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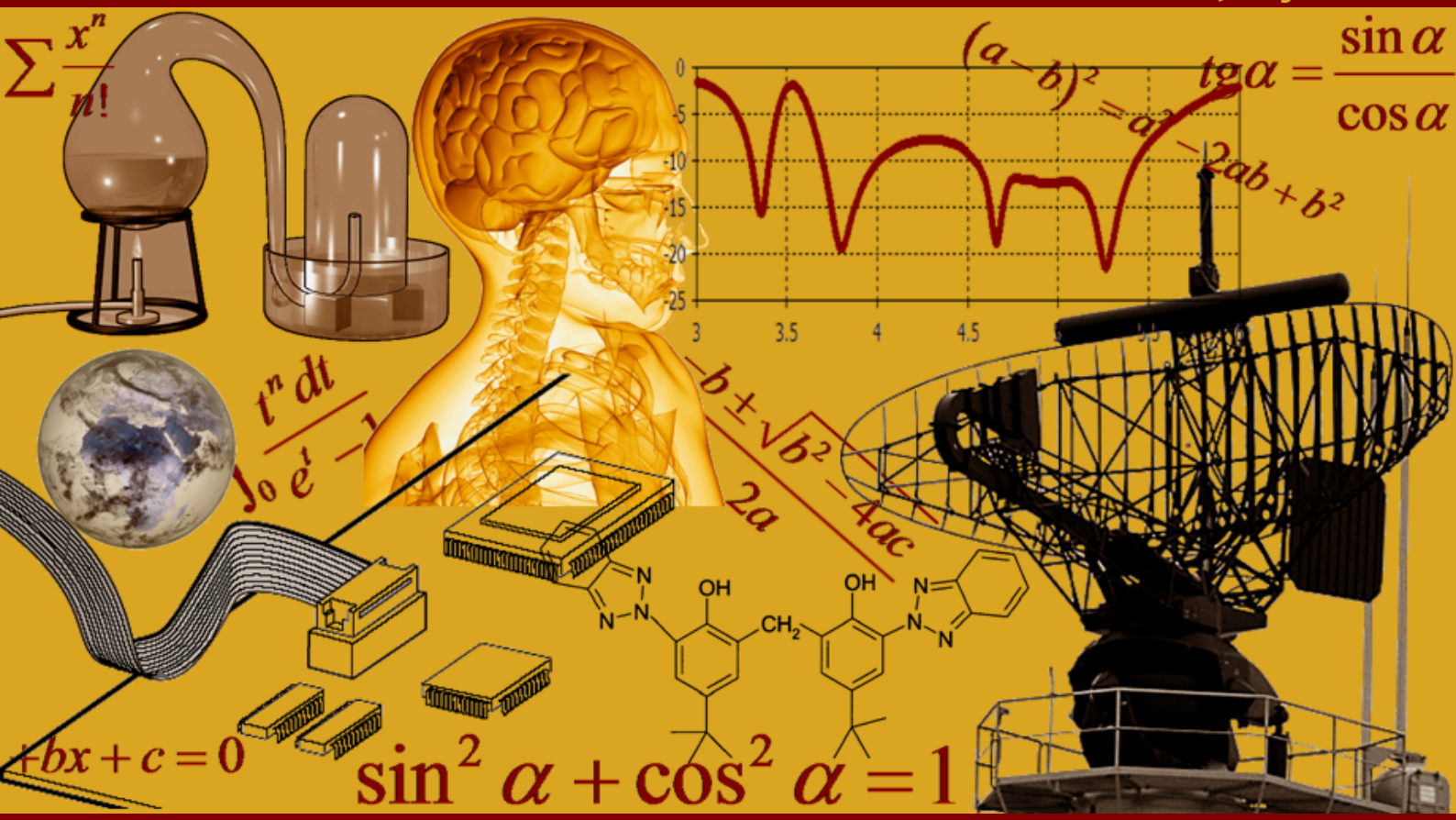

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Serum osteocalcin levels and bone mineral density in ovariectomized rats

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ABSTRACT:
Objective: This study aims to investigate ovariectomy effect on serum osteocalcin levels and bone mineral density in rats.
Methods: Forty five female Sprague Dawley rats were divided into 3 groups (n = 15 rats per group): sham-operated control, Ovariectomized, and Ovariectomized plus estrogen. After 3 months of experiment, rats were killed by decapitation after a 12 hour fast, obtained serum from rats' blood sample was kept at –80°C. For all groups of rats, serum osteocalcin levels were measured by ELISA. The rats' left femoral bone mineral density was measured by dual energy X-ray absorptiometry. Weights and lengths of the left femur were measured with electronic balance and Vernier caliper respectively.
Results: This study revealed an increase in serum osteocalcin levels in ovariectomized rats and in ovariectomized plus estrogen rats, alongside decrease in left distal femur bone mineral density in both groups was observed when compared to the control. The mean values of both serum osteocalcin and bone mineral density between the ovariectomized rats and the control were statistically significant. Estrogen administration in ovariectomized rats showed no significant changes in both serum osteocalcin levels and bone mineral density.
Conclusion: This study concludes that estrogen-deficiency by ovariectomy induces an increase in bone turnover with higher serum osteocalcin levels in ovariectomized rats and that the combination of serum osteocalcin levels and bone mineral density measurement may be a better predictor of the fracture risk.

KEYWORDS: estrogen, bone turnover, post menopause, osteoporosis, serum osteocalcin.

1 INTRODUCTION

Osteoporosis is another major public health problem; it has been well documented to be a progressive systemic skeletal disorder characterized by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture [1]. This disease has been reported to have a tremendous impact on the lives of many postmenopausal women. According to the World Health Organization, osteoporosis is second only to cardiovascular disease as a leading non-communicable health care problem. Worldwide, lifetime risk for osteoporotic fractures in women is 30-50% and in men, the risk is 15-30% [2]. Recent findings showed that high adipocyte count in bone marrow is directly related to bone loss as fat cells replace osteoblasts resulting in reduced bone mineral density (BMD) and increased propensity towards osteoporosis. This close relationship has a positive aspect whereby higher osteocalcin levels results in increased adiponectin production while the presence of adiponectin influences osteoblast proliferation and differentiation in a positive way [3]. Osteoblasts appear to regulate energy expenditure by acting on adipocytes and pancreatic islet cells via OC. In return, adipose tissue may also influence bone remodeling by regulating the activity of osteoblasts through adipokines, including leptin and adiponectin [4]. Further studies showed that an increase in OC concentration has been

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associated with increased proliferation of β-cells, insulin gene expression, and division of adipocytes, leading to increased adiponectin production and hence better insulin sensitivity [5]. Research has also shown that in vivo, increase in serum OC has been found to have a beneficial effect on insulin secretion [6]. Osteocalcin is a bone matrix protein synthesized by mature osteoblasts, and constitutes approximately 15% of noncollagenous bone matrix proteins [7]. Moreover it has been well shown that 80 to 90% of the osteocalcin are adsorbed to bone hydroxyapatite, with a minor percentage leaking into the circulation [8]. Furthermore, Hsu et al. also showed that postmenopausal women with a higher percentage of body fat may have a higher risk for osteoporosis, osteopenia, and non-spinal fractures [9]. Although age-related bone loss has been reported to be caused mainly by increased bone resorption, impaired bone formation also contributes, and during menopause, bone resorption does increase more than bone formation [10-11]. Moreover, since the increased bone resorption and the impaired compensatory bone formation occur simultaneously at menopause; both are almost certainly induced by oestrogen deficiency. In addition, decreased oestrogen concentrations at menopause lead to lower intestinal absorption of calcium resulting in low serum calcium concentrations and increased osteoclastic resorption of bone. Both increase bone turnover and constitute risk factors for the development of osteoporosis [9]. Furthermore, Menopause and aging are associated with accelerated loss of cortical bone. Bone loss is the result of a negative remodeling balance due to impaired bone formation and/or increased bone resorption [12-13]. Osteocalcin has a high affinity for calcium and has a compact alpha helical conformation that is calcium dependent. The alpha-carboxyglutamic acid (Gla) residues of OC are capable of binding to bone matrix hydroxyapatite, thus leading to bone mineralization. Calcium and phosphorus deficient osteoporotic women may have a decreased rate of bone mineralization due to a reduction in hydroxyapatite crystal formation. In this condition, free OC may be present in the circulation, thus explaining the increased serum OC concentration in osteoporotic postmenopausal women [14-16]. Currently, biochemical markers of bone turnover are being used for predicting the bone loss rate and for assessing the risk of fractures in postmenopausal women. Estimation of bone turnover rates may be obtained through determination of the serum concentrations of certain proteins that are representative of the bone remodeling process. These proteins may be divided into bone formation markers and bone resorption markers. The most specific and sensitive bone formation markers include osteocalcin and bone alkaline phosphatase (AKP), which are indicative of osteoblastic activity, whereas bone resorption markers, such as tartrate resistant acid phosphatase (TRAP) reflect osteoclastic activity [17].

2 MATERIALS AND METHODS

2.1 ANIMALS AND DIETS

This study was realized on Forty five female Sprague Dawley rats of SPF. The rats were purchased from the Hercynian Pool-Rubicam Experimental Animal Co., Ltd., Shanghai. All rats were fed adaptively in one week, weight-matched and randomly divided into 3 groups: sham operation group (SHAM, n=15), ovariectomized group (OVX, n=15) and ovariectomized plus estrogen group (OVX+ E_2, n=15). Ovariectomized (OVX) rats and ovariectomized plus oestrogen group (OVX + E_2) were anesthetized with 2% sodium pentobarbital by intraperitoneal injection (0.2ml/100g), and after anesthesia, these rats underwent open surgery, bilateral ovaries were found and were completely removed; sham operation group was anesthetized with 2% sodium pentobarbital anesthetized by intraperitoneal injection (0.2ml/100g), and after anesthesia, underwent open surgery and the adipose tissues around the ovaries were removed. The size of adipose tissue around each ovary was similar to the ovary. After the surgery, normal drinking and eating was administered to the rats. Two weeks after operation, in the third week ovariectomized rats plus oestrogen group (OVX+ E_2) were daily gavaged with Estradiol-Valerate. Animals received suspension at a dose of 1ml/100g, the suspension concentration was 0.08 mg/ml. Ovariectomized group and sham operation group were also daily gavaged with saline at an amount of 1ml/100g. All three groups were fed ad libitum with normal chow and had free access to water under room temperature (20 ± 2) °C, relative humidity of (50 ± 10) % and simulating a 12-hour light-dark cycle for three months. Provided by Beijing China Fukang Biological Technology company Ltd, the chow contained 21.88% protein, 13.68% fat and 64.44% carbohydrates, with energy density of 3.29kcal/g. At the end of the experiment, rats were killed by decapitation after a 12 hour fast. Obtained serum from rats' blood was kept at –80°C for further analysis. Both animal facilities and protocols for this study were reviewed and approved by the Institutional Animal Care and Use Committee of Tongji Medical College.

2.2 SERUM OSTEOCALCIN LEVELS

Serum osteocalcin concentration was measured by Enzyme-linked Immunosorbent Assay (Rat osteocalcin ELISA kit from Biological Technology Company, Ltd. Shanghai China) according to manufacturer's instructions.

2.3 BONE MINERAL DENSITY (BMD) OF THE LEFT FEMUR

Whole BMD measurements (g/cm^2) for the left femur were obtained by dual-energy X ray absorptiometry (DXA). The weights and lengths of the left femur were measured with electronic balance and Vernier caliper respectively.

2.4 STATISTICAL ANALYSIS

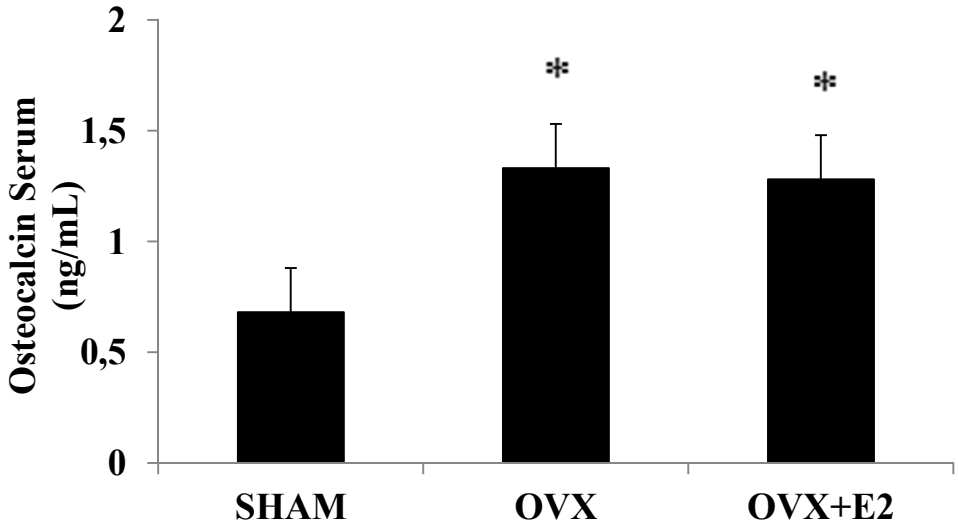
All data were entered to SPSS format using version 13.0 (SPSS Inc., Chicago, IL, USA). Variables were summarized using mean and standard deviation. One-way analysis of variance (ANOVA) was used to compare the mean deference in BMD and in serum osteocalcin levels. Post hoc analysis was performed using a LSD test or Dunnett's T3 test when appropriate. Significance was accepted at $P < 0.05$.

3 RESULTS

3.1 EFFECT OF OVARIECTOMY ON RATS' SERUM OSTEOCALCIN LEVELS

In this study, there were three sample groups randomized as follows: the control sham-operated group (SHAM), the ovariectomized group (OVX), and the ovariectomized plus oestrogen group (OVX +E_2). At the end of the experiment, serum osteocalcin was assessed and was estimated by ELISA (rat OC Enzyme-linked Immunosorbent Assay kit). The mean levels of serum osteocalcin showed a significant difference between the ovariectomized rats and the sham-operated control group (F= 6.563, P = 0.006), as shown in **[Fig-1].** Serum osteocalcin levels increased highly in OVX group compared with the SHAM group, and showed a statistical significance (P= 0.002). There were also increases observed in serum OC levels in the OVX + E_2 groups compared to the SHAM group with a significant difference (P = 0.011). But, when comparing the OVX group to the OVX + E_2 group, no statistical difference were found (P = 0.490).

Figure 1 Rats' serum osteocalcin levels measurement



SHAM, sham operated group; OVX, ovariectomized group; OVX+E2, ovariectomized plus estrogen group; Serum Osteocalcin levels observed within the three groups. *OVX compared with SHAM group at P < 0.05; * OVX+E2 group compared to the SHAM group at P < 0.05. Values are means ± standard deviation (SD). A one-way ANOVA was used to analyze all data.

3.2 OVARIECTOMY EFFECT ON RATS' LEFT FEMUR WEIGHT, TOTAL BMD, AND DISTAL BMD

Both total BMD and distal BMD of the left femur were measured. There were no statistical differences observed in total BMD among groups (F = 1.022, P = 0.369). Also, no statistical difference (F = 0.799, P = 0.459) was observed in the left femoral weight among the different groups **[Table 1]**. But, the distal BMD showed a statistical significance between the ovariectomized rats and the sham-operated control group (F = 6.291, P = 0.004). In the ovariectomized rats (OVX and OVX + E_2 groups), the distal bone mineral density (BMD) of the left femur decreased compared to the Sham-operated control group

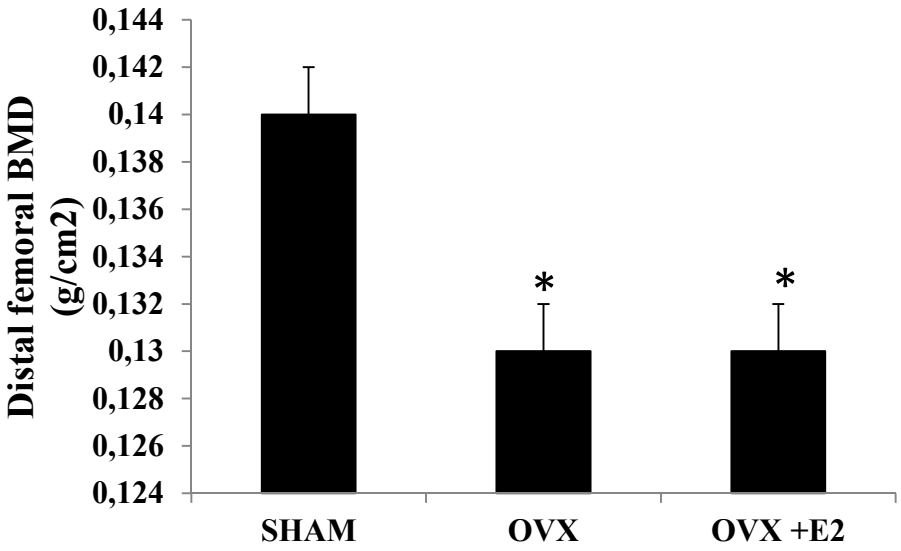
and showed a statistical significance in turn (P = 0.003 and P = 0.004) **[Fig-2]** but no statistical differences were found between OVX and OVX + E_2 groups (P = 0.901).

Table 1 Ovariectomy effect on rats' weight, total BMD and distal BMD of the left femur

Group	SHAM(n =14)	OVX(n =15)	OVX+ E2 (n =15)
Left femur weight (g)	0.64± 0.03	0.63± 0.04	0.63± 0.03
Total femoral BMD (g/cm2)	0.12± 0.01	0.11± 0.01	0.11± 0.01
Distal femoral BMD (g/cm^2)	0.14±0.01	0.13±0.01*	0.13± 0.01*

SHAM, sham-operated group; OVX, ovariectomized group; and OVX+E2, ovariectomized plus oestrogen group. BMD: bone mineral density; *OVX compared with SHAM group at P < 0.05; *SHAM group compared with OVX +E2 at P <0.05. Values are means ± standard deviation (SD). A one-way ANOVA was used to analyze all data.

Figure 2 The distal bone mineral density of the left femur



BMD, bone mineral density; SHAM, sham operated group; OVX, ovariectomized group; OVX+E_2, ovariectomized plus estrogen group. Distal BMD of the left femur from the three groups; *OVX compared with SHAM group at P < 0.05; * OVX+E_2 group compared to the SHAM group at P < 0.05. Values are means ± standard deviation (SD). A one-way ANOVA was used to analyze all data.

3.3 MEAN COMPARISON BETWEEN SERUM OC AND BMD OF THE LEFT FEMUR IN THE OVX AND IN THE SHAM RATS

In this study, the mean levels of serum osteocalcin and BMD showed a significant difference between the OVX group and the control group (F= 82.107, P = 0.000). While increased serum OC levels were observed in the OVX rats, a decrease in the left femoral total and distal BMD was observed alongside with statistical significance (P = 0.000) when compared to the control group **[Table 2].**

Table 2 Mean comparison between serum osteocalcin and bone mineral density

Group	n	SHAM	n	OVX
OC (ng/mL)	10	0.68 ± 0.44	7	1.33 ± 0.34
Total femoral BMD (g/cm2)	15	0.12 ± 0.01*	14	0.11 ± 0.01*
Distal femoral BMD (g/cm^2)	15	0.14 ± 0.01*	14	0.13 ± 0.01*

OC: Serum Osteocalcin, OVX: Ovariectomized group, and BMD: bone mineral density; the mean comparison in the OVX and in the control rats group. * Total femoral BMD compared with OC at P < 0.05; * Distal femoral BMD compared with OC at *P* < 0.05. Values are means ± standard deviation (SD). * indicate the OVX, and ##/# indicate the control group (SHAM). A one-way ANOVA was used to analyze all data.

4 DISCUSSION

To mimic the internal environment of postmenopausal women, ovariectomies were performed on female Sprague Dawley rats, an animal model with characteristics that are comparable with those of early postmenopausal trabecular bone loss [18]. It is now well established that increased bone turnover occurs during the early stages of oestrogen deficiency. Oestrogen deficiency in postmenopausal women induces the imbalance between bone resorption and bone formation, which reduces skeletal mass [19-20]. Hence, loss of oestrogen function is the single most important factor in the development of osteoporosis in postmenopausal women. Furthermore, oestrogen deficiency has been attributed for stimulation of increased bone resorption compared to bone formation [21-23]. In this present study, the left distal femoral BMD in OVX rats was found to be significantly decreased as compared to the control group **[Table 1/Fig 2]**, which is similar to the findings of Kalaiselvi et al. [24] and they reported that the bone mineral density was significantly decreased in postmenopausal osteoporotic than non-osteoporotic subjects. This result agrees with the findings of the study carried up by Johannes *et al* [25] and by Neetakumar *et al* [26]. In this study, the mean levels of serum osteocalcin were found also to be significantly increased twofold in OVX rats when compared with the control [Fig-1]. This increased levels of serum osteocalcin in the OVX rats group is attributed to the induced oestrogen deficiency. Therefore, this result agrees with others studies that reported in principle, a clear correlation between oestrogen deficiency and the especially elevated levels of serum osteocalcin, which is a marker of bone turnover [27-29]. It is well documented that osteocalcin is synthesized in the skeleton by osteoblasts, cells that are responsible for bone formation, [7] and osteocalcin is also a major and thoroughly studied and characterized non collagenous protein in mature human bone. It is a highly sensitive marker for bone formation. Osteocalcin has a high affinity for calcium and exhibits a compact calcium dependent Alpha helical conformation, in which the Gamma carboxyglutamic acid (Gla) residues bind and promote absorption to hydroxyapatite in bone matrix. Normal bone mineralization takes place in this condition. The deficiency of oestrogen in the OVX rats or during the menopausal period induces a lower intestinal absorption of calcium, resulting in decreased serum calcium levels and an increased osteoclastic resorption of the bone [14]. Both calcium and phosphorus deficiencies reduce hydroxyapatite crystals formation. When the bone mineralization decreases, free osteocalcin may be available for circulation in the blood. This may explain the increased concentrations of osteocalcin in the serum of osteoporotic postmenopausal women [30] or in the ovariectomized rats. Hence, deficiency in oestrogen and the reduction of hydroxyapatite crystals formation lead to increased bone turnover, thereby contributing as risk factors for the development of osteoporosis [9]. In addition, in almost all cases of osteoporosis, bone formation remains at least partially coupled to bone resorption; even the resorption rate can far exceed the formation. Therefore, during the states of elevated turnover, markers of bone formation should be increased. Furthermore, oestrogen deficiency also prolongs the resorption phase of remodeling cycle because of increased lifespan of osteoclasts and induces a high bone turnover, i.e. high bone turnover can disrupt the trabecular architecture and its deterioration is a contributory factor to the bone fragility, which increases the incidence of trabecular perforation and buckling, thus reducing the bone strength in osteoporosis, ultimately resulting in decreased levels of bone mineral density as showed the findings of this study **[Fig-2]**, BMD is the best quantifiable predictor of osteoporotic fractures. Serum osteocalcin being a dynamic marker, the efficacy of treatment can be assessed by repeating the estimation of osteocalcin and by comparing it with its original value. Thus, a single measurement of a biochemical marker of bone turnover may be unable to predict even short term individual fracture risk. However, the assessment of osteoporotic risk fractures can be done effectively by a combination of BMD, which provides a static feature of the skeleton and the biochemical marker, osteocalcin, which provides a dynamic measure of the bone remodeling unit, as was evidenced from the study of Vanitha *et al*. [16] although the main effect of estrogen replacement is to suppress bone turnover, which prevents trabecular bone loss. However the decreased bone formation

observed in OVX rats treated with oestrogen **[Fig-1 & 2]** appears to be secondary to the reduced bone resorption since oestrogen administration was shown to stimulate bone formation in vivo [31-32]. Indeed, treatment with 17beta-estradiol prevented the decreased metaphyseal bone loss in OVX rats, the total bone mineral density measured was not completely corrected by oestrogen replacement **[Fig-1]**. The most likely explanation for the discordance between the effects of oestrogen on trabecular bone volume and BMD is that DXA measures combined cortical and trabecular bone, whereas the histomorphometric method measures only trabecular bone, which is mainly affected in OVX rats [33]. In this study, no significant difference was found between the OVX rats and OVX+ E2 rats in BMD and in serum osteocalcin levels [Fig-3 & 4]. While increased serum osteocalcin levels were observed in the OVX rats, in the same OVX rats, a decrease in the left femoral BMD was observed alongside **[Table 2]**. Therefore, these findings suggest a negative correlation between the serum osteocalcin levels and the BMD measurement supported by findings of Kalaiselvi Vs *et al* [24]. In addition, the high value of serum osteocalcin noticed in ovariectomized rats is also consistent with the study conducted by Vanitha *et al*. [16]; they reported that elevated levels of serum osteocalcin in postmenopausal women can be considered as prognostic marker of osteoporosis for better management of postmenopausal osteoporosis in women.

