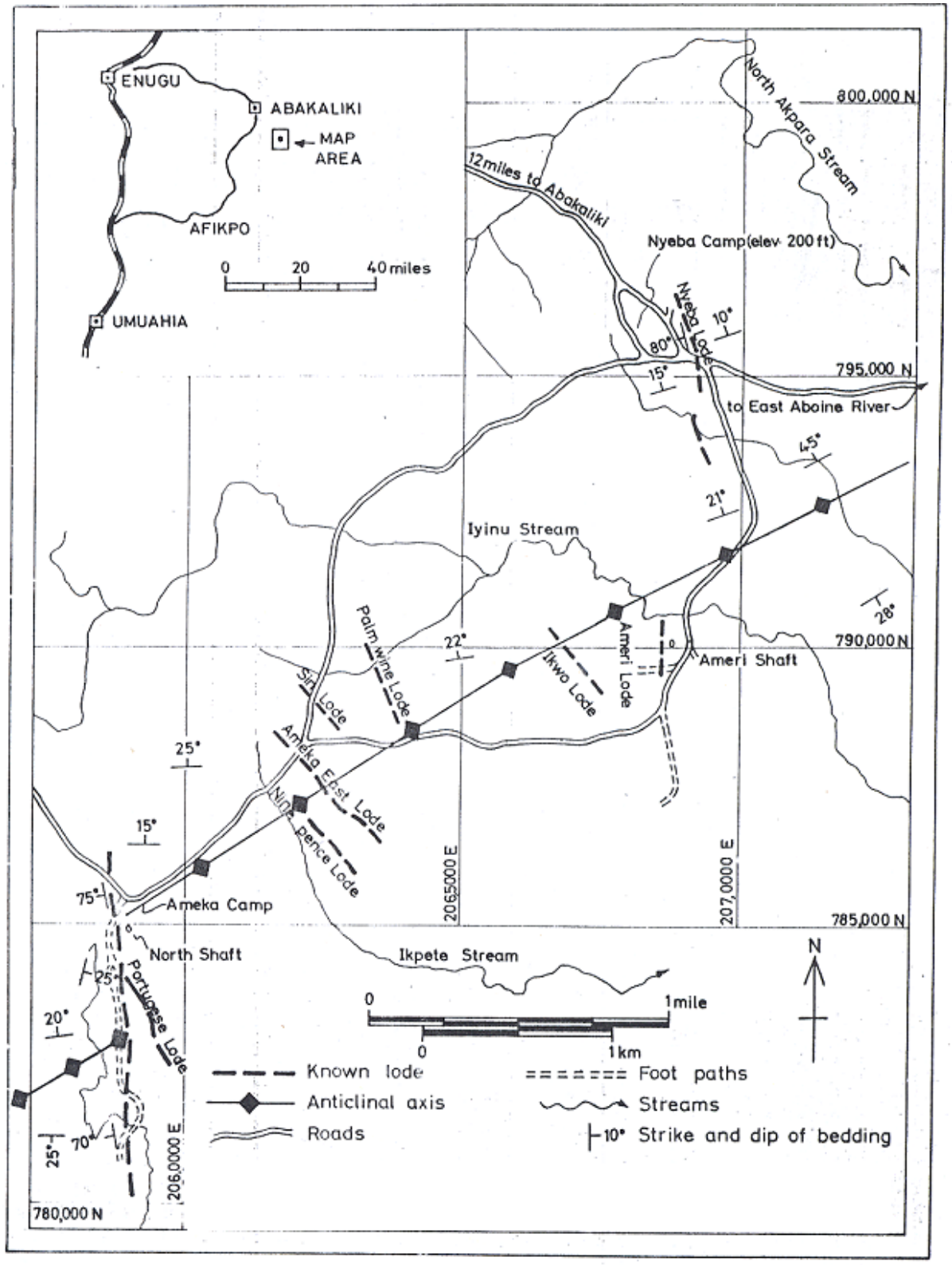

Figure 1. Geological map of lead-zinc deposits of Enyigba district, near Abakaliki, Lower Benue Trough. The area is underlain by Abakaliki shales (Modified from Orajaka, 1965).

The content of these heavy metals in average shale, the crust and normal soil were used as control.

1.1 PHYSIOGRAPHY

In the study area, the topography is undulating plain alternating with running of ridges and hills from east to west. The plains are underlain by shale and some mudstones. The Enyigba, Ameri and Ameka are marked by undulating range of shale outcrops, which serves as the host for Pb-Zn mineral ore bodies. The whole area formed the "Abakaliki antichrionium" and generally underlain by shales. The area had about 60m as its highest elevation and 30m as its lowest elevation above sea level. The area falls within the tropical rainforest belt of South East Nigeria, and characterized by an average rainfall of 1750-2000 mm per annum. The rainy season and dry season are the two major seasons that prevail in the area. The vegetation cover in Enyigba is controlled by its climatic condition. The highlands are characterized by drought resistance grasses, along stream and rivers. Among the vegetation includes economic mangoes trees, orange trees, and palm and coconut trees. The drainage system of the area is dendritic in pattern, which is a function of the lithology. The area is majorly drained by Ebonyi River. All the drainage systems flow eastward to join the Cross River somewhere outside the area.

2 GEOLOGY

The Abakaliki shale of lower Cretaceous age is exposed in the area. The sedimentary rocks are predominantly black calcareous (calcite-cemented) shale with occasional intercalation of siltstone (Figure 2). The shale formation belongs to the Asu-River Group of the Albian Cretaceous sediments. The Asu River group which consists of alternating sequence of shales, mudstone and siltstone with some occurrence of sandstone and limestone lenses in some places and attains an estimated thickness of 1500 meters (Agumanu 1989, Farrington, 1952). Kogbe (1989) described the sediments as consisting of rather poorly-bedded sandy limestone lenses. The shales in some places are highly weathered and ferrugenized. The rocks are extensively fractured folded and faulted. From field observations, the rocks of the area consist of variably coloured shale and mudstone that has been imbedded by lead – zinc vein mineralization, baked intrusive shale as well as ironstone along veins. The ironstone occur as inter-beds within the shale and as vein filling. The vein mineralization is hosted within the dark shale (Nnabo et al. 2011). The geology and mineral resources are the major factors responsible for availability of the heavy metals in the area. While the sulphide mineralization have high concentration of these metals, the shale host are capable of retaining them from ancient sea (Nnabo et al. 2011).

3 METHODOLOGY

Several techniques and scientific methods were employed to achieve and fulfill the aim and objectives of this research work. Unmined, mineralized, unmineralized and altered rock samples were collected from rock outcrops. The samples are typically composite chip samples collected at mining sites. Single grab samples were collected where compositing was not possible. A total of twenty-one (21) rocks samples were collected with their descriptions appropriately recorded (Figure 3). Rock samples were collected from each sampling point and were then crushed to get fine grain sizes. The choice of fine-grained material for this analysis is because higher metals concentration is generally found on smaller grain of rocks due to higher metals surface area to grain size ratio (Kabata-Pendias, 1995). A positive correlation usually exist between decreasing grain-size and higher metal concentration. Moreover this is to say that fine-grained sediments have greater absorption surface area than coarser particles, especially clay minerals, Organic matter and Fe-Mn oxylydroxide complexes are able to absorb larger quantities of metal through cation exchange processes (Kabata-Pendias, 1995).

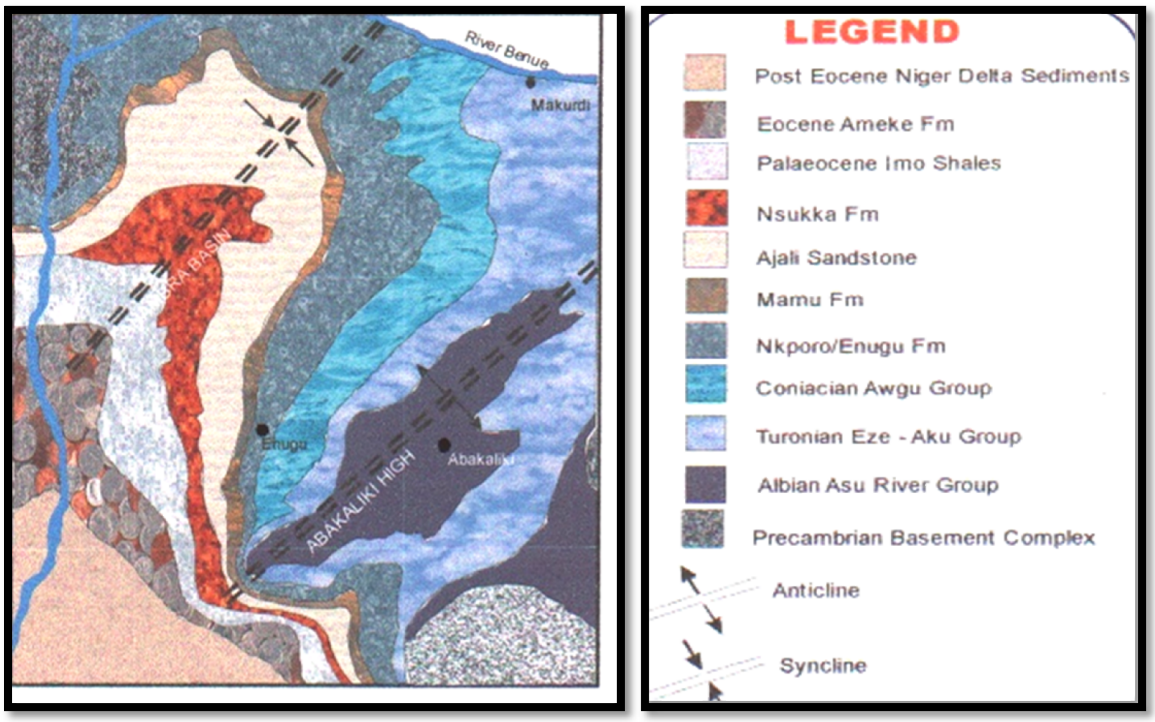

Fig. 2: General geologic map of Southeastern Nigeria showing Abakaliki basin in the Lower Benue Trough (Modified after Hoque, 1984)

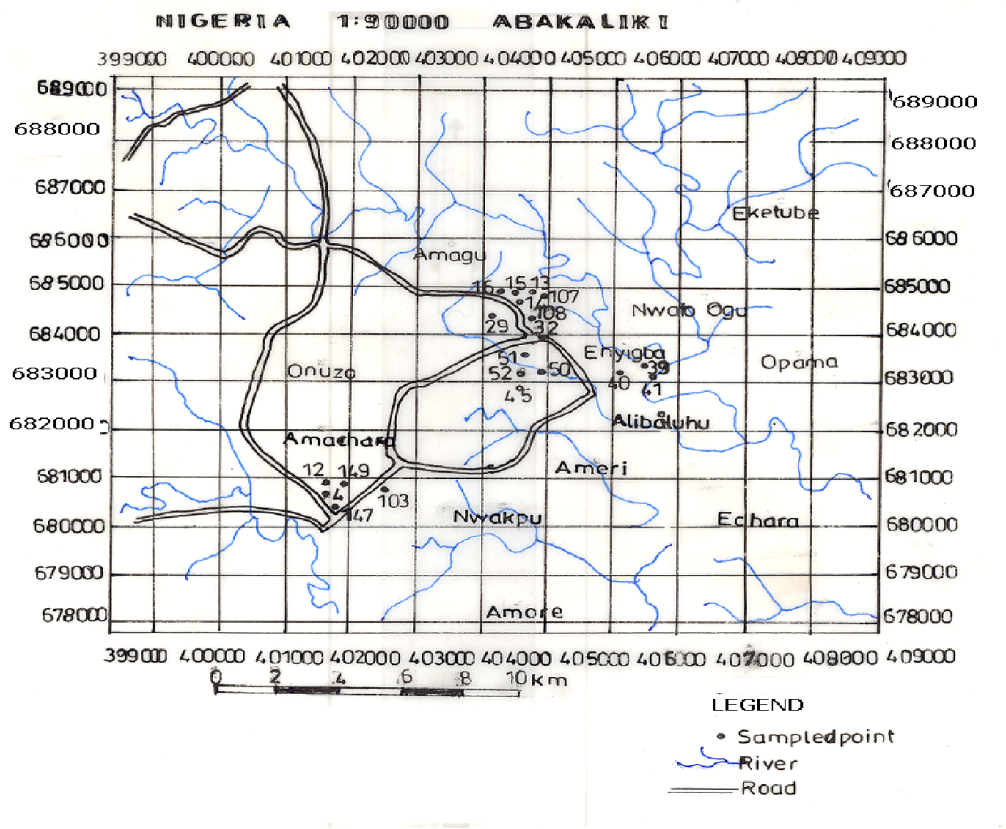

Figure 3. Map of Enyigba Area showing the Rock Sample Points

In the laboratory, the rock samples were reduced to about 0.5 cm fragments, crushed and then split. For each sample, an approximately 100g portion was pulverized with ceramic mortar and with pestle. The sample was grounded and then sieved until 100% passed an 80-mesh screen (< 180 µm). The sample was mixed to ensure homogeneity, and then served for chemical analysis. The remaining portion was archived for subsequent analysis. To ensure thorough cleanliness to avoid any level of cross-contamination especially when ore-grade samples were prepared, a small amount of the next sample to be prepared was crushed and discarded with the crusher scrubbed out thoroughly prior to preparing the whole sample.

The solid samples from outcrops were digested in the laboratory using the passive leach method that provides a measure of reactions in nature. In this method 100g of the samples was measured and placed in beaker with 200 ml of deionized water, stirred slightly and initial pH and temperature were measured. At 24 hours, the pH and temperature of the leach were again measured and a 60 ml aliquot was taken with a syringe and filtered. The leachate solutions were acidified with 5 drops of 1.1 ultrapure nitric acid (HNO_3) to stabilize metal in solution. The leachate was sent for analysis. A total of nine elements were analysed for and they include As, Ca, Cd, Co, Cu, Mn, Ni, Pb and Zn.

4 RESULTS

The result of analysis for As, Ca, Cd, Co, Cu, Mn, Ni, Pb, and Zn in rock samples for leach test and geochemical test are presented in Tables 1 and 2 below. The summarized basic statistics for rock samples geochemical data are also included.

Table 1: Result of partial leach test of rock samples

S/N	Sample No	Initial pH	pH @24hrs
1	PH/R/4	6.1	6.4
2	PN/R/10	6.1	6.2
3	PN/R/12	3.5	3.4
4	PN/R/13	9.1	8.6
5	PN/R/14	9.2	8.9
6	PN/R/15	8.5	8.4
7	PN/R/16	8.9	8.3
8	PN/R/29	9.5	9.3
9	PN/R/32	8.9	8.6
10	PN/R/39	9.1	8.6
11	PN/R/40	8.4	8.2
12	PN/R/41	4.6	4.6
13	PN/R/45	9.3	9.2
14	PN/R/50	9.3	9.5
15	PN/R/51	9.0	8.9
16	PN/R/52	9.1	9.4
17	PN/R/103	4.2	4.3
18	PN/R/ 107	8.5	8.2
19	PN/R/108	8.7	8.1
20	PN/R/147	4.6	6.0
21	PN/R/149	4.4	6.2

Table 2. Concentration of Mobile Heavy Metals in Rock from Enyigba Area

S/N	Location	As	Ca	Cd	Co	Mn	Cu	Ni	Pb	Zn	pH
1	Ameka	4.04	107400	1.35	4.00	940.30	40.28	5.34	93.92	13.95	6.4
2	Ohankwu	31.09	12304.0	10.38	31.80	1041.50	310.90	16.55	103.62	107.76	6.2
3	Ohankwu	0.85	2244.00	0.28	0.86	201.20	8.60	1.10	20.04	2.91	3.4
4	Enyigba	5.31	1379.20	1.78	5.34	1240.00	53.10	7.06	124.07	18.30	8.6
5	Enyigba	7.38	7887.00	2.46	8.04	920.20	73.92	9.87	91.23	25.59	8.9
6	Enyigba	0.66	7122.00	2.22	6.80	1201.00	66.60	0.88	116.45	23.08	8.4
7	Enyigba	2.80	13250.0	11.57	4.04	1060.00	346.60	26.18	110.19	120.00	8.3
8	Ameri	5.82	6271.00	1.96	6.62	136.01	58.70	7.76	13.56	20.35	9.3
9	Ameri	7.54	9362.00	5.85	18.03	408.40	175.22	10.34	40.88	60.73	8.6
10	Ameri	7.20	7695.00	2.41	7.25	168.43	72.50	9.65	16.82	25.00	8.6
11	Ameri	6.92	7374.00	2.81	6.96	202.20	69.50	9.22	22.22	23.92	8.2
12	Ameri	5.64	6014.00	1.88	5.62	6.00	56.29	7.50	0.53	19.33	4.6
13	Ameri	0.67	15200.00	16.23	41.00	1141.60	486.90	70.50	113.55	168.78	9.2
14	Ameri	9.07	9683.00	3.03	10.06	121.80	90.66	12.10	21.25	31.40	9.5
15	Ameri	12.85	13724.0	4.28	12.30	300.00	128.84	17.23	30.07	44.51	8.9
16	Ameri	6.40	9682.00	3.03	10.06	212.80	90.66	12.10	21.25	31.40	9.5
17	Ohankwu	2.19	11735.0	7.32	22.04	512.80	219.30	29.29	51.26	76.16	4.3
18	Enyigba	2.87	15744	9.01	30.06	687.70	294.90	39.30	68.77	102.12	8.2
19	Enyiba	24.44	13050.0	8.17	24.70	570.20	244.60	32.55	56.99	84.65	8.1
20	Ohankwu	4.77	12682.0	1.59	4.82	108.83	47.45	6.30	11.07	16.43	6.0
21	Ohankwu	5.06	13442.0	1.68	5.03	110.88	50.47	6.70	11.76	17.47	6.2
	Total	153.57	206584.2	99.28	261.37	12689.05	2951.63	337.5	1271.05	1034.22	159.3
	Mean	7.31	9837.34	4.73	12.45	604.67	140.55	16.07	60.53	49.25	7.59
		7.31	3848.01	4.09	10.80	457.46	125.07	15.77	45.33	43.04	1.78
	Shale	10	$2.55.10^4$	0.3	20	850	50	80	20	90	
	Crust	2.5	$6.4.10^4$	0.08	26.6	1000	27	59	11	72	
	(Kabata- 1984,1995)	20	--	0.5	50	--	100	30	20	300	

Arsenic was evenly distributed in rocks around Enyigba and its environs. The mean concentration of As was 7.3 mg/kg. The maximum concentration of As was 31.09 mg/kg with range of concentration of 0.66-31.09 mg/kg. Ca was well dispersed in the rocks in the area due to its mineral forming-element, calcite. The total mean concentration of Ca was 98 37.34 mg/kg with the range of 2244.00-15744.00 mg/kg. Its highest occurrence was record in Enyigba around the mining area, while its lowest concentration was recorded in Ohankwu.