5 CONCLUSION

In this study, a negative correlation was observed between the serum osteocalcin levels and the bone mineral density measurement. The mean levels of both serum osteocalcin and bone mineral density between ovariectomized rats and sham-operated rats were statistically significant. This study also finds that ovariectomy decreases significantly the left femoral bone mineral density at the distal levels. We find that estrogen administration is not an effective treatment for preventing or controlling serum osteocalcin levels and bone mineral density. However, it is evident that a combination of serum osteocalcin levels and bone mineral density measurement may be a better predictor of bone fracture risk, which provides a static picture of the skeleton.

ACKNOWLEDGMENTS

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AUTHOR CONTRIBUTION STATEMENT

Camara Ce is the primary researcher and corresponding author under the supervision of **Prof. Nianhong Yang. Dong Yu** and **Yaowu Zhao** carried out operational procedures on the subjects, and Linyuan Zhou assisted in carrying out standardized laboratory procedures.

CONFLICT OF INTEREST

The study was conducted independently and there is no an ethical problem or conflict of interests.

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La quête du bonheur dans « poème sur la loi naturelle » de voltaire

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ABSTRACT: It is claimed that happiness is the motive and the aim of every human act at the same time. Around this issue, so many opinions and ideologies are forged which ponder upon the possible means that allow Man to fulfill his/ her happiness. In the XVIIIth century, the quest of happiness is often laid in an ineluctable philosophic paradox. That is to say, Man wants to be happy, but he /she ignores the means to achieve it. To Voltaire, this paradox starts by the demonstration of the tension between good and bad, and between melancholy and happiness. In his poem « On the natural law », his ultimate objective is to get rid of such tension. For him, Man should dodge every cruel act to seize the opportunities of happiness; this happiness cannot be possible only through a universal morality which unites all human beings such as the execution of the law of natural religion which permits to get rid off of irrational dogma and every insignificant illusion. In this case, Man, the first responsible of his/ her proper happiness, should get away from prejudices and metaphysical ideas in order to have access to the approval of the universal morality translated by the justice and tolerance and not by fanatism and intolerance. The voltairien humanism is in this case an important condition.

KEYWORDS: happiness, prejudices, Reason, universal morality, humanism.

RESUME: Il est avéré que le bonheur est à la fois le motif et la fin de tout acte humain. Autour de cette question sont forgées maintes opinions et idéologies qui réfléchissent sur les moyens possibles permettant à l'homme de réaliser son bonheur. Au XVIII^{ème} siècle, la quête du bonheur est souvent bâtie sur un paradoxe philosophique inéluctable: l'homme veut être heureux mais il ignore les moyens pour y accéder. Chez Voltaire, ce paradoxe débute par la démonstration d'une tension entre le mal et le bien, entre le malheur et le bonheur. Dans son *Poème sur la loi naturelle*, son objectif ultime sera d'éviter une telle tension. Selon lui, l'homme doit esquiver tout acte maléfique pour cautionner plus d'opportunités de bonheur, lequel bonheur ne serait possible qu'à travers une morale universelle qui unit tous les hommes comme l'exige la loi d'une religion naturelle permettant d'esquisser tout dogme irrationnel et toute illusion insignifiante. Dans ce cas, l'homme, premier responsable de son propre bonheur, doit dissiper les préjugés et les idées métaphysiques pour en fin de compte accéder à l'approbation d'une morale universelle traduite par la justice et la tolérance non le fanatisme et l'intolérance. L'humanisme voltairien est dans ce cas une condition pour y accomplir.

MOTS-CLEFS: bonheur, préjugés, Raison, morale universelle, humanisme.

1 INTRODUCTION

A travers divers siècles, on voit surgir et évoluer toute une philosophie de bonheur qui propose un grand dialogue à travers lequel maints philosophes, à l'instar de Montaigne au XVI^{ème} siècle, Pascal au XVII^{ème} siècle, Voltaire, Rousseau et Diderot au siècle des Lumières, essayaient de répondre à une même question : comment accéder au bonheur ? A partir de cet objectif ultime, les points de vue changent d'un écrivain à un autre. S'inscrivant chacun dans une école philosophique, ils suggèrent divers itinéraires afin de se procurer de ce sentiment naturel. Montaigne, lecteur des penseurs grecs et latins, et

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auteur des *Essais*, réaffirme solennellement le besoin, voire l'aptitude de l'homme au bonheur. Etant du côté des épicuriens, il voit dans la jouissance, ainsi que dans le plaisir terrestre, la meilleure voie cautionnant la vie heureuse.

Cependant, pour Blaise Pascal, le vrai bonheur ne pouvait se trouver qu'en Dieu, que dans l'au-delà, tout en condamnant les jouissances terrestres qui ne font que détourner l'homme de l'essentiel, c'est-à-dire de la pensée en Dieu : « Pour Pascal […], seul Dieu peut combler cette angoisse qui pousse l'homme à regretter un paradis perdu. Pascal n'admet le divertissement que comme un pis-aller, le vrai bonheur ne pouvant se trouver qu'en Dieu » [1]. Donc, Pascal dénie tout bonheur immédiat, le salut est l'unique condition d'un bonheur éternel.

Cette position de Pascal pourrait résumer l'attitude de toute une religion janséniste qui tend à la soumission et à la grâce et vient s'opposer par conséquent à une autre conception, celle des philosophes des Lumières qui tentaient de réhabiliter désormais la situation de l'homme sur terre : la recherche du bonheur est dans l'ici-bas et maintenant. L'écriture de Rousseau, qui réaffirme en quelque sorte « la même entreprise que Montaigne » [2], est un appel incessant à la satisfaction perpétuelle du désir, *La Nouvelle Héloïse*, *Les Confessions* et notamment *Les Rêveries du promeneur solitaire* sont propices à une quête permanente de la réconciliation entre l'homme et ses aspirations naturelles et jouissives. Selon lui, le bonheur est lié à l'expérience personnelle vécue au sein de la nature, au présent mais aussi et surtout au passé. D'ailleurs, comme le signale Philippe Pruvost, pour Montaigne et Rousseau, « le malheur promis n'existerait […] pas; il ne reste alors que le bonheur d'exister. Certitude qui ne doit plus rien à la raison ni à la foi, mais à la seule expérience personnelle.» [3].

Voltaire, lui, prône l'existence d'un paradis terrestre que l'homme doit en jouir. Selon sa conception, le bonheur est à la portée de tout le monde, il est dans la vie quotidienne ; c'est un sentiment lié au moment présent et aussi à la civilisation, au progrès et au luxe. Pour s'attarder sur la conception voltairienne en rapport avec la question de bonheur, mon choix s'est fixé sur son « Poème sur la loi naturelle » : d'un côté, la poésie de Voltaire semble ignorée de l'histoire littéraire. D'ailleurs, lorsqu'il s'agit de Voltaire et de la question de bonheur, les contes philosophiques ou les correspondances seront les textes paradigmatiques qui viennent tout de suite à l'esprit des chercheurs, *Candide ou l'optimisme* est sans aucun doute le conte philosophique directement convenable à l'investigation d'un tel sujet. D'un autre côté, le poème choisi me parait intéressant dans la mesure où il est propice à une représentation exhaustive et récapitulative du point de vue de Voltaire sur le thème qui articulera ce travail, lequel sera envisagé en vue de deux parties fondamentales. Tout d'abord, je vais fixer l'analyse sur le sujet concerné par la question du bonheur, à savoir l'homme. A ce moment mon objectif est de montrer pourquoi celui-ci est à la recherche du bonheur, voire pourquoi aura-t-il besoin de ce sentiment ? Ensuite, je me préoccupe de mettre en évidence l'opportunité dont il jouit pour justement atteindre son but : être heureux.

2 L'ETRE HUMAIN : UN DESTRUCTEUR DE SON PROPRE BONHEUR

Au XVIII^{ème} siècle, l'une des stratégies argumentatives qu'utilisent les philosophes était celle de retourner à l'origine des choses, de savoir leur fondement, voire la cause d'un préjudice bien particulier. A l'instar de Rousseau qui a écrit « *Discours sur l'origine et les fondements de l'inégalité parmi les hommes* », Voltaire semble suivre la même démarche en essayant de chercher les causes primordiales du malheur, en d'autres termes les obstacles qui empêchent la réalisation du bonheur.

2.1 L'ILLUSOIRE « TOUT EST BIEN »

Comme toute conception, on ne peut pas définir le bonheur sans évoquer son contraire le malheur, autrement dit le mal. En fait, le mal est une notion pré-humaine ; il est considéré comme étant déjà là, avant même que l'homme n'advienne. C'est par le mal que l'homme se créait ; ce monde est fondé sur un péché, une malédiction qui vouait l'homme à une souffrance interminable, à un mal qui l'accompagne jusqu'à la fin de sa vie. Cette notion de l'existence du mal s'éclipsait là où on évoquait une seconde conception selon laquelle « tout est bien », c'est-à-dire que le mal est au service du bien général. Dans ce cas, les exemples les plus éloquents sont ceux de Leibniz et notamment de Pope qui affirmait dans sa quatrième épître sur le tout est bien qu'« il n'y a pas de maux, s'il y a des maux particuliers, ils composent le bien général » [4]. L'opinion de Voltaire vient s'opposer d'une manière radicale à une telle pensée. Une opposition qui se montre assez claire et solennelle dans son « Poème sur le désastre de Lisbonne » qui s'ouvre sur des interjections successives mettant en exergue l'existence du mal, un mal horrible, inévitable et surtout inutile :

« O malheureux mortels ! Ô terre déplorables !

O ! De tous mortels assemblage effroyable !

Philosophes trompés qui criez « tout est bien » [5]

Cette même idée trouve son écho dans son « Poème sur la loi naturelle » où il évoque notamment un mal dû en premier lieu à l'homme. Pour ce faire, il énumère maints exemples historiques réels qui manifestent le mal causé par des êtres humains :

« Du pape Borgia le bâtard sanguinaire

Dans les bras de sa sœur assassine son frère ;

Là, le froid hollandais devient impétueux,

Il déchire en morceaux deux frères vertueux […] » [6]

Donc, selon Voltaire l'homme est l'incarnation par excellence du mal, en d'autres termes, l'homme est à l'origine de ses malheurs. Pour lui, ce sont notamment les rois qui ne cessent de multiplier les souffrances et les douleurs de leurs peuples. Ce sont des êtres égoïstes qui se baignent dans leur ignorance sans jamais penser qu'« [ils] sont sous la main d' [un] maître invisible » [6]. Bien au contraire, ils pensent à leurs intérêts futiles, à leurs plaisirs fugaces, bref à leur propre bonheur et non pas à celui de leurs sujets. Par exemple, Voltaire se montre sévère à l'égard des hommes politiques, en particulier le roi de France en l'attaquant et en lui adressant un discours franc et direct :

« Vous êtes, ô grand roi, compris dans l'anathème.

En vain, par des bienfaits signalant vos beaux jours »[6].

Egalement, les hommes de religion sont la cause de maintes souffrances, les ecclésiastiques sont générateurs de fanatisme, d'intolérance et d'injustice. Voltaire les décrits en tant qu'« imposteurs odieux» [6] et voit qu'ils sont à l'origine des « infâmes querelles » qui crée la différence entre les hommes et détruisent par conséquent leur bonheur et leur union :

« Tous traitent leurs voisins d'impures et d'infidèles

Des chrétiens divisés les infâmes querelles

Ont, au nom de seigneur, apporté plus de maux,

Répondu plus de sang, creusé plus de tombeaux[…] » [6]

Cependant, cette imposture du pouvoir, cette critique acerbe des représentants de la religion est accompagnée par une vision optimiste : le mal peut être empêché et évité ; une mission qui pourrait être accomplie uniquement par les rois. Ceux-ci sont appelés à contrôler les prêtres et à gouverner les hommes de religions pour qu'ils puissent être le remède qui calme les douleurs et les maux des hommes. Dans ce cas, Voltaire leurs propose le meilleur itinéraire :

« A l'humaine raison vous donnez des secours,

Aux beaux-arts des palais, aux pauvres des asiles,

Vous peuplez les déserts, vous les rendez fertiles […] » [6]

Ces trois vers, ces interminables demandes montrent clairement un point de vue cher à notre philosophe, celui de croire en l'importance du progrès et de civilisation afin d'accéder au bonheur. D'ailleurs et à maintes reprises, sa poésie est l'occasion d'un éloge sur l'art. Citons à titre d'exemple, l'éloge de la poésie, un art qui est et qui doit être en faveur de l'intérêt de l'homme :

« L'art quelquefois frivole et quelques fois divin,

L'art des versest, dans Pope, utile au genre humain. » [6]

2.2 LES PREJUGES

Comme il est défini par Voltaire, « le préjugé est une opinion sans jugement » [7]. Donc, Voltaire est contre toute opinion préconçue, fondée sur le doute et les soupçons. Il s'oppose aux décisions aléatoires et non conscientes qui obscurcissent plus qu'elles éclairent. Bref, il oppose les préjugés à la Raison :

« Couvrez-moi des rayons de cette pure flamme

Qu'allume la Raison qu'éteint le préjugé » [6].

Par ailleurs, les préjugés seront la cause primordiale de « cette nuit d'erreur où le monde est plongé » [6], un monde qui s'écarte de la vérité à cause des opinions irrationnelles. Les hommes qui sont normalement d'« une même semence » [6]se trouvent défigurés par ces opinions anticipés, sans fondement et qui ne font que détruire leur union. Delà s'organise le projet d'avoir une même loi naturelle, une même source qui unit tous les hommes, qui détruit les préjugés et accède en fin de compte à la vérité. Pour ce faire, Voltaire énumère dans la troisième partie de son « poème sur la loi naturelle » maints exemples mettant en lumière la divergence qui sépare nos opinions et qui détruit notre bonheur :

« L'univers est un temple où siège l'Eternel.

Là chaque homme à son gré veut bâtir un autel

Chacun vante sa foi, ses saints et ses miracles,

Le sang de ses martyrs, la voix de ses oracles » [6]

Ces vers montrent que l'homme est hanté par ses opinions subjectives et habité par des préjugés ni calculés ni objectifs qui le condamnent à tomber dans la maladresse et la sottise, comme les décrit Voltaire qui affirme : « C'est que les préjugés sont la raison des sots » [6]. La faute de ces hommes est d'avoir recouru à la violence brutale pour imposer leurs opinions, surtout religieuses. Le dogmatisme de ces hommes est générateur de crime, de supplice et d'horreur. Donc, désormais tout dépendra de l'homme, cet être raisonnable qui baigne dans ses préjugés est appelé à profiter de la faculté de la Raison, de ce don donné par Dieu afin d'esquisser tout ordre régressif qui prône l'ignorance et rejette tout itinéraire qui mène à la vérité.

Par ailleurs, loin d'étouffer la loi de la nature, ces préjugés peuvent être évités si l'on prend comme point de départ de nos idées une seule source, déjà sûre et autoritaire, celle de la loi de l'Etre suprême qui permet de s'éloigner des ordres artificiels et révélés qui nous éloignent de l'accès à la vérité. Une fois l'homme aura ce commencement sûr, il pourrait aspirer à un avenir meilleur où il sentirait le bonheur et la paix. Voilà donc posée une question fondamentale : comment l'homme peut cautionner ou assurer son propre bonheur ? En d'autres termes, comme l'indique Paul Hasard, « l'homme veut être heureux, l'homme n'agit qu'en vue de son bonheur, mais pour satisfaire à ce désir qui l'aiguillonne sans cesse, et pour parvenir au but qu'il se propose avec tant de constance, il faut qu'il chérisse nécessairement les moyens propres à l'y conduire » [8].

3 UN BONHEUR ASSURE

En suivant la stratégie argumentative de Voltaire, nous assistons à une dialectique bien claire : il s'agit d'exposer la chose et son contraire, ou encore de poser le problème et sa solution, voire son remède. Selon lui, il s'agit de nier une idée afin de fonder une autre, plus forte et moins impondérable. Dans ce cas, la morale, la Raison et la tolérance vont remplacer l'illusion, l'injustice et les préjugés.

3.1 UNE MORALE UNIVERSELLE

Personne ne peut nier que la mission de l'écrivain lui impose d'avoir la même voix que sa société, sa mission sacrée lui impose de partager les questions humaines et de généraliser l'écriture pour que tout lecteur se retrouve dans ses écrits. Ainsi, au XVIII^{ème}, la quête philosophique suit un itinéraire collectif, tel est le cas de la recherche du bonheur, un objectif ultime à atteindre. Delà, se trace le point de vue de Voltaire, celui de garantir à l'humanité un bonheur universel. Robert Mauzi apporte sur ce point délicat un éclaircissement assez décisif : « Si la recherche du bonheur est le seul mobile de l'homme, le point d'origine de cristallisation de toutes ses tendances, cette position ne doit être vraie seulement de manière subjective, mais objectivement; elle doit se vérifier par tous » [9].

Dans ce même sens, pour Voltaire, on ne peut pas cautionner notre bonheur qu'à travers une morale universelle, laquelle morale à pour origine *« l'Etre suprême »* qui *« jeta dans tous les cœurs une même semence » [6]*. Par ailleurs, afin d'être heureux, cette morale universelle, ce besoin d'association entre tous les hommes, serait fortement indispensable dans la création d'un regroupement, d'une union couverte de tolérance et de fraternité, dénonçant par conséquent toute sorte de

fanatisme. Pour ce faire, Voltaire consacre toute une partie de son poème, déjà intitulé « Poème sur la loi naturelle », pour répondre aux objections évoquées par Cardan Spinosa contre les principes d'une morale universelle :

« J'entends avec Cardan Spinosa qui murmure :

Ces remords, me dit-il, ces cris de la nature,

Ne sont que l'habitude et les illusions

Qu'un besoin mutuel inspire aux nations » [6]

Toutes ces objections viennent, selon Voltaire, de la part d'un « *raisonneur malheureux » [6]*, autrement dit, ce sont les propos des métaphysiciens qu'il rejette souvent. C'est presque le même point de vue traité dans son ouvrage intitulé *Le Dictionnaire philosophique,* plus précisément dans l'article « Âme » où il voit que la métaphysique est imposture du pouvoir, elle accepte comme sûres des idées sans fondements, les métaphysiciens, au lieu d'éclairer, obscurcissent la réalité et la compliquent, d'où le langage métaphysique aboutit à des absurdités et à des extravagances.

En fait, tout au long du poème, la stratégie de Voltaire est bien lucide afin de défendre ses pensées. Il suffit de donner des exemples réels, des preuves historiques réellement vécues. Ainsi, pour répondre à Spinosa et pour légitimer l'exigence d'une morale universelle, il énumère maints exemples véridiques pour montrer que *« les lois que nous faisons »* sont *« fragiles, inconstantes »* [6] et différentes d'un lieu à un autre :

« Jacob, chez les Hébreux put épouser deux sœurs ;

David, sans offenser la décence et les mœurs

Flatta de cent beautés la tendresse importune ;

Le pape au Vatican n'en peut posséder une […] » [6]

En outre, l'objectif de Voltaire est de fonder une morale universelle dépourvue de toute autorité humaine, de toute opinion spéculative manifestée par des religions révélées inhérentes au bonheur collectif et à l'union pacifique. Donc, à cette *« loi des chrétiens »*, à cet *« ineffable mystère » [6]*, Voltaire substitue la loi de la nature sur laquelle est fondée la religion, une loi qui garantit tout ce qui est nécessaire à l'homme :

« La nature a fourni d'une main salutaire

Tout ce qui dans la vie à l'homme est nécessaire » [6]

En d'autres termes, c'est à partir de cette nature, à partir de ses lois que l'homme est appelé à chercher Dieu sans médiateurs, ni intermédiaires, sans clergés, ni prêtres. Dieu est la seule voie qui mène à une vérité qui n'est pas accessible qu'à travers *« la morale uniforme en tout temps, en tout lieu, à des siècles sans fin parle au nom de ce Dieu » [6].*

3.2 LA RAISON

Ayant la volonté de faire table rase du passé et des absurdes spéculatives, Voltaire va chercher à rétablir désormais la faculté naturelle de l'homme, à savoir la Raison. C'est dans ce sens que Hazard annonce : « La Raison agressive prétendait faire table rase de toutes les erreurs passées […] mais à condition d'étendre sans limites et jusqu'aux extrêmes audaces, les pouvoirs de cette faculté » [10].

Dans « Poème sur la loi naturelle », l'attitude de Voltaire à l'égard de l'exploitation et la manipulation de la Raison parait assez décisive. En effet, dès l'ouverture du poème, on assiste à un appel franc qui invite les philosophes à couvrir le poète de *« cette pure flamme, qu'allume la raison, qu'éteint le préjugé » [6]*. Par ailleurs, pour Voltaire, la Raison est le moyen le plus efficace afin de surpasser « les préjugés » et les jugements futiles qui ne font qu'enfoncer l'homme dans l'obscurité et dans les ténèbres. Donc, la Raison serait une solution, un point de départ que chaque philosophe doit prendre en considération. Le philosophe est, selon Voltaire, un être de puissance, un homme d'action qui agit et combat contre toute force obscurantiste, contre toute spéculation qui empêche l'accès à la vérité. Voltaire ne cesse de rendre hommage au mérite des philosophes et de philosophie :

« Enfin, grâce en nos jours à la philosophie

Qui de l'Europe au moins éclaire une partie » [6]

De ce fait, les philosophes sont la seule incarnation de la Raison, laquelle est l'unique accès à la vérité. C'est grâce à cette faculté naturelle que l'homme peut chercher Dieu, que l'homme peut connaître l'Etre suprême, seule et unique ressource d'une morale universelle, voire d'un bonheur universel et collectif, dépourvu d'injustice et d'intolérance. Bref, cette grande importance accordée à la Raison peut être résumée dans les propos de Roland Barthes qui, parlant de Voltaire, affirme : « Nul mieux que lui n'a donné au combat de la Raison l'allure d'une fête » [11].

3.3 L'HUMANISME VOLTAIRIEN

A l'instar de plusieurs écrivains au XVIII^{ème} siècle, les pensées de Voltaire s'occupent de l'homme dans ses diverses dimensions. Entre autres projets, nous pouvons signaler celui de garantir son bonheur. En effet, ceci n'est possible qu'à travers l'application d'une morale universelle qui serait accessible par la concrétisation de différentes conditions. De prime abord, pour Voltaire c'est l'intolérance qui vient à l'encontre du fanatisme empêchant les hommes de s'aimer comme frères. Ainsi, à la fin de la troisième partie du « Poème sur la loi naturelle », l'appel à la tolérance est assez enthousiaste :

« Enfants du même Dieu, vivons au moins en frères ;

Aidons-nous l'un l'autre à porter nos fardeaux ;

Nous marchons tous courbés sous le poids de nos maux » [6].

Outre la tolérance, la justice permet également de rétablir le bonheur de l'homme. En fait, pour Voltaire maintenir la justice revient d'emblée à ceux qui détiennent le pouvoir politique ou religieux, c'est à eux de *« calmer les malheureux disputes de l'école qui troublent la société »*, c'est à eux aussi d'*«êtrejuste[s] »* pour pouvoir garantir *« la paix de nos cœurs » [60]*. Bref, c'est au gouvernement que revient la grande part, pour ne pas dire toute la part, afin de semer le bonheur et le calme dans le cœur de chacun.