The Cd concentration in rocks around Enyigba was not much when compared with other heavy metals. The mean concentration was 4.73 mg/kg while the maximum and minimum concentration was 16.23mg/kg and 0.28 mg/kg respectively. The concentration of Co ranges from 0.84-41.00 mg/kg with the distribution almost equal in most of the samples. It ranges in concentration from 1528.00 mg/kg to 6.00 mg/kg. The mean concentration of Cu was 140.55mg/kg and it ranges from 8.60 to 486.90 mg/kg. Total mean concentration was 16.07mg/kg while Pb total mean concentration was 60.53 mg/kg. The distribution of Pb in the rocks of Enyigba was not much when compared with Ca and Cu respectively Zn was evenly distributed in the rocks of Enyigba and its environs. The total mean concentration Zn was 49.25 mg/kg. The minimum and maximum concentrations were 2.90 mg/kg and 168.78 mg/kg respectively.

5 DISCUSSION

The assessment of heavy metal distribution in rocks from Enyigba and environs was carried out using the Geoaccumulation Index, Metal Enrichment Index (MEI) and Enrichment Factor (EF). These parameters were employed to access the pollution of individual metals of interest in rocks.

5.1 GEOACCUMULATION INDEX

Geoaccumulation Index (Igeo) is the enrichment on geological substrate and described by equation of Muller,1988 (cited in Yao 2008). The classes of intensity based on Igeo is as given in Table 3. The values of Igeo in rocks of the study area are given in Table 4.

$(Igeo) = Log_2 (Cn/1.5 \times Bn)$ - (1)

Where Cn is the measured concentration of the element and Bn is the geochemical background value (Average Shale) in earth's crust.

The concept of Igeo has been widely used to evaluate the degree of metal contamination in terrestrial, aquatic and marine environment, (Yao, 2008; Kumar and Edward, 2009). The geoaccumulation index compares the measured concentration of the element in the sample fraction; Cn with the geochemical background value, Bn. For samples of mineralized rocks, Bn was considered as average concentrations of the elements in the bed rock unit.

Table 3. Classes of concentration intensity of heavy metal based on Igeo

CONTAMINATION INTESNITY							
Item	Practically unpolluted	Slightly polluted	Moderately polluted	Moderately to strongly	Strongly polluted	Strongly very strongly	Very strongly
Igeo	< O	> O < 1	>1. <2	>2-<3	>3.<4	>4-<5	>5
Igeo Class	0	1	2	3	4	5	6

Table 4. Geoaccumulation indices (Igeo) of heavy metals in rocks from Enyigba) geoaccumulation indices of heavy metals in rock samples from the Enyigba environs

Sample No	**As**	**Igeo**	**Ca**	**Igeo**	**Cd**	**Igeo**	**Co**	**Igeo**	**Mn**	**Cu**	**Igeo**	**Ni**	**Igeo**	**Zn**	**Igeo**	**Pb**	**Igeo**	**Itot**
PN/R/4	4.04	0.08	10740.00	0.09	1.35	0.90	4.00	0.04	940.30	40.28	0.16	5.34	0.01	13.95	0.03	93.92	0.94	2.47
PN/R/10	31.09	0.62	2244.00	0.10	10.38	6.94	31.80	0.29	1041.50	310.09	1.24	16.55	0.04	107.76	0.24	103.62	1.04	10.76
PN/R/12	0.85	0.02	2244.00	0.02	0.28	0.19	0.86	0.01	201.20	8.60	0.03	1.10	0.003	2.91	0.01	20.04	0.20	0.53
PN/R/13	5.31	0.11	1379.20	0.01	1.78	1.19	5.34	0.05	1240.00	53.10	0.21	7.06	0.02	18.30	0.04	1247.07	1.24	3.16
PN/R/14	7.38	0.15	7887.00	0.06	2.46	1.64	8.04	0.07	920.20	73.92	0.30	9.87	0.02	18.30	0.04	124.07	1.24	3.16
PN/R/15	0.66	0.01	7122.00	0.06	2.22	1.48	6.80	0.06	1201.00	73.92	0.30	9.87	0.02	25.59	0.06	91.23	0.91	3.43
PN/R/16	2.80	0.06	13250.00	0.11	11.57	7.71	4.04	0.04	1060.00	66.60	0.27	0.88	0.002	23.08	0.05	116.45	1.16	3.37
PN/R/29	5.82	0.12	6271.00	0.11	11.57	7.71	4.04	0.04	1060.00	346.60	1.39	26.18	0.07	120.00	0.27	110.19	1.10	11.00
PN/R/32	7.54	0.15	9362.00	0.07	5.85	3.91	18.03	0.16	408.40	58.70	0.23	7.76	0.02	20.35	0.05	13.56	0.14	2.01
PN/R/39	7.20	0.14	7695.00	0.06	2.41	1.61	7.25	0.07	168.43	175.22	0.70	10.34	0.03	60.73	0.13	40.88	0.41	5.66
PN/R/40	6.92	0.14	7374.00	0.06	2.81	1.87	6.96	0.06	202.20	72.50	0.29	9.65	0.02	25.00	0.06	16.82	0.17	2.46
PN/N/41	5.64	0.11	6014.00	0.05	1.88	1.25	5.62	0.05	6.00	69.50	0.28	9.22	0.02	23.92	0.05	22.22	0.22	2.75
PN/R/45	0.67	0.01	15200.00	0.12	16.23	10.82	41.00	0.37	1141.60	56.29	0.23	7.50	0.02	1933	0.04	0.53	0.01	1.77
PN/R/50	9.07	0.18	9683.00	0.08	3.03	2.02	10.06	0.09	212.80	486.90	1.95	70.50	0.18	168.78	0.38	113.55	1.14	15.24
PN/R/51	12.85	0.26	13724.00	0.11	4.28	2.85	12.30	0.11	300.00	90.66	0.36	12.10	0.03	31.40	0.07	21.25	0.21	3.09
PN/R/52	6.40	0.13	9682.00	0.08	3.02	2.01	6.00	0.05	1528.00	128.84	0.52	17.23	0.04	44.51	0.10	30.07	0.30	4.36
PN/R/103	2.19	0.04	11735.00	0.09	7.32	4.88	22.04	0.20	512.80	56.30	0.23	12.08	0.03	31.78	0.07	152.8	1.53	4.49
PN/R/107	2.87	0.06	15744.00	0.13	9.01	6.01	30.06	0.27	687.70	219.30	0.88	29.29	0.07	76.16	0.17	51.26	0.51	6.96
PN/R/108	24.44	0.49	13050.00	0.10	8.17	5.45	24.70	0.22	570.20	294.90	1.18	39.30	0.10	102.12	0.23	68.77	0.69	8.83
PN/R/147	4.77	0.10	12682	0.10	1.59	1.06	4.82	0.04	108.83	244.60	0.98	32.55	0.08	84.65	0.19	56.99	0.57	8.21
PN/R/149	5.06	0.10	13442	0.11	1.68	1.12	5.03	0.05	110.88	50.47	0.20	6.70	0.02	17.47	0.04	11 76	0.12	1.79
Av. Shale	**10**		**$2.5.10^4$**		**0.3**		**20**		**850**	**50**		**80**		**90**		**20**		

In terms of Igeo, As, Ca, Co, Mn and Zn values in ricks showed practically uncontaminated condition (Table 4) and made little contribution to I(tot). The content of As in rocks showed only moderate enrichment factor and health risk level varying from 0 to 2.

Cd in rock reached very strong enrichment conditions in many parts of the area. It also contributed significantly to the high I(tot) recorded. In all, Cd showed strong to very strong enrichment. As, Ca, Co, Mn, Ni and Zn, showed practically unpolluted conditions. The main polluting trace metals are Cd, Pb and Cu, followed by Zn, As Mn, Ni and Co.

5.2 ENRICHMENT FACTOR (EF)

The enrichment factor (EF) was based on the standardization of the tested element against a reference. A reference element is the one characterized by low occurrence variability. The most common reference elements are Si, Mn, Ti, Al and Fe (Kumar and Edward 2009). Mn was used as the reference metal using the formula below. This was justified based on high correlation of Mn with some of the other heavy metals.

EF = Cn (Sample)/Cref (Sample)/

Bn (Background)/Bref (Background)

Where Cn (sample) is the concentration of the examined element in the examined environment, Cref (Sample) is the content of the reference element in the examined environment and Bref (background) is the content of the reference element in the reference environment. For this analysis, the average shale was taken as the reference environment while Cref was taken as the average Mn content of the analysed rock samples (604.67mg/kg, see Table 2) of the Enyigba and environs. The enrichment of heavy metals in rocks of the area is as given in Table 5. Six pollution conditions and health risk levels recognized on the basis of the enrichment factor as shown in Table 6. The health risk level was determined by the value of enrichment factor, so that the enrichment factor represents the impact level of the metal on the environment.

Table 5. Enrichment Factor (EF) of Heavy Metals in Rocks from Enyigba Enrichment Factor of Heavy Metals in Rocks from Enyigba and Environs

Sample Code	As	EF	Ca	EF	Cd	EF	Co	EF	Cu	EF	Ni	EF	Zn	EF	Pb	EF
PNR/4	4.04	1.00	10740.00	0.40	1.35	6.38	4.00	0.33	40.28	1.11	5..34	0.10	13.95	0.21	93.92	7.77
PNR/10	31.09	5.00	12304.00	0.69	10.38	49.05	31.80	2.63	310.90	8.57	16.55	0.30	107.76	1.62	103.62	8.57
PNR/12	0.85	0.14	2244.00	0.13	0.28	1.32	0.86	0.07	8.60	0.24	1.10	0.02	2.91	0.04	20.04	1.66
PNR/13	5.31	1.00	1379.20	0.08	1.78	8.41	5.34	0.44	53.10	1.46	7.06	0.13	18.30	0.28	124.07	10.26
PNR/14	7.38	1.00	7887.00	0.44	2.46	11.62	8.04	0.66	73.92	2.04	9.87	0.18	25.59	0.38	91.23	7.54
PNR/15	0.66	0.11	7122.00	0.40	2.22	10.49	6.80	0.56	66.60	1.84	0.88	0.02	23.08	0.35	116.45	9.63
PNR/16	2.80	0.46	13250.00	0.75	11.57	54.67	4.04	0.33	346.60	9.55	26.18	0.48	120.0	1.80	110.19	9.11
PNR/29	5.82	1.00	6271.00	0.35	1.96	9.26	6.62	0.55	58.70	1.62	7.76	0.14	20.35	0.31	13.56	1.12
PNR/32	7.54	1.00	9362.00	0.53	5.85	27.64	18.03	1.49	175.22	4.83	10.34	0.19	60.73	0.91	40.88	3.38
PNR/39	7.20	1.00	7695.00	0.43	2.41	11.39	7.25	0.60	72.50	2.00	9.65	0.18	25.00	0.38	16.82	1.39
PNR/40	6.92	1.00	7374.00	0.41	2.81	13.28	6.96	0.58	69.50	1.92	9.22	0.17	23.92	0.36	22.22	1.84
PNR/41	5.64	1.00	6014.00	0.34	1.88	8.88	5.62	0.46	56.29	1.92	7.50	0.14	19.33	0.29	0.53	0.04
PNR/45	0.67	0.11	15200.00	0.85	16.23	76.69	41.00	3.39	486.90	13.42	70.50	1.30	168.78	2.54	113.55	9.39
PNR/50	9.07	1.00	9683.00	0.54	3.03	14.32	10.06	0.83	90.66	2.50	12.10	0.22	31.40	0.47	21.25	1.76
PNR/51	12.85	2.00	13724.00	0.77	4.28	20.22	12.30	1.02	128.84	3.55	17.23	0.32	44.51	0.67	30.07	2.49
PNR/52	6.40	1.00	9682.00	0.54	3.02	14.27	6.00	0.50	56.30	1.55	12.08	0.22	31.78	0.48	152.8	12.63
PNR/103	2.19	0.36	11735.00	0.66	7.32	34.57	22.04	1.82	219.30	6.04	29.29	0.54	76.16	1.15	51.26	4.24
PNR/107	2.87	0.47	15744.00	0.89	9.01	42.57	30.06	2.49	294.90	8.13	39.30	0.72	102.12	1.54	68.77	5.69
PNR/108	24.44	4.00	13050.00	0.73	8.17	38.60	24.70	2.04	244.60	6.74	32.55	0.60	84.65	1.27	56.99	4.71
PNR/147	4.77	1.00	12682.000	0.71	1.59	7.51	4.82	0.40	47.45	1.31	6.30	0.12	16.43	0.25	11.07	0.92
PNR/149	5.06	1.00	13442.00	0.76	1.68	7.94	5.03	0.42	50.47	1.39	6.70	0.12	17.47	0.26	11.76	0.97
Av.Shale	10		$2.5.10^4$		0.3		20		50		80		90		20	

Table 6 Pollution condition and health risk (HR) level based on class of enrichment factor

EF	Pollution condition	Health Risk level
EF<1	Deficient	0
EF=1-2	Minimal	1
EF=2-5	Low	2
EF = 5-20	Significant	3
EF = 20-40	Very High	4
EF > 40	Extremely high	5

Enrichment factor (EF) of heavy metal in rock from Enyigba and environs Ca has extremely high enrichment in four sample points, with the highest at Ameri PN/R/45 (76.69). Cu show significant enrichment in six sample points with highest of 13.42 at Ameri, and this location corresponds to site of high Ca enrichment Pb was significantly enriched with the highest value of 12.63 at Ameri at sample point PN/R/52. Co is significantly enriched in only four sample point with the highest of value 3.39. The level of enrichment is significant in only two sample points with highest value of 5.0 at Ohankwu (PN/R/10). the concentration of Zn enrichment is significantly high in only one sample point with a value of 5.54 which correspond to site of high Ca enrichment.

5.3 CONTAMINATION FACTOR (CF)

The assessment of contamination of rocks of Enyigba and environs was also carried out using the contamination factor. This calculation was used to evaluate the potential risk of the heavy metal to the enrichment using the formula below (Kumar and Edward, 2009).

$$Cf = \frac{C^{i}_{0-1}}{C^{1}_{n}}$$

Where C^{i}_{0-1} is the mean concentration of the metal from sampling sites of Enyigba and environs (at least five) and Cn was taken as the average concentration of elements in the earth's crust as a reference value. Four categories of contamination factor have been distinguished in Table 7. Table 8 shows the calculated contamination factor of heavy metals in rock of the area.

Table 7. Categories of contamination based on contamination factors.

$C^{i}F$	Category of contamination
$C^{i}F < 1$	Low contamination factor indicating low concentration
$C^{1}f = 1-3$	Moderate contamination factor
$C^{i}f = 3-6$	Considerable contamination factor
Cf > 6	Very high contamination factor

Table 8: Calculated contamination factor in rock from Enyigba

Elements	Mean	Contamination factor CF
As	7.31	2.92
Cd	4.73	59.13
Co	12.45	0.47
Cu	140.55	5.21
Mn	604.67	0.60
Pb	60.53	5.50
Zn	49.25	0.68
Ni	16.07	0.27
Ca	9837.34	0.32

The contamination factor (Cf) of Co, Mn, Zn, Ni and Ca is less than one i.e (CF < 1). This shows low contamination. The contamination factor of As is greater than 1 and less than 3 that is, (CF > 1<3.) This show that As is of moderate

contamination in the rock of Enyigba are. Cu and Pb show considerable contamination factor of 5.21 and 5.5 respectively. The Cd has a very high contamination factor of 59.13 which is the highest value of contamination factor among other heavy metals around Enyigba area.

5.4 THE EFFECT OF THE ESTABLISHMENT METAL DISTRIBUTION IN THE ROCK

It has been established that most of the rocks around Enyigba are moderately to very highly contaminated with heavy metal such as Cu, Pb, Cd, and As. This may be as a result of mining activities going on in the area. The weathered rock formed soil in which plants grow. In most natural setting, heavy metal accumulation in organisms are not very serious because of the natural contaminations of these metals are low in soil it begins when human activities locally disturb the natural cycle. This results in distribution of this heavy element in the rock and soil, where weathering and erosion may also contribute to the dispersion of these heavy elements in the soil. By this process contaminants are introduced into new areas, there-by becoming available for ingestion by greater number of microorganisms. A feature that the heavy metals have in common is that they tend to accumulate in the bodies of organisms that ingest them. therefore, the concentrations increase up a food chain.

The effect of heavy metal on plants and animals depend on ingested dosage and may cause serious problem to the living organisms. This may lead to:

(1) Low agricultural production

(2) Decreases among animals

(3) Diseases among human beings

(4) Death of plants and animals as the case may be.

6 CONCLUSION

The Enyigba area presents a good case of heavy element distribution and with high concentration of As, Ca, Cd, Co, Mn, Cu, Ni, Pb, Zn in rock were recorded in most the sample points. These are location where active mining took place or still taking place at present. Geoaccumulation index environment factor and contamination factor were used to assess the level of heavy metal distribution in the rock of Enyigba area. Cd shows very high contamination factor of 59.13 which is toxic for both animals and plants. As also shows moderate contamination in the rock. Three parameters were used to evaluate the contamination status of rocks in Enyigba show low to very high contamination.

The comparison between the three methods indicates that the rocks fall, between uncontaminated to highly contaminated status. These levels of metal concentration may have direct toxicity on plants and animals in contact with the soil.