Entre autres remèdes de malheurs, c'est le fait d'éviter la guerre, ce fléau dangereux qui détruit la paix et menace la tolérance entre les hommes. Selon Voltaire, la guerre est un problème crucial. Elle fait partie de l'ensemble des méfaits humains qu'il dénonce. Il serait ainsi une partie de « l'infâme » puisqu'on est dans ce cercle vicieux où l'homme continue à tuer et à être tué. Pour lui, la guerre n'est ni belle ni merveilleuse, mais elle est absurde, elle est une source de malheur et non de bonheur. Cependant, quand il s'agit de résoudre ce problème, il ne trouve pas mieux que de condamner les religions artificielles, les religions révélées et soutenues par les hommes du pouvoir sont derrière les conflits meurtriers, c'est plutôt le fanatisme religieux qui pousse les gens à s'entre-tuer :

« *Aux yeux de ses sujets, le plus grand des Henris.*

Voilà le fruit affreux des pieuses querelles :

Toutes les factions à la fin sont cruelles ;

Pour peu qu'on les soutienne, on les voit tout oser :

Pour les anéantir il les faut mépriser. » [6]

De ce fait, pour être heureux, l'homme est appelé à comprendre d'emblée pourquoi est-il malheureux ? Autrement dit, il doit connaître et concevoir les causes primordiales de son malheur, il doit les analyser dans une perspective rationnelle au sens d'y trouver des résolutions lui permettant, d'une part de clarifier la voie du bonheur, et d'autre part d'accéder au changement, puisqu'en fin de compte, comme le confirme Paolo Legrenzi, être heureux c'est tout d'abord « apprendre à ne pas être malheureux […]. On peut apprendre le bonheur et, en cela, on peut être aidé » [12].

4 CONCLUSION

En guise de conclusion, je ne peux que signaler le paradoxe qui constitue la quête du bonheur : l'homme veut se procurer du bonheur mais il méconnait les moyens d'y accéder. L'analyse du poème a permis de relever le sentiment d'angoisse qui hante l'esprit de l'être humain, son caractère illusoire lui pousse à s'enfoncer dans l'obscurité, dans la métaphysique et par conséquent le mène vers une existence futile et dépourvue de bonheur. Par ailleurs, le point de départ, le point culminant qui génère l'enthousiasme vers un état d'ataraxie n'est autre que l'homme lui-même. Celui-ci doit cesser d'être l'incarnation

du mal par excellence ; les métaphysiciens, les ecclésiastiques et les hommes de pouvoir doivent éviter de cultiver l'illusion dont souffre l'homme, une illusion qui, nourrie par les préjugés et le non-sens, éloigne ce dernier de la vérité, et alors du bonheur. A cause de son acte maléfique, considéré comme inutile et dépourvu de tout gain, ce dernier est condamné à être à la merci du mal et à souffrir au sein du carcan du malheur.

En contrepartie, la pensée de Voltaire parait féconde et optimiste. Celui-ci se préoccupe d'esquisser tout obstacle au bonheur, notamment l'ignorance qui prédomine l'esprit de l'homme. Ainsi, afin de garantir plus d'opportunité pour que l'homme soit heureux, il bâtit tout un projet philosophique : il s'agit de proposer des réformes religieuses : la religion naturelle qui est révélée spontanément à tous les hommes et qui n'a besoin ni de livres ni d'hommes de religion serait capable d'humaniser l'homme. Elle le rend rationnel et lui éviterait ainsi de sombrer dans le non-sens des conflits armés. Bref, une religion qui humaniserait l'homme serait la seule et unique source de son bonheur.

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A Comparative Study Between the Hidden Markov Models and the Support Vector Machines for Noisy Printed Numerals Latin Recognition

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ABSTRACT: In this paper, we present a comparison between methods of learning-classification, the first one is called Hidden Model Markov (HMM) which is based on a unsupervised learning, and the second one called Support Vector Machine (SVM) which is based on a supervised learning. Those techniques are used for printed Latin numerals recognition, in different situation: rotated, resized and noisy. In the pre-processing phase we use the thresholding technic and in the features extraction we use the Hu invariants moments (HIM). The simulation results demonstrate that SVM is more robust than the HMM technic in the printed Latin numerals recognition.

KEYWORDS: The noisy printed Latin numerals, the thresholding technique, the Hu invariant moments, the Hidden Model Markov, the Support Vector Machine

1 INTRODUCTION

The optical character recognition (OCR) is considered as a one of the most successful and powerful applications of the automatic pattern recognition. It's really a very active field of research and development.

Several studies have been carried on Latin, Arabic numerals and characters by using: the hidden models Markov [1-4], the support vectors machines [5-10] or moments [11-14].

However, our study is focused on Latin numerals recognition.

A succession of operations in this recognition system can be divided into three principal phases. The first is a pre-processing which serves to clean the numeral image just for improving its quality. The second phase is the features extraction from pattern for avoiding data abundance and reducing its dimension. The third phase is the learning-classification. During this phase the images of learning base that are converted to vectors in the second phase should be to train with a learning process. After the images of the test database must be classified.

In this study the pre-processing numerals is carried by the thresholding technique. In the phase of extraction of the primitives from numeral image the Hu invariants moments (HIM) [15] that are used to transform each image of numeral to a vector that will used as an input vector of HMM and of SVM which are used to train the images of the training database and then to classify those of the test database. The last phase takes place as follows:

- By using the HMMs:

In the learning phase, each numeral image is converted to a vector by calculating the HIM; this vector will be used as an observation vector of an initial own HMM of this numeral ~~for~~ to determine the probability which have generated this observation. Then this model must be re-estimated in order to ~~reason for~~ maximize this probability ~~by~~ using the Baum-Welch algorithm. All the re-estimated models (optimal models) of all numerals are saved ~~for~~ to form the learning base.

In the classification phase, we will present an unknown numeral (test numeral) translated, rotated or resized and influenced by noise. Those numerals are used ~~noisy~~ like a vector of observation by calculating its HIM, then we calculate the probability generated by this observation by all the optimal models already recorded in the learning base by the forward algorithm. The recognition will be given to the numeral with highest probability.

- By using the SVMs:

In the learning phase, we have used the SVM whose the strategy is one against all. This separation was made for each image which modeled by a class labeled by the value 1 of the learning base to the rest of all the other images that are modeled by ~~a~~ another class that has a label equal to -1.This separation (maximizing the margin between two classes) is therefore creating a decision function separating these two classes. We have 10 numerals. So we will have 10 decision functions each of them will separate a pair of classes (1 and -1) among the 10 pairs.

In the classification phase, we calculate the image of the vector that models the test numeral preprocessed translated, rotated or resized and containing a noise by 10 decision functions. The recognition will be assigned to the numeral whose decision function separates its class to another class containing the rest of all others numerals which gives the biggest value among all the values calculated of the 10 images of the numeral ~~of~~ test.

2 THE RCOGNITION SYSTEM

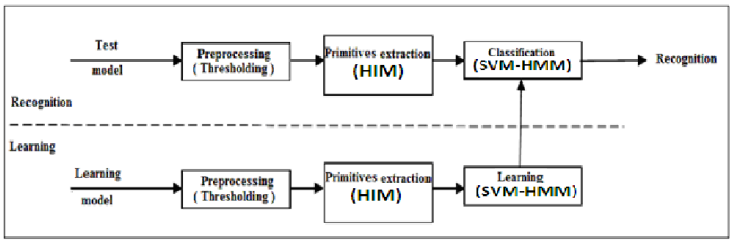

Fig. 1. System for Latin numerals recognition.

3 PREPROCESSING

Pre-processing is the first part of Latin numerals recognition system. This is used to produce a cleaned up version of the original image so that it can be used efficiently by the feature extraction components of the OCR.

In our study, we preprocess the images by a thresholding technic; in order to construct the images containing only the black and ~~the~~ white colors according a preset threshold.

4 FEATURES EXTRACTION

The second phase of the Latin numeral recognition system is features extraction. Several methods can be used to compute the features. In this recognition system, we use the Hu Invariant moments (HIM)

Firstly, we recall the definition of the geometric moment of order $(p+q)$ of an image function $f(x,y)$ of a size NxN is:

$$m_{pq} = \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} x^p y^q f(x, y) \qquad (1)$$

These moments are not invariant to geometric transformations: translation, rotation and scaling. For to make it invariant to translation, we present the central moment of order $(p + q)$:

$$\mu_{pq} = \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} (x - \bar{x})^p (y - \bar{y})^q f(x, y) \qquad (2)$$

$\bar{x}$ and $\bar{y}$ are the coordinates of the center of gravity of the image calculated by:

$$\bar{x} = \frac{m_{10}}{m_{00}} \quad , \quad \bar{y} = \frac{m_{01}}{m_{00}} \tag{3}$$

The centered normalized moment of order $(p+q)$ which is at a time invariant to translation and scaling is:

$$\eta_{pq} = \frac{\mu_{pq}}{m_{00}^{\gamma}} \quad , \quad \gamma = \frac{p+q}{2} + 1 \quad , \quad (p+q) \geq 2 \tag{4}$$

Hu was established seven moments following which are invariant to translation, rotation and scaling:

$$\varphi_1 = \eta_{20} + \eta_{02}$$

$$\varphi_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2$$

$$\varphi_3 = (\eta_{30} - 3\eta_{12}) + (3\eta_{21} - \eta_{03})^2$$

$$\varphi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$

$$\varphi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12}) * [(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{12} - \eta_{03})(\eta_{21} + \eta_{03}) * [3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

$$\varphi_6 = (\eta_{20} - \eta_{02}) * [(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$

$$\varphi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12}) * [(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + 3(\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03}) * [3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2]$$

5 LEARNING PHASE

5.1 THE HIDDEN MARKOV MODELS

The Hidden Markov model (HMM) [16] bases on a doubly stochastic processes whose one of them is hidden. The transition of the process from the actual state to the next is based on this underlying process. The observable outputs or the observations are generated by other stochastic process which is given by probabilities. The HMM with a discrete observation symbol is defined by $\lambda = (A, B, \pi)$, where A is the matrix of the probabilities of transitions, B is the matrix of the probabilities of observations, and π is the vector probability of initial states. N : The number of states $s_1, s_2 \ldots\ldots s_N$.

T : The number of observations.

q_t The state of the process at the time t ($q_t = \{s_1, s_2, \ldots, s_N\}$).

o_t The observation at the time t ($o_t = \{v_1, v_2, \ldots, v_M\}$).

M : The size of observations $v_1, v_2 \ldots\ldots v_M$.

$$A = \{a_{ij} = \Pr ob(s_j / s_i)\} \; ; \; \sum_{j=1}^{N} a_{ij} = 1 \tag{5}$$

$$\pi = \{\pi_i = \Pr ob(s_i)\} \quad ; \; \sum_{i=1}^{N} \pi_i = 1 \tag{6}$$

$$B = \{b_j(k) = \Pr ob(o_t = v_k / o_t = s_j)\} \; \sum_{k=1}^{M} b_j(k) = 1 \tag{7}$$

* The hidden Markov model with a continuous observation symbol is defined by $\lambda = (A, \pi, \mu_i, \sigma_i)$ where μ_i and σ_i are respectively the mean and the standard deviation of the state i of the Gaussian function that used for to generate the probability of observation:

$$b_j(k) = \text{Prob}(o_t = v_k / o_t = s_j) = \frac{1}{\sigma_i \sqrt{2\pi}} e^{\frac{(o_t - \mu_i)^2}{2\sigma_i^2}} \quad (8)$$

In our work we used the HMM with the continuous observation. Each numeral is converted to a vector O_t of 7 components calculated by the HIM and has a particular initial model.

6 THE SUPPORTS VECTORS MACHINES

6.1 PRINCIPE OF FUNCTIONING BETWEEN TWO CLASSES OF SVM

6.1.1 THE LINEAR CASE

For a set of vectors $x_i \in \Re^n$ with n is the dimension of the vector space and given a 2 classes. the first class containing a party of these vectors and bears a label equal to 1, the second class contains the other party of vectors labeled by the value -1.The goal of the SVM[17] is to determine a classifier that well separates these 2 classes and maximizes as much as possible the distance between the 2 classes. This classifier called hyperplan (see figure 2)

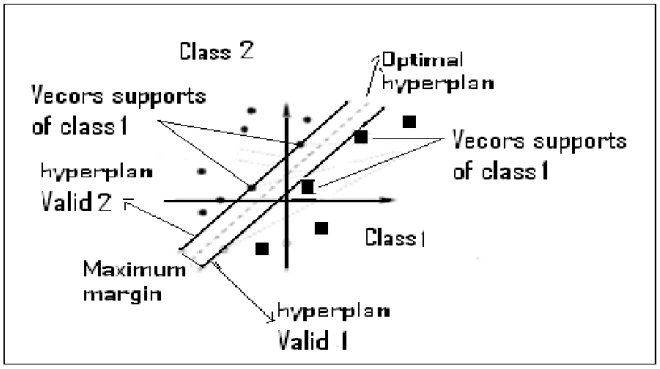

Fig. 2. The determination of optimal hyperplan, vectors supports, maximum Marge and valid hyperplans.

The nearest points that only are used for the determination of hyperplan are called the support vectors. The property of SVM is that this hyperplan must be optimal, that is to say it must maximize the distance between support vectors of a class and those of other. The classifier is represented by the function:

$$f(x, w, b) : x \rightarrow y \quad (9)$$

Where w and b are the parameters of the classifier y is the label.

6.1.2 THE PRIMAL/DUAL PROBLEMS

6.1.2.1 THE PRIMAL PROBLEM

For to maxim the distance between the supports vectors of a class and those of other class, we must to solve a problem of a minimization under some constraints called the primal problem:

- To minimize

$$P(w, b) = \frac{1}{2} \|w\|^2 \quad (10)$$

- Such that

$$y_i (wx_i + b) \geq 1$$

6.1.2.2 The dual problem

For to simplify the calculations, it's necessary to introduce a formulation called problem dual by using the Lagrangian operator:

$$L(w,b,\alpha) = \frac{1}{2}\|w\|^2 - \sum_{i=1}^{n} \alpha_i [y_i (wx_i + b) - 1] \quad (11)$$

The dual variables α_i intervening in the Lagrangian is called Lagrange multipliers. The dual problem is:

- To maximize

$$D(\alpha) = \sum_{i=1}^{n} \alpha_i - \frac{1}{2} \sum_{i=1}^{n} \sum_{i=1}^{n} \alpha_i \alpha_j y_i y_j x_i x_j \quad (12)$$

- Such that

$$\sum_{i=1}^{n} \alpha_i y_i = 0$$

$$\alpha_i \geq 0 \ , \ \forall i = 1,2,....n,$$

Only the α_i^* corresponding to the points which are nearest to hyperplane is nonzero, we speak of the support vectors. The decision function associated to this separation is:

$$f (x) = \sum_{i=1}^{n} \alpha_i^* y_i x_i . x + b \quad (13)$$

6.1.3 THE NON LINEAR CASE

In the linear case(see figure 2), the classification of the data is easy, but in the nonlinear case the optimal separation between the two classes is carried by virtue an special type of functions called the kernel functions:

$$K : \Re^n x \Re^n \rightarrow \Re^p \qquad p \succ n \quad (14)$$

$$(x_i , x_j) \rightarrow K (x_i , x_j)$$

We must solve therefore:

- To maximize

$$D(\alpha) = \sum_{i=1}^{n} \alpha_i - \frac{1}{2} \sum_{i,j} \alpha_i \alpha_j y_i y_j K(x_i, x_j)$$

- Such that

$$\sum_{i=1}^{n} \alpha_i y_i = 0 \quad (15)$$

$$0 \leq \alpha_i \leq C \ , \ \forall i = 1,2,....., \quad n$$

The parameter C which appears here is a positive constant fixed in advance; it's called the constant of penalty. The decision function has the form:

$$f (x) = \sum_{i=1}^{n} \alpha_i^* y_i K (x , x_i .) + b \quad (16)$$

Some examples of the kernel functions:

Table 1. Examples of kernel functions

Kernel linear	xy
Kernel polynomial of degree n	$(axy + b)^n$
Gaussian radial basis function (GRBF):	$e^{-\frac{\|x - y\|^2}{2\sigma^2}}$

6.1.4 PRINCIPE OF FUNCTIONING BETWEEN A SEVERAL CLASSES OF THE SVMS

The method described above is designed for a problem of two classes only, many studies treat a generalization of the SVM to a multi-classification of classes [18], among these studies we cite the two strategies frequently used: the first approach is based to use N decision functions (one against all) allowing to make a discrimination of a class contains a one vector against all other vectors existed in a other class opposite. The decision rule used in this case is usually the maximum such that we will assign an unknown vector X into a class associated with a output of SVM is the largest.

$$i = \arg \max_{i=1,2,\ldots,N}(f_i(X)) \quad (17)$$

The second method is called the one against one instead of learning N decision functions; each class is opposed against another. So $\frac{N(N-1)}{2}$ decision functions are learned and each of them performs a voting for the assignment of a new test (unknown) vector X. its class then becomes the majority class after the vote. In our study, we used the kernel function GRBF with the standard deviation σ = 1 and a penalty constant. C = 10^4

7 THE CLASSIFICATION PHASE

- By using the HMMs :

We present an unknown numeral (test numeral) translated rotated or resized and noisy as a vector of observation by calculating its HIM, then we will calculate the probability generated by this observation by all optimal models already saved in the learning base by the Forward algorithm, the recognition will be assigned to the numeral that the optimal model which gave the biggest probability.

- By using the SVMs :

After having built the10 decision functions between the 10 pairs of classes in the learning phase by the strategy of (one against all) we calculate all the values of the images of the vector that models the numeral test by the all the 10decision functions, the recognition will be assigned to the numeral whose an decision function separating its class to another class contains the rest of the other numerals that gives the largest value among all values calculated of the 10 images of the numeral test.

8 EXPEREMENT RESULTS

We choose the sizes of all images 30x30.Each numeral was converted to a vector of 7 components which is the HIM values For to take all the image size, we must varying x and y into[-1 1](as a case of Legendre moment)instead of [0 30] Therefore we will to perform the following change of variable:

$$u = \frac{x - \frac{30}{2}}{\frac{30}{2}}, \quad v = \frac{y - \frac{30}{2}}{\frac{30}{2}} \quad (18)$$

The Hu moments values is very small, so we have used $\log(\varphi_i)$, i = 1,2…7. First we present a test numeral translated, rotated or resized and not noisy, then we add increasingly a quantity of noise of type 'salt & pepper' for to know the effect of noise added on the rate recognition of each numeral. The noise values are:

[0,0.01,0.02,0.03,0.04,0.05,0.06,0.07,0.08,0.09,0.1,0.11,0.12,0.13,.14,0.15,0.16,017,0.18,0.19,0.2,0.21,0.22,0.23,0.24,0.25, 0.26,0.27,0.28,0.29,0.30].

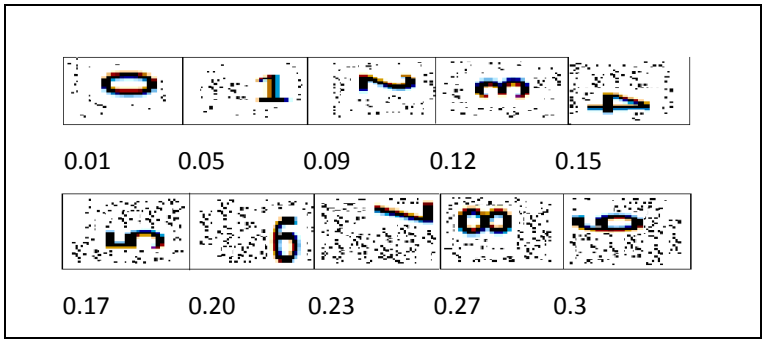

Fig. 3. The Latin numerals noisy by different values of noise of type 'salt & pepper'.

We used 30 numerals in the learning base and 990 in the test base.

We group the values of the recognition rate τ_n for each numeral that we obtained in the following table

Table 1. The recognition rate for each numeral.

Numeral	τ_n (HMM)	τ_n (SVM)
0	100%	100%
1	100%	100%
2	96,77%	100%
3	32,26%	96,77%
4	100%	100%
5	87,10%	93,55%
6	100%	100%
7	100%	100%
8	100%	100%
9	100%	100%

We present the evolution of the global recognition rate τ_g in function of noise added to numerals:

Table 2. The global recognition rate in function of noise added of HMM and SVM.

Noise	τ_g (HMM)	τ_g (SVM)
0.00	100.00%	100%
0.01	100%	100%
0.02	100%	100%
0.03	100%	100%
0.04	100%	100%
0.05	100%	100%
0.06	100%	100%
0.07	100%	100%
0.08	96,67%	100%
0.09	93,34%	100%
0.10	90%	100%
0.11	90%	100%
0.12	90%	100%
0.13	90%	100%
0.14	90%	100%
0.15	90%	100%
0.16	90%	100%
0.17	90%	100%
0.18	90%	100%
0.19	90%	100%
0.20	90%	100%
0.21	90%	100%
0.22	90%	100%
0.23	90%	100%
0.24	90%	100%
0.25	86,67%	100%
0.26	83,34%	96,67%
0.27	80%	93,34%
0.28	76,67%	90%
0.29	73,34%	80%
0.30	73,34	80%

And the graph associated:

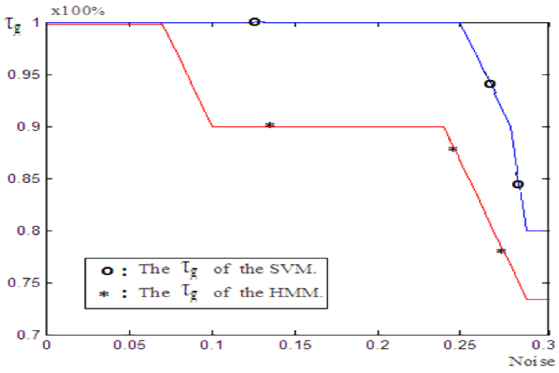

Fig. 4. The variation global recognition rate in function of noise added of HMM and SVM

Explication of obtained results:

The global rate recognition τ_g is a decreasing in function of noise added to numerals, but the important remark is that the falling of this rate of HMM is greater than the rate of SVM, this shows that the SVM is more performing than the HMM in recognition of noisy numerals.

9 CONCLUSION

The results obtained in the recognition of noisy Latin numerals show that reliable recognition is possible by using the thresholding technique in the preprocessing phase and the HIM in the primitives extraction phase. The simulation results demonstrate that the SVM method is more precise than the HMM technic in the recognition of printed Latin numeral.

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The Effect of Using the Constructivist Learning Strategy developing some of Reading and Thinking Skills of First Year General Secondary Stage Students

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ABSTRACT: The study attempts to answer the following major question: What is the effect of using the strategy of constructive learning on teaching reading to develop some basic reading and thinking skills among first secondary grade students?

KEYWORDS: Learning Strategy, Thinking Skills, Secondary Stage, Students.

THE PROBLEM OF THE STUDY

The study attempts to answer the following major question:

What is the effect of using the strategy of constructive learning on teaching reading to develop some basic reading and thinking skills among first secondary grade students?

Then, it answers a number of sub-questions as follows:

1- What are the reading skills suitable for first secondary grade students?
2- What are the thinking skills suitable for first secondary grade students?
3- How to set up a suggested unit in reading to develop reading and thinking skills by using the strategy of constructive learning among first secondary grade students?
4- What is the effect of teaching the suggested unit by using the strategy of constructive learning on developing some reading and thinking skills among first secondary grade students?

The second chapter discusses the previous Arabic and English studies relevant to the topic of the present study. The third chapter handles the strategy of constructive learning. The fourth chapter is divided into two sections: The first section discusses the reading concept while the second discusses the thinking concept.

The experimental framework of the study:

The researcher developed an experimental framework represented in the sample, the tools, and the variables.

Chapter six presents the results of the questionnaire and the test relevant to reading and thinking skills. The study revealed the following results:

1 - The reading and thinking skills appropriate for first secondary grade students.

2 - The experimental group outperformed the control group in the post-test of reading and thinking skills.

The following table shows the results of the post-test for the two experimental and control groups:

Table (1)

The means, standard deviations, T values, and their significance of the experimental and control groups in reading and thinking skills in both pre- and post-tests:

Firstly: Reading Skills

skill	Test type	Control group group		Experimental group		(T) Value	Significance
		Mean	Deviation	Mean	Deviation		
Understanding	Pre-test	1.84	1.88	0.795	0.775	(0.236)	Insignificant
	Post-test	2.92	0.978	3.5	0.743	3.09	Statistically insignificant
Criticism	Pre-test	2.02	0.834	2.01	0.809	(0.225)	Insignificant
	Post-test	2.85	0.861	4.29	0.990	4.83	Statistically insignificant
Explanation	Pre-test	1.90	0.731	1.90	0.684	(0.448)	Insignificant
	Post-test	2.75	0.978	3.36	0.765	3.46	Statistically insignificant
Summary	Pre-test	1.25	0.687	1.18	0791	(0.530)	Insignificant
	Post-test	0.408	0.619	2.79	2.363	3.85	Statistically insignificant
Evaluation	Pre-test	1.086	0.771	1.18	0791	(0.580)	Insignificant
	Post-test	2.67	0.892	3.25	0.734	5.18	Statistically insignificant

Secondly: Thinking Skills

Observation	Pre-test	1.78	0.702	1.76	0.669	(0.164)	Insignificant
	Post-test	3.0	0.913	3 .71	0.727	4.19	Statistically insignificant
Comparison	Pre-test	1.8	0.714	1.75	0.673	(0.334)	Insignificant
	Post-test	2.68	0.883	3.25	0.751	4.70	Statistically insignificant
Classification	Pre-test	1.71	0.669	1.76	0.660	(0.349)	Insignificant
	Post-test	2.8	0.883	3.73	0.764	5.61	Statistically insignificant
Inference	Pre-test	1.8	0.850	1.75	0.781	(0.284)	Insignificant
	Post-test	3.1	0.885	3.7	0.780	3.33	Statistically insignificant
Analysis	Pre-test	1.82	0.650	1.86	0.681	(0.287)	Insignificant
	Post-test	0.284	0.925	3.69	0.724	4.74	Statistically insignificant

Firstly, table (1) shows that there are no statistically significant differences between the experimental and control groups in reading and thinking skills in the pre-test. Secondly, there are statistically significant differences between the means of the students' marks in the experimental group in pre- and post- tests in both reading and thinking skills for the post test.

Table (2) measures the effect size of the strategy of constructive learning on some reading and thinking skills.

Statistics	(T) Value	impact factor	Statistical Significance
experimental group (N) = 44	4.8	1.036	Highly significant: More than 0.8
control group (N) = 44			

Table 2 shows that the magnitude of the impact has reached (1.00). This means that the strategy of constructive learning has a significant impact on teaching and developing reading and thinking skills among first secondary grade students.

It also shows that the strategy of constructive learning has a significant impact on developing reading and thinking skills because the value of D is more than 0.8. In general, the results of the study indicate that reading and thinking skills should be developed.

- Recommendations for further study:

A. Depending on the present results, the researcher provides a number of recommendations:

- Preparing various samples of curricula and teaching methods in accordance with the strategy of constructive learning through creating real problems and asking the students to find solutions to these problems.

- Emphasizing on teaching methods that focus on the meaningful learning such as constructive learning that allows students to learn new concepts based on their cognitive information.
- Preparing courses and training programs for teachers, mentors, and students (teachers) in the faculties of education about how to use and employ the strategy of constructive learning in the teaching-learning process in order to enable them to master the skills of reading and thinking. In addition, the counselors should guide teachers to develop the reading and thinking skills of their students.

- Focusing on using, through this strategy, the different means of evaluation so that the evaluation becomes continuous or real and is not represented in the final test.

- The Arabic language teacher should use all the branches of the subject to develop the skills of reading and thinking among his/her students. In addition to reading, literature is considered as a rich area to practice the skills of reading and thinking. Essay is another area for practice because it reflects social issues, so students can apply what they have learned.

- Providing and designing many programs, educational activities, and different means to integrate both reading and thinking skills in the curricula.

- Preparing a teacher's guide that enables the teacher to develop reading and thinking skills among students within the stages of general education. The teacher's guide of the present study can be used to prepare the new one.

B - The Suggested Studies:

In the light of the present findings and the previous recommendations, the researcher suggests conducting research and future studies, focusing on the issue of the present study:

- The impact of using the strategy of constructive learning on the development of creative thinking skills in the subjects of poetic writings.
- The impact of integrating some constructive learning strategies in the teaching of different syntactic topics.
- The impact of using the strategy of constructive learning on the development of some comprehension skills of literary texts among first secondary grade students.
- The impact of using the strategy of constructive learning on the development of higher-order thinking skills in the teaching of rhetoric among first secondary grade students.
- The impact of early reading on the development of some reading and thinking skills among first secondary grade students.
- The impact of free reading on the development of some silent reading and thinking skills among first secondary grade students.
- The impact of using the strategy of constructive learning on other variables like creative thinking, scientific thinking, and reasoning among first secondary grade students.
- The impact of using the strategy of constructive learning on changing the teaching style of the Islamic curriculum to first secondary grade students.

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Efficiently Mining the Frequent Patterns in Mobile Commerce Environment

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ABSTRACT: Nowadays, a rapid development in the communication technology and increasing the usability of powerful portable devices, mobile users can use their mobile devices to access the information. One of the active areas is the mining and prediction of users' mobile commerce behaviors such as their movements and purchase transactions. The important issue is to mine the rare frequent items from database to satisfy the user needs. In this paper, we propose a technique that can efficiently satisfy the user needs. It predicts the frequent item based on the user selection. Systolic tree implementation is used to predict the frequently moved item in the database. The main aim is to recommend the stores and items previously to unknown user. We evaluate our system in real world and deliver good performance in terms efficiency and scalability.

KEYWORDS: Data Mining, Frequent Pattern, Mobile Commerce, Prediction.

1 INTRODUCTION

The advance of powerful portable devices with wireless communication technologies, has made the mobile services available at anywhere at any time. In future, it is expected that hundreds of millions of users will carry their mobile phones that use wireless connection to access the information making the mobile commerce [9] a reality. Mobile Commerce [19] is a new emerging technology with greater scope. Mobile commerce is the buying and selling of goods and services through wireless handheld devices. Mobile devices mainly smart phones overcome laptops and desktops in many perspectives. Its size, portability, convience and so on. It is advantage to the customers during purchasing, customers usually carry a mobile device mainly a smart phone than laptops because of its smaller size and portability. Mobile commerce [9] has several applications, in that localization of products and services plays a major role. It is used to know user locations and the services requested by the user.

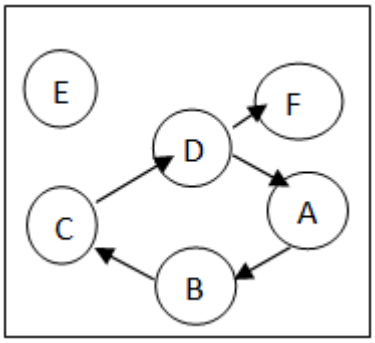
Association rule mining [15] is a popular and well researched method for discovering interesting relations between variables in large databases[12]. It is used to identify strong rules discovered in databases (e.g. Basket data analysis, clustering, classification). The association rule mining can be of two types:

1. Frequent item sets: The items that frequently occur in the database and satisfies the minimum support count.
2. Generate strong association rules from the frequent item sets: Satisfy the minimum support and minimum confidence based on the rules.

For example:- A user request a service A1 in the location L1 and request a service B1 in the location L2. This is an example of locations and service requested by the user in that location. (i.e., when a user goes to the location L1, he requests the service A1, and when he goes to the location L2, he requests the service B1)

This paper is aimed to satisfy the user needs based on their selection. It is mainly used to mine the rare frequent item from the database. In the past, only the frequently moved item was predicted to the user. It does not satisfy the user needs. The

user behavior must be predicted efficiently based on both the movements and purchase transactions. In the past, the Association rule mining[10] is used to predict the frequent item from the database, but it takes more time. To overcome this, systolic tree implementation is proposed to predict the frequent item from the database in a short time. In the past, the mobile commerce behavior was predicted based on multiple users, but we are going to mine the mobile commerce behavior for individual user. Fig. 1a shows a moving sequence, where store labels indicate some transactions takes place. Fig. 1b shows the transaction records of a user, where item i1 was purchased when the user is in store A. For example, the mobile transaction generated by the user is {(A,{i1}), (B, {i2,i3}), (C, ∅), (D, {i4}), (E, ∅), (F,i6)}



Shop	items
A	i1
B	i2, i3
C	-
D	i4
E	not visited
F	i6

(a) (b)

Fig. 1. An example for mobile transaction sequence. (a) Moving trajectory (b) Transactions

The main contribution of our approach is to discover the user behavior efficiently and satisfy the user needs. In addition, a systolic tree implementation was proposed, to discover the frequent item in an efficient and time consuming manner. Based on the movements and purchase transactions, the user behavior can be predicted for each and every individual user.

The remainder of this paper is organized as follows. In Section 2, we briefly review some related work. Section 3, discuss the system architecture in detail. Section 4, describes about the proposed work and algorithms. Section 5, concludes this paper and discuss the future work.

2 RELATED WORK

Efficient algorithms for finding the frequent item set or sequences in very large database have been one of the key success of data mining research. In order to discover patterns from two-dimensional mobility data, Tseng et al. [2] first studied the problem of mining associated services in mobile web environments. It is mainly used to understand the behavior of mobile users. The patterns are mined based on two kinds of hierarchies, the location and service hierarchies.

In [3], Yun et al, proposed Mobile Sequential Pattern (MSP) to take moving path into consideration and add the moving path to the left hand and right hand. Mobile sequential pattern[3] takes both the moving and purchase patterns of the customers. The goal of this paper is to mine the user behaviour efficiently.

In [1], Y. Zheng et al, proposed a method for mining the interesting locations and travel sequences in a given geospatial region, in that TBHG is used to mine the multiple individuals' location histories. In this, they are creating a geo-related web community, in that they can upload GPS logs. Based on TBHG[1], they propose a HITS based model to know the users travel experience and interesting location within a region.

In [7], J. Pei et al, proposed a method, namely WAP-Mine, for discovering the web access patterns from web logs by using a tree-based data structure without candidate generation. Weblogs is like a storage medium, which contains the information about the accesses are recorded, including the URL, origin of request and timestamp. Weblogs is divided into several pieces by pre-processing technique. With the each piece of web log [7] they can't able to predict the frequent sequential pattern.

In [4] V.S. Tseng et al. modelled an efficient mobile behavior prediction system. When users moves between the stores in the mobile network, their location and services are stored in a mobile transaction database. It has an offline mechanism for mining and online engine for mobile behavior prediction.

In [8], D. Xin et al, overcome the sheer size in the frequent pattern mining with a tightness measure and representative pattern. The patterns are clustered with a tightness measure and representative pattern can be selected for each cluster. Several techniques are proposed[8], in that RPglobal is used to mine frequent patterns. RPlocal is much more efficient and quite good compression quality.

To overcome the difficulty in predicting the user behavior, [5] V.S. Tseng and K.W. Lin proposed SMAP-Mine to discover mobile users' sequential movement patterns with the service that was requested. By using the mobile,we can get various kinds of services in any time.To predict the user behavior is an difficult task,so they proposed a data mining method called SMAP-Mine[5], is used to predict the sequential mobile patterns,from that we can efficiently discover the user behavior.

In [11], Eric Hsueh-Chan Lu Et al. proposed a framework called MCE framework for mining and prediction of mobile users movements and purchasing transactions. Its goal is to predict the behavior of individual users. The mobile network database maintains detailed store information which includes the location. The mobile users moves between the stores and purchase the items, and all these information are stored in mobile transaction database.

3 SYSTEM ARCHITECTURE FOR MOBILE LOG PROCESS

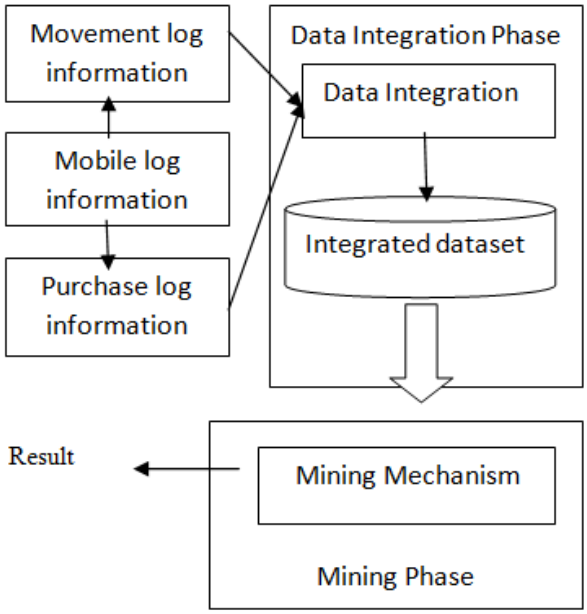


Fig. 2. System architecture for mobile log process

In this section, we represent the system architecture with the data mining module for mobile log pattern. It is conducted to extract the movement and purchase information based on the mobile log information. Fig. 2 describes the data mining system architecture for mobile log process. The work flow of the system is divided into two phases. This system is associated with the logs of users' movements and users' purchase transactions and all are stored in database. The first phase of the system architecture, Data integration phase, is to collect and integrate users' log into one dataset to efficiently discover the user behaviour information. For this phase, the attributes related to mobile user's behaviour will be extracted from the dispersed log files and joined to from an integrated log file. Next, Mining phase is an novel data mining method to discover the frequently moved item from the integrated log dataset. Finally, the best results are delivered, associated with the mobile log information and produces efficient and accurate result.

Table 1. Mobile Transaction Database

T_{id}	U_{id}	Mobile Transaction Sequence
1	1	$(A,\{i_1\}),(B,\emptyset),(C,\{i_3\}),(D,\{i_2\}),(E,\emptyset),(F,\{i_3,i_4\}),(I,\emptyset),(K,\{i_5\})$
2	1	$(A,\{i_1\}),(B,\emptyset),(C,\emptyset),(D,\{i_2\})$
3	1	$(A,\{i_1\}),(B,\emptyset),(C,\emptyset),(D,\{i_2\}),(E,\emptyset),(F,\{i_3,i_4\}),(I,\emptyset),(K,\{i_5\})$
4	1	$(A,\{i_1\}),(D,\{i_6\}),(C,\{i_5\})$

4 PROPOSED WORK

In this section, we discuss about the proposed work. Mobile commerce is used to predict the mobile user behaviour such as their movements and purchase transactions. It predicts the frequently moved item to the user based on their selection.

4.1 PROBLEM STATEMENT

When the user enters the store, the system predicts the frequently moved item to the user wireless handheld devices. It is a predetermined target, so it does not satisfy the user needs because the user may have a thought of buying another item. And also the time to retrieve information from the database is more. To overcome the issue, we are going to mine the rare association rule to satisfy the user needs. In this, after entering the store, the system will not predict the frequently moved item, the user can purchase the items based on their choice. Then the system will predict the possible items related to user choice.

4.2 FREQUENT PATTERN MINING

Frequent patterns are patterns that appear in a database frequently (e.g. a set of items,such as iphone and headset, that appear frequently in a transaction data set is a frequent itemset). A set is called frequent if its support is no less than a given absolute minimal support[10].Two measures are used they are, 1. Support and 2. Confidence.In support, the rule holds with support *sup* in *T* (the transaction data set) if sup% of transactions contain $X \cup Y$. In confidence, the rule holds conf in *T* if conf% of tranactions that contain *X* also contain *Y.* In the following, we describe the methods for mining frequent itemsets.

In this phase, we mine the frequent transactions (FTransactions) for each user by applying a modified Apriori algorithm [15]. Table 1 shows the mobile transaction database . At first, the support of each (store, item) pair is counted for each user. The patterns of frequent 1-transactionsare obtained when their support satisfies the user-specified minimal support threshold TSUP.

A candidate 2-transaction, indicating that two items are purchased together in the transaction, is generated by joining two frequent 1-transactions where their user identifications and stores are the same. For example, the candidate 2-transaction (F; fi3; i4g) is generated by joining (F; fi3g) and (F; fi4g), because the user identifications and purchased stores of them both are U1 and F, respectively. Thus, we keep the patterns as frequent 2-transactions, when their support is larger than TSUP.

Finally, the same procedures are repeated until no more candidate transaction is generated. We use an item mapping table to relabel item sets in order to present F-Transactions for each unique item set, we use a symbol LIi (Large Item set i) to represent it, where i indicates a running number. The mapping procedure can reduce the time required to check if a mobile commerce pattern is contained in a mobile transaction sequence.

4.3 PATTERN MINING

Pattern mining is a data mining method that involves finding existing patterns in data. In this context *patterns* often means association rules. The original motivation for searching association rules came from the desire to analyze supermarket transaction data, that is, to examine customer behavior in terms of the purchased products. For example, an association rules "beer ⇒ potato chips (80%)" states that four out of five customers that bought beer also bought potato chips.

4.4 METHODOLOGY

4.4.1 USER INTERFACE

The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals—what is often called user-centered design. Good user interface design facilitates finishing the task at hand without drawing unnecessary attention to it. Graphic design may be utilized to support its usability. The design process must balance technical functionality and visual elements (e.g., mental model) to create a system that is not only operational but also usable and adaptable to changing user needs.

Interface design is involved in a wide range of projects from computer systems, to cars, to commercial planes; all of these projects involve much of the same basic human interactions yet also require some unique skills and knowledge.

4.4.2 ENROLLMENT PROCESS

Enrollment process is adding the information in database. The enroll process involves shop information, customer information and item information.

Shop information is used to maintain the shop details like shop name and the shop position like latitude and longitude information. In this we simulate the shop and location based on X and Y position.

Item enrollment process is used to enroll the item details in the shop. The item details contain the item number, item name, and item cost.

The customer enrollment process is used to enroll the customer details that have process the mobile commerce. The customer details have customer username, name, city, mail id, mobile number. All these information are stored in the database.

4.4.3 MOBILE MOVEMENT PROCESS

Manage information about objects moving in two- (or higher) dimensional spaces are important for several emerging applications including traffic supervision, flight control, mobile computing, etc. In order to avoid frequent location updates, the database stores the items purchased and its location. M-commerce services will be able to capture the moving trajectories and purchase transactions of users.

Mobile behaviour predictions can be used by nonlinear models. The nonlinear models capture objects' movements with sophisticate regression functions. Thus, their prediction accuracies are higher than those of the linear models. Recursive Motion Function (RMF) is the most accurate prediction method in the literature based on regression functions.

4.4.4 SHOPPING PROCESS

After completing all the process, customer gets the option to move various shop based on mobile movement process. If the customers reach the shop he/she view the products from the shop. When mobile users move between the stores, the mobile information which includes user identification, stores, and item purchased are stored in the mobile transaction database.

When a mobile user moves and purchases items among the stores, the next steps will be predicted according to the mobile user's identification and recent mobile transactions. The framework is to support the prediction of next movement and transaction.

4.5 GENERATION OF FREQUENT PATTERN

Although serval methods have been developed for mining frequent patterns and closed patterns, such mining frequently generates a huge number of frequent patterns. People would like to see only interesting ones. In our work we mine frequent patterns from transactional log based on systolic tree implementation.

4.5.1 SYSTOLIC TREE

A systolic tree is an arrangement of pipelined processing elements (PEs) in a multidimensional tree pattern. The goal of our architecture is to mimic the internal memory layout of the FP-growth algorithm while achieving a much higher throughput. The role of the systolic tree as mapped in FPGA hardware is then similar to the FP-tree as used in software. The formal definition of FPtree can be found in supplementary.

The design principle of the WRITE mode algorithm is that the built-up systolic tree should have a similar layout with the FP-tree given the same transactional database. The software sends a candidate pattern to the systolic tree. After some clock cycles, the systolic tree sends the support count of the candidate pattern back to the software. The software compares the support count with the support threshold and decides whether the candidate pattern is frequent or not. After all candidate patterns are checked with the support threshold in software, the pattern mining is done. The approach to get the support count of a candidate pattern is called candidate item set (pattern) matching.

4.5.2 CREATION OF SYSTOLIC TREE

A systolic tree is an arrangement of pipelined processing elements (PEs) in a multidimensional tree model. The goal of the architecture is to copy the internal memory layout of the FP-growth algorithm while achieving a much higher throughput. The function of the systolic tree is to mapped in FPGA hardware is then similar to the FP-tree as used in software. A simple example for the systolic tree implementation is shown in Fig 2.

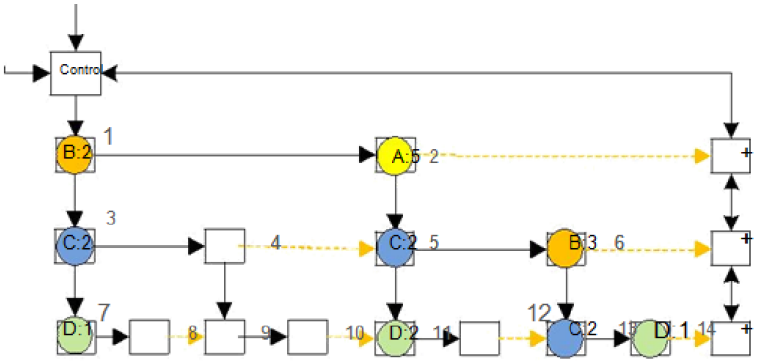


Fig. 3. The Systolic Tree Architecture

Figure 2 shows the static systolic structure where *K*=2 and *W* =3. Each node in the systolic tree architecture is also referred to as a processing element (PE). Each PE has its local data structure and corresponding operations upon re-ceiving signals from outside. The Fig. 2 denotes the three kinds of processing elements. The root PE is the control node discussed. The PEs in the rightmost column is the counting nodes which are specifically used for frequent item set dictation. The third kind of processing elements are the general PEs.

Each node has a counterpart in the general processing elements in Fig. 2, but the converse does not hold. Each general PEs has one input from its parent and two outputs to its child and siblings respectively. Each PEs has a connection with its leftmost child only. It sends the data to its rightmost child, then the data will be passed to its leftmost child and then through its siblings and through all children on the way. The general processing elements which do not contain any item are empty. The items in one transaction are transferred into the architecture in an ascending order, any PEs must contain a smaller item than that of its children.

Each PE in the systolic tree has three modes. In that WRITE mode is discussed as follow, During the building phase of tree, PEs are in WRITE mode. An item is loaded into the control PEs each cycle which in turn transfer each item into the general PEs. If the item is already present in a PE, the corresponding count value will be increased. Otherwise, an suitable empty PEs will be located for it. The algorithm for WRITE mode in each PEs is given in Fig. 4. The input of the algorithm is an item *t*. The *match* flag is set when the item in PEs matches *t*. The *Inpath* flag is not set when the PEs does not contain any item of the current transaction.

For example, the PEs under the control of PE in Fig. 2 must not contain the item B in a new transaction *{*A,B,C*}*. After all items are sent to the systolic tree, a control signal that state the termination of an old transaction and the start of a new one is sent to the control PE. The signal will be broad-casted to all PEs which reinitialize themselves for the next transaction. The initialization includes resetting of *match* and *Inpath* flags in the first line of Fig. 3.

```
Algorithm: WRITE mode(item  t)
match:= 0;  InPath:= 1;
(1)if  P E is empty  then
store the item t;
count:= 1;
match:= 1;
stop forwarding;
(2)if(t is in PE)and ( InPath=1) then
match:= 1;
count++;
stop forwarding;
(3)if(match=0) then
forward t to the sibling;
InPath:= 0;
else
forward t to the children
```

Fig. 4. WRITE mode Algorithm

Let's illustrate the creation of systolic tree with an exam-ple shown in Fig. 3. In order to clearly differentiate PEs a number in light scale is placed in the top-right corner. Sup-pose a new transaction {A,B,D} is to be added into the systolic tree. The control signal which indicates WRITE mode is first broadcasted from the control PEs. Then the transaction {A,B,D} is send to control PEs sequentially. When PE1 receives A, the step (3) in Fig.4 is triggered and A is forwarded to PE2. The *Inpath* flag in PE1 is set to zero. Step (2) is triggered in PE2. The *count* value in PE2 is increased by 1. The *match* flag is set to 1. PE2 stops forwarding A to other neighbors. The item A is sent to PE2 by PE1, then the second item B is sent to PE1 by the control node. Step (3) is triggered in PE1. Item B is sent to PE2. Since the *match* flag is set to 1, the item B is sent to PE5. Next, step (3) is triggered in PE5. B is then sent to PE6. The *count* value is increased by one in PE6. In the similar way, the item D is sent to PE14.

5 EXPERIMENTAL EVALUATION

In this section, we conducted a series of experiments to evaluate the performance based on systolic tree implementation under various system conditions. All the experiments are implemented in Java on a 3.0GHz machine with 1GB of memory running windows XP.