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Comparison and Modeling of Various Packing Materials in a Packed Column Using Two Slightly Soluble Solute Gases

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ABSTRACT: Comparison of various packing's on the basis of their materials using two different solute gases, CO2 and O2, is being presented. Calculations were done on the liquid side and height of transfer units as well as number of transfer units obtained for various flow rates. The result shows superiority of steel Raschig rings over ceramic, glass and plastic rings. Results were analyzed considering material properties such as wettability, surface area offered per square inch, packing factor and voidage. The operating conditions were Temperature = 25°C and Pressure = 1atm. The values of effective interfacial area offered by Raschig rings of different materials vary to some extent. Steel rings hold sway over ceramic rings but the difference is not much. Glass rings and plastic rings come third and fourth respectively and are way behind in perform- mince. The high density of ceramic Ranching rings and steel rings provides each ring with high me- chemical strength and can thus be stacked in larger quantities within your column to further boost the required process. In Ranching rings ceramic is a bet- term option than plastic or metals due to high tolerance levels against high heat and strong acids.

KEYWORDS: Packing, effectiveness of packing, material of packing, absorption, height of transfer units, modeling of packing materials, O2 absorption.

1 INTRODUCTION

Absorption is a mass transfer phenomenon which occurs due to a concentration difference between liquid and gas phase. It depends upon the solubility of solute vapor from the mixture in the liquid. It is controlled by the following four factors

1. Ratio of liquid flow to gas flow (Lm/Gm)
2. Contact time between two fluids
3. Temperature of the heavier liquid flow
4. Reflux stream near the middle of the column

Packed columns have been used extensively on industries for mass transfer processes like gas absorption and distillation. For over 100 years, the factors which govern the rate of absorption of gases by liquids have interested Chemical engineers. In about 1830, for instance, William Gossage filled a derelict windmill with brushwood and ran water over it in order to absorb hydrochloric acid vapor from the manufacture of alkali. This perhaps marks the invention of the first practical absorption tower. A British patent of 1836, incidentally, protected the principle. The chemical and process industries have a lot of examples where absorption of a gas by a liquid is necessary, e.g.; Absorption of nitrous gases in water or nitric acid, during nitric acid manufacture, Absorption of chlorine by alkaline solutions to give hypo chlorites, absorption of oxygen by fermentation broths, removal of carbon dioxide from water-gas by absorption in water or in solutions of alkalis or amines, removal of carbon monoxide from water-gas by absorption in solutions of copper complexes, absorption of hydrogen by petroleum fractions in processes to remove sulphur as hydrogen sulphide, absorption of chlorine and propylene in water to give the chlorohydrin. Packing material should be chemically inert to fluids, strong enough without excessive weight, provide

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good contact between liquid and gas, be reasonable in cost and provide adequate passage without excessive hold up or pressure drop. Most of the published results for transfer coefficients in packed towers are for small laboratory units of 50-250mm diameter, and there is some uncertainty in extending the data for use in industrial units. Although shapes have a larger impact on the effectiveness of packing, the effect of material cannot be denied. Kowalke, Hougen and Watson determined mass transfer coefficient for absorption of ammonia in water with a packing 1-2m deep in 1925 [1]. Borden and Squires studied the absorption of ammonia in a ring-packed tower with gas mass velocity ranging from 0.07-0.69 Kg/m^2.sec and liquid mass velocity ranging from 0.572-2.67 Kg/m^2.sec [2]. Fellinger studied the absorption of ammonia in water and acids in various standard packing by using 450mm diameter stoneware column in which a perforated packing support was fitted with 20 down comers extending to within 25mm at the bottom of the tower and 120 risers were fitted extending 31mm above the upper surface [3]. He used Raschig rings of different sizes and compared their effectiveness in mass transfer. His results indicated that smaller sized Raschig rings gave comparatively smaller values of height of transfer units and thus higher mass transfer coefficients. Norman performed experiments on the absorption of ammonia in water as well as evaporation of water in an air stream, using packing of carbon slates having volume $11250mm^3$ with V-notches as distributor [4]. His findings backed the earlier results presented by Kowalke. Molstad, Mckinney, and Abbey measured the absorption of ammonia in water using a tower of 384 mm side packed with wood grids, or with rings or saddles [5]. They were able to measure mass transfer coefficient by direct experiment. Cooper [6] established that, at high liquid rates and low gas rates used in practice, and with a tower packed to a depth of 2.2m, the transfer rates were much lower than those determined earlier. Traditional methods of assessing the capacity of tower packing, involving the use of a specific surface area S and void age e, were useful for a packed bed of granular material, such as granite, limestone and coke. With the introduction of Raschig rings and other specially shaped packing, it was necessary to introduce new methods which could be used to compare their relative efficiencies. Shulman [7] in the early 1950s showed that the total area offered by Raschig rings was not used and varied considerably with hydraulic loading. Further evidence of the importance of the wetted fraction of the total area came with the introduction of pall rings. It was established that the effectiveness of packing depends upon its amount of wetting. Later, Semmelbauer [8] presented equations to evaluate HG and HL for Raschig rings and berl saddles. Morris and Jackson [9] presented values of the heights of individual film transfer units for various rings. Coughlin [10] reported data for overall liquid side mass transfer coefficient of 3/8 in. Raschig rings made of ceramic, polyethylene and Saran. The values for overall liquid side mass transfer coefficients were same for both Saran and polyethylene rings while those for ceramic rings were 25% higher. Whitney and Vivian [11] reported some data on absorption of lean SO2 in water in a packed column provided with 1 in. ceramic Raschig rings and found that kGa varies as $L^{0.25}$. Dwyer and Dodge [12] reported that kGa varies as $L^{0.20}$.

2 EXPERIMENTAL

Specifications of the column designed: diameter of the column = 6.35 cm height of the column = 110 cm height of packing = 74 cm Surface area of the column = 1475.486 cm^2 volume of packing = 3.5 L packing size = 10*10 mm air flow meter range = 20-180 L/min water flow meter range = 1-22 L/min gas flow meter range = 1-10 L/min air compressor capacity = $0.15m^3$/min @ 0.3bar void fraction = 0.40

Absorption column was installed as shown in figure 1. Water was showered from the top and gas injected from the bottom. When equilibrium was attained, a sample was withdrawn. In the case of CO2, KOH was instantly mixed in the sample to prevent CO2 from escaping during titration. With CO2, the titration method was adopted to find the concentration of CO2 absorbed in the sample. HCl was taken in the burette as the titrant. The first end point was colorless using phenolphthalein indicator and second was reddish orange using methyl orange as an indicator. From the volume, first concentration and then the number of transfer units were calculated. With O2 as the solute, DO meter was used to calculate the dissolved Oxygen in the sample. From the concentration obtained, transfer units were calculated.

3 RESULTS AND DISCUSSION

3.1 HEIGHT OF TRANSFER UNIT

The height of transfer unit is the defining factor with regards to the efficiency of the packing used. It measures the separation effectiveness of a particular packing for a separation process. The more efficient packing gives smaller value of HTU. The values of HTU can be estimated from empirical correlations or pilot plant tests, but the

applications are rather restricted. Figure-1 shows that steel rings and ceramic rings have lower values of HoL as compared to plastic and glass rings and hence they give better mass transfer in the case of CO2 absorption. It is also seen that height of transfer unit values dip at the start and after reaching their lowest ebb, start rising. This shows that the flow rates reach an optimum value and after those loading and flooding conditions start making their presence felt. In both the cases, steel rings give the best results followed by ceramic rings while plastic and glass rings lag behind. Figure-2 shows the effect of gas flow rate on the height of transfer unit in case of O2 absorption. Again the results paint the same picture. Although the difference is not as much as the ones observed with CO2 absorption, still the order remains the same with steel rings offering the minimum height of transfer unit followed by ceramic, plastic and glass rings respectively. Equation of straight lines is also given which makes it possible to calculate HoL at any flow rate. Table-1 shows the exponential relationship between height of transfer unit and gas flow rate for various rings in the case of CO2 absorption. Table-2 shows the exponential relationship between height of transfer unit and gas flow rate for various rings in the case of O2 absorption.

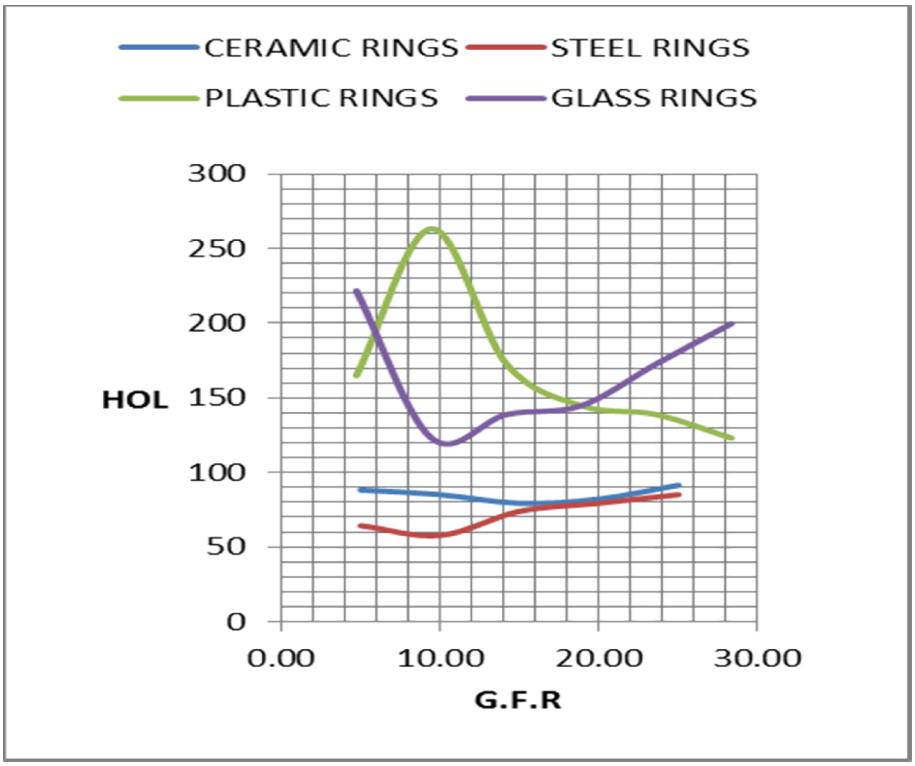

Figure 1 straight line equations and graphical trends of packing studied (CO2 absorption)

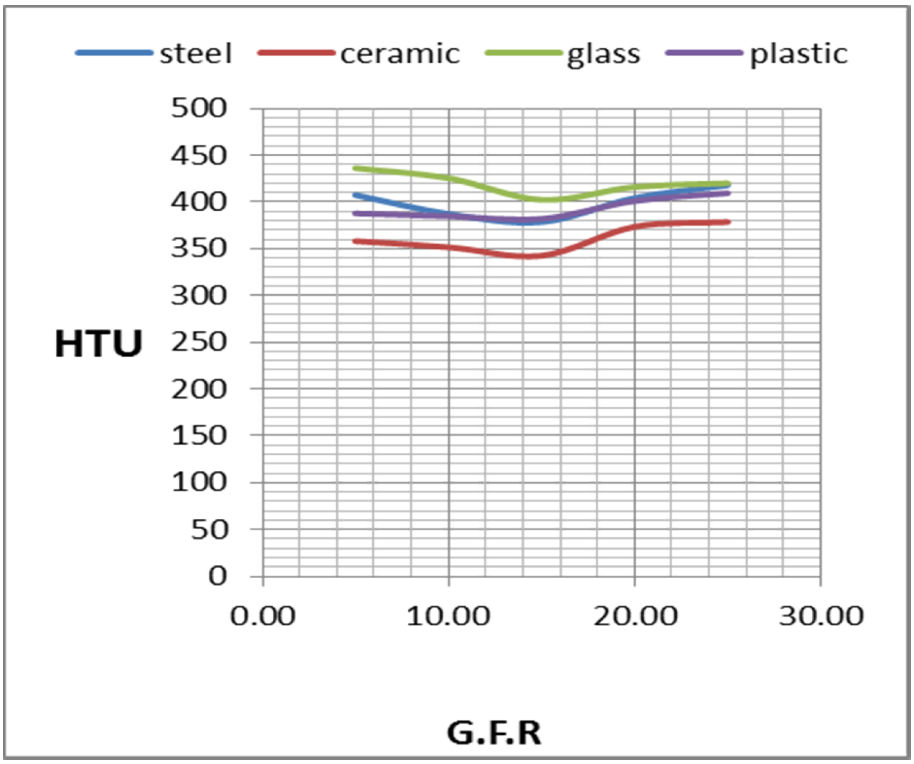

Figure 2 straight line equations and graphical trends of packing studied (O2 absorption)

Table 1 Relationship between G.F.R and H.T.U for the packing studied (CO2 absorption)

Type of packing	Relationship between GFR and HTU
Ceramic	$HoL = 84.249e^{0.0007GFR}$
Steel	$HoL = 54.797e^{0.0176GFR}$
Plastic	$HoL = 232.38e^{-0.022GFR}$
glass	$HoL = 154.78e^{0.0032GFR}$

Table 2 Relationship between G.F.R and H.T.U for the packing studied (O2 absorption)

Type of packing	Relationship between GFR and HTU
Ceramic	$HoL = 342.49e^{0.0034GFR}$
Steel	$HoL = 387.59e^{0.0019GFR}$
Plastic	$HoL = 375.47e^{0.003GFR}$
glass	$HoL = 432.33e^{-0.0022GFR}$

3.2 NUMBER OF TRANSFER UNITS

Higher the value of height of transfer unit, lower the value of number of transfer units and vice versa.

Results show that steel rings, when employed, require the highest number of transfer units and are more efficient than the other packing.

3.3 SURFACE AREA

Taking 0.5in size as an example, contact surface area is 368, 417, and 374 m^2/m^3 for ceramic, steel and carbon respectively. This clearly shows that metal rings offer better surface area and thus greater transfer characteristics. However, a packing providing a large surface area may not necessarily result in good mass transfer unless the liquid is distributed uniformly over the surface of the packing.

3.4 WETTING RATE

Wetting rate = (volumetric liquid rate per unit cross sectional area of column)/ (packing surface area per unit volume of column). Wetting rate is critical because if it is too low per unit area or is unevenly applied, it will cause poor performance in all distillation and mass transfer columns. If an area of the packing goes dry, a hot spot will be created and the material will coke and plug up the packing. Wettability for a rough surface is greater than that for a smooth one. Better results for steel rings in our experiment can be attributed to their higher wetting rate as compared to other packing.

3.5 FREE SPACE

Although the free space in the case of metal rings is greater than that for ceramic rings (table-4), for small columns, this difference is not so significant.

4 CONCLUSIONS

The following conclusion can be deduced from the experiments performed: The values of effective interfacial area offered by Raschig rings of different materials vary to some extent. Steel rings hold sway over ceramic rings but the difference is not much. Glass rings and plastic rings come third and fourth respectively and are way behind in performance. Ceramic raschig rings and steel rings have high density and mechanical strength and can thus be stacked in larger quantities to improve the required process. In Raschig rings ceramic is a better option than plastic or metals due to high tolerance levels against high heat and strong acids. The right packing can be very helpful in increasing contact area as well as enhancing liquid gas distribution without sudden drop in pressure. This results in savings in energy as well as optimized mass transfer.

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Removal of dyes from textile waste water using adsorption by activated carbon of rice husk

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ABSTRACT: Results of removal of dyes from textile waste water using adsorption by activated carbon of rice husk are being presented. This research work is based on case study of waste water treatment plant of koh-e-noor textile industry located in Pakistan. Dyes used in research were Congo red and Magenta. Two parameters (agitation time and adsorbent dose) were selected to investigate the % age removal of dyes. Both of the dyes selected are hygienic, cause skin irritation and allergic dermatitis. It was found that the %age removal of both dyes increased as agitation time and adsorbent dose increased. The %age removal of Congo red was 88% and magenta was 85% by different agitation time, while in case of different adsorbent dose, the % age removal of Congo-red was 69.3% and magenta was 95.3%. It was observed that both of these dyes can be removed by activated carbon of rice husk. These results showed that adsorption by activated carbon of rice husk is a good economical method for the removal of dyes.

KEYWORDS: Textile waste water, dyes, Congo red, magenta, activated carbon, rice husk, removal of dyes, adsorption method, agitation time.

1 INTRODUCTION

Textile waste water contains caustic soda, starch, detergents, wax, pigments, and dyes. Presence of these pollutants increases Biochemical oxygen demand (BOD), chemical oxygen demand (COD), solid contents and toxicity of textile waste water. This untreated waste water is discharged by textile mills into municipal or industrial sewers as well as nearby drains and stagnant ponds. Environmental Protection Agency (EPA) has become effective in Pakistan. Textile waste water should be discharged after proper treatment and in compliance with National Environmental Quality Standards (NEQS). Textile industries in Pakistan are trying to find economical and best possible methods of waste water treatment.

2 TREATMENT METHODS FOR REMOVAL OF DYES

Main Methods/technologies for color removal can be divided into three categories, provided below. All of them have advantages and drawbacks. These methods of color removing are as under;

1. Biological treatment
2. Chemical treatment
3. Physical treatment

A lot of research work has been done on textile waste water treatment. Marrot and Roche [1] have given more than hundred references on textile waste water treatment. Pala and Tokat [2] studied the adsorption processes (on activated carbon, Biological sludges). Malik and Sanyal [3] described the methods like chemical coagulation, air floatation and adsorption for the removal of dyes. Basibuyuk and Forster [4] studied that AZo dyes are not prone to biodegradation under aerobic conditions. Halliday and Beszedits [5] treated textile mill waste water by adding PAC (Powder Activated Carbon) to

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activated sludge. Brower and Reed [6] showed that color of industrial origin cannot be removed by using municipal biological treatment processes. Balarubramanya [7] used anaerobic, batch fermentation method to treat willow dust residue, a solid cellulose textile waste. Panswad and Wong chaisuwan [8] showed that magnesium carbonate hydrated basis was better than alum and quick lime for removing reactive dye because of synergistic sorbing capacity of Mg (OH) 2 and CaCO3. Kannan and Sundaram [9] studied the adsorption of canto red on various activated carbons. P.K Malik [10] used activated carbons prepared from sawdust and rice-husk for adsorption of acid dye, acid yellow 36 and concluded that their adsorption capacity was reasonable good. He used adsorbent dose, pH and contact time as the basis. Namasivayam and Kavitha [11] studied the removal of Congo red from water by adsorption onto activated carbon prepared from coir pith, an agricultural solid waste. Gregorio Crini has done a lot of work on adsorption for the removal of dyes from waste water in the last decade. He Studied adsorption of dyes on betacyclodextrin polymer [12], non-conventional Low cost adsorbents for dye removal [13], Application of chitosan, a natural amino polysaccharide, for dye removal from aqueous solutions by adsorption processes using batch studies [14], Flour of Corn for dye removal from pulp and paper effluents [15], Preparation, characterization and sorption properties of cross-linked starch-based exchangers [16], the adsorption of several types of dyes on Cross-linked polysaccharides derivatives [17], starch-based modified filters used for the removal of Dyes from waste water [18].