5.1 SIMULATION MODEL

In the base experimental model, the network is modelled as a mesh network with size W, and there are 10,000 users in this network. The total number of services that the users may request is modeled by parameter N. The number of mobile transaction D is generated. When a customer moves among the cells for shopping, the mobile transaction sequences consists of a moving path and a set of transactions for each and every customer. To build the systolic tree the items in transactional database are sent to the tree one by one in each clock cycle. The time to build the systolic tree is less than the Apriori Algorithm.

$$\text{Precision} = \frac{P+}{P+ + P-}$$

$$\text{Recall} = \frac{P+ + P-}{R}$$

$$\text{F\_measure} = \frac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}$$

5.2 GENERATION OF MOBILE TRANSACTION SEQUENCES

In the experiments, the moving scenario with transaction is predicted and it is simulated. The mobile commerce service is a new application in the near future, we believe that the customers have the similar behaviours to those of them in the current data network when they first use this service. After the service is used by customers, the behaviour will then be changed according to their usage experiences. Thus, in this paper, the simulation model for generating synthetic mobile sequences is in the fact similar to that in the companion papers [13][14]. Explicitly the method for generating moving patterns is similar to that in [14] and the method for generating transactions is similar to that in [13].

In the experiments, $|D|$ is the number of mobile transaction sequences generated. When a customer moves among cells for shopping in the MC environment, the mobile transaction sequence completed by this customer consists of a moving path and a set of transactions made in the corresponding cells. The starting position of each mobile sequential pattern can be either vistor location register (VLR) or home location register (HLR) and is randomly selected among these cells [2]. A moving path consists of cells moved by a user. The size of each moving path is determined from a Poisson distribution with mean equal to $|P|$. When a customer moves to a cell, the probability that this customer makes the transaction in this cell is denoted by *Pb*. For each cell, once the number of items is determined, the items that could be purchased in each cell are fixed. The method for generating transaction data in each cell is similar to the one in the prior work [13]. In the mobile commerce environment, people tend to buy sets of items together, which are also called potential maximal frequent sets.

In the Fig. 5, shows the support count value between the two algorithms in that, s varies from 1.5% to 0.25%. As the minimum support decreases, the execution time of the existing algorithms increases because of the increases in the total number of frequent patterns.

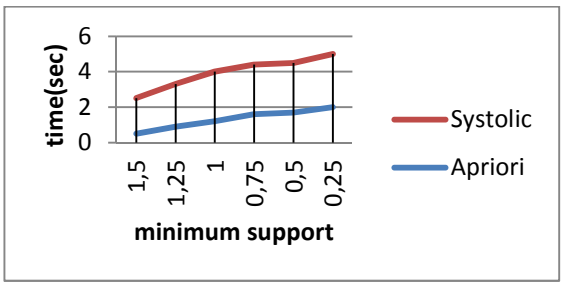


Fig. 5. Minimum support

5.3 Location Prediction by Mobile Commerce

This series of experiments show the effects on the prediction for location , services, and L&S with varying confidence value.we observe that it can be fortuitous to predict the correct location by the probability of 1/25 when the networksize jWj is set to 5*5 (i.e. there are 25 nodes in the mesh network). Take a small network for explanation. Let the network size be 2*2Z4 nodes, namely a, b, c, and d. We now want to predict the next location of a mobile user who is going to location b with the past behavior (a, I). Using (a, I) as the LHS to predict the next location means that the user is following the discovered event. In this case, if the user is following the discovered event, the prediction will exactly be correct. Otherwise, if the user moves randomly, the prediction will still have ¼ probability to be correct although it is fortuitous. We name this kind of prediction as fortuitous prediction. As can be seen, the probability of fortuitous prediction is relatively low. But in mobile commerce it is relatively higher than the other methods.

Based on the simulated result, we compare the mining time of systolic tree with Apriori algorithm in Fig. 6. The mining time of the software algorithm is collected from a PC with Pentium D 3GHz CPU, 2GB RAM. The benchmark is several transactional dataset which is collected and integrated from the Keel repository datasets. This database has several transactions. In our experiments, we change the support count threshold to get different numbers of frequent items. Note that the run time of the Apriori algorithm is closely related to the size of the database while the run time of the systolic tree

implementation is only determined by the number of frequent items. It can be observed that the threshold size of the systolic tree must be no more than 11 in order to be faster than Apriori algorithm. When the size of the systolic tree is 10, the mining speed is 24 times faster than Apriori.

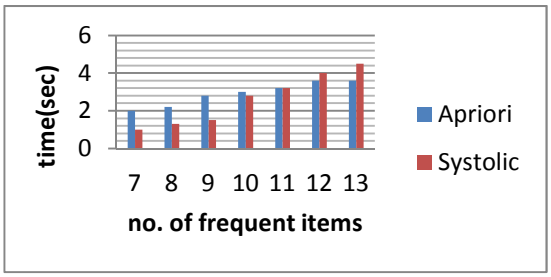


Fig. 6 Execution time comparison

6 CONCLUSION

In this system, a novel framework, namely Mobile Commerce, is used for mining and prediction of the mobile user behavior such as their movements and purchase transactions. It is used to recommend the stores and items to the unknown user. When mobile users move between the stores, the system predicts the frequently moved items to the user based on their selection, which includes the mobile information such as user identification, stores, and items purchased are stored in the mobile transaction database. In that a new systolic tree-based algorithm is an efficient and effective one to mine the frequent item sets. It produces better results in performance than the other algorithms. Our future work is to implement it in real world.

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LANGUAGE OF RELIGION

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ABSTRACT: Religion is a set of beliefs of an individual or a set of people. Language of religion is as sacred as any religion is itself. Language of religion is distinctive as well as prior to everyday language. In spite of many distinctive features language of religion is also having some similar features to the other registers. Language of religion is dynamic and complex regarding its function, style and interrelation with other texts. In this article language of religion is stylistically analyzed. Stylistic features like grammatical level, graphological effects, phonological level and semantics discussed on the basis of stylistic analysis.

KEYWORDS: religion, graphological effects, grammatical level, semantic level, phonological level.

1 INTRODUCTION

An organized collection of beliefs, cultural systems and world views that relate to an order of existence is called religion. It is the set of beliefs, values and social norms that gives people a proper code of life to live their lives according to that. Language is a medium by which the presence and activity of beings can be made presupposed. It is the medium of communication through which the norms, values, beliefs, ideas and codes of life are communicated among the people of particular societies or among the societies. Language represents the culture, religion and social norms of a particular society or even of a particular register.

Language of religion is a register that represents the variation of language, used in the setup of religion, from the everyday language and other setups. Language of religion is totally different from the everyday language. It is the language in which certain aspects of everyday language are altered or sometimes suspended. Language of religion is considered prior to everyday language. It is considered prior may be because of its relation to Devine Beings, Devine Beings or Super Beings are involved in the production of words in religious language. There are many holy books that are directly related to God Almighty and are descended in the shape of revelation. So the language of these books is not produced by any human being. For example, sacred book of Muslims the Holy Quran is known as the only book in the same condition as it was descended on Holy Prophet Muhammad (peace be upon him). It is in its original form as it was revealed on Holy Prophet Muhammad (peace be upon him).

Religious language becomes standard of the contemporary language. Origin language of The Holy Quran is Arabic and due to its unique style Holy Quran has been considered the standard of Arabic. Bible also consists of standard language and it is full of figurative language. Mean to say that religious language is also full of figures of speech and it is also full of literary devices like any good piece of literature. There are a lot of examples, to support this idea, in Holy Quran, Bible and even in Hadith and Sermons. There are many salient stylistic features of religious language that make distinction between language of religion and language of other registers. Stylistic features of religious language are further discussed below in this paper.

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2 STYLISTIC FEATURES

2.1 GRAPHOLOGICAL LEVEL

In religious language foregrounding of the style as well as of theme is frequently found. It is very common and usually used device that is very present in Holy Quran, Bible, Books of Hadith and even in sermons etc.

In Holy Quran we find a lot of graphological effects that make its style prominent. The first and the foremost graphological effect is the name of surah in Quran, it consists the gist of the happenings in that specific Surah or chapter. For example Surah Baqrah is title of the longest surah in Holy Quran and the main theme and story discussed in this surah is related to the story of cow. In Surah(chapter) An-Naas we find the word NAAS foregrounded. There are six sentences (ayats) in it and at the end of every sentence we find the word "Naas". In hadith foregrounding is also found. For example often Haidth starts with a question in which the theme is foregrounded and it so in order to make the listener more attentive and curious. In sermons thematic words are foregrounded by speaking aloud than other words. Alliteration is also a feature that shows the graphological effect in religious language. The words or sentences that are to be foregrounded are used repeatedly in the same order. For example in Surah e Rahmaan one sentence (ayat) "Which then, of the favors of your Lord will you deny?" is repeated thirty one times.

2.2 GRAMMATICAL EFFECTS

In religious language grammar is followed properly except some particular situations. If we take examples from Bible, we find that grammar is properly followed. As it is already stated that mostly the language of religion standardizes the contemporary language, so the idea of proper grammar should also be cleared that if a language is standard then how can it be grammatically poor?

Revelation 2.11:"He who overcomes will not be hurt by the second death."

This is a sentence of Bible New Testament. This shows and represents the proper grammar of The Bible. In the same way we find that the most of the religious texts follow the rules of grammar.

Rules of punctuation are followed in religious language. In Quran there is a proper pattern of punctuation and same is in Bible. There is proper and unique use of sentence markers in Quran as well as in Bible. For example:

Surah Baqarah (ayat 2): "This is the Book in which there is no doubt, a guide for the righteous."

Surah Baqarah (ayat 12): "In fact, they are the troublemakers, but they are not aware"

Surah Baqarah (ayat 12): "Do you command people to virtuous conduct, and forget yourselves, even though you read the Scripture?"

These three sentences represent the unique style of Quran regarding the sentence markers and regular structure of the sentence. Same examples can be driven from Bible.

Sometimes for the sake of mentioning the importance or significance of anything, the rule of regular sentence structure is violated.

2.3 PHONOLOGICAL LEVEL

The sound of the word or phrase affects much in the style of a text. In religious language we find that text is found in both prose and poetic style. It is also having the great deal with phonetic level of stylistic analysis. Hymns that are sung or written in the praise of God are the example of poetic style. In religious language we find great effects of phonetics. The reason of this may be the purpose, to effect and soften the hearts, of the preaching of religion. Though the proper sound patterns effect the heart and mind more, that is why it is needed in language of religion. But purpose is not our concern in this paper.

In religious language we find both prose and poetic style. Even the sacred books are having poetic diction. If we stylistically analyze Holy Quran we find that it is also having poetic diction along with prose style. The best example is Surah e Kuasar. There are also many other Surahs in Holy Quran having poetic style. Poetic style is also found in Bible. For example: In Psalm (122.6-7) poetic style is shown.

"Entreat the peace of Jerusalem,
May they prosper who love you.
May peace is within your walls,
Security within your towers."

There are hymns in every religion sung or written for their God or the super human beings like Lord Buddha etc. Hindus are having proper songs for their gods.

As for as the punctuation is concerned we find proper punctuation in Holy books like Quran and Bible. The examples of punctuation already have been given in grammar section. Rhyming schemes are also found in language of religion. If we analyze Surah e Kausar in Holy Quran we find that it is having rhyme scheme of A, A, A. Above mentioned poetic stanza of Bible is having rhyme scheme of A, B, C, and D. So the proper and improper rhyme scheme is found in the poetic diction of religious language.

Religious language is also having the examples of assonance and alliteration. In language of religion to make the style prominent assonance and alliteration is used. In Bible Prophetic and poetic writings, such as Micah, Psalms, etc., use alliteration, same consonants in the initial positions in a line, for narrative effect.

Repetition of the same words and even of same lines is also very present in religious language. Drawing an example from holy Quran in Surah An-Naas we find the word "Naas" at the end of every sentence (ayat). It is the repetition of same word. Repetition of same line can also be noted in Surah e Rehmaan of Holy Quran. The line "Which then, of the favors of your Lord will you deny?" is repeated thirty one times.

2.4 SEMANTIC LEVEL

Semantics is the study of meanings of words that how they can be interpreted. Through the analysis of religious language at semantic level we come to know about the brevity and universality of religious language. The use of symbols, similes, metaphors, allusion, hyperbole, paradox etc. is found in language of religion. It means that language of religion is figurative language in which we notice the use of figures of speech.

Reasons behind the use of figurative language are:

- Presentation of descriptive truth.
- For the better comprehension of listeners or readers.
- Brief but comprehensive presentation of ideas.
- To make zealous and more engaging.
- Easy to remember.

The examples of the use of figures of speech in language of religion are as under:

The use of figurative language in Bible and Quran can be observed from the examples given below.

James 3.6: "The tongue also is a fire, a world of evil among the parts of the body."

In this line tongue is used as a metaphor.

Prov. 10.26: "*Like* vinegar to the teeth, and smoke to the eyes, so are the lazy to their employers."

Smoke and vinegar are used as simile.

Revlation.13.1: "Then I saw a beast coming out of the sea"

Here the technique of symbolism is used through the symbol of beast.

Surah al-Ahzaab (The Confederates) 33: 10. "When they came upon you from above you and from below you, and when the eyes grew wild and the hearts reached to the throats, and you were harbouring doubts about Allah."

Here the technique of hyperbole is used.

Surah Al- Baqrah 74: "Then your hearts hardened and became like rocks, or even harder."

Here simile as a figure of speech is used.

John 3.3: "...no one can see the kingdom of God unless he is born again."

In this line we find the example of paradox in Bible. So it can be said that religious language is full of figures of speech and it is very much aware of the use of figures of speech. We find figurative language even in Holy Books of different religions.

3 CONCLUSION

So it can be concluded that the language of religion is distinctive as well as prior to everyday language. In spite of many distinctive features language of religion is also having some similar features to the other registers. Language of religion is dynamic and complex regarding its function, style and interrelation with other texts.

Language of religion is considered prior or sometimes superior to everyday languages because of its standard and brevity. Examples in this respect are already given in the early part of the paper. Language of Holy books (especially that of descended books) is the standard language because of its affiliation with the God Almighty. It is in every respect, perfect regarding grammar and other initial aspects of any standard language. Religious speech situation often differs from that of everyday language. Everyday speech situation is a joint production of sharing words or phrases. In this register it is very necessary and important to know that what is being shared and by whom it is being shared. In the religious conversation because most of the religious conversation is the only sharing of the particular personality or power and sometimes this power is invisible and what is shared by Him all is of much Importance like Quran is shared by God and even a single word of it is having great importance and is having universal brevity and meanings.

We find that language of religion is having different features that are to some extent similar to that of everyday language. Levels of stylistic analysis are very much present in the language of religion. There is the foregrounding of theme as well as foregrounding of style in it. Grammar is mostly followed properly and the sentence structure is frequently found to be regular. As for as the semantic level is concerned, the figures of speech are present in the language of religion. Language of religion deals with different literary devices in order to foreground its theme, conciseness and preciseness, comprehension and to make its message remember able.

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DEDICATION

This work, first of all, is dedicated to ALLAH ALMIGHTY who helped us in completing it.

And it is also dedicated to our dearest brother Naeem Ahmed Jan Shaheed PAKISTAN NAVY (TMGHA-E-BASALAT).

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Perceptron Multicouches et réseau à Fonction de Base Radiale pour la prédiction du taux d'humidité

[Multilayer Perceptron and Radial Basis Function network to predict the moisture]

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ABSTRACT: This work presents the development of an artificial neural network model based on the Multi-layer Perceptron (MLP) and Radial Basis Function (RBF) for predicting the moisture in the zone of Chefchaouen (Morocco). Our objective is to treat a chronological series of measured data for network response evaluation. For this reason, we used a basic learning neural model for the years 2008 and 2013, the latter consists of a number of meteorological parameters such as humidity, temperature of the air, dew point temperature, air pressure, visibility, cloud cover, wind speed and rain. To determine the network architecture to be used, we varied the number of hidden number of neurons in hidden layers, transfer functions and pairs of transfer functions and learning algorithms. Models performances have been evaluated and developed through the study of the Mean Squared Error (MSE) and correlation coefficient (R). We demonstrated in this study for the prediction of moisture, the best performing model is the one used as transfer functions, the Tansig function in the hidden layer and the Purelin function in the output layer, while using a learning algorithm LM, PMC type of configuration [7-5-1].

KEYWORDS: Moisture, Artificial neural networks, PMC, RBF, Prediction, Learning algorithms.

RESUME : Ce travail présente le développement des modèles statistiques neuronaux de type Perceptron Multicouches (PMC) et réseau à Fonction de Base Radiale (RBF) pour la prédiction du taux d'humidité de la zone de Chefchaouen (Maroc). Notre objectif est de traiter une série chronologique des données mesurées entre les années 2008 et 2013 pour évaluer la réponse du réseau. Cette série est constituée d'un certain nombre de paramètres météorologiques telles que le taux d'humidité, la température de l'air, la température de rosée, la pression atmosphérique, la visibilité, la nébulosité, la vitesse du vent et la précipitation. Pour déterminer l'architecture du réseau à utiliser, nous avons varié le nombre des couches cachées, le nombre de neurones dans une couche cachée, les fonctions de transfert et les couples de fonctions de transfert ainsi que les algorithmes d'apprentissage. Les performances des modèles ainsi développés ont été évaluées grâce à l'étude de l'erreur quadratique moyenne (MSE) et le coefficient de corrélation (R). Nous avons montré par cette étude que pour la prédiction du taux d'humidité, le modèle le plus performant est celui qui utilise comme fonctions de transfert, la fonction Tansig dans la couche cachée et la fonction Purelin dans la couche de sortie, tout en utilisant un algorithme d'apprentissage LM, de type PMC de configuration [7-5-1].

MOTS-CLEFS: Taux d'humidité, Réseau de neurones artificiels, MLP, RBF, Prédiction, Algorithmes d'apprentissage.

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1 INTRODUCTION

Les modèles statistiques neuronaux sont des techniques très puissantes pour des données non linéaires. De ce fait, ils ont été appliqués dans divers domaines, notamment en climatologie et particulièrement en météorologie. Les réseaux de neurones artificiels (RNA) ont été utilisés pour approximer la relation entre les différentes variables météorologiques. Différentes études sont proposées dans la littérature à savoir :

Abdelli et *al*. [1] ont utilisé la méthode des réseaux de neurones de type perceptron multicouches, pour la prévision des polluants d'air. Leur objectif est de prévoir les concentrations de NO_2 et de trouver ses relations avec les autres variables météorologiques. Ils ont démontré que la concentration du NO_2 est une variable qui n'agit pas seule, mais elle est expliquée par d'autres variables, telles que la vitesse du vent, la direction du vent, la température et l'humidité.

Cheggaga et *al*. [2] ont développé et mis au point un logiciel qui permet l'estimation et la prédiction de la vitesse de vent dans le temps et dans l'espace en trois dimensions (rayon r, hauteur h, temps t), à base des réseaux de neurones, pour un apprentissage de quelques jours. Ils ont montré la possibilité de l'utilisation des réseaux de neurones à couches non-récurrentes pour l'extrapolation, la prédiction et l'interpolation de la vitesse de vent à partir des données météorologiques.

Abdallaoui et El Badaoui [3] ont utilisé les RNA pour le développement d'un modèle performant pour la prédiction des concentrations des métaux lourds dans les sédiments fluviaux marocains, à partir d'un certain nombre de paramètres physico-chimiques.

Bélanger et *al*. [4] ont utilisé aussi les réseaux de neurones multicouches pour la prédiction de la température de l'eau à partir des paramètres hydrométéorologiques, en se basant sur le modèle de l'intelligence artificiel.

L'objectif de la présente étude est le développement d'un modèle neuronal pour la prédiction des variations du taux d'humidité en fonction de variables météorologiques. Pour cette raison, nous avons utilisé les réseaux de neurones de type perceptron multicouches et les réseaux à fonction de base radiale, à cause de leurs structures simples, de leur utilisation dans une grande variété de problèmes de prédiction et de leurs aptitude à réaliser une transformation arbitraire des entrées vers les sorties.

2 MATERIEL ET METHODES

2.1 BASE DE DONNEES

Dans cette étude, nous avons utilisé une base de données qui est constituée de 1856 jours et huit variables météorologiques de la zone de Chefchaouen (Fig. 1). Ces variables sont définis comme suit :

- Sept variables indépendantes (explicatives) : la température de l'air (T_a), la température de rosée (T_r), la pression atmosphérique (P_a), la visibilité (Vis), la nébulosité (Néb), la précipitation (P_r) et la vitesse de vent (V).
- Une variable dépendante (à expliquer) : le taux d'humidité (H).

Les valeurs de ces variables ont été relevées toutes les quatre heures pendant 1856 jours entre les années 2008 et 2013. Elles ont été converties en moyennes journalières pour toutes les variables, sauf pour la précipitation (la quantité de pluie) qui est été transformée en une valeur cumulative de toute la journée [5].

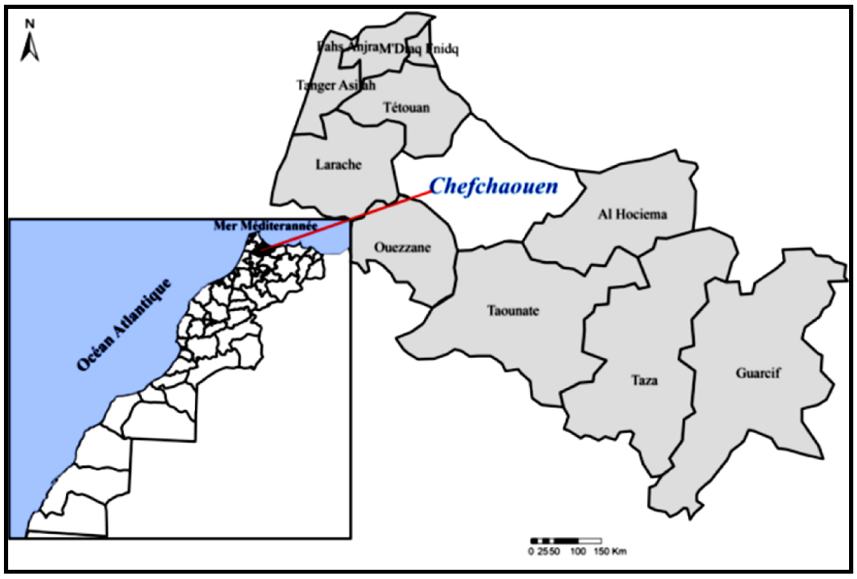

Fig. 1. Situation géographique de la zone de Chefchaouen

2.2 MISE EN FORME DES DONNEES

Les données d'entrée (variables indépendantes) sont des valeurs brutes non transformées qui ont des ordres de grandeurs très différents selon les variables. Afin d'uniformiser les échelles de mesures, ces données ont été converties en valeurs standardisées. En effet, les valeurs I_i de chaque variable indépendante (i) ont été standardisées par rapport à sa moyenne et son écart-type suivant la relation [6], [7], [8]:

$$\hat{I}_i = \frac{I_i - \mu_i}{\sigma_i} \quad (1)$$

$\hat{I}_i$: Valeur standardisée relative à la variable i ;

I_i : Valeur brute relative à la variable i ;

μ_i : Valeur moyenne relative à la variable i ;

σ_i : écart-type relative à la variable i.

Les valeurs correspondantes aux variables dépendantes ont été également normalisées dans l'intervalle [-1,1] à partir de la relation suivante [9]:

$$\hat{I}_i = \frac{2(I_i - \mathrm{Min}(I_i))}{(\mathrm{Max}(I_i) - \mathrm{Min}(I_i))} - 1 \quad (2)$$

3 RESEAUX DE NEURONES ARTIFICIELS (RNA)

Les réseaux de neurones artificiels constituent une nouvelle approche de modélisation des systèmes complexes, particulièrement utile lorsque ces systèmes sont difficiles à modéliser à l'aide des méthodes statistiques classiques. Les réseaux de neurones artificiels sont issus des premiers travaux réalisés dans le domaine de l'intelligence artificielle pour modéliser le fonctionnement du cerveau humain en se basant principalement sur le concept des neurones. Il s'agit d'un modèle empirique non linéaire [10], [11].

3.1 MODELE MATHEMATIQUE D'UN NEURONE ARTIFICIEL

Le modèle mathématique d'un neurone artificiel est illustré par la figure 2. Un neurone est essentiellement constitué d'un intégrateur qui effectue la somme pondérée de ses entrées. Le résultat de cette somme ensuite transformée par une fonction de transfert *f* qui produit la sortie O_n du neurone.

Les n entrées du neurone correspondent au vecteur noté: $\vec{I} = (I_1; I_2; I_3; \ldots; I_n)$

Le vecteur de poids est représenté par : $\overrightarrow{W} = (W_1; W_2; W_3; \ldots; W_n)$

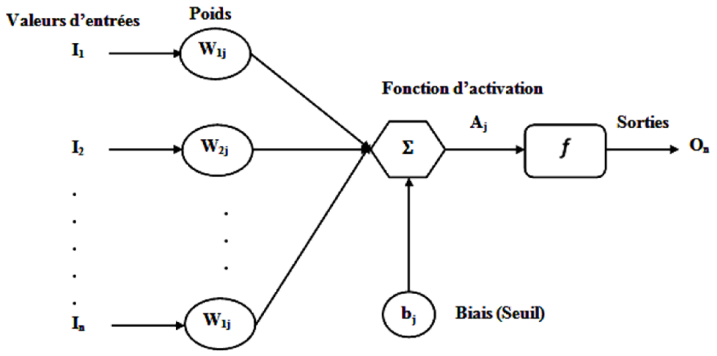

Fig. 2. Structure d'un neurone artificiel

La sortie O_n de l'intégrateur est définie par l'équation suivante :

$$O = W^T I - b \quad (3)$$

Le résultat de la somme pondérée représente le niveau d'activation du neurone. Le biais b est le seuil d'activation du neurone [12].

3.2 Développement des modèles de type PMC

Il existe un grand nombre de types de réseaux de neurones, dont chacun a des avantages et des inconvénients. Le réseau choisit dans notre cas est un réseau multicouches. Ce choix est fait pour la facilité et la rapidité de sa construction et encore par le fait que notre problème présente un nombre limité de variables d'entrées [13], [14]. La figure 3 illustre le Perceptron Multicouches dans le cas d'une seule couche d'entrée, de cachée et de sortie [15], [16].

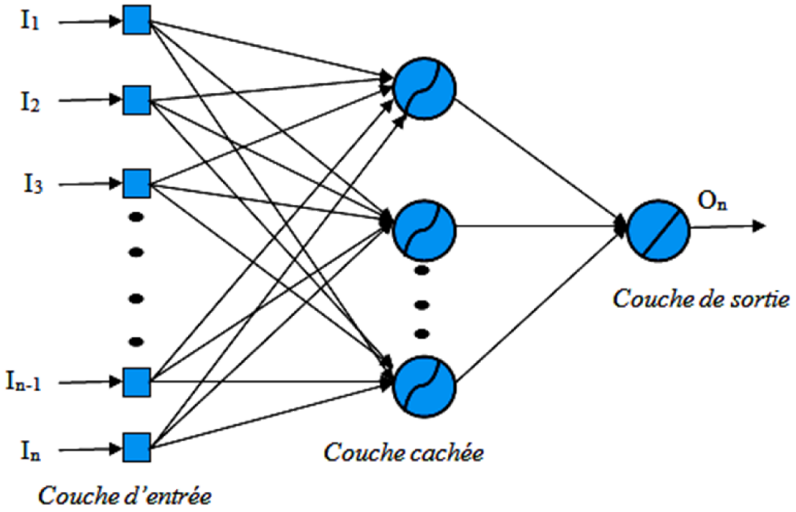

Fig. 3. Exemple d'architecture d'un PMC à n variables d'entrée, n neurones pour la couche cachée et un neurone pour la couche de sorties

Le Perceptron Multicouches est composé d'un assemblage de neurones répartis sur L couches. La première couche correspondant au vecteur composé des données d'entrée, la dernière couche contient le vecteur de sortie composé des valeurs desirées et entre ces deux couches il existe un certain nombre de couches cachées. La complexité du réseau est en fonction du nombre de ces couches cachées et du nombre des neurones élémentaires composant chaque couche.

3.3 Développement des modèles de type RBF

Le réseau RBF fait partie des réseaux de neurones supervisés. Il est constitué de trois couches (figure 4): une couche d'entrée qui retransmet les entrées sans distorsion, une seule couche cachée qui contient les neurones RBF qui sont généralement des fonctions gaussiennes [17], [18], [19] et une couche de sortie dont les neurones sont généralement animés par une fonction d'activation linéaire.

Chaque couche est complètement connectée à la suivante et il n'y a pas de connexions à l'intérieur d'une même couche. La différence fondamentale par rapport au Perceptron est que le réseau de neurones de type RBF permet d'introduire une contrainte de couverture de la zone d'activation du neurone. Il devient alors possible d'apporter au réseau de neurones, au moment de sa conception, de l'information sur le système considéré. Comme un PMC, un RBF peut être utilisé dans la prédiction, l'identification, la classification …, mais les réseaux RBF diffèrent des réseaux PMC, du fait que les fonctions d'activation des nœuds de la couche cachée sont des fonctions gaussiennes.

Le modèle de réseau RBF est caractérisé par quatre paramètres principaux, qui doivent être réglés, lors de l'étape de construction du réseau. Toute modification d'un de ces paramètres entraîne directement un changement du comportement du réseau. Ces paramètres sont :

- Le nombre de neurones RBF dans l'unique couche cachée ou le nombre des gaussiennes,
- La position des centres des gaussiennes de chacun des neurones.
- La largeur de ces gaussiennes.
- Le poids des connexions entre les neurones RBF et le(s) neurone(s) de sortie.

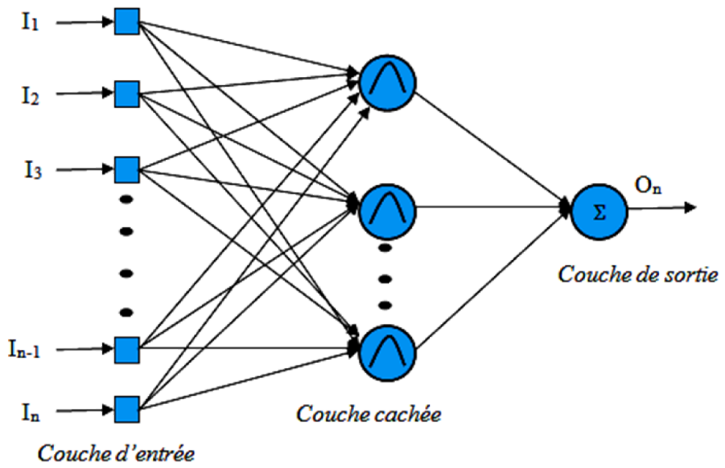

Fig. 4. Structure typique d'un réseau de neurones de type RBF

La couche cachée contient les n nœuds, qui appliquent une transformation non linéaire sur les variables d'entrée. Plus spécifiquement, chaque nœuds n a un centre C_n, où C_n est un vecteur dont la dimension est égale au nombre d'entrées.

Pour chaque nouveau vecteur d'entrée I= [I_1, I_2, …, I_n], la norme de la distance euclidienne entre le vecteur d'entrée et le centre de nœuds est calculée comme suit [20], [21] :

$$\nu_n(I) = \|C_n - I\| = \sqrt{\sum_{i=1}^{n} (I_i - C_{n,i})^2} \quad (4)$$

Le rendement (sortie) des nœuds de la couche cachée est déterminé par une fonction d'activation non linéaire de type gaussien :

$$f(\nu) = \exp\left(-\frac{\nu^2}{\sigma^2}\right) \quad (5)$$

Avec σ est l'écart-type de la fonction d'activation. Une règle empirique consiste à prendre :

$$\sigma_n = \left(\frac{d_n}{\sqrt{2M}} \right) \quad (6)$$

Où d_n est la distance maximale entre le centre n et les autres centres et M présente le nombre total des centres de la couche cachée.

Ainsi, le rendement du nœuds j de la couche cachée est donné par :

$$Z_j = f(\nu_j) \quad (7)$$

Un ensemble de poids synaptique W_j, j = 1, 2, ..., j est appliqué aux raccordements entre la couche cachée et la couche de rendement. Les nœuds dans la couche de rendement servent seulement comme unités d'addition, qui produisent le rendement final du réseau. La sortie de la couche de rendement sera donnée comme suit :

$$O = f \left(\sum_{i=1}^{n} W_j \, Z_j + b_j \right) \quad (8)$$

Avec *f(n)=n* : Fonction linéaire

L'ensemble des poids synaptiques qui existent entre la couche cachée et la couche de rendement est calculé en fonction du vecteur cible, $O = [O_1, O_2, \ldots, O_n]$ qui est donné par [22], [23] :

$$W = \text{inv} (Z^T Z) Z^T Y^T \quad (9)$$

Avec inv : Inverse

A travers les formules mathématiques citées précédemment, nous avons présenté la topologie à suivre pour le développement du réseau neuronal RBF [24], [25], [26], [27], que nous appliquerons par la suite pour la prédiction du taux d'humidité.

4 RESULTATS ET DISCUSSION

4.1 Réseau de neurones de type PMC

Dans le cadre de ce travail, nous avons utilisé les réseaux de neurones non récurrents de type PMC. Le choix d'exploiter un type de réseaux de neurones par rapport à un autre n'est pas arbitraire, mais repose sur les fondements qu'exige le problème en question. Sachant que chaque type de réseaux, en termes d'apprentissage, est conseillé pour une application donnée. Nous avons opté donc pour le PMC puisqu'il répond aux spécificités du problème de prédiction. Ce réseau apporte des résultats très significatifs et le taux de précision de la prédiction étant meilleur.

Pour déterminer l'architecture du réseau à utiliser, nous avons varié le nombre de couche cachée, le nombre de neurones dans une couche cachée, les fonctions de transfert, le nombre d'itération et le pas d'apprentissage [26]. Pour cela nous avons divisé aléatoirement notre base de données en trois parties : 60% pour l'apprentissage, 20% pour le test et 20% pour la validation.

Dans le tableau, 1 nous avons présenté les calculs des MSE et R pour une, deux, trois et quatre couches cachées et nous avons remarqué que l'augmentation du nombre des couches cachées augmente la charge des calculs sans aucun gain de performance. Nous pouvons donc, affirmer que l'utilisation d'une seule couche cachée est meilleur pour le modèle de type PMC.

Table 1. Performances du système en fonction du nombre de couches cachées

Nombre de couches cachées	MSE (10^{-5})	R
1	**3,6**	**0,97**
2	5,39	0,96
3	5,71	0,94
4	40,41	0,39

Par ailleurs, signalons que nous avons choisi d'utiliser, pour l'apprentissage l'algorithme de Levenberg-Marquardt (LM) qui repose sur une méthode standard pour l'optimisation de l'erreur quadratique due à ses propriétés de convergence rapide et de robustesse. La méthode de cet algorithme s'appuie sur les techniques des moindres carrés non-linéaires et de l'algorithme de Gauss-Newton à voisinage restreint.

La principale motivation du choix de l'algorithme de Levenberg-Marquardt (LM) repose sur les avantages suivants :

- Facilité des modifications des critères de convergence,
- Interprétabilité des critères de convergence,
- Facilité de récupérer les variances des estimations,
- Rapidité de la convergence vers un minimum.
- Pour déterminer le modèle de type PMC, nous avons changé le nombre de neurones dans la couche cachée ainsi que les couples de fonctions de transfert. Les performances ont été évaluées grâce à l'erreur quadratique moyenne et le coefficient de corrélation. Les résultats obtenus sont illustré dans les figures (5 et 6) et le tableau 2.

D'après ces résultats (figures 5 et 6, et le tableau 2) nous notons que:

- le couple de fonctions de transfert (Tansig -Tansig) a donné une erreur quadratique moyenne de 8,5 x 10^{-5}, avec un réseau d'architecture [7-8-1]. Avec cette configuration nous arrivons à une meilleure performance pour l'algorithme d'apprentissage LM. Cette performance a été rencontrée au bout de 50 itérations.
- Avec la fonction de transfert Tansig pour la couche cachée et la fonction Logsig pour la couche de sortie, la meilleure performance pour l'algorithme LM est obtenue avec le réseau de neurones qui a comme architecture [7-9-1]. Cette configuration a enregistré une erreur quadratique moyenne de 27 x 10^{-5}, au bout de trente itérations.
- Pour l'algorithme d'apprentissage LM, la meilleure performance est obtenue avec un réseau de neurones d'architecture [7-5-1], avec la fonction Tansig comme fonctions de transfert pour la couche cachée et la fonction purelin pour la couche de sortie, Avec 5 neurones cachés, l'erreur quadratique moyenne converge vers le minimum d'erreur (MSE=1,5 x 10^{-5}).
- Pour le couple de fonctions de transfert (Logsig-Logsig), le minimum de l'erreur quadratique moyenne, a été obtenu avec un réseau d'architecture [7-10-1].
- Nous avons obtenu les meilleurs résultats pour (MSE=7,8 x 10^{-5}) avec un réseau de neurones d'architecture [7-9-1] et qui a comme couple de fonctions d'activations (Logsig-Tansig). Ce couple est de même configuration neuronal que le couple de transfert (Tansig-Logsig).
- L'architecture [7-11-1] avec une fonction Logsig pour la couche d'entrée et une fonction Purelin pour la couche de sortie, a donné les meilleures performances pour une valeur minimale de l'erreur quadratique moyenne égale 7,8 x 10^{-5}.

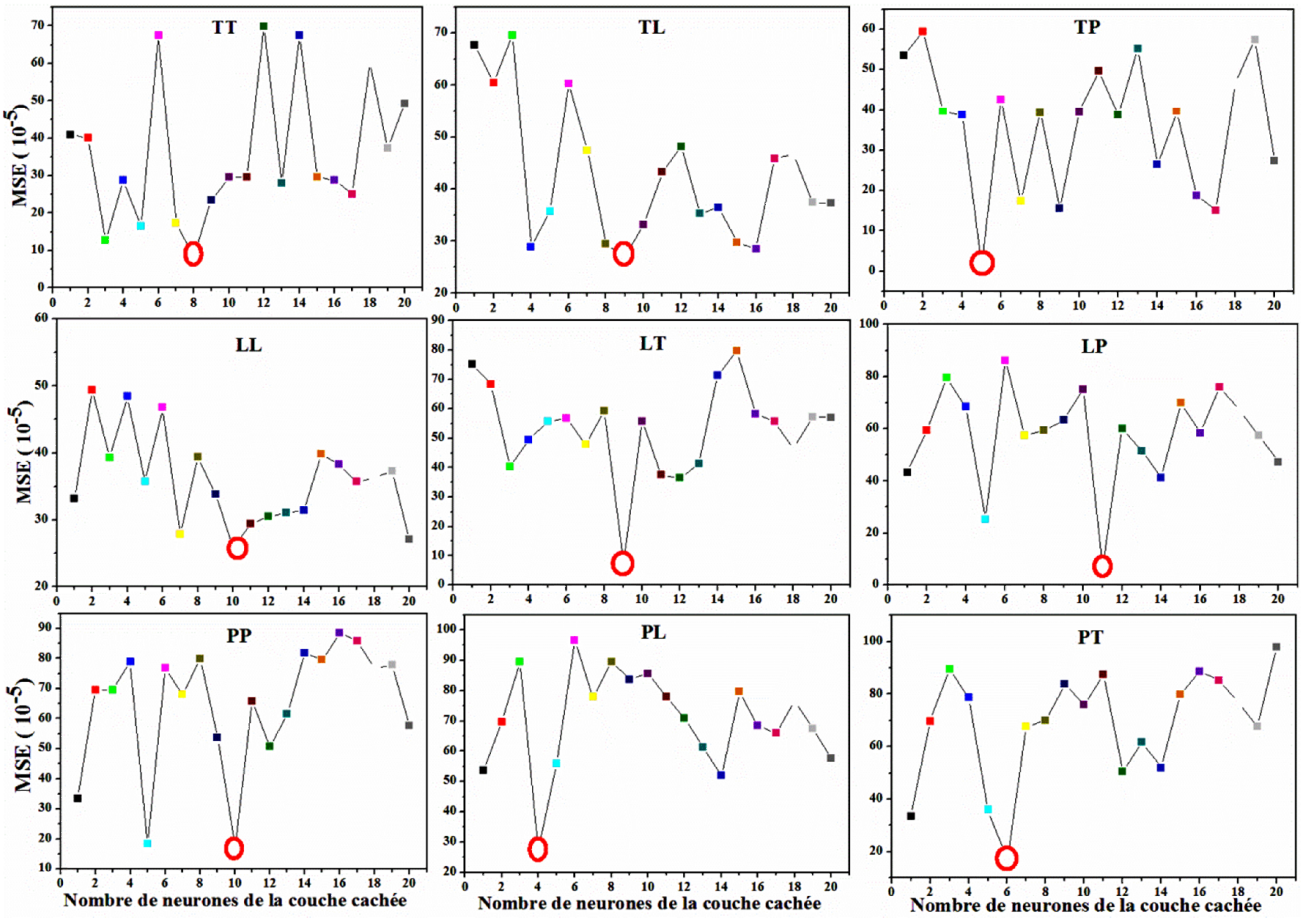

Fig. 5. Variation du MSE en fonction du nombre de neurones de la couche cachée pour l'algorithme d'apprentissage LM et pour différentes couples de fonctions de transfert

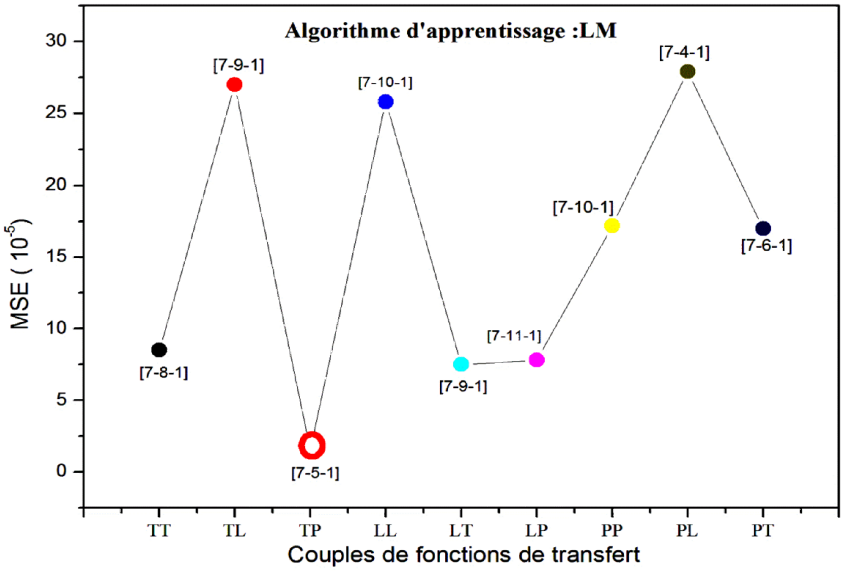

Fig. 6. Variation du MSE en fonction des couples de fonctions de transfert pour l'algorithme d'apprentissage LM

Désignations des couples de fonctions de transfert :

TT:	Tansig-Tansig;	**TL:**	Tansig-Logsig;	**TP:**	Tansig-Purelin;
LL:	Logsig –Logsig;	**LT:**	Logsig-Tansig;	**LP:**	Logsig-Purelin;
PP:	Purelin-Purelin;	**PL:**	Purelin- Logsig;	**PT:**	Purelin-Tansig.

- Pour la combinaison de fonctions de transfert Purelin-Purelin le minimum de l'erreur quadratique moyenne est égal à 17,2 x 10^{-5}. Ce minimum est obtenu pour la configuration de réseau [7-10-1].
- L'architecture [7-4-1] avec une fonction Purelin pour la couche d'entrée et une fonction Logsig pour la couche de sortie, a donné la meilleure performance pour l'algorithme Levenberg-Marquardt, avec MSE= 27,9 x 10^{-5}.
- Pour le couple de fonctions de transfert (Purelin-Tansig), le minimum de l'erreur quadratique moyenne est égal 17 x 10-5, obtenu pour le réseau d'architecture [7-6-1] et pour quatre vingt itérations.
- L'algorithme LM converge avec le minium du nombre d'itérations, 27 itération pour le couple de fonctions de transfert Tansig-Purelin et 90 représente la valeur maximale d'itération pour les combinaisons de fonctions de transfert Purelin-Tansig, cet algorithme est réputé très performant dans l'approximation des fonctions surtout quand le réseau contient moins d'une centaine de poids, surtout quand la taille du réseau est assez grande.

Table 2. Meilleures performances de LM obtenues pour chaque couples de fonctions de transfert

Couche cachée	Couche de sortie	Désignations	MSE (10^{-5})	Architecture	Nombre d'itérations
Tansig	Tansig	TT	8,50	[7-8-1]	50
Tansig	Logsig	TL	27,00	[7-9-1]	30
Tansig	***Purelin***	***TP***	***1,50***	***[7-5-1]***	***27***
Logsig	Logsig	LL	25,80	[7-10-1]	60
Logsig	Tansig	LT	7,50	[7-9-1]	30
Logsig	Purelin	LP	7,80	[7-11-1]	30
Purelin	Purelin	PP	17,20	[7-10-1]	30
Purelin	Logsig	PL	27,90	[7-4-1]	60
Purelin	Tansig	PT	17,00	[7-6-1]	90

Par ailleurs, signalons que d'après ces résultats, nous pouvons affirmer que pour la prédiction du taux d'humidité le modèle le plus performant est celui qui utilise comme fonctions de transfert, la fonction Tansig dans la couche cachée et la fonction Purelin dans la couche de sortie, tout en utilisant un algorithme d'apprentissage LM, de type PMC de configuration [7-5-1] et renfermant trois couche (Figure 7) :

- 7 neurones dans la couche d'entée, représentant les variables météorologiques indépendantes ;
- 5 neurones dans la couche cachée, déterminés par les des indicateurs statistiques,
- Un seul neurone de la couche de sortie, qui représente le taux d'humidité.

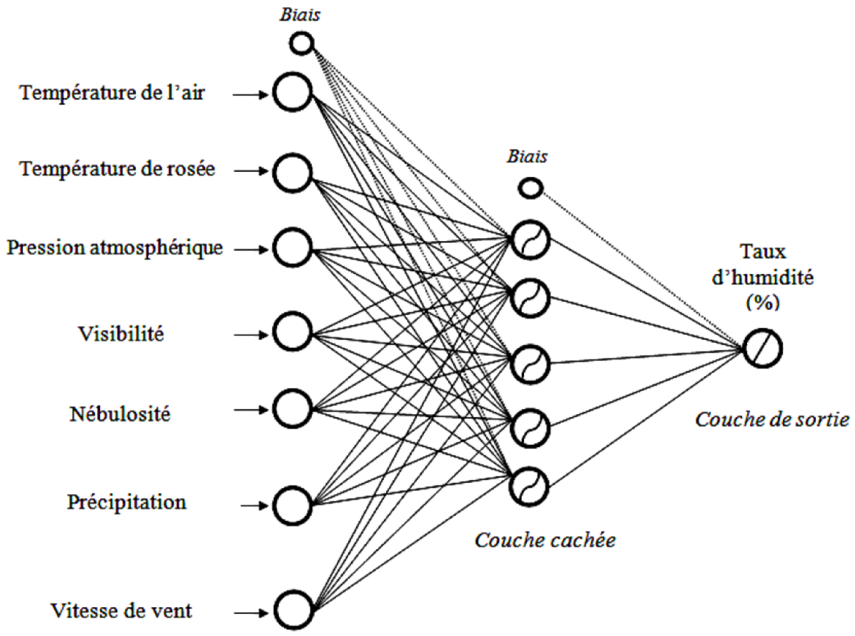

Fig. 7. Architecture du réseau de neurones à trois couches de configuration [7-5-1] développée dans cette étude

4.2 Réseau de neurones de type RBF :

Le réseau de neurone artificiel RBF se compose d'une couche d'entrée contenant sept neurones, d'une couche cachée et d'une couche de sortie contenant un seul neurone.

Les variables d'entrées se composent de sept vecteurs I_1, I_2, I_3, …, I_7, indépendants et normalisés entre -1 et 1 qui sont: la température de l'air, la température du point rosée, la pression atmosphérique, le vent, la pluie, la nébélosité et la visibilité.