3 EXPERIMENTAL

First of all I prepared the stock solutions (1000 mg per liter) of dyes (Congo-red and magenta). Then prepared the standard solution from the stock solution (10 to 100 mg/ liter) and measured absorbance using visible spectrophotometer. From the data obtained drew the calibration curves (between concentrations versus absorbance) at the wavelength for maximum absorbance (max = 497, 510 nm for Congo red and magenta). Took 30 ppm concentrated solution of Congo red dye and added activated carbon 0.1 gram into the solution. Transferred the solution into the magnetic shaker and observed the change in concentration from the absorbance of the solution with respect to time (interval 5 minute).Drew the graph between agitation times versus percentage removal of dye. Noted down the qt which is the amount of dye absorbed at any time t. Also drew the graph between logs (qeqt) versus time and find out the date of absorption. Took 65 ppm concentrated solution of magenta dye from the stock solution. Added Activated carbon from 0.1 gram to 1.0 gram into the solution. Put the solution into magnetic shaker and shake the solution for 5minutes. Found out the concentration with the help of absorbance. Drew the graph between percentage removal of dye and adsorbent dose and noted down the qt which is the amount of dye absorbed at any time t? Also drew the graph between log (qe-qt) versus time and determined the date of absorption.

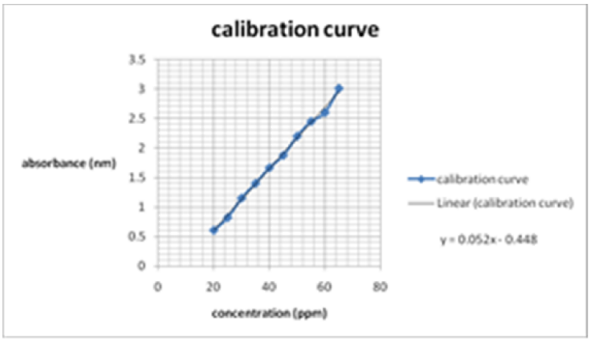

Figure 1 calibration curve

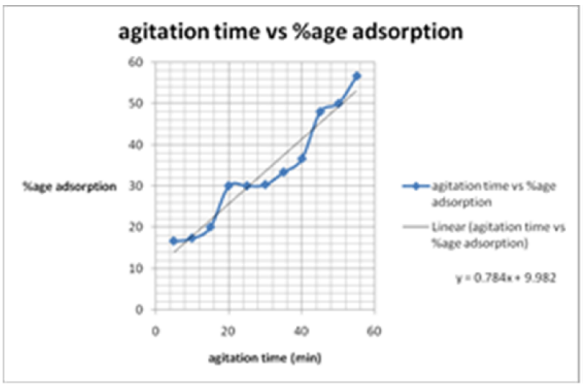

Figure 2 effect of agitation time on %age adsorption for congo red

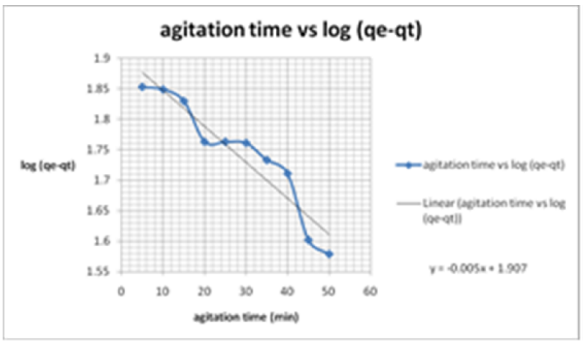

Figure 3 residual concentration of dyes as a function of time

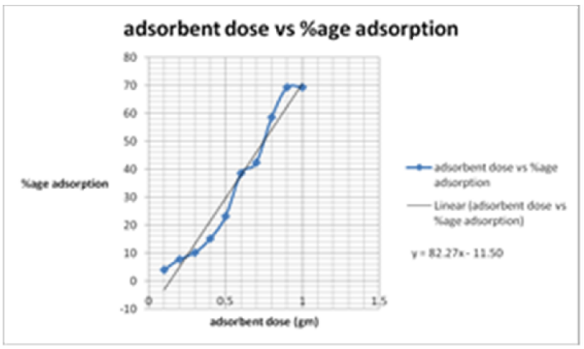

Figure 4 effect of adsorbent dose on %age adsorption for congo red

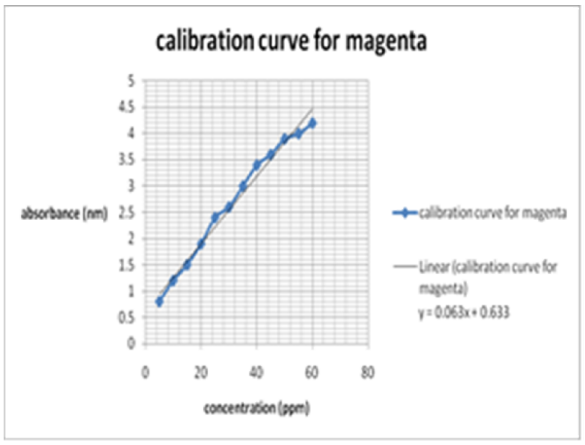

Figure 5 Calibration curve for magenta

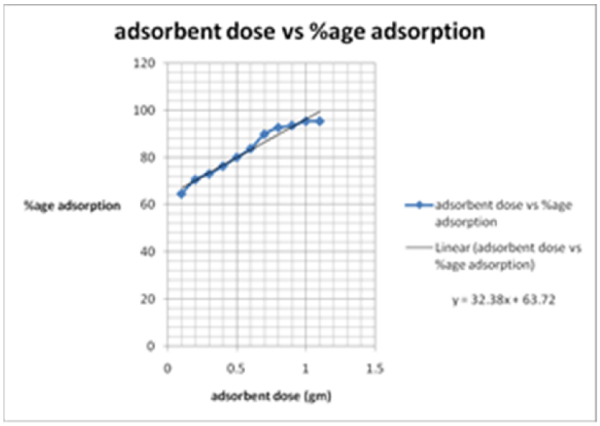

Figure 6 effect of agitation time on %age adsorption for magenta

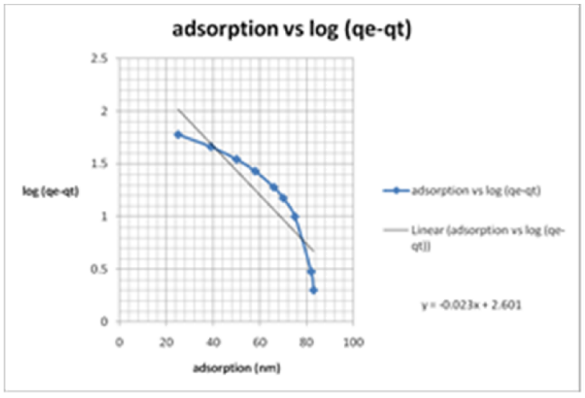

Figure 7 Kinetic model of absorption

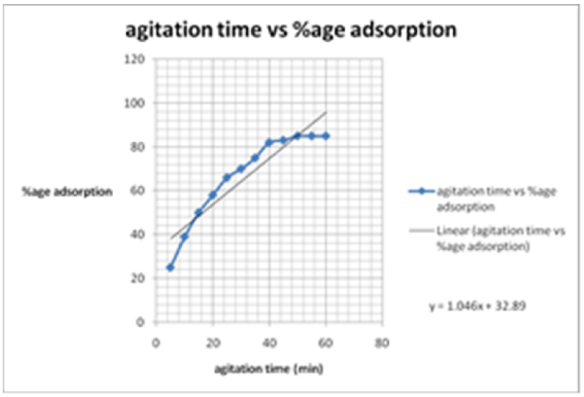

Figure 8 effect of adsorbent dose on %age adsorption for magenta

4 RESULTS AND DISCUSSION

The adsorption of dyes was investigated by using the two parameters.

1. Agitation time
2. Adsorbent dose

4.1 CALIBRATION

Calibration curve data (figure-1) shows that as the concentration of Congo red dye is increased the absorbance is also increased. Curve b/w concentration of Congo red and absorbance is a straight line, which shows the maximum absorbance against Congo red solution. The calibration curve shows beers law is obeyed in concentration range (0.5 65 mg). Figure-5 shows that Calibration curve of magenta dye is straight line. The calibration curve shows that as the concentration of solution increased absorbance is also increased.

4.2 EFFECT OF AGITATION TIME

The samples of Congo red and magenta of initial concentrations 30mg/l were taken in flask and treated with 0.1 gm. of adsorbent dose. Effect of contact time and initial dye concentration on adsorption of Congo red is shown in figure-2. It shows that the graph b/w agitation time and %age adsorption is straight line which shows that as the agitation time increased % age adsorption is also increased. Data shows that the increase in %age adsorption is slow in start but as time passed increase in % age adsorption is also increased the variation in % age adsorption of dye occurring due to the elapse time is shown. it is evident from the graph that activated carbon of rice husk treatment result in 50% removal of Congo red in 55 min which increased up to 88% in the 70 min while the figure-6 shows that removal of magenta is 75% in 35 min which increased up to 85% in 65 min. It is due to the formation of monolayer coverage on the outer surface of the adsorbent [9]. The increase in the rate of color removal with agitation time may be attributed to a decrease in the diffusion layer thickness surrounding the adsorbent particles.

4.3 ADSORPTION DYNAMIC

Adsorption dynamics were studied using various concepts of rate controlling step. Figure-3 shows that the rate of adsorption of Congo red solution is 0.00187307, the equilibrium time is determined by series of measurements. The curve shows the residual concentration of dyes as a function of time. Results show that within one hour, adsorption reaches complete equilibrium. Figure-7 shows that rate of adsorption of Magenta is 0.02329min^{-1} **For Congo red kad =** min^{-1}**is 0.008173007**

For magenta red kad = min^{-1}**is 0.02329**

4.4 EFFECT OF ADSORBENT DOSE

The effect of adsorbent dose is also investigated for the removal of dyes from the aqueous solution. Take Congo red and magenta of initial concentration 65 mg/l and treat with different adsorbent dose from 0.1 gm. to 1.1 gm. with keeping other

parameters constant. Figure-4 and figure-8 show that %age adsorption is increased as adsorbent dose increases. Data and graph describes that the increase in %age adsorption is linear. It shows that 1 gm. of activated carbon of rice husk is required to remove the 65ppm solution of Congo red dye. It is observed that after some time adsorption of dyes become constant; the % age adsorption of Congo red is 69.3% at 0.9 g dosage % age adsorption of magenta is 95.3% at 1 g dosage. Graphs show that the % age adsorption of dyes increase due to the adsorbent dose because it is known as fact that more adsorbent dose is more helpful to absorb the dyes from its solution and at last a point reaches where the maximum adsorption is done at specific dose. This dose is considered as constant parameter.

5 CONCLUSIONS

I adopted the adsorption method by using activated carbon of agricultural waste (i.e. rice husk) and found that it is the best economical method for the removal of dyes. Efficiency can certainly be improved and more research is recommended in this area. During the performance, I selected only two dyes (Congo red, magenta). Research on other dyes using the same method can help in analyzing the effectiveness of the process still further. Agitation time and adsorbent dose were the parameters I worked on and found that %age adsorption is directly proportional to both of them. There are various other parameters whose effect should be investigated and results analyzed to make an even better assessment.

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Molecular Characterization of Selected Landraces of Rice for Salt Tolerance Using SSR Markers

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ABSTRACT: Salinity stress is the major constraint in rice production. Selection for salinity tolerance genotypes of rice based on phenotypic performance alone is less reliable and will delay in progress in breeding. Recent advent of molecular markers, microsatellites or simple sequence repeats (SSRs) were used to find out salt tolerant rice genotypes. In this study three selected SSR markers viz. RM336, RM510 and RM3412 were used to screen the germplasm for salt tolerance. For genotyping rice germplasm, DNA was extracted from leaf samples using CTAB mini-prep method. The number of allele per locus was 10, with an average number of 10 per locus. The average gene diversity of overall SSR loci for the 25 genotypes was 0.8693, ranging from 0.8608 to 0.8768. The PIC values for 3 SSR markers varied from 0.8456 (RM336) to 0.8645 (RM510) with an average PIC of 0.8556. Unweighted Pair Group Method of Arithmetic Means (UPGMA) dendrogram, constructed from Nei's genetic distance produced three distinct clusters of 25 rice genotypes which is very much similar to Principal Component Analysis (PCA). It can be concluded that Jamai naru, Kajol shail, Hogla, Khak shail, Tal mugur, BINA dhan8 were salt tolerant compared to FL 478 because they showed a lower similarity value with FL 478. Marker RM510 showed the highest level of diversity due to high PIC value. This scientific information could be used for selection of suitable parents and development of salt tolerant rice varieties as well.

KEYWORDS: Saltol, Gene diversity, Genetic distance, microsatellite markers, Principal Component Analysis, UPGMA dendrogram.

1 INTRODUCTION

Rice is a highly polymorphic crop species with wide geographic distribution [1]. It is one of the most important world food crops, serving as the staple food for over one-third of the world's population [2]. It serves as the principal source of nourishment for over half of the global population and is the most important cereal crop. Rice breeders are increasingly challenged in the new century to meet the rapidly growing food demands of an increasing human population. Presently, growers in many regions have extended cultivation into marginal lands where salinity levels in soils are above thresholds affecting rice growth and yield. These instances, along with water conservation practices such as irrigating crops with marginal quality water have increased the need for genetic improvement of salt tolerance in rice. Unfortunately, there exists tremendous variation for salt tolerance within the species of rice [3]. Salinity ingress has lead to deterioration in the environment in the coastal areas with adverse implication on agriculture [4]. Progress in salinity tolerance breeding is slow due to the following aspects as limited knowledge in the genetics of tolerance, complexity of the several tolerance mechanisms involved, inadequate screening techniques, low selection efficiency and poor understanding of salinity and environmental interactions [5], [6]. Breakthrough in salinity tolerance breeding became feasible after the identification of major chromosomal regions (Qualitative trait loci, QTLs) underlying salinity (Saltol) stresses, the development and use of marker system for their speedy incorporation into modern high yielding and popular varieties through marker assisted

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backcrossing [7]. With the recent development in the field of molecular marker analysis, it is now feasible to analyze both the simple inherited traits and the quantitative traits and then identifying the individual genes controlling salinity tolerance which could facilitate selection in rice for this low heritable trait [8]. Looking into the above facts, the present investigation was carried out with the objective of assessing the presence and level of genetic diversity among O. sativa cultivars and for identifying microsatellite markers for salinity resistance genes.

2 MATERIALS AND METHODS

The experiment was conducted at the glasshouse, experimental field and Biotechnology Laboratory of Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh from May 2012 to March 2013. A total of 25 traditional and improved rice germplasm were collected to carry out the objectives of this research work. List of the rice genotypes are presented in Table 1.

Table1. List of rice genotypes used in the experiment

SL. No.	Genotypes	Origin and Identity	Source of Collection
1	Hogla	Satkhira	Bangladesh Institute of Nuclear Agriculture (BINA)
2	Jamai Naru		
3	Dakh Shail		
4	Patnai		
5	Kute Patnai		
6	Holde Gotal		
7	BazraMuri		
8	Ghunshi		
9	Tal Mugur		
10	Nona Bokhra		
11	Khak Shail		
12	Jota Balam		
13	Hamai		
14	Karengal		
15	Mondeshor		
16	Nona Kochi		
17	Kajol Shail		
18	Bhute Shalot		
19	Kashrail	Noakhali	
20	BINA dhan 8	IRRI	
21	FL 478		
22	BINA dhan 7		
23	Pokkali		
24	Jolkumari	Patuakhali	
25	Kalo Mota		

25 rice genotypes obtained from the Biotechnology Division of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh were used for molecular analysis. Total DNA was extracted from three weeks old seedlings by Cetyl Trimethy Ammonium Bromide (CTAB) method [9]. DNA concentration was measured using Spectrophotometer. For this study DNA quantification was done at central library of Bangladesh Agricultural University and the absorbance was taken at 260nm. 2000 µl dH_2O and 2µl DNA was used for this purpose. Each polymerase chain reaction was carried out in 13.0 µl reaction volume containing 1.5 µl 10x Buffer, 1.0 µl dNTPs, 1.0 µl Primer forward, 1.0 µl Primer reverse, 0.25 µl Taq polymerase, 7.25 µl ddH_2O and 1µl genomic DNA using Eppendorf and Applied biosystem thermal cyclers. Thermal cycler programme for PCR comprised 95ºC for 5 minutes for initial denaturation, followed by 36 cycles of 95ºC for 45 seconds, 55 to 65ºC for 45 seconds, 72ºC for 45 seconds and ending up with 7 minutes at 72ºC for the final extension. The annealing temperature was adjusted based on the specific requirements of different primer combinations. The PCR products were resolved by electrophoresis in 2 agarose gel containing 0.5 g/mL of Ethidium Bromide prepared in 1X TBE buffer at a constant voltage of 80v for period of 2h. The gel was visualized in UV transilluminator and documented using SYNGENE GENESNAP G-BOX gel

documentation system. Ethidium bromide staining of agarose gels generally revealed a multiple number of bands. The size of the most intensively amplified band for each microsatellite marker was determined based on its electrophoretic mobility relative to molecular weight marker (25 bp). Amplified products from microsatellite analyses were scored qualitatively for presence and absence of each marker allelegenotype combination. The SSR bands amplified by using given primers were further treated as a unit character. The data were entered into a binary matrix as discrete variables (e.g., 1 for presence and 0 for absence of character). The relevant primers were employed on the basis of polymorphism extent. The Polymorphic Information Content (PIC) value of the used marker was calculated by following a method developed by Anderson *et al.*, [10]. The pair-wise comparisons of the cultivars based on the proportion of unique and shared amplification products (alleles) were used to measure the genetic similarity by Dice coefficients. The Dice coefficients were employed by using Simqual sub-program in similarity routine of software NTSYS-pc version 2.2 (Exeter Software, Setauket, NY, U.S.A.) software package. The estimation of genetic similarity (F) were calculated by following the method described elsewhere [11]. The resultant similarity matrix data was employed to construct a dendrogram by using Sequential Agglomerative Hierarchical Nesting (SAHN) based on unweighted pair-group method with an arithmetic average (UPGMA) to infer genetic relationships and phylogeny among cultivars. The principal component analysis (PCA) was also done by using the subroutine EIGEN. All computations were done by using the NTSYS-pc, Version 2.2 package [12]. Further details are available elsewhere [13].