Pour le developpement du réseau RBF, nous calculons le centre gaussien de chaque vecteur : C_1, C_2, C_3, …, C_7 par l'utilisation de la moyenne arithmétique (Tableau 3), ainsi que la distance euclidienne entre les sept vecteurs et leur centre. Cette distance euclidienne est présentée à la couche cachée, pour être transformé en employant une fonction gaussienne.

Table 3. Calcul du centre gaussien pour chaque variable météorologique

Variable météorologique	Centres gaussien
Température de l'air (T_a)	18,82 (°C)
Température rosée (T_r)	11,78 (°C)
Pression atmosphérique (P_a)	1016,57(hPa)
Vitesse du vent (V)	10,56 (km/h)
Précipitations (Pr)	1,23(mm)
Nébulosité (Néb)	3,12(Octas)
Visibilité (Vis)	13,62(km)

La sortie de chaque neurone de la couche cachée sera amplifié par les poids W_i. Ces derniers ont été calculés par l'équation de pseudo-inverse, puis rajoutés au biais b_j de la couche de sortie et transformés enfin par une fonction linéaire. Nous obtenons alors le modèle du réseau RBF, tout en fixant les poids et les biais relevés dans la phase d'apprentissage. La

partie test consiste à valider l'architecture neuronale RBF de configuration [7-5-1] en jugeant sa capacité de prédiction. Nous avons par ailleurs comparé les performances des modèles statistiques neuronaux PMC et RBF.

Dans le tableau 4, nous donnons les moyennes des taux de prédiction relevés lors des phases d'apprentissages, de validation et de tests pour les modèles des réseaux neuronaux RBF et PMC.

Cette comparaison a pu mettre en évidence le fait que le modèle PMC est celui qui présente les meilleures performances. Bien qu'en terme de corrélation les trois phases soient identiques pour PMC. La part d'information apportée par chacun des modèles sur les observations réelles est également supérieure pour le modèle PMC, avec un coefficient de corrélation de 97%, et de 72% pour le modèle neuronal RBF (Tableau 4).

Table 4. Taux de prédiction moyens obtenus par les réseaux RBF, PMC

Réseaux	RBF	PMC
Taux d'apprentissage moyens (%)	73	97
Taux de validation moyens (%)	70	97
Taux de test moyens (%)	72	97

Avec les réseaux de neurones de type PMC, les modèles ont des coefficients de corrélation presque égal à l'unité ($R \sim 1$), Ceci montre qu'il y a un grand rapprochement entre les valeurs mesurées et celles simulées par le modèle PMC développé dans le cadre de ce travail. Ce modèle est peut donc être considéré comme un outil d'une grande efficacité dans le domaine de l'étude de la prévision du taux d'humidité de la zone de Chefchaouen.

Par l'étude des réseaux PMC et RBF, nous permettons de dégager les points suivants: les résultats obtenus par les deux modèles neuronaux sont satisfaisants, les taux d'apprentissage fournis par le PMC sont souvent les meilleurs, mais ses performances dépendent de l'initialisation des poids. La phase d'apprentissage du réseau PMC est plus rapide que celle de modèle neuronal RBF et il converge pour un nombre réduit d'itérations par rapport au réseau RBF. Par contre l'apprentissage du réseau RBF est simple, Ceci est en accord avec les résultats de quelques études plus récentes qui ont démontré que les modèles de type PMC sont plus performants comparativement à ceux établis par les modèles de type RBF [28], [29], [30].

5 Conclusion

Nous avons montré lors de cette étude, les performances de la méthode de prédiction par les réseaux de neurones en utilisant les réseaux PMC et RBF pour prédire l'humidité relative de la zone de Chefchaouen.

les résultats obtenus par l'ensemble des modèles sont satisfaisants; les taux d'apprentissage fournis par le PMC sont les plus meilleurs mais ses performances dépendent de l'initialisation des poids. Les taux de test du réseau PMC sont les plus meilleurs que ceux des autres réseau neuronal RBF, d'où le réseau PMC a bien généralisé les nouvelles données. La phase d'apprentissage du réseau PMC est plus rapide que celle des réseaux neuronaux à fonction de base radiale et il converge pour un nombre réduit d'itérations par rapport aux réseaux RBF.

L'utilisation de ces modèles neuronaux dans le domaine de la prédiction s'est avérée intéressante et encourageante, pour cela nous envisageons l'application d'une autre base de donnée plus élargie et aussi l'utilisation d'autres techniques surtout pour mieux améliorer le taux d'apprentissage du réseau RBF.

Il est à signaler que notre étude nous a permis d'affirmer que pour la prédiction du taux d'humidité le modèle le plus performant est celui qui utilise comme fonctions de transfert, la fonction Tansig dans la couche cachée et la fonction Purelin dans la couche de sortie, tout en utilisant un algorithme d'apprentissage Levenberg-Marquardt, de type PMC de configuration [7-5-1] et renfermant trois couche.

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Effect of Textile, Dyeing and Printing industrial effluents on river Kshipra at Bherugarh Ujjain, M.P., India

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ABSTRACT: Water is the resource that sustains all life on earth and is a key element of sustainable development. It is essential if human beings are to enjoy healthy and safe lives or realize social and economic development.
Water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. Water pollution means such contaminations of water or such alteration of the physical, chemical or biological properties of water likely to create a nuisance or render such water harmful to public health or safety.
Present study deals with the study of the pollution levels of Kshipra river at Bherugarh, Ujjain. There are many small scale textile, dyeing and printing industries in this locality. In these industries many chemicals, dyes, detergents, waxes, starch and cellulose are used. These industrial effluents are directly thrown in the river without prior treatment. Due to this effluent, river water gets polluted hence this water becomes unfit for drinking, bathing and even washing purposes.
The physicochemical study of river indicates that river water is highly polluted. All parameters showed higher values than the prescribed standard values.

KEYWORDS: Sustainable development, Contamination, Kshipra river, Bherugarh, Physicochemical.

INTRODUCTION

All known forms of life depend on water. Water is vital both as a solvent in which many of the body's solutes dissolve and as an essential part of many metabolic processes within the body. Water had been regarded as an infinite resource. As population growth and economic expansion accelerated and intensified the use and abuse of water resources over the past few decades, a greater and greater imbalance between water availability and water demand has resulted. This imbalance has brought a veritable crisis with regard to water in many regions of the world, including but not limited to such problems as widespread water scarcity, water quality deterioration, and the destruction of freshwater resources[1]. From biological standpoint, water has many distinct properties that are critical for the proliferation of life that set it apart from other substances. It carries out this role by allowing organic compounds to react in ways that ultimately allow replication. Clean and plentiful water provides the foundation for prosperous communities.

Pollution means the introduction of materials that harm the health or survival of plants, animals and humans. Pollutants increasingly overwhreth the biosphere's capacity to deal with them and often have long term consequences[2].

Water pollution includes all of the waste materials that cannot be naturally broken down by water. In other words, anything that is added to the water, above and beyond its capacity to break it down, is pollution. A toxic substance is a chemical pollutant that is not a naturally occurring substance in aquatic ecosystems. Water pollution is a major global problem that requires on going evaluation and revision of water resource policy at all levels (from international down to individual aquifers and wells). In addition to the acute problems of water pollution in developing countries, industrialized countries continue to struggle with pollution problems as well[3].

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Ujjain is a holy city, situated in Madhya Pradesh, India. Mokshdayani river Kshipra encircles this region. This river has a special religious importance. Present state of river is miserable. It is polluted to such a level that it is not even fit for washing purposes. Many planktons etc. grow in it. It has lost its flow due to pollution and eutrophication. City waste and industrial waste is directly thrown in to the river.

Bherugarh is a village situated in the north of Ujjain on the banks of river Kshipra. The main occupation of people in this region is Bherugarh printing and dyeing cotton textiles which is small scale industry. Here cotton printing is done and in this printing many chemicals, dyes, detergents, waxes, starch and cellulose are used, its effluent is directly thrown in the river without treatment.

The water of river gets contaminated affecting the flora, fauna, microbial population, health of people and aquatic ecosystem.

AIM

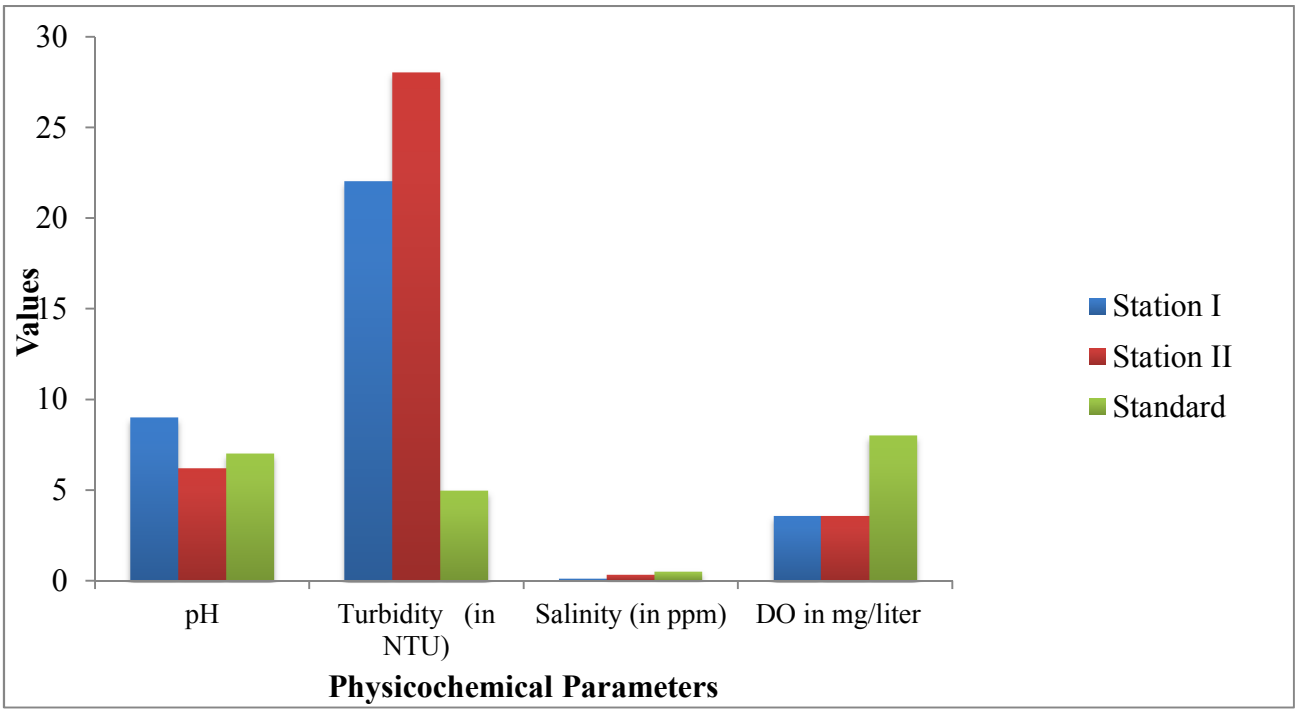
The objectives of present study is to study the pollution level of river Kshipra at different sampling stations of Bherugarh with the help of different physicochemical parameters, to check the potability of water.

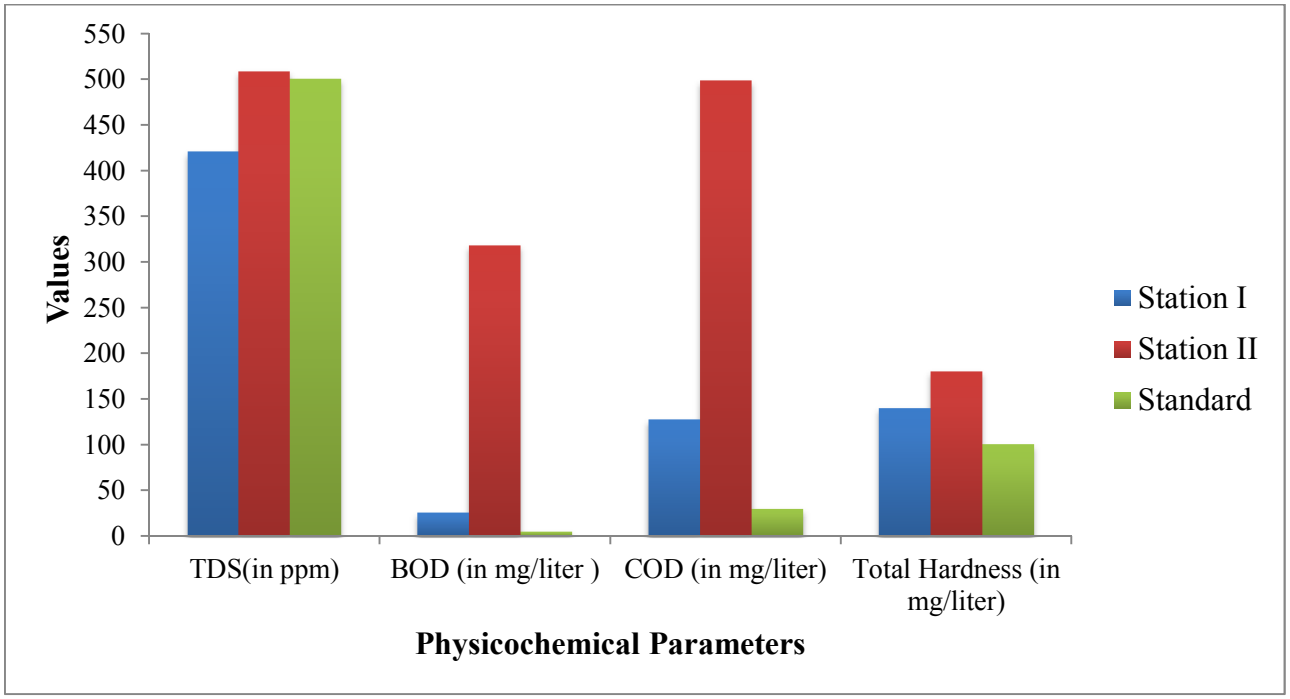
MATERIALS AND METHOD

In present study physicochemical parameters of the river Kshipra at Bherugarh were analysed at two sampling stations, which were selected for sample collection. First sampling station is river Kshipra before joining of the effluent drain and the second sampling station is at the confluence of effluent drain and river Kshipra. Physicochemical parameters studied were i.e. pH, TDS, turbidity, Salinity, BOD, COD, Total hardness and DO by using methods from APHA, AAWA and WPCA[4].

Parameters	Station I	Station II	Standard
pH	9.0	6.2	6.5
TDS(in ppm)	420	508	500
Turbidity (in NTU)	22	28	5
Salinity (in ppm)	0.10	0.32	0.5
BOD (in mg/liter)	26	318	<=5
COD (in mg/liter)	128	498	30
Total Hardness (in mg/liter)	140	180	100
DO in mg/liter at 35^0C	3.6	3.6	8.0

Observation- TABLE (1):- Study of physicochemical parameters





RESULTS AND DISCUSSION

pH- At station I and station II the pH was reported as 9.0 and 6.2 respectively, which indicated the drain water is slightly acidic, while river water is alkaline. When the pH value falls below 6.15 or rises above 8.5, many of the basic nutrients become died up, so that they are unavailable to plants and the overall productivity is lowered. pH is affected not only by the reaction of carbon dioxide but also by organic and inorganic solutes present in water. Any alteration in water pH is accompanied by the changes in other physico-chemical parameter. pH maintenance is one of the most important attributes of any aquatic system since all the biochemical activities depend on the pH of the surrounding water[5].

TDS- The value of TDS at station I is 420mg/l. At station II TDS is 508mg/l. TDS value of drain is slightly higher than the river water that indicates that the drain water is polluted. NAFDA (2001) recommended maximum TDS value of 500mg/l in drinking water supply. In natural waters, dissolved solids are composed mainly carbonates, bicarbonates, chlorides,

sulphates, phosphates, nitrates, magnesium, sodium, potassium, iron and manganese etc. The excess amount of TDS in waters disturb the ecological balance and cause suffocation of aquatic fauna[6].

Turbidity- At station I the turbidity is 22NTU and at station II the turbidity is 28NTU which is much higher than the standard value. Turbidity of water may be of organic or inorganic origin. The higher the turbidity level, the higher the risk that people may develop gastrointestinal diseases. This is especially problematic for immune-compromised people, because contaminants like viruses or bacteria can become attached to the suspended solids[7]. The suspended solids interfere with water disinfection with chlorine because the particles act as shields for the virus and bacteria.

Salinity- At station I the salinity is 0.10 and at station II salinity is 0.32. After the addition of industrial effluent salinity value has increased three fold. There by affecting the quality of water in the river. Salinity is the total concentration of all dissolved ions in the water and is measured in mg/l or ppm. Fresh water species have limited range of tolerance to salinity fluctuations (stenohaline). In fresh water ponds high salinity may have an adverse effect on the growth and survival of plants and animals, ultimately affecting the yield of the crop.

BOD- At station I BOD is recorded as 26mg/l. At station II the BOD value was 318mg/l. At both the stations BOD value is higher than the standard value but at station II the value is much higher indicating that the water has got polluted on addition of effluent. BOD is a measure of the oxygen in the water that is required by the aerobic organisms[8]. BOD is an important parameter that indicates the magnitude of water pollution by oxidizable organic matter. The main source of organic pollution include untreated domestic sewage, agricultural runoff containing residual fertilizers. The components of oxidizable matter include carbonaceous organic matter, nitrogenous compounds and chemically reducing compounds. In natural course the organic matters on oxidation enters into bio-geo-chemical cycles. BOD is measure of oxygen required by microbes to degrade the organic matter under aerobic condition. BOD increases inflow of the domestic waste [9].High BOD depletes the oxygen level to a critical condition thus indicating the pollution status of water, due to discharge of animal fecal wastes coupled with high temperature indicating organic pollution. BOD is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water. It represents a significant positive correlation with temperature and COD[10].

COD- COD determines the oxygen required for chemical oxidation of organic matter with the help of strong chemical oxidant. COD is an oxygen demand to decompose the biodegradable as well as non biodegradable organic waste. At station I COD value is 128mg/l. At station II COD is 498mg/l. At both the station the value of COD is much higher than the standard value but at station II the value of COD is very high. COD is a measure of the oxygen equivalent of the organic matter content of water that is susceptible to oxidation by a strong chemical oxidant. Thus, COD is a reliable parameter for judging the extent of pollution in water .The COD of water increases with increasing concentration of organic matter[11]. COD is a measure of oxygen required to oxidize the organic matter by a strong chemical oxidant. It is used to measure the pollution strength of domestic and industrial wastes. COD gives an idea of concentration of substances, which may undergo immediate chemical oxidation. All organic compounds with little exception can be oxidized by the action of strong chemical oxidants under acidic condition. The estimation of COD is of great importance for water having unfavorable conditions for the growth of microbes, such as in the presence of toxic chemicals. It is a fact that all organic compounds with few exception, can be oxidized for the action of strong oxidizing agents under acidic condition, COD test is useful in pinpointing toxic condition and presence of biologically resistant substance.

Total Hardness- The value of total hardness is 140mg/l at station I. At station II the value of total hardness is 180mg/l. At both the stations Hardness value is higher than the standard value, addition of effluent increased hardness. Water hardness refers to the concentration of Ca and Mg. As calcium and magnesium bond with carbonates and bicarbonates and water hardness are closely interrelated and produce similar measured levels[12]. The hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca and Mg expressed as $CaCO_3$. The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature.

DO- At station I DO is 3.6mg/l. At station II DO is 3.6mg/l. DO is governed by rate of photosynthesis, BOD, water temperature and carbon dioxide concentration. Low content of DO is sign of organic pollution, is also due to inorganic reductants like ammonia, nitrates, and other such oxidisable substances. Since DO in water samples depends on water temperature, partial pressure of the gas in contact with water, the concentration of the dissolved salts, biological activities and geology of river basin. Further, concentration of DO is inversely proportional to temperature at a given time. DO is negatively correlated with temperature, BOD and COD[12].

The values of physicochemical parameters indicate that the river water is itself polluted and addition of industrial effluent at Bherugarh increases most of the parameters studied. This indicates that it is polluting the river to such an extent that the river water has become much more polluted which may cause serious problems if the water is used for any of the purposes.

Hence it becomes necessary to remove or detoxify the pollutants from the river water for its potability and use for other purposes.

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STEREOTYPICAL GENDERING IN SECONDARY SCHOOLS: REPERCURSIONS FOR STUDENTS' PERFORMANCE IN TANZANIA. A CASE OF MOROGORO MUNICIPAL

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ABSTRACT: The main purpose of the study was to assess teachers' and students' perception of gendering process over girls and boys at secondary schools. Specifically the study aimed at examining the impact of socialization to the students' academic performance in secondary schools. A total of 182 respondents were interviewed by the use of semi structured questionnaires, Focus Group Discussion and direct observations were employed to obtain the required information. Results show that the common gender stereotypes in secondary schools include "boys are intelligent", "boys prefer studying science subjects", "girls prefer studying art subjects", and "girls are inferior". Results reveal that socialization process promotes effective learning and teaching, increases cooperation and participation, improves students' performance and promotes school ethics conformity. The study concludes that Gender – aware and - sensitive teachers and students play a vital role in promoting gender equality and in turn will interact in a gender lens with the society they are born into. The existing negative stereotyping notions and prejudices amongst students and teachers over girl students; call for re-thinking of the current Tanzanian Women and Gender and Development policy to address negative assumptions and prejudices over girls.

KEYWORDS: Socialization, gender stereotypes, academic performance, equality.

1 INTRODUCTION

According to Bhasin (2000), the specific process which teaches children their gender roles is also called gendering or gender indoctrination. Bhasin continues by saying that, the difference with which children are addressed, handled, treated and clothed and, through this regulation, taught how they should behave to be part of the society they are born in. Human beings are deeply influenced by and involved with other people (Farley, 1998). "Through socialization people adapt and learn to modify their behaviour, thoughts, feelings and attitudes according to the requirements of their culture and society" (Romer, 1981). Also, through socialization, gender stereotyping are learned. Gender stereotyping greatly influence how people think and behave. According to traditional stereotypes, males are strong and dominant, while females are submissive. Gender stereotypes are disadvantageous in that they create bias and prejudices against females.

Gender stereotyping refers to structured sets of beliefs about the personal attributes, behaviours and roles of a specific social group, (Wakhungu, 2008). Cuz (2012), also defined gender stereotyping as putting down someone because of their "sex" or not believing they are able to do something because they are either male or female. According to Women information centre (2005), gender stereotyping occurs when certain characteristics or roles are persistently attributed to men or women, thereby creating the belief that these are invariably linked to sex. For instance, the perceptions that all men (boys) are intelligent and breadwinners while women (girls) are less intelligent, dependent and carers of children and the family as a whole.

Education is one of the pivotal institutions in terms of socialization. It deals with the change of people's attitudes toward themselves, their lives and the surrounding world (Tjernstrom, 2005). Since human beings lack highly developed inborn knowledge, the knowledge and the technology necessary to make life easier must be transmitted to each new generation. Before modern times, the family was mostly responsible for these transmissions especially in the provision of skills necessary

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for survival in the society. As a result of transition from agricultural society to industrialized societies, the educational institutions needed a big transformation as well as other pivotal institutions (agents of socialization) among which are; the family, religion, peer groups, state, mass media and work place, from informal to formal education (Romer, 1981). Because family members could not teach all that a child needs to know, formal education, known as schooling, took most of the mission of the family during that time. However socialization differs across societies; the more complex the society is, the more lengthy the education process. Idealistically, in modern societies, the central element of education lies in the belief that schools offer equal opportunities for all individuals (Romer, 1981).

2 PROBLEM STATEMENT

Although education is very important in community development, formal education still has biasness among female and male students that is why today there are too many boys in secondary schools compare to girls. In secondary schools the impact of socialization is vivid because majority of teachers do believe that boy students are born intelligent compared to girls. This is more expressed in performance, responding to questions, undertaking of science versus arts subjects whereby teachers tend to favour boys over girls. Also, most of employed teachers in secondary schools are men, and so there is a high chance of differential treatment between boys and girls in selection of subjects. For instance, boys are encouraged to take science subjects while girls advised to take arts subjects. At the same time, boys are praised than girls to show that they are more intelligent. In these context boys seem to be good in performance compare to girls, something which is not true. It is from this experiences that the researcher decided to investigate the impact of gender stereotypes on students' performance in secondary schools in Morogoro Municipal.