3 RESULTS AND DISCUSSION

3.1 DNA AMPLIFICATION AND CULTIVAR IDENTIFICATION

A total of ten microsatellite or SSR markers (i.e. RM 315, RM 7102, RM 336, RM 337, RM 3412, RM 510, RM 10890, RM 6737, RM 493 and RM 315) covering all 12 chromosomes were utilized to characterize and assess genetic diversity among thirty five rice varieties from different location of Bangladesh. Amplification profiles as revealed by RM337, RM3412, RM510 across a number of cultivars used is depicted in Figure 1,2,3. In this study, a considerable variability was found among different cultivars. In most of the cases, FL478 and other salt tolerant cultivars exhibited similar banding patterns. The used markers showed several bands, which were shared among the FL478 and other salt tolerant cultivars. Contrarily, the salt tolerant and non - salt tolerant cultivars of rice shared a few bands. The cultivar Jamai naru, Kajol shail, Hogla, Khak shail, Tal mugur, BINA dhan8 displayed unique bands in comparison with all other nonsalt tolerant genotypes. Many primers showed characteristic fragments in this cultivar, which were not produced in any of the other nonsalt tolerant cultivars used. Microsatellite markers have been used to investigate genetic diversity of a large number of cultivars in rice [14]. It has shown high levels of polymorphism in many crops including rice (*O. sativa* L.), wheat (*Triticum aestivum* L.), and maize (*Zea mays* L.). Kanawapee *et al.,* [15] evaluated genetic diversity of the 30 rice cultivars for salinity tolerance during the seedling stage using RAPD and simple sequence repeats (SSR) markers.

3.2 GENETIC DIVERSITY

According to Nei's [16], the highest level of gene diversity value (0.8768) was observed in loci RM510 and the lowest level of gene diversity value (0.8608) was observed in loci RM336 with a mean diversity of 0.8693 (Table 2). It was observed that marker detecting the lower number of alleles showed lower gene diversity than those which detected higher number of alleles which revealed higher gene diversity. The other primer showed a gene diversity value of 0.8704. The maximum number of repeats within the SSRs was also positively correlated with the genetic diversity. This result is consistent with previous work done by Heenan *et al.,* [17], who observed that the gene diversity at each SSR locus was significantly correlated with the number of alleles detected, number of repeat motif and with the allele size range.

3.3 PIC VALUES

Expected heterozygosity amongst 25 rice genotypes was observed in the range of 0.8456-0.8645, where in the marker RM 510 revealed the highest value of 0.8645 (Table 2). The average expected heterozygosity was 0.8556. The present result corroborates with the results of Davla *et al.*, [18], where molecular characterization of rice (*Oryza sativa* L) genotypes for salt tolerance using microsatellite markers including RM 336 was performed. Among the primers used in the present study, RM510 is highly informative since it recorded high PIC value (0.8645).

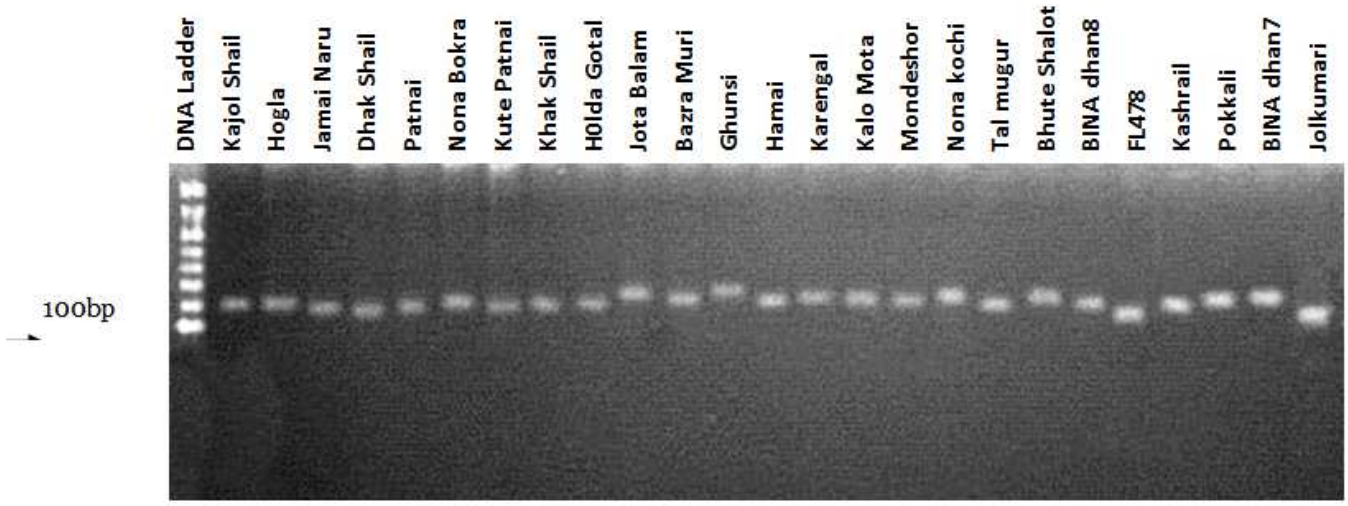

Fig.1. SSR Profiles of 25 Genotypes of Rice Using Primer RM336 (Ladder = 100bp)

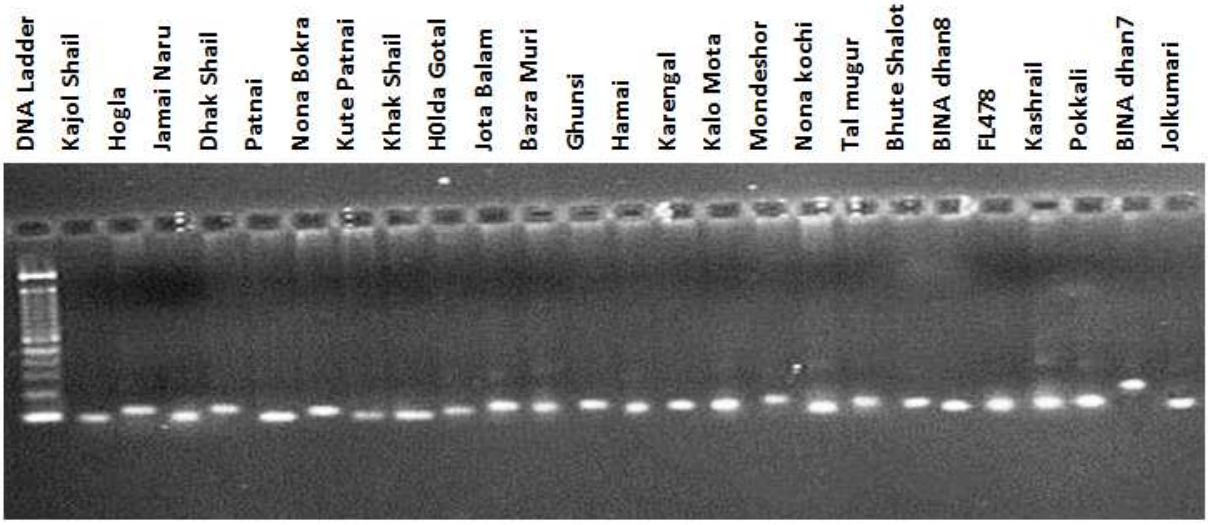

Fig. 2. SSR Profiles of 25 Genotypes of Rice Using Primer RM510 (Ladder = 100bp)

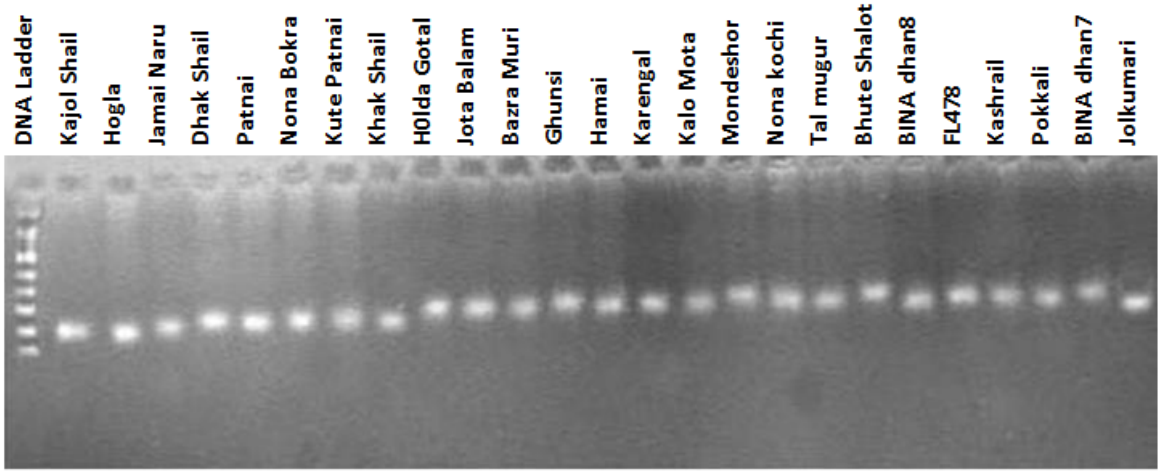

Fig. 3. SSR Profiles of 25 Genotypes of Rice Using Primer RM3412 (Ladder = 100bp)

The markers showed an average PIC value of 0.8556 which indicated that SSR markers used in this study were highly informative because only PIC values higher than 0.5 indicate high polymorphism. Markers with PIC values of 0.5 or higher are highly informative for genetic studies and are ex-tremely useful in distinguishing the polymorphism rate of a marker at a specific locus [19]. All loci are revealing a high degree of diversity among the accessions.

Table 2. Data on repeat motif, number of alleles, number of rare alleles, polymorphism information content (PIC) value and gene diversity) found among 25 rice genotypes for 3 microsatellites (SSR)

Locus	Repeat Motif*	Allele Size ranges(bp)	Difference (bp)	No. of alleles	PIC	Gene Diversity
RM336	(CTT)8	131-235	104	10	0.8456	0.8608
RM510	(GA)15	100-266	166	10	0.8645	0.8768
RM3412	(CT)17	164-338	74	10	0.8569	0.8704
Mean				10	0.8556	0.8693

** = Motif of the SSR and number of repeats as previously published on http://www.gramene.org*

3.4 NUMBER OF ALLELES AND ALLELE SIZE FREQUENCY OF ALLELES

The allele length for this 3 SSR markers varied from 100-338bp, whereas the highest allele length was recorded for RM 3412 338bp. In respect of primer RM336, allele size ranged from 131bp - 235bp, whereas primer RM510 showed a range 100bp - 266bp and primer RM3412 gave a range from 164bp - 338bp (Table 2). A total of 30 alleles were detected with an average number of alleles of 10 per locus (Table 3). Nearly similar observation was found by Thomson *et al.,* [20], where they got that the number of alleles per locus ranged from 4 alleles to 31 alleles with an average of 13 alleles per locus. Jain *et al.,* [21] got as like similar observation of number of allele per locus ranged from 3 to as high as 22 with average number of allele per locus 7.8. The allele frequency produced by different markers was20%. Similar results were also obtained by Singh *et al.*, [22].

Table 3: Size and frequency of alleles at 3 SSR loci of 25 rice germplasms

Sl. No.	Locus	Allele size	Allele Frequency
1	RM337	131	0.0400
		140	0.0400
		149	0.0800
		159	0.0800
		170	0.2000
		181	0.1600
		193	0.0400
		206	0.2000
		220	0.0400
		235	0.1200
2	RM 510	100	0.0800
		105	0.1200
		125	0.0800
		133	0.1200
		141	0.0800
		149	0.2000
		158	0.1600
		168	0.0800
		188	0.0400
		266	0.0400
3	RM3412	164	0.0400
		174	0.0400
		209	0.1200
		222	0.0800
		235	0.0400
		318	0.1600
		338	0.1600
		359	0.0800
		381	0.2000
		405	0.0800

3.5 GENETIC DISTANCE-BASED ANALYSIS

Pair-wise comparison value of Nei [23] genetic distance (D) between varieties was computed from data of 3 primers and ranged from 0.333 to 1.000 (Table 4). The higher genetic distance between them indicates that genetically they are diverse compare to lower genetic distance value. Basically this value is an indication of their genetic dissimilarity. Variety pair with higher value is more dissimilar than a pair with a lower value. The lower genetic distance (0.333) was observed in Holde Gotal vs. Bazra Muri, Bazra Muri vs. Ghunshi, Karengal vs. Mondeshor, Nunnia vs. Kali Boro, Chinisail vs. Kali Boro, Jamai Naru vs. Hari and Jamai Naru vs. Kute Patnai variety pair indicating that they are genetically much closer among the varieties. Most of the varieties of lowest genetic distance were collected from Satkhira, only Kalomota and Jolkumari were collected from Patuakhali. But it was observed that, varieties of Satkhira and Patuakhali showed a lower genetic distance with other varities from Satkhira and Patuakhali. FL 478 showed a higher genetic distance with most of the varieties except Holde Gotal, Bazra Muri and Hamai. A subset of 3 rice groups (including traditional and evolved Basmati and semi dwarf non-Basmati) was analyzed by using 19 SSR loci and 12 inter-SSR-PCR primers by Nagaraju *et al.*, [24] and they observed that the lowest genetic distance was among the traditional Basmati varieties, whereas the EB varieties showed the highest genetic distance by both the marker assays and they also reported that average genetic distance for the *indica* and *japonica* were 0.675 and 0.484 respectively. The means of genetic distances between germplasms were used to evaluate the genetic diversity of different germplasms. Dhar *et al.*, [25] concluded that the values of pair-wise comparisons of Nei, [23] genetic distance (D) between varieties were computed from combined data for the 6 primers which ranged from 0.200 to 1.000.

3.6 SIMILARITY INDEX BASED ANALYSIS

A similarity index determines how closely the current plant community resembles either the potential natural community or some other reference community. The similarity index provides a distinct measurement in germplasm screening and diversity analysis after Nei genetic distance based analysis. In this study, the similarity value was ranged from 0.000 to 0.667 (Table 5). When the value is zero, it indicates that, there is no similarity between the variety pair. Highest similarity value was observed mostly between those varieties pairs which showed lowest genetic distance value in Nei genetic distance based analysis. Similarity Index value of 0.6667 was observed in Jota Balam vs. Bazra Muri, Jota Balam vs. Ghunsi, Bazra Muri vs. Holda Gotal, Talmugur vs. Pokkali, Talmugur vs. BINA dhan 7, Jamai Naru vs. Kuta Patnai and Dhak Shail vs. Bute Shalote. The lowest similarity value was observed in most of the varieties just as the highest genetic distance was observer in most of the varieties. Similar values of 0.77 to 0.98 were detected among 16 accessions of traditional, long-grain Iranian rice and 7 cultivars from other countries [26]. Similarity coefficients ranging from 0.36 to 0.96 were obtained among 45 accessions of AA-genome *Oryza* species from various locations suggesting a wider range of genetic variability [27]. As expected, similarity coefficients among 193 accessions of parental lines used at IRRI obtained from 26 countries were relatively low ranging from 0.22 to 0.68 [28].

3.7 GENETIC SIMILARITY ANALYSIS USING UNWEIGHTED PAIR GROUP METHOD OF ARITHMETIC MEANS (UPGMA) AND PRINCIPAL COMPONENT ANALYSIS

The The multivariate nature of SSR markers has the unambiguous advantage of discriminating genotypes more precisely. The UPGMA analysis could reveal allelic richness of three clusters (Fig.4) for various sizes at a similarity coefficient level of 0.12. Among them Jamai naru, Kajol shail, Hogla, Khak shail, Tal mugur may be chosen as a parent for hybridization with any of the land races from other divergent cluster involving land races. SSR analysis resulted in a more definitive separation of cluster of genotypes indicating a higher level of efficiency of SSR markers for the accurate determination of relationships between accessions that are too close [29]. Grouping based on SSR markers, in general, agreed with the parental pedigree information provides indispensable information regarding the genetic diversity among the genotypes. Varieties and lines sharing the common ancestry were clustered in to the same group, indicating the efficiency of SSR markers in detecting the genetic diversity in rice [22].The PCA was also done to determine the genetic relationships among the rice varieties from different regions of Bangladesh (Fig. 5). The groupings identified by PCA were very similar to those identified by the UPGMA cluster analysis. Of 25 rice genotypes 7 cultivars formed a distinct cluster in the right side of the diagram, formed a distinct cluster in the right side of the diagram, separated from the main cluster. This cluster corresponded to the 8 varieties that appear as a major group in Fig.5. A second group of 18 genotypes corresponded well with the second and third group of varieties in the dendrogram.

Table 4. Summary of (Nei's, 1973) Genetic Distance Values for 25 Rice Germplasms

Genotypes	Kajol Shail	Jota Balam	Bazra Muri	Ghunsi	Hamai	Karengal	Kalo Mota	Mondeshor	Nona Kochi	Tal Mugur	Bhute Shalot	Hogla	BINA Dhan 8	FL 478	Kashrail	Pokkaly	BINA Dhan 7	Jolkumari	Jamai Naru	Dakh Sail	Patnai	Nona Bokra	Kute Patnai	Khak Sail	Holda Gotal
Kajol Shail	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.67	1.00
Jota Balam	1.00	0.00	0.33	0.33	1.00	0.67	0.67	1.00	1.00	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67
Bazra Muri	1.00	0.33	0.00	0.67	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.33
Ghunsi	1.00	0.33	0.67	0.00	0.67	0.33	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hamai	1.00	1.00	0.67	0.67	0.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00	1.00	1.00	1.00	0.67	1.00	1.00	1.00	0.67	1.00	1.00	0.67
Karengal	1.00	0.67	0.67	0.33	0.67	0.00	0.67	0.67	1.00	1.00	1.00	1.00	1.00	0.67	1.00	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Kalo Mota	1.00	0.67	0.67	1.00	1.00	0.67	0.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	0.67	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	0.67
Mondeshor	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Nona Kochi	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.00	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67
Tal Mugur	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.67	0.67	0.67	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00
Bhute Shalot	1.00	0.67	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.67	1.00	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hogla	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	1.00	0.00	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67
BINA Dhan 8	1.00	1.00	1.00	1.00	0.67	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.00	0.67	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
FL 478	1.00	0.67	0.67	0.67	1.00	0.67	1.00	1.00	1.00	0.67	1.00	1.00	0.67	0.00	0.67	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Kashrail	0.67	1.00	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.33	0.67	0.67	0.67	0.67	0.00	0.67	1.00	0.67	1.00	1.00	1.00	1.00	1.00	0.67	1.00
Pokkaly	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	0.33	1.00	1.00	0.67	0.67	0.67	0.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
BINA Dhan 7	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	0.67	1.00	1.00	1.00	1.00	0.67	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Jolkumari	1.00	1.00	1.00	0.67	0.67	0.67	0.67	1.00	1.00	1.00	0.67	1.00	1.00	1.00	0.67	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Jamai Naru	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.67	1.00	0.67	0.33	0.67	1.00
Dakh Sail	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.00	0.67	0.33	1.00	1.00	1.00
Patnai	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.00	1.00	0.67	1.00	1.00
Nona Bokra	1.00	1.00	0.67	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.33	1.00	0.00	1.00	1.00	0.67
Kute Patnai	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	1.00	0.67	1.00	0.00	0.67	1.00
Khak Sail	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	0.67	1.00	1.00	1.00	0.67	0.00	1.00
Holda Gotal	1.00	0.67	0.33	1.00	0.67	1.00	0.67	1.00	0.67	1.00	1.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.67	1.00	1.00	0.00

Table 5. Similarity index of 25 rice germplasms

OTU	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	1.00																								
2	0.00	1.00																							
3	0.00	0.67	1.00																						
4	0.00	0.67	0.33	1.00																					
5	0.00	0.00	0.33	0.33	1.00																				
6	0.00	0.33	0.33	0.67	0.33	1.00																			
7	0.00	0.33	0.33	0.00	0.00	0.33	1.00																		
8	0.00	0.00	0.00	0.00	0.00	0.33	0.33	1.00																	
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.00																
10	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00															
11	0.00	0.33	0.00	0.33	0.00	0.00	0.33	0.00	0.00	0.00	1.00														
12	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	1.00													
13	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.33	0.00	0.00	1.00												
14	0.00	0.33	0.33	0.33	0.00	0.33	0.00	0.00	0.00	0.33	0.00	0.00	0.33	1.00											
15	0.33	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.67	0.33	0.33	0.33	0.33	1.00										
16	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.67	0.00	0.00	0.33	0.33	0.33	1.00									
17	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.33	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.33	1.00								
18	0.00	0.00	0.00	0.33	0.33	0.33	0.33	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	0.00	0.00	1.00							
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00						
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.00					
21	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.00				
22	0.00	0.00	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.67	0.00	1.00			
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.33	0.00	1.00		
24	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0..33	0.00	0.00	0.33	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.33	1.00	
25	0.00	0.33	0.67	0.00	0.33	0.00	0.33	0.00	0.33	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	1.00

1=Kajol Shail, 2= Jota Balam, 3=Bazra Muri, 4=Ghunsi, 5= Hamai, 6=Karengal, 7=Kalo Mota, 8=Mondeshor, 9= Nona Kochi, 10=Tal Mugur, 11=Nona Bokra,12= Hogla,13= BINA dhan 8, 14= FL 478, 15= Kashrail,16= Pokkali, 17=BINA dhan 7, 18=Jolkumari, 19=Jamai Naru, 20=Dhak sail, 21=Patnai, 22=Bute Shalot , 23=Kute Patnai, 24=Khak Shail, 25=Holda Gotal

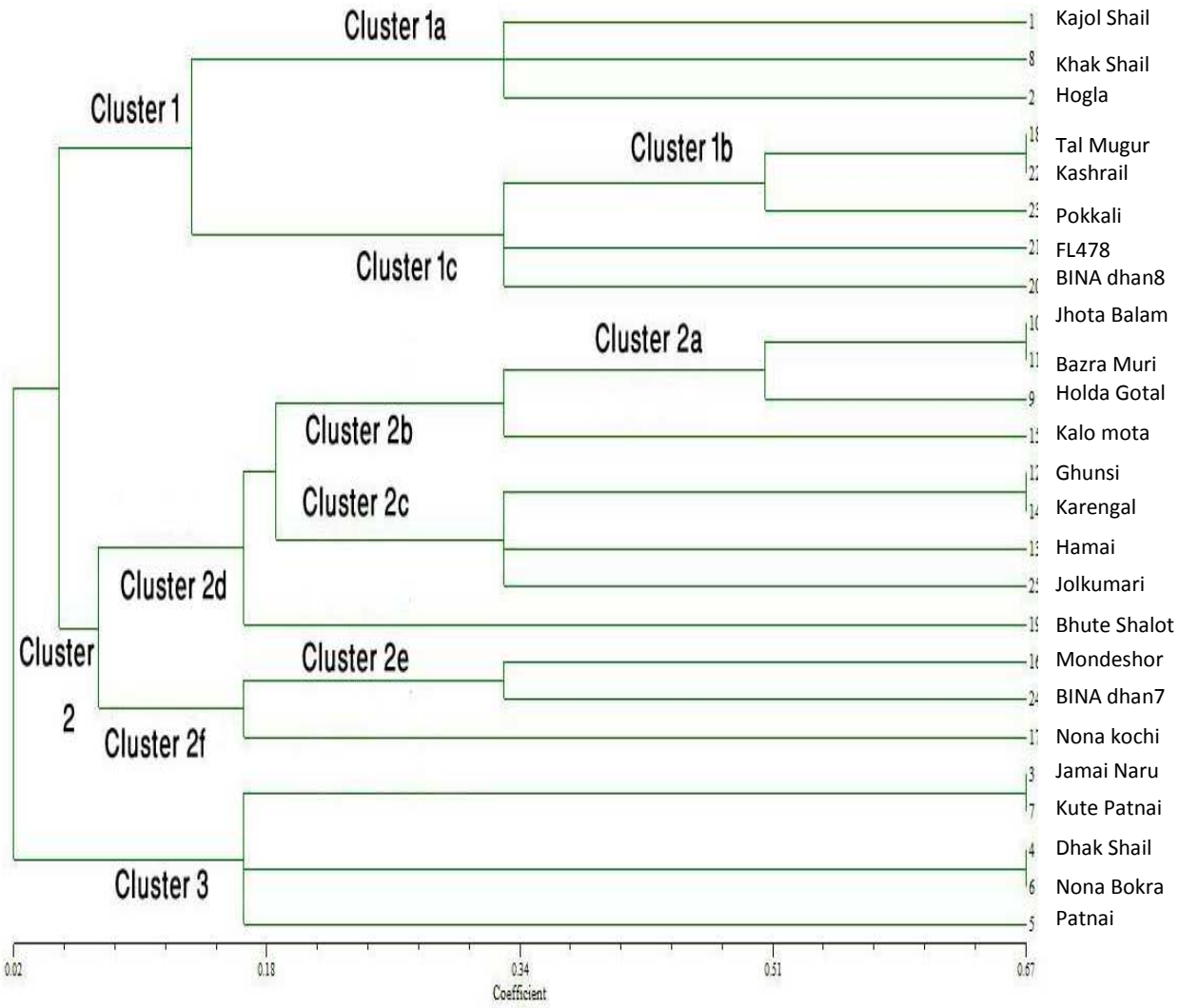

Fig. 4. Dendrogram for 25 rice germplasms derived from a UPGMA cluster analysis

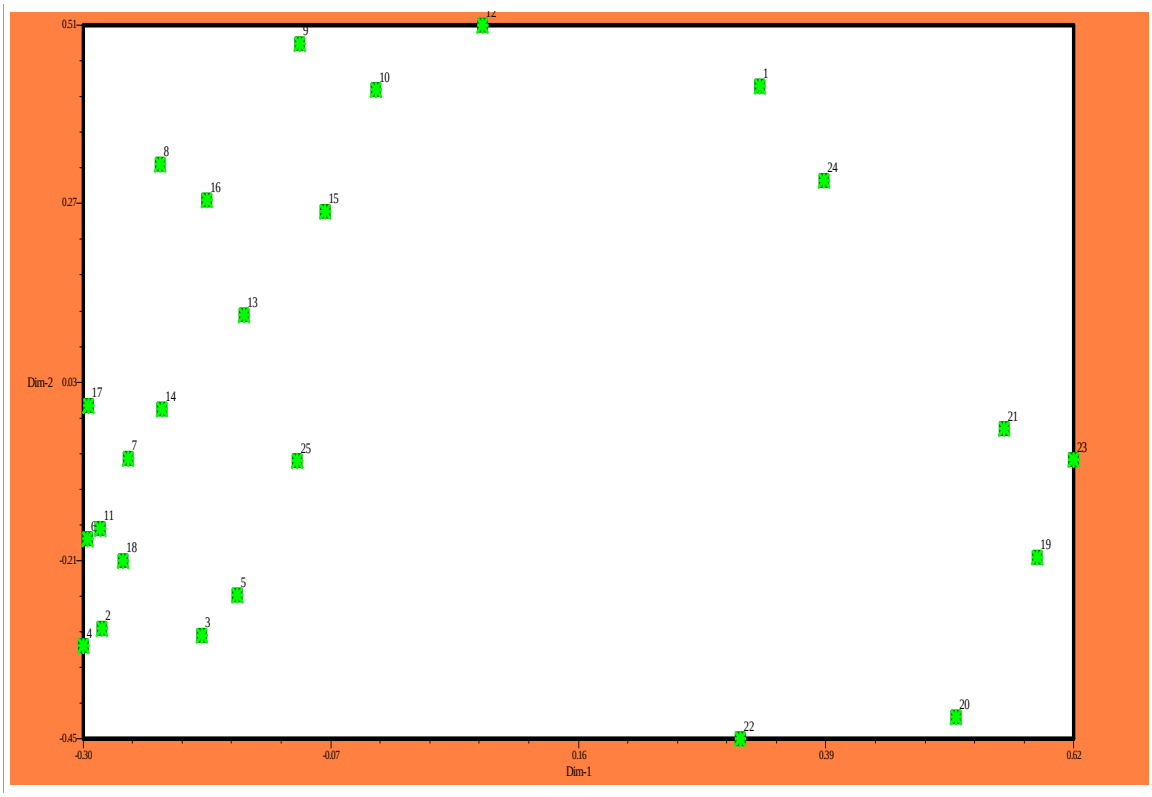

Fig.5. Principle Component Analysis grouping of 25 O. sativa species based on pooled SSR markers

1=Kajol Shail, 2= Jota Balam, 3=Bazra Muri, 4=Ghunsi, 5= Hamai, 6=Karengal, 7=Kalo Mota, 8=Mondeshor, 9= Nona Kochi, 10=Tal Mugur, 11=Nona Bokra,12= Hogla,13= BINA dhan 8, 14= FL 478, 15= Kashrail,16= Pokkali, 17=BINA dhan 7, 18=Jolkumari, 19=Jamai Naru, 20=Dhak shail, 21=Patnai, 22=Bute Shalot , 23=Kute Patnai, 24=Khak Shail, 25=Holda Gotal

4 CONCLUSION

The present study showed average number of alleles of all the rice genotypes were 10 over the three microsatellite loci. The Unweighted Pair Group Method of Arithmetic Mean (UPGMA) dendrogram based on Nei [21] genetic distance, resulted in three major clusters with several sub cluster. Through the present study, a total of 25 variety's specific alleles were identified with specific SSR primer. The result of the present study would be useful to know genetic variation, population structure, parentage assessment, genome mapping, Marker Assisted Selection (MAS), forensics, stock purity, etc. of different populations of the studied species before undertaking any breeding any breeding program, and also will be used as baseline information for further study. However, more extensive molecular data is needed in order to draw and conclusive remarks about the relationship between rice cultivars. Large number of samples would be necessary to determine if there are inherent differences in genetic distance between the rice cultivars. Moreover, using higher number of markers would give a clear idea about the genetic variation and genetic diversity which might be of greater interest for the plant breeders for the development of rice varieties. The results derived from analyze of genetic diversity at the DNA level could be used for designing effective breeding programs aiming to broaden the genetic bases of commercially grown varieties.

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Enjeux de l'aménagement linguistique dans le milieu scolaire à Yaoundé

[The issues of linguistic development in school in Yaoundé]

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ABSTRACT: Language management in Cameroon and its challenges for the Cameroonian school is an always topical subject, more than fifty years after reunification. The formalization of French and English helped relegate local languages to a domestic role. What has caused the death of several of them. To preserve the national heritage, and promote these languages, the Government has decided to introduce them into education. The words of this article, built from the perspective of linguistic development and which is essentially based on field investigations and a multidisciplinary approach, is to analyze the implications of the teaching of the national languages in school, under the perception that children have of the languages of their environment. On the one hand, the results obtained show that representations and family attitudes towards native languages have consequences on representations and attitudes of students towards these languages, and their level of proficiency in these languages; On the other hand, students place great importance to the status of languages. It thus follows the need to legitimize the relationship with these native languages to promote the success of such an undertaking.

KEYWORDS: Attitudes, Representations, Perception, National language, Official language, Linguistic.

RESUME: L'aménagement linguistique au Cameroun et ses enjeux pour l'école camerounaise est un sujet toujours d'actualité, plus de cinquante ans après la réunification. L'officialisation du français et de l'anglais a contribué à reléguer les langues locales à un rôle domestique. Ce qui a entrainé la mort de plusieurs d'entre elles. Afin de préserver le patrimoine national, et promouvoir ces langues, le gouvernement a décidé de les introduire dans l'enseignement. Le propos de cet article, construit sous l'angle de l'aménagement linguistique et qui s'appuie essentiellement sur des enquêtes de terrain et une approche pluridisciplinaire, est d'analyser les implications de l'enseignement des langues nationales à l'école, au regard de la perception que les enfants ont des langues de leur entourage. Les résultats obtenus révèlent d'une part que, les représentations et les attitudes familiales à l'égard des langues d'origine ont des conséquences sur les représentations et les attitudes des élèves à l'égard de leurs langues d'origine, et leur niveau d'aptitude dans ces langues ; D'autre part, les élèves accordent beaucoup d'importance au statut des langues. Il en résulte donc, la nécessité de légitimer la relation avec ces langues maternelles pour favoriser le succès d'une telle entreprise.

MOTS-CLEFS: Attitudes, représentations, perception, langue nationale, langue officielle, Linguistique.

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1 INTRODUCTION

1.1 CONTEXTE ET JUSTIFICATION

Principal moteur du développement économique, social et culturel, l'éducation est en crise dans nombre de pays africains. On note un taux élevé d'abandons, des problèmes d'accès et de parité, l'insuffisance de rendement des systèmes éducatifs. Certains linguistes se sont interrogés sur le dysfonctionnement des systèmes éducatifs, en s'attardant particulièrement sur la discontinuité sociolinguistique entre l'environnement familial de l'enfant et le milieu scolaire. Cependant, à la fin de l'entreprise coloniale, la République Fédérale du Cameroun établit l'anglais et le français comme langues officielles et promeut le bilinguisme individuel total anglais/français dans le système éducatif. En portant le choix sur ces langues comme langues officielles du Cameroun fédéral, les premiers dirigeants camerounais ont entériné ainsi une situation déjà très funeste aux langues du terroir. De nombreuses recherches en linguistique révèlent cependant que :

> L'enseignement des langues nationales et dans les langues nationales permet de l'avis des psychologues et des didacticiens, de rendre l'école plus conviviale pour l'enfant et de réduire les déperditions importantes enregistrées au début du cycle primaire, déperditions essentiellement imputables à la non maîtrise de la langue d'enseignement. (MBASSI, 1992 : 31)

L'acquisition du langage et l'apprentissage des langues premières sont donc essentiels à la maîtrise des disciplines non linguistiques. Il est de ce fait évident qu'une pédagogie consistant à faire des seules langues française et anglaise, les langues d'alphabétisation n'est pas adaptée à la réalité culturelle et linguistique des apprenants camerounais. Ceci leur barre inévitablement l'accès à un enseignement de qualité et indubitablement au savoir lui-même. C'est la position défendue par BOT BA NJOCK au séminaire de Libermann en 1974, en ces termes :

> L'emploi en milieu linguistique négro-africain d'une langue d'enseignement indo-européenne constitue pour les enfants un obstacle souvent insurmonté et pour l'enseignement, une des causes principales de son faible rendement.

Récemment, les autorités camerounaises ont reconsidéré leur position vis-à-vis des langues nationales. Divers textes de lois, programmes et résolutions officiels de recherche en vue de la promotion des langues du terroir ont été lancés, d'où la décision autrefois utopique d'intégrer les langues nationales dans le système éducatif au Cameroun. Les Ministère de l'Éducation Nationale et des Enseignements Secondaires à qui incombent le devoir de généraliser la pratique de l'enseignement des langues nationales s'attèlent à créer des écoles pilotes dans toutes les régions, et des partenariats avec les structures compétentes en la matière telles que l'ANACLAC, la SIL ou encore les Universités. C'est ainsi que, depuis 2008, un département de langues et cultures camerounaises à été crée à l'École Normale Supérieure de Yaoundé, afin de former des professeurs de langues et de cultures nationales au savoir nécessaire. Une première phase dite expérimentale de l'enseignement des langues et cultures nationales a déjà été lancée dans cinq lycées, auprès d'élèves en première année du secondaire, sur l'étendue du territoire camerounais. C'est dire que le système éducatif du pays en fait une priorité idéologique. La principale raison qui justifie la mise en œuvre de cet enseignement, est la nécessité d'enraciner l'apprenant dans sa culture. Étant donné que l'école constitue l'un des lieux et l'un des moyens par excellence de la transmission du patrimoine, l'école camerounaise doit être ancrée dans les acquis des cultures, les savoir-faire linguistiques, les technologies et les productions littéraires et artistiques endogènes. La langue apparaît ainsi comme un instrument essentiel au développement et à l'épanouissement de l'être humain. Cette initiative de grande envergure, suscite notre plus grand intérêt, d'autant plus que le Cameroun est un des Etats les plus plurilingues d'Afrique, et compte autant de langues qu'il y'a de groupes ethniques[1]. Par ailleurs, la langue représente partout l'élément fondamental de la vie d'un peuple car elle sert de véhicule à la culture des peuples qui la parlent. C'est le noyau autour duquel se constituent les ensembles culturels. A l'aube de l'intégration effective de l'enseignement des langues nationales au Cameroun, il semble plus que nécessaire d'être au fait des représentations et attitudes des principaux concernés par cet enseignement, afin d'évaluer leurs aptitudes et degré d'enracinement dans leur culture, et de prévoir le succès d'une telle entreprise. Quelles sont les attitudes et représentations des élèves, à l'égard de l'enseignement des langues d'origine à l'école ? Qu'est-ce que les élèves pensent des langues qu'ils

[1]Les enquêtes sociolinguistiques antérieures y ont dénombrés 239 langues (M. Dieu et P. Renaud, 1983 :352), puis 248 langues (R. BRETON et BIKIA FOHTUNG, 1991 : 11).

parlent ? Et quel peut ou pourra être le rôle de ces opinions sur l'apprentissage de ces langues ? Subséquemment, nous chercherons à savoir, quelle est la pertinence de l'intégration des langues dans le système éducatif au Cameroun ?

1.2 OBJECTIF

L'objectif que poursuit la présente contribution est alors d'évaluer la pertinence de l'enseignement des langues nationales à l'école, au regard de la perception que les enfants ont de ces langues. Nous formulons d'ores et déjà comme hypothèses que d'une part, les attitudes et représentations face aux langues locales, auront un impact négatif ou favorable à la réussite de l'initiative d'insertion de ces langues dans le système éducatif ; D'autre part, si les élèves du secondaire sont plus favorables à l'apprentissage des langues officielles au Cameroun, cela pourrait mettre en péril l'enseignement des/en langues nationales à l'école.

1.3 DÉFINITIONS DES TERMES CLÉS

Les notions d'*attitudes* et de *représentations sociales* ont été étudiées à la fois séparément et ensemble. Au fil des recherches et des années, ces notions initialement inhérentes à la psychologie sociale, sont parvenues à expliquer divers phénomènes dans divers autres domaines, parmi lesquels celui de la linguistique. *Attitudes et représentations linguistiques* relèvent de l'*imaginaire linguistique*. Cette dernière est définie ici à la fois comme un ensemble d'images et de représentations que l'on se fait de Soi et de l'Autre à travers la langue, et comme un mode de créativité langagière aboutissant, par le travail de l'imagination, à l'invention des formes et des sens nouveaux. L'inventivité, qui recèle un aspect esthétique et poétique autant que cognitif, doit être considérée à la fois comme une contribution à la dynamique des langues et comme un mode de rénovation de la parole ou de l'écriture, littéraire ou non. L'imaginaire linguistique concerne donc aussi bien l'attitude envers l'Autre et son parler que l'aptitude du sujet parlant (ou écrivant) à imaginer, façonner, inventer, créer de nouvelles formes linguistiques ou, plus largement, langagières. Au travers des réponses que les élèves auront données à nos questions, notre étude tentera de montrer l'incidence des attitudes et représentations linguistiques dans l'acquisition des langues locales, selon que Marie DOLLE écrit ***« …la représentation des langues joue un rôle déterminant, non seulement dans le choix de la langue mais dans la manière de l'utiliser*** » (Marie DOLLE, 2001 : 21).

Ainsi, en linguistique, l'expression *attitudes linguistiques* fait référence à différentes variations comportementales observées au sein d'un groupe ou d'une communauté qui ont trait aux représentations faites des langues. Les attitudes linguistiques reflètent les impressions, les préférences, les opinions, les sentiments qui animent les individus suite à la répartition fonctionnelle des langues de leur répertoire. BITJA'A KODY (2000 : 56) qui reprend D. LAFONTAINE (1986 : 9-18) affirme qu'il s'agit de :

> Comment le locuteur évalue, juge, jauge, perçoit, conçoit, estime, se représente les réalités et les variétés linguistiques… tels sont les phénomènes … que le sens commun et la plupart des spécialistes englobent dans la vaste catégorie des attitudes linguistiques … on désigne par-là les jugements de valeur individuels sur la langue, la façon dont l'individu évalue les productions linguistiques d'autrui et les siennes propres, ainsi que les représentations qu'il se fait de différents phénomènes linguistiques

Par conséquent, on associera une image positive aux langues qu'on aime, et une image négative à celles auxquelles on attache très peu d'intérêts. De ce fait, les représentations linguistiques englobent toutes les images que les locuteurs ont des langues qu'ils parlent. La population d'étude a été restreinte aux élèves du secondaire de certains établissements scolaires de la capitale du Cameroun. L'approche du terrain scolaire a été renouvelée par des recherches récentes en sociolinguistique, aussi bien sur le plan méthodologique que sur le plan théorique. Alors que ce milieu a été conçu avant tout comme un lieu de transmission et d'imposition des normes dominantes (BOURDIEU 1982 : 36), des chercheurs ont mis en exergue l'intérêt du champ scolaire comme lieu de confrontation et de négociation des normes sociales et linguistiques : ce champ représente un microcosme au sein duquel se nouent des rapports sociaux (entre classes, entre sexes, entre groupes ethniques, etc.) qui se traduisent à travers la variation sociolinguistique. Comme l'a démontré ECKERT (2000 : 44 - 46), l'enseignement secondaire correspond pour les adolescents à une période cruciale au cours de laquelle ils sont amenés à se constituer une identité sociale et à adopter une attitude donnée par rapport aux normes linguistiques en concurrence. Par ailleurs, la ville est le cadre de la majorité des recherches sociolinguistiques contemporaines parce qu'elle constitue le lieu par excellence de la rencontre de pratiques sociales et linguistiques diverses (CALVET 2002).

1.4 REVUE DE LA LITTÉRATURE

Les recherches sur les attitudes et les représentations linguistiques sont nombreuses et variées, notamment dans le domaine de l'éducation. Une grande partie des études sur les attitudes linguistiques a consisté à évaluer le statut et les usages d'une langue en particulier auprès de populations. Quant aux représentations linguistiques, c'est surtout dans le domaine de l'éducation que l'on retrouve des écrits.[2] Plusieurs recherches pertinentes en Europe et en Amérique, nous ont permis de mieux concevoir notre objet de recherche. Danièle MOORE (1994) a mené une étude auprès d'élèves bilingues âgés de 14 à 15 ans, d'origine indo-pakistanaise dans des écoles secondaires d'une petite ville du nord de l'Angleterre. Un premier groupe d'écoles valorise clairement les langues d'origine des élèves, alors que l'autre ne le fait pas. Toutefois, MOORE explique que la langue d'origine n'est pas *neutre* non plus. En effet, celle-ci peut-être issue de groupes dominés et par conséquent peut engendrer une image fortement négative de soi (1994 : 130). Il est intéressant de constater que dans les écoles où les langues d'origines sont dévalorisées, les élèves bilingues apprennent le français, pour se *revaloriser* par le choix d'une langue dite prestigieuse, en parallèle à l'apprentissage de leur langue d'origine (idem : 135). Finalement, cette étude montre entre autres, que ce n'est pas autant la langue en soi, mais le statut qu'elle occupe dans l'école qui influence les attitudes des élèves sur la langue d'enseignement, la langue d'origine et les autres langues dans le milieu. L'étude de HELLER (1999) pousse beaucoup plus loin l'analyse de ce phénomène de la langue légitime, s'inspirant de la théorie de BOURDIEU (1977) sur l'économie des échanges linguistiques. Elle a conduit une recherche ethnographique dans une école française secondaire en Ontario afin de comprendre les représentations linguistiques de ses élèves. On y retrouvait des francophones ontariens bilingues (anglais/français), des francophones québécois ayant immigré en Ontario, des francophones internationaux et d'allophones/anglophones. La langue légitimée par l'école est le français, mais pas toutes les variétés de français. C'est en fait, le français dit *« international »*, qui a la plus grande légitimité. Au fil des conversations entre les jeunes, on réalise les conséquences de ce fait sur l'identité linguistique de ces différents jeunes, ainsi que sur les relations sociales qu'ils entretiennent au sein de cette école. Il est donc très clair que la langue qui sera légitimée dans l'école aura une influence sur la façon dont les élèves construisent leurs représentations d'autres langues.

En Afrique, Saint CHAMAS (2005) présente une étude des comportements langagiers dans les milieux diglossiques : en analysant le cas de l'Algérie. Les représentations sociolinguistiques langagières ont pris une place privilégiée dans les recherches portant sur les attitudes, les comportements, et les fonctionnements linguistiques. Le problème est d'autant plus complexe en Algérie que les représentations langagières se développent dans un pays où l'arabe est la seule langue officielle, à côté d'une autre, non encore institutionnalisée (le français), malgré sa présence, même par des degrés différents dans les institutions étatiques et non étatiques. Au Cameroun, BITJA'A KODY (2000b), (2000c), démontre à partir des résultats d'enquêtes, que les langues officielles et surtout le français gagnent de plus en plus de terrain dans tous les secteurs d'activités. L'auteur constate que les langues nationales jadis utilisées dans les foyers et d'autres situations de communication, sont aujourd'hui fortement supplantées par le français dont toutes les couches sociales participent à l'expansion à travers un usage quotidien. L'étude révèle aussi que bon nombres de jeunes (plus de 30%) ont pour seule langue de communication le français.

1.5 MÉTHODOLOGIE ET CADRE THÉORIQUE

La présente recherche offre par conséquent la possibilité de dépasser une des limites des travaux antérieurs sur la situation sociolinguistique de Yaoundé. Elle va plus en profondeur en tentant de connaître le comportement adopté à l'école par une catégorie, face à l'enseignement des langues locales et la multiplicité des langues qui sont parlées autour d'eux. SINGY (1997) affirme que c'est à l'âge de douze ans à peu près que les enfants semblent devenir de plus en plus conscients du jeu des normes qui régulent les pratiques linguistiques qui sont utilisées dans la société. Il ajoute que les attitudes sont intégrées et développées à partir de cet âge et sont affirmées vers l'âge de 18 ans (SINGY, 1997 : 279). L'étude des représentations et des attitudes envers les langues d'élèves de 6^{e} et 5^{e} est donc tout à fait intéressante, dans la mesure où nous sommes au début du processus de construction chez l'enfant. Manifestement, quelle que soit la matière : mathématiques, physique, français, chimie, les attitudes et représentations sont considérées comme déterminantes pour ce qui est de la motivation, ainsi que de la réussite ou de l'échec des élèves dans ces disciplines. Théoriquement, l'idée que les gens se font d'un objet social influence les rapports qu'ils entretiennent avec ce dernier. Et parce que « *le langage*

[2]En effet, plusieurs recherches ont démontré un impact important des attitudes et représentations des élèves sur leur apprentissage des langues (CAIN et DEPIETRO, 1997 : MATTHEY, 1997), surtout de l'allemand en Europe (MULLER, 1997).

représente un certain type d'institution sociale » (PERROT, 1953 : 116), il n'échappe pas à cette règle : les gens s'en font une idée. Le langage est un objet de représentations sociales, les croyances qui l'entourent ont des conséquences sur les individus.

Cette recherche s'inscrit dans le cadre théorique de la macro / micro sociolinguistique[3], et s'appuie essentiellement sur une enquête empirique et une approche pluridisciplinaire. Cependant, si l'on examine les attitudes et représentations linguistiques qui peuvent paraître individuelles, parce que collectées auprès des sujets, c'est uniquement dans le but de mieux imputer les comportements langagiers en milieu plurilingue aux politiques linguistiques qui établissent des rapports durables entre le français et les langues identitaires.

Le rapport aux langues nationales va ainsi être montré, au travers de la perception de la compétence, de l'apprentissage dans ces langues, la perception des locuteurs de ces langues, enfin de l'usage présent et futur du rôle des langues en général. La démarche ici consiste à démontrer que toute représentation sociolinguistique repose sur une idée, dans la majorité des cas subjective, motivée par une représentation culturelle qui renvoie au milieu dans lequel l'individu évolue, et développe ses compétences et ses pensées. Le recueil de données dans le cadre de ce travail, s'est fait au moyens d'outils tels que le questionnaire : un questionnaire collectif destiné à tous les élèves, un autre destiné aux parents d'élèves ; Un guide pour les groupes de discussion. Ces données, ont été recueillies auprès de 2357 élèves camerounais des classes du secondaire de six (6) établissements scolaires reparties dans différents types de quartiers de la ville de Yaoundé.

2 RÉSULTATS

2.1 DIFFÉRENTES CARACTÉRISTIQUES DE L'ÉCHANTILLON

Tableau 1. Répartition des écoles échantillons

Types de quartiers	Etablissements scolaires	Nombre d'interviewés	Total par établissement en pourcentage
Populaire	Lycée d'Ekounou	468	19,8%
	Lycée d'Etoug Ebe	362	15,3%
Semi-Populaire	Lycée de Biyem-assi	453	19,2%
	Lycée Leclerc	386	16,4%
Résidentiel	Collège de la Retraite	392	16,7%
	Collège Vogt	296	12,5%

Tableau 2. Répartition de l'échantillon selon le sexe et le lieu de naissance

	Yaoundé	**Douala**	**Edéa**	**Bamenda**	**Dschang**	**Mbouda**	**Nkongsamba**	**Bafoussam**	ALC
filles	912	118	9	31	42	24	17	20	249
garçons	444	23	38	27	21	7	21	34	320
Total	1356	141	47	58	63	31	38	54	569
	57,53%	5,98%	1,99%	2,46%	2,67%	1,31%	1,61%	2,29%	24,14%

On peut remarquer que 57,53% seulement de notre population d'étude est née et est originaire de Yaoundé. Cette information est d'autant plus importante qu'il est question d'identifier les attitudes et les représentations des élèves de cette ville. Les 42,47% restant, constituent les enfants dont les parents ont émigré de différentes régions du pays et se sont installés à Yaoundé. La durée de résidence moyenne de ces derniers est de 9 ans. De l'analyse du corpus, il découle une structure du multilinguisme scolaire pouvant se repartir en 4 grands groupes ci-après :

[3]« *Dans une étude macro sociolinguistique, la recherche porte sur un ensemble géographique important (un pays par exemple) dont il s'agit d'étudier les usages linguistiques d'un point de vue social* **»** (Pierre DUMONT & Bruno MAURER, 1995 : 5-6). Or la micro sociolinguistique examine l'utilisation individuelle de la langue au sein de petits groupes.

- Le monolingue en langue française (MLF) : l'enfant qui ne parle que le français;
- Le bilingue en langue nationale et langue française (LN/LF) : l'enfant qui parle l'une des langues nationales et le français ;
- Le multilingue en langues nationales et langue française (MLN/LF) : l'enfant qui parle au moins deux langues nationales en plus du français.
- le multilingue en langues étrangères (MLE) : l'enfant qui parle plusieurs langues étrangères, y compris le français et l'anglais.

L'analyse générale des données concernant les langues parlées par les parents et par les élèves révèle quelques tendances intéressantes.

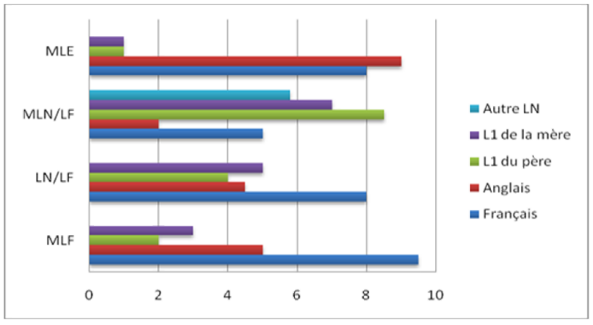
Tableau 3. Principales L1 et L2 parlées par les pères, mères et élèves

		français	duala	béti-fang	basaa	ghomala'	médumba	yamba	fufuldé	autr
Pères	L1	22,7	5,2	18,7	11,4	8,3	11,2	15,1	3,8	3,3
	L2	39,2	9,3	11,3	3,8	1,9	4,9	4,1	0,9	24
Mères	L1	21,4	5,6	18,0	11,2	8,0	11,1	14,8	2,6	6,9
	L2	38,1	6,6	19,6	2,1	3,6	4,9	4,6	0,3	19,9
Elèves	L1	48,7	2,6	11,3	5,6	7,7	4,4	4,6	3,0	11,6
	L2	52,2	1,4	6,5	0,3	2,2	0,5	1,1	0,08	35,4

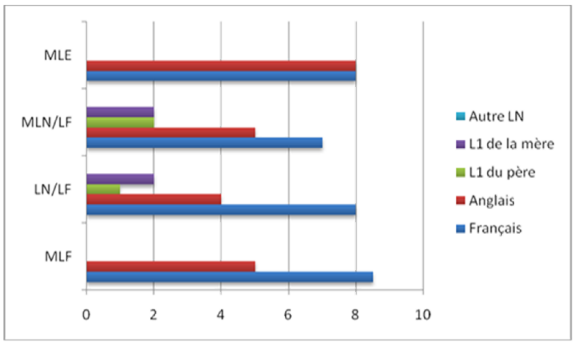
De nombreux élèves ont pour L1 le français, ce qui n'est pas le cas des parents. En linguistique générale, la langue maternelle (L1) désigne habituellement la première langue acquise de façon naturelle et dès le plus jeune âge, au moyen des interactions au sein de la famille. Or, d'après les données recueillies, la majorité des répondants a eu pour première langue de socialisation ou d'ouverture au monde la langue française (92,8%), laquelle est pour eux d'après la définition ci-dessus, leur langue maternelle. L'objectif étant de cerner principalement l'origine ethnique linguistique des enfants afin d'évaluer le rapport qui existe entre eux et leur(s) langue(s) ancestrales, il a fallu revoir l'expression à employer. La langue d'origine signifie généralement la langue qui est parlée durant l'enfance et qui est parlée par le groupe ethnoculturel dont la personne est issue. Dans la présente étude, le concept de langue d'origine est défini comme étant toutes les langues parlées par les parents et la famille élargie de l'enfant, car il s'agit ici, de comprendre la relation que l'enfant entretient avec la ou les langues parlées par le ou les groupes ethnoculturels de sa famille. Et donc, qu'elles parlent une, deux ou plusieurs autres langues, ces familles peuvent choisir de transmettre cet héritage linguistique aux enfants partiellement ou dans sa totalité. Il serait donc à propos, d'analyser le rapport qu'entretiennent les enfants avec une ou plusieurs langues d'origine et langues officielles, qu'ils les maîtrisent ou non.

2.2 LA PERCEPTION DE LA COMPÉTENCE

Graphique 1
Perception de la compétence orale des langues d'origine par rapport aux langues officielles



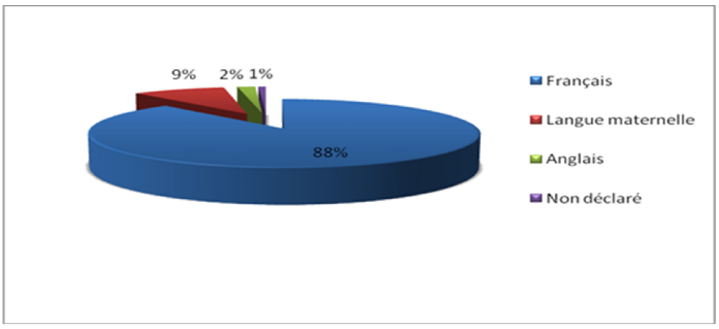
Graphique 2
Perceptionde la compétence écrite des langues d'origine par rapport aux langues officielles



Dans leur grande majorité, les apprenants se considèrent plus compétents en français et en anglais autant à l'oral qu'à l'écrit, qu'en langues locales.

2.3 LANGUE QUI PERMET DE MIEUX EXPRIMER SES IDEES

Graphique 3
Perception de la langue qui permet de mieux exprimer ses idées

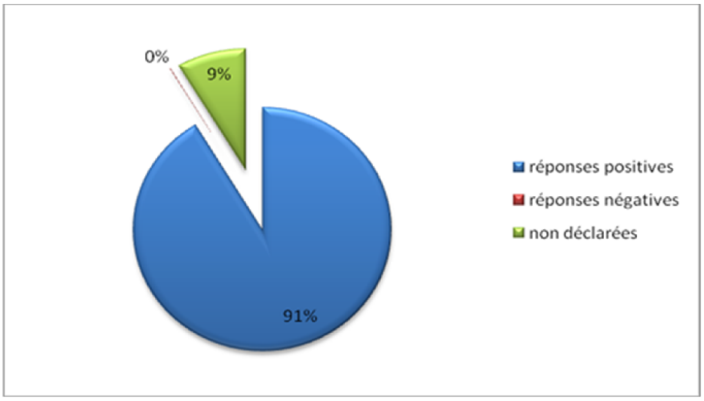


La langue française permet à 88% de mieux exprimer ses idées. 9% seulement peut le faire dans sa(es) langue(s) maternelle(s). Ce qui semble se dégager grosso modo des perceptions de ces écoliers sur leur maîtrise de leur(s) langue(s) d'origine, est une certaine lucidité quant à l'existence de ces langues et la conscience que leurs connaissances à ce propos sont limitées. Ce qui n'est pas le cas pour les langues étrangères, auxquelles ils portent beaucoup d'intérêt. Ceci amène à s'interroger sur la perception qu'ils auront de l'enseignement des langues locales à l'école.

2.4 PERCEPTION DE L'APPRENTISSAGE DES LANGUES NATIONALES

A la question « aimes-tu ta langue maternelle ? », presque tous les enfants répondent par l'affirmative, sans plus de commentaires. Le graphique qui suit (6), montre le rapport affectif que les élèves de l'échantillon entretiennent avec leur(s) langue(s) locale(s).

Graphique 4
Rapport affectif des élèves à l'égard de leur(s) langue(s) d'origine



En ce qui concerne le fait d'être enseigné dans leur(s) langue(s) d'origine à l'école, 62 avouent ne pas y être disposés, et 125 n'ont pas d'avis. Seulement 1967 se disent prêts pour cela. Ce qui nous fait un pourcentage de 83,4%, tant qu'il s'agit d'acquérir des connaissances en sa langue, et non pas apprendre d'autres matières dans cette unité linguistique.

2.5 PERCEPTIONS DE L'USAGE ET DU ROLE DE LA LANGUE MATERNELLE

Par ailleurs, on a voulu savoir comment les sujets situent leur langue d'origine dans un contexte plus général et quelles sont leurs réactions par rapport à cette position. Dans un environnement immédiat, la famille est le terrain par excellence de la cohabitation des langues. En effet, la connaissance des langues se forge dans le moule des pratiques langagières quotidiennes des membres de la famille vivant dans la même maison. De l'analyse des réponses données par les enfants, il ressort que, 45.3% font usage de leur langue d'origine à la maison. Il s'agit des « bilingue en langue nationale /française, et multilingues en langues nationales / langue française ». Il est a noté que cet usage de la langue, n'est aucunement exclusif. 27.4% de ces apprenants ont en commun le fait d'appartenir à des ménages endogamiques. Dans ces foyers, on note la volonté des parents de transmettre leur langue à leurs enfants. La LO_1 est d'après les données, à 99,2% prédominante dans les usages familiaux à Yaoundé. Toujours en rapport avec la cellule familiale, on a été curieux de savoir *quelle langue les élèves aimeraient que leurs enfants parlent dans le futur*. Les réponses obtenues sont plus ou moins mitigées. Le grand groupe constitué d'enfants ne parlant pas la L1 avouent vouloir que leurs enfants sachent parler l'anglais, l'espagnol, le chinois. Les raisons évoquées sont que ces langues symbolisent la réussite sociale. Elles sont à leurs yeux utiles. Tous les autres ont parlé de leur intention de continuer à parler leurs langues d'origine afin de maintenir le contact avec leur famille. À l'école, 82,3% des apprenants ne trouvent pas adapté de communiquer en langues locales, d'autant plus qu'ils ne comprennent pas les langues de leurs camarades. Ces langues serviraient à masquer des propos malveillants des uns aux autres. On a pu percevoir, un sentiment de gêne chez nos sujets quant à l'usage des langues d'origine à l'école. Dans un contexte plus large, comme au marché, dans les foires, au travail, la langue la plus utilisée est le français. Son usage est prédominant à 74,8% .

Le thème majeur à cet égard est le concept de langue minorisée. Les enfants pensent clairement qu'il y'a des langues qui sont plus importantes que d'autres, parce qu'on les utilise dans les médias et qu'elles sont parlées par un grand nombre de personnes, tandis que d'autres n'ont qu'un usage domestique. Cet état de choses, fait que les enfants ont tendance à dévaloriser les langues parlées par un petit groupe de locuteurs. La principale fonction reconnue à la langue d'origine, est celle de préserver l'identité, la culture. D'après tous les élèves qui parlent une langue nationale, celle-ci leur permet de savoir qui ils sont véritablement, quels sont les principes de vie et valeurs morales associés à leurs cultures. Cette langue leur accorde de percevoir le monde d'une manière particulière. Une autre fonction est le lien de rapprochement qu'elle permet d'entretenir avec parents, grands-parents et autres membres de sa communauté villageoise, qui ne s'expriment pas toujours en français. Cette fonction est importante dans la mesure où, parents et enfants entretiennent ainsi un lien fort, lequel les garde unis. La langue d'origine peut alors servir de code secret lorsqu'on se retrouve en public. Les parents peuvent alors communiquer des secrets à leurs enfants en public, en étant certains que seuls les destinataires de ces messages comprendront. C'est une fonction indispensable qui est reconnue par plusieurs élèves.

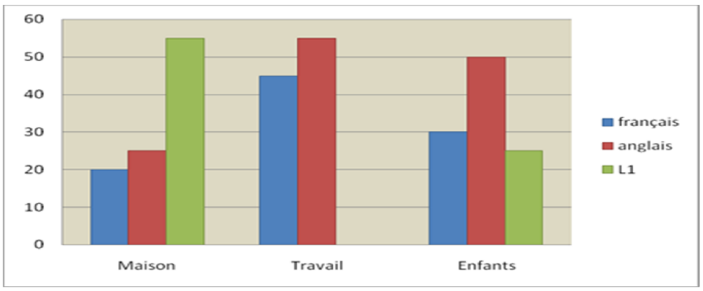
2.6 PERCEPTIONS DES LOCUTEURS DES LANGUES DU TERROIR

Il n'a pas spécifiquement été posé aux élèves de question leur demandant de décrire les locuteurs des langues d'origine. On a cependant pu noter lors du focus group discussion avec les élèves quelques remarques involontairement faites qui pourraient justifier entre autres, leur choix d'aimer certaines langues plus que d'autres. Des élèves de sexe masculin trouvent les filles *fulbés* très belles; D'autres trouvent que les *duala* ont du style, certains leur envieraient leur style de vie qui serait comme celui des occidentaux; D'aucuns pensent que les locuteurs du *yemba* seraient des personnes solidaires. Les enfants dans leur grande majorité trouvent que le « bamiléké » (expression qu'ils utilisent pour qualifier les langues de l'ouest en général) ferait mal aux oreilles. D'autres affirment que le basaa est la langue de personnes qui aiment à se disputer, parce que « *lorsqu'on entend des basaa parler on a l'impression qu'ils se disputent* » ; « *l'arabe est la langue des terroristes* ». Nous pensons que quelques-unes de ces observations sont davantage inspirées des adultes plutôt que des enfants, qui a priori n'auraient pas assez de vécu pour faire certaines remarques. Mais également, elles nous montrent que les enfants sont conscients de l'actualité et des évènements qui ont lieu autour d'eux. Ces derniers ont une incidence sur leur perception du monde et une influence sur leurs choix de vie, notamment des langues à apprendre pour ce qui est du cadre linguistique. Ces représentations que se font les enfants des locuteurs de certaines langues semblent avoir un impact non négligeable sur leur motivation à vouloir apprendre ces langues. En outre, toujours d'après notre échantillon, une langue est supérieure à une autre si ses locuteurs sont les plus riches. Les locuteurs de l'anglais et du français dans le monde semblent avoir une belle vie. Le français est parlé dans quelques pays européens tous développés, et l'anglais est parlé en Amérique, en Angleterre, en Australie, bref des sites du monde qui représentent pour eux le rêve, l'abondance, la richesse.

2.7 EMPLOI PROSPECTIF DES LANGUES

Après avoir inventorié les réponses de nos répondants sur la place qu'ils donneraient à l'anglais, au français et à leur langue d'origine dans leur vie future, on a pu dresser un graphique des usages linguistiques prospectifs.

Graphique 5
Usages linguistiques prospectifs



L'anglais et le français occupent une place plus ou moins équivalente pour ce qui est de son usage en milieu professionnel, et sont donc plus importants à inculquer à leurs enfants. Ce qui n'est pas le cas à la maison, où devrait dominer les langues maternelles.

3 CONCLUSION

L'objectif principal était d'évaluer la pertinence de l'enseignement des langues nationales à l'école, au regard de la perception que les enfants ont de ces langues. Pour apprécier le bien-fondé de cette initiative, un premier sous-objectif était d'identifier les représentations et les attitudes de quelques élèves vivant en milieu plurilingue, à l'égard de leur(s) langue(s) maternelle(s) /ou d'origine et des locuteurs de ces langues. Les élèves, qui baignent tous dans un environnement plurilingue, semblent avoir une vision particulière du plurilinguisme. Outre leur valorisation générale de celui-ci, les enfants bilingues ou plurilingues sont capables d'évaluer leurs compétences avec nuance, avouant leurs forces et leurs faiblesses dans chacune des langues. Leur perception rejoint un des arguments de COSTE (2001) cité par MARAILLET, E et.ARMAND, F., (2004), selon lequel les langues en présence ne sont à égalité ni en termes de degré de maîtrise, ni en termes d'ordre et de modalité d'acquisition. Ces enfants se voient donc comme ayant des compétences linguistiques diverses. Par ailleurs, quand les élèves ne sont pas multilingues au sens strict du terme, ils mettent en valeur leurs capacités à reconnaître d'autres langues, indiquant parfois même qu'ils « connaissent » une langue dès qu'ils sont capables d'en prononcer quelques mots. Les

données recueillies indiquent que les élèves, ne sont pas indifférents à leur langue d'origine, malgré le statut qu'elle a dans la société. Cependant, leur sentiment de fierté par rapport aux langues d'origine dépend du contexte. Que ce soit une langue assez reconnue de par le monde ou non, un sentiment de gêne peut aussi y être associé. Elle ne provient pas de la langue elle-même, puisque, cette gêne, due à l'environnement, semble pouvoir s'estomper lorsque les personnes qui les entourent sont familières avec les langues parlées et que leurs attitudes sont positives face à celles-ci. HELLER (1999) avait mis en évidence que la langue légitimée à l'école a une influence sur la façon dont les élèves construisent leurs représentations des autres langues. Il est évident que « la » langue de l'école de nos sujets est en grande partie la langue française et dans certains cas la langue anglaise. Quant aux langues d'origine, bien que valorisées en soi, leur utilisation n'est pas particulièrement encouragée à l'école. Le fort accent mis sur le bilinguisme anglais-français dans le milieu scolaire camerounais en général, semble donc influencer la façon dont les enfants gèrent l'usage d'autres langues. Il est évident que les élèves de cet âge nourrissent déjà quelques jugements à l'égard des langues, du fait de la position sociale de natifs de ces langues, ou des différents endroits connus où ces langues sont parlées. Pour ce qui est du désir d'apprendre d'autres langues, il apparaît comme étant étroitement lié à la perception de l'utilité et de la facilité à apprendre les langues. En effet, la plupart des élèves interrogés disent souhaiter apprendre l'anglais, le français, l'allemand, l'espagnole, le chinois non seulement parce que ce sont des langues très répandues, mais aussi parce qu'elles sont perçues comme étant des langues d'avenir, de la réussite sociale. Les paroles des élèves appuient tout autant l'idée que toutes les langues sont égales, que l'idée qu'elles ont différentes fonctions. Le choix des langues qu'ils désirent apprendre est intimement lié à la fonction que celles-ci compléteraient dans leur vie. Pour ces enfants, le français est reconnu comme la langue commune nécessaire à l'école et à la ville de Yaoundé en général si nous voulons être en mesure de comprendre tout le monde, et que l'anglais soit considéré comme la langue commune importante si nous voulons nous donner des moyens de communiquer à un niveau plus global. Dans ce sens, on pourrait deviner un certain sentiment d'insécurité par rapport à cette diversité linguistique environnante, ce qui ne les empêche pas d'en tirer les informations qu'ils jugent intéressantes ou pertinentes et, ainsi, d'en profiter.

Globalement, les élèves valorisent moyennement leur(s) langue(s) maternelles, ce qui donne de croire qu'ils ne seront pas totalement réfractaires à leur apprentissage à l'école, surtout si l'accent est mis sur la valorisation de la culture. Les élèves ont une conscience sociolinguistique assez prononcée. Dans l'optique d'une intégration véritablement utile et profitable de l'enseignement en/des langues nationales à l'école, les résultats qui suivent indiquent plusieurs éléments qui mériteraient d'être mentionnés. Il s'agit de l'urgence de la réflexion sur la prise en compte et la valorisation des cultures que ces langues véhiculent. Les représentations et les attitudes familiales à l'égard des langues d'origine ont des conséquences sur les représentations et les attitudes des élèves à l'égard de leurs langues d'origine, et le niveau d'aptitude des élèves dans ces langues. En effet, il est apparu que plusieurs familles ont fait le choix de ne pas transmettre leur langue maternelle à leurs enfants, ou du moins n'ont pas fait les efforts nécessaires à son maintien. Cette décision résulte en un statut un peu particulier de la langue d'origine pour les élèves de ces communautés linguistiques qui sont affiliés à la langue de leur famille par des liens affectifs et symboliques, mais qui ne la maîtrisent pas. Il faudrait réfléchir à comment gérer cette situation dans la salle de classe et dans le cadre de l'enseignement des langues. Cette étude démontre le grand besoin de légitimer la relation avec une langue d'origine lorsque celle-ci n'est pas maîtrisée et la prise en compte de l'éventualité que l'enfant ne veuille pas en parler, tout en favorisant l'intérêt et la curiosité par rapport aux fondements et à l'originalité de ces langues. Il faudrait réfléchir à différentes approches dans ce sens. Bien que plus délicate à gérer, cette question converge plus ou moins avec une autre : Comment inclure les enfants monolingues dans un projet visant la prise en compte des langues parlées par les autres élèves de la classe? Nous sommes d'avis que la salle de classe devrait être considérée comme le lieu de rencontre et de partage de diverses contributions. Il pourrait s'agir des connaissances au sujet de différentes langues que les élèves connaissent déjà, de connaissances recueillies auprès de la famille, d'amis ou encore de voisins, mais aussi qui pourraient être issues de recherches dans des livres ou sur internet. Il est important que tous les élèves contribuent selon leur libre choix sur la langue, de façons spontanée et / ou volontaire. Alors que l'enseignement des langues peut être vu comme une panacée dans la résolution de tensions linguistiques particulières, les moyens de concrétiser son action sont à cerner. L'école a déraciné bon nombre de Camerounais, l'école se doit de réparer ce forfait. C'est pourquoi il faut, dès maintenant, s'engager dans une réflexion qui cherchera à répondre aux questions suivantes : Quel rôle l'enseignant devrait-il tenir? Quelle approche et quelle pédagogie devraient être adoptées? Par ailleurs, la formation des enseignants ressort comme étant un point clé de cet enjeu. En effet, on conviendra que les représentations et les attitudes propres aux enseignants contribuent à la manière dont ils abordent la diversité linguistique dans leur enseignement, surtout dans un contexte présentant des tensions ancrées historiquement. C'est pourquoi des initiatives dans ce sens sont à encourager, notamment, favoriser des moments de rencontre visant la discussion de certains sujets sensibles par les enseignants et les chercheurs, ainsi qu'une réflexion sur les pratiques d'un enseignement des langues qui prendrait en compte la complexité linguistique du milieu.

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