3 OBJECTIVES OF THE STUDY

This study assesses teachers' and students' perception of gendering process over girls and boys at secondary schools. Specifically, it aimed at examining the impact of gender stereotypes on students' academic performance in secondary schools.

4 RESEARCH METHODOLOGY

4.1 RESEARCH DESIGN

This study adopted *an ex post facto* design. It is a kind of systematic empirical inquiry whereby a researcher does not have direct control over independent variables because their manifestations have already occurred or because they are inherently not manipulable (Kerlinger, 1973). The study was carried out in Morogoro Municipality in four (4) selected secondary schools namely SUA, Morogoro, Mafiga and Kayenzi secondary schools.

4.2 SAMPLE AND SAMPLING PROCEDURE

The sample of this study comprised of Heads of schools, Teachers, WEO, MCDO, WECO, School inspectors and Parents. The sample size of the study was one hundred and eighty two (182) respondents.

Table 1. Sample and sample size distribution

Respondents' category	No of respondents	Percentage (%)
MCDO	01	0.55
Schools inspector	01	0.55
Heads of schools	04	2.20
Teachers	10	5.49
Students	166	91.21
Total	**182**	**100**

Source: Research findings, 2013

Both probability (simple random) and non probability (purposive) sampling techniques were applied. According to statistics from selected schools, the total student population was one thousand, six hundred and sixty three students. The 10 percent of the sample was therefore one hundred and sixty six students of which one hundred and thirty six were boys and one hundred and thirty were girls. However, the total teacher population was 102 and its 10 percent was ten teachers. Simple random sampling technique was used to obtain 166 students and 10 teachers. While purposive sampling technique was used to select one MCDO, one Municipal secondary schools inspector and 4 heads of schools.

5 DATA COLLECTION METHODS AND INSTRUMENTATION

Data collection included primary sources and secondary sources. Primary data was exhausted through interviews, questionnaires, Focus Group Discussion (FGD) and observations. While, secondary data was obtained by the use of books, internet, government and relevant schools' reports.

5.1 INTERVIEW

Interviews were conducted to all respondents. The questions were systematically arranged in order to maintain both consistency and direction in the interview. Face to face interaction between the researcher and respondents was held to pursue the responses and ask for elaboration in case of ambiguous matters.

5.2 QUESTIONNAIRE

Questionnaires were prepared in such a way that it aided to obtain relevant information including the way teachers treat boys and girls according to their specific needs, how do they consider boys and girls in academic matters. The questionnaires were administered MCDO, schools inspector, heads of schools and teachers

5.3 DOCUMENTARY REVIEW

Documentary included the use of books, internet, newspapers, government and NGOs publications together with different reports were reviewed. This helped the researcher to capture the required information pertaining to this study.

5.4 OBSERVATION

Ocular findings were obtained by open eyes through observing the real life situation on how socialization was taking place, especially aspects like lifestyles, interactions, behaviours, total number of boys and girls in school and other similar nature from different school in Morogoro municipality.

5.5 FOCUS GROUP DISCUSSION (FGD)

The researcher hold discussion with students by using a checklist of questions well prepared to capture relevant information. Discussion was carried out by timing students during break sessions. This method was applied in order to boost the answers to questions which was not answered correctly using other methods and was specifically applied to students.

5.6 DATA PROCESSING, PRESENTATION AND ANALYSIS

Data collected in Kiswahili language were processed in English language. Moreover, data obtained from the field were edited, coded, so as to be useful in analysis. This study adopts interpretive naturalistic approach as a kind of qualitative analysis as narrated by (Gladding, 2008). This approach involves acquiring detailed information about phenomenon being studied and establishing patterns and trends from the information gathered (Frankfort-Nachmias & Nachmias, 2006). This is followed by assigning meaning to the huge information which was collected through organizing the data, categorized them and creating specific themes for easy understanding.

6 RESEARCH FINDINGS AND DISCUSSIONS

6.1 STUDENTS' AND TEACHERS' STEREOTYPES OVER BOYS AND GIRLS.

The table below shows various assumptions expressed by students and teachers over boys and girls in regard to academic aspects.

Table 2. Produced stereotypes by students and teachers over boys and girls

Gender stereotypes as a result of socialization	Frequency of responses	Percentage (%)
Boys are intelligent	98	59.04
Girls prefer studying art subjects	117	70.48
Girls are inferior	114	68.67
Boys prefer studying science subjects	109	65.66

Source: Research findings, 2013

'Boys are intelligent'

In table 2 above 98 (59.04%) of all respondents said that boys are intelligent compared to girls in the sense that they perform better than girls. Boys are viewed as rational, logical, unemotional, and strong and are also expected to be friendly, smart, and naturally academically talented. In contrast, girls are said to more likely to receive criticism rather than praise for risk-taking behaviour. This result suggests that, as schools operate through the interactions among students and between students & teachers therefore there is a chance to construct gender inequality in the classes and thereby impacts the learning environment. Also result suggests that, in schools, gender stereotypes attribute boys' academic success to innate intelligence and dwindle girls' efforts toward higher achievements.

The assumption that "boys are intelligent" may be a product of the customs and traditions of most of Tanzanian societies which tend to deny girls with education opportunities through assigning them with reproductive role that tend to consume a lot of their time in expense to self studying. Customs and traditions put majority of girls under pressure of cultural belief that they are the once supposed to attempt reproductive role than studying, thereby discouraged them to study hard when at schools. According to Campbell et al (1994), gender stereotyping occurs when a person is expected to enact a series of norms or behaviours based upon their sex. Although, girls depend upon their socio-economic status, but many societies reinforce and support gender stereotypes that always male are breadwinners while female are housekeepers.

'Girls prefer to study art subjects'

117 (70.48%) of all respondents showed that girls are considered, treated, handled and addressed differently from boys, impacts students' perceptions of the girls' abilities and their achievements. This finding is supported by the above discussion that, teachers' and students' expectations of girls & boys' abilities, achievements and behaviours are influenced by gender stereotyping. However, gender stereotyping is usually subtle, and often unrecognized or unchallenged.

In Tanzanian societies there are assumptions that girls are less intelligent in school but are capable in art subjects like history, Kiswahili[1] and civics, and quiet and unassertive behaviour, can mean that they set aside their own learning needs for others. Boys are assumed to be intelligent. Gender stereotype suggests that they should have natural talent to achieve, and that they are expected to exhibit rationality and logic as well as loud, dominant behaviours. These cases of girls are capable in art subjects is supported by MCDO who said;

*"Male students do very well in science subjects and girls perform better in humanities subjects.'' (**Mama Lindi.**)*

Gender stereotypes remain strong influences in schools, community and the daily life in classrooms. Yet inequities because of gender issues are often rendered invisible to girls and teachers by their very occurrence in classrooms. A major challenge for teachers is to establish classroom environments that do not favour one group of students to the loss of another

[1] *Kiswahili is a National Language of Tanzania*

group. And recognize that gender stereotypes do not influence development of girls in schools' organization, instead of that practices students' attitudes and behaviours of feel being intelligent and less intelligent among girls and boys.

'Girls are inferior'

Table 2 above shows that, 114 (68.67%) of all respondents responded that girls are inferior. For instance teachers' and students' notion over girls is such that girls are caring, nurturing, quiet, considerate of others, and place others' needs before their own while boys were being rewarded for assertive behaviour, uniqueness, and risk-taking. Respondents further explained that, there are differences in attitude and understanding between girls and boys. Girls' preference for a positive, personal connection with their teachers can also influence their course selection. For example, girls may avoid mathematics or science because they dislike the teacher.

Girls' motivation for succeeding in school is often related to satisfy others, such as parents and teachers, rather than themselves. This idea is supported by one studen who said;

> *"Patriarchy system in our school and community at large is more common and places females (both women and girls) in subordinate position thereby exacerbate their vulnerability as well as dependence behaviour to males."(**Edina Mkuki**.)*

Negative stereotypes over girls are learned and helplessness. This is because when girls struggle with learning materials, teachers often give them the answer, propagating a status of learned helplessness. In other words, because they are given the answers, girls learn that they are inferiors in learning process.

Girls as a one group isolated, create different feeling, attitude, idea and direction as believing that they are less intelligent. So, no need to study hard hence deciding to engage in wrong behaviors which bring out truancy, spread of diseases and early pregnancy because of wrong thinking towards the teachers, boys and learning environments. These mislead them, hence fall down academically.

'Boys prefer to undertake science subjects'

109 (65.66%) of all respondents said that boys prefer to undertake science subjects. Respondents believe that science subjects are difficult so it is only boys who can manage to study them because boys are also considered to be intelligent and great thinkers. Typical sex differences contributed to fewer female studies in the sciences subjects like physics and biology. Due to that assumptions, society tend to support more boys in educational matters as compared to girls thereby build assertive behaviour to boys which enables them to have more access to and control over school resources. For example, in classes boys dominate books and girls are relegated to roles such as listeners, data recorder, or cleaning up the classrooms etc. However, laboratory works can be important facet for girls to learn science subjects since they can be full engaged in carrying out experiments than sitting aside watching their counterparts doing exercises. Society's views of science as a masculine endeavor may promote girls to perform passive roles.

Campbell *et al* (1994) shows that there are closely equal numbers of girls and boys enrolled in secondary school science classes, with the exception of physics and biology science courses. Girls prefer studying subjects that they perceive as having value, being connected to people or other living things and having relevance in their lives. Often science is taught without an emphasis on how the subject connects to the "real" world. Boys are viewed as less able than girls in reading and the language arts, subjects that are stereotyped as feminine. It is bringing back positive socialization which develops girls and boys academically in those art and science subjects.

6.2 IMPACT OF SOCIALIZATION IN STUDENTS' ACADEMIC PERFORMANCE

Effective learning and teaching

121 (66.48%) of all respondents said that effective learning and teaching is an impact of socialization that stimulates and increases the effective learning among students. It was observed by researchers that, in classrooms, girl and boy share one desk, ideas and challenges against their studies. Under this context, students learn from each others without marginalize others. In learning process everyone feels freely to ask, be asked and approach anyone she or he think can be helpful. One teacher of Morogoro secondary school who said;

> *"Having proper indoctrination at school, will encourage both boys and girls to respect each others and work hard in a cooperative manner. By doing so it is my hope that, academic performance will be improved." (**Mrs. Rehema Athuman**.)*

Results from SUA secondary school shows that 2010 and 2011were increased by 05% and 08% respectively. The strategies employed in such increased performance included more gender responsive teaching and learning environment. There were gender friendly school attitude and mentoring programs which focused boys and girls exclusively whereby students of different sexes were being taught on gender perspective, different life skills/experience and define intelligence in classes and outside school compound.

Increased cooperation and participation

Table 3 below shows that 125 (68.68%) of all respondents said that, socialization lead to collaboration and participation among students while at school and even with their families at home. This implies that when students are socialized to work together it reduces chances of discrimination among students based on sex. This study suggests that, equal teachings between boys and girls eliminate the notion that certain tasks are appropriate for either sex instead it imparts the sense of equality especially towards accomplishment of responsibilities as assigned by their teachers. This case of cooperation and participation is supported by the witness of school inspector, who said;

> *"Girls and boys do cooperate in various school matters ranging from class assignments and outside activities and this is a result of good job done by their teachers'' (**Mrs. Mercelina Baitilwake.)***

However, socialization towards equality brings the sense of solidarity among boys and girls during learning process because it can help them to gain the sense of ''we feeling'' for instance they can work very well during their studies if boys and girls cooperate in studies. Also socialization in classes offers sharing and collaboration in academics which in turn creates unity and solidarity among students. Equal sharing socialized students have higher chances of well mental development through their participation in academic aspects. This phenomenon can build in students' intelligence and eliminates all the negative attitudes about girls.

It can be noted here that, teachers can promote equal participation between boys and girl only if they concur to human rights principles at their workplaces such that; every person/people are entitled to active, free and meaningful participation in contribution and realize freedom. Other principle is equality and non discrimination in teaching environment which recognizes that "all individual are equal as human beings and by virtue of their inherent dignity". In so doing, all the biases, prejudices, bad stereotypes, barriers to education opportunities over girls will be eliminated. Human Development Department (HDD) (2009), documents that "Equality of access to education for boys and girls at secondary levels of education, does not only imply that girls and boys have equal access to schooling. It also means that the processes of schooling must ensure that boys and girls are able to access the full range of opportunities and experiences that are available to expand their capacities, develop their potential so that they can contribute to the development of a more just, and compassionate society.

Table 3. Impact of socialization in students' academic performance

Impact of socialization in secondary	Frequency of responses	Percentage (%)
Effective learning and teaching	121	66.48
Increased cooperation and participation	125	68.68
Improved students' performance	132	72.53
Promotes school ethics conformity	103	56.59

Source: Research findings, 2013

Improved students' performance

The study finding shows that 132 (72.53%) of all respondents said that increased performance of girls and boys, is among the impacts of socialization. Performance measured by their general knowledge and skills on art and science subjects, and reading assessment scores. The students (girls and boys) seem to perform well due to being aware/socialized among them.

Teachers encourage students to form groups for discussion, academics clubs like mathematics, English, Kiswahili and biology clubs, and debates by taking into account gender equality in those groups. This phenomenon calls for students' participation in academic issues whereby learning from one another can be an opportunity to advance their performance. In that way, socialization improves and enhances good performance due to encouragement from other students who feel as closely friend or relative.

Promote school ethics conformity

103 (56.59%) of all respondents said that teachers promote respect and obedience amongst students (both girls and boys) and this maintains gender equality. This role discourages gender stereotypes and disparities among students thereby improve cooperation and participation in academic context. This gives impression that if students respect their teachers and respect each others then they stand a good chance cooperate and participate in academic context, in turn it has meaning to effective learning and thereby improves students' intellectuals. One student supports this idea by saying;

"Our school has regulations whereby each student (girls and boys) have to obey and whoever goes against it the strict punishment is imposed". ***(Monica, aged 16 years)***

However observation by researchers shows that, teachers were punishing students in classrooms which shows that those students infringed rules and regulation were summoned and punished to maintain orders.

7 CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

Gender – aware and - sensitive teachers as well as students play a great role in promoting gender equality between girls and boys in schools thereby act as a gender lens to the society they are born into. That means socialization play great role in creating equality, to remove gender stereotyping which seems to be sanction of equality in different schools. The students can understand that to be intelligent does not correlate with being boy or girl. It is own capacity of each one, there is no need to discourage one from benefiting educational opportunities and services.

Different social mechanisms teach children masculinity and femininity of personality and make them internalize behaviour, attitudes and roles. Therefore if teachers and community members at large practice bad/harmful traditions and customs will end up building patriarchal system which gives boys feelings that they intelligent, strong and dominants thereby widening gender gap between boys/men and girls/women. Hence, it is imperative to create and promote positive socialization towards boys and girls, so as both can enjoy equal access to and control over resources, opportunities, services and events at schools.

As schools are potential institutions for socialization, girls and boys are expected to be good future mothers and farthers respectively if are well prepared, treated, handled in terms of equality basis by their teachers, school advisors, and parents. However, such well preparation, treatment, handling of girls and boys is useful in course of obtaining knowledge and skills for the sake of future nation's standard workforce. Government and community members play major part in addressing negative gender stereotypes through different interventions which focus community as well as through socialization.

7.2 RECOMMENDATIONS

There is a need for teachers to be gender aware especially on issues relating to gender stereotypes so as to eliminate inequalities between girls and boys students in secondary education, and then to general issues that may improve well-being of students (girls and boys).

Education oriented stakeholders need to promote equal opportunity and participation to girls and boys in order to bridge gap and eliminate negative perceptions over girls, this can be achieved through carrying out gender sensitive and awareness campaigns, trainings seminars and exhibitions.

The existing negative stereotyping notions and prejudices amongst students and teachers over girl students; call for re-thinking of the current Tanzanian Women and Gender and Development policy to address negative assumptions and prejudices over girls.

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Who paid the cost for Free Web Service

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ABSTRACT: This paper reviews the factors that drive web service to be free for client. Some of web service stand pure and still free and other adopt advertisement banner. However, we trying to understand both and based on which element they run advertisement. Besides, how advertisement assist web as dual advantage for business and client. Illustrate the relation between free web service and advertisement in four specific factors, and how that affect industrial and future product. However, those factors try to indicate to right decision based on analysis and evaluation of data collected. Factors are two types. Some of them have direct effect and other have indirect influence. Developer highlighted those based on information and data analysis seeking better result to serve market. Furthermore, third party might play some rules beside, factors such as traditional and culture based on different region. Many journals and articles observed during research, which they are relevant to the topic, and due to limited to range of source, which serve the aim of research within certain interest. The model goal to understand free web service, and which kind of factor improve the relation between industry and customer through advertisement tool. In additional, web service decide the range of advertising based on the factor. This paper show how web service is provide service to client without cost, and the web service expects from the client to share their interested. Based on the feedback, advertisement delivers industrial product to customer.

KEYWORDS: Web Service, Advertising, Data Collecting, Privacy, Broker.

1 INTRODUCTION

Nowadays, through flat screen, people could do almost everything related with their life, which force many organizations to expand their service into virtual world to approach their client demand. [1] when internet page related with business is called ecommerce website, and the organization pay the expanse of their website. Furthermore, web service is not related particular product or represented organization, and sometimes, they do not have specific sponsor to reimburse the fee charge. [2] Advertisements corporate and display the product in many website based on collecting data to match the client's interested. There is no guarantee for web to advertise accurate ads which matches client interested, but they tried to provide something relevantly to user data collected. [3] p. 2.

Collecting data is one main topic of argue in internet where some users disagree for personal reason. When users put their trust in some website, and somehow website allow unauthentic advertising that cause problem where client lost their trust. Besides, some advertisement contain Trojan and malware, and that is not only annoying for consumer. That cause damage in client property as Hardware and Software, and that habit is illegal. [4]

However, Client might agree to share their data with certain website service and particular business, but they feel they are losing their privacy when their information had been sold to third part without their acknowledgement. Perhaps the idea of product does not have any problem, but the way of presenting it is against or creating conflict with some traditional and culture. That is why company need to modify their advertisement based on region using IP address as identification. [5].

In additional, broker play major character in business process, but some researcher think broker inflate some page ranking to convince advertiser to display their ads. [6]. Such as important for advertisement meets consumer interested to

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be accepted and successful, and advertiser also want advertising to reach majority of people, so they concern about time of advertise, location, and repeating ads. Time, Location, and Repeating are essential to rate the price cost and revenue as advantage and disadvantage of market target. [7]

2 FREE WEB SERVICE & ONLINE ADVERTISING WORK AS TEAM TO SERVE CLIENT & USER

Users usually are looking for a free service to serve their need. Because of that, web service provides spaces for advertisement to make revenue to cover their expanse. However, Web service need to choose the kind of ads carefully to maintain the balance between keeping their client not board, and increase the demand to advertise at their web. [8] p.1.
Users do not mind to see web service to embed ads unless the ads harms their interest, and other client are willing to support web service as donation to maintain web service their quality. However, web service agrees to add ads, and they comprehend this decision will provide mutual profit for advertiser, and their client where client does not need to concern about expanse of service. [9]

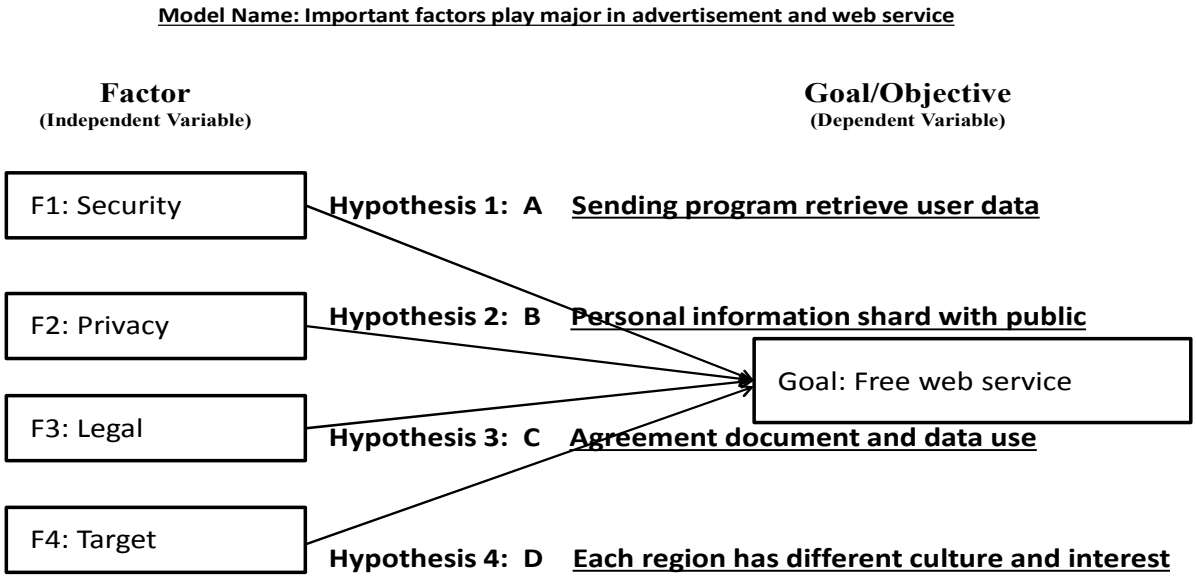

Figure 1. The Medical Device Design Process success factors.

Figure 1: important factors play major in advertisement, and give a hint for web service based on what they should display, and for industrial get clue, which best web service could broadcast their product.

3 GOAL ADVERTISEMENT DECISION

Engineering develop new algrithms for matchmaking word, pattern of searching, and model, and they executed value for each queries. [10] Whenever word used or search pattern called, algorithms rate them and add tag for next research. The value increase and decrease based on ranking scores, and that helps to choose the right advertisement [11] p. 1.

The strategy of evaluating word grow in digital world and the idea adopted by many organization to scale the value of rank in business term [12] p. 6. Web service have to manage service free in the loop with their client and fee cost. Otherwise, they will run to bankrupt. [13] p. 1. Provides information or monitoring client data is enormous subject, and we are going to focus in some aspect of it that's related directly to our topic. However, commercial service works with some free web service remotely for mutual advantage collecting data from verity geographical locations as source for future determination of decision. [14] p. 1.

Some collection data became redundant, so developers come with process to remove idleness informations and discover the importance to achieve satisfaction based on user query. [15] p. 1.

The Goal is keeping increase free web service by enhancing right adverting in right region based on understanding the factors. Learn how the advertisement can be made more effective by using testimonials of clients and customers. Marketing tips from expert writers like; how to set up a money back guarantee program, how to create an ad campaign and more.

4 FACTORS

4.1 FACTOR 1: SECURITY

Rare people do not mind to be monitor by other and collect their information and study their behavior, and same time, people bother to receive advertisement not related or far from their behavior. Because of that, researcher are trying to find grey ground where they could combine different perspective. [14] p. 1. One of things bothers client during monitoring their behavior when their information leak and that might create problem when no one want to have. Because of that, security become important for user to prevent clash with their privacy, and integrated from end to end. [16] p. 5. As much as company care about their conditionality on online without complicated security procedure that required to for web service to extend service oriented and client with respectful distance where everyone does not lost their oriented. [17] p. 1. Many people get confuse between secure web and secure data. First one mean the web site is protected with particular protocol and they are usually inform their client at the corner of website at beginning of their link with “https” which stand for Hypertext Transfer Protocol and S stands for Secure where normal web does not have it. However, secure data is issue about data had been collected from user and sold or shared with their party. [18] p. 1. The web service has standard of security policy and that based on specification and requirement associate with web services but that does not cover everything. [19] p. 2. Since web service is wide application and it does not have restrict rules, some the information is false and even malicious. As consequence, third party provide not only uninterested commercial. It goes to inappropriate ads. Which cause difficulty to maintain web service with good quality and that lead to lose trust of users’ needs. [20] p. 3. Some online advertisement across the purpose. Sometimes, they become reason of destroying client property in term of software, hardware or both of them by sending some program cause of process jamming or computer frozen.

4.2 FACTOR 2: PRIVACY

Web Service policy change depend on the region and some countries have some rule and scale as policies of user information. For instance European Union’s ePrivacy Directive and United States Federal Trade Commission have same law using cookies, and on the other hands, Australia’s National Privacy Principles (ANPP) against that where they see the confidentiality is priority and user has right to be aware about collecting information, and what it’s for. [21] p. 1.

Privacy on Web service still active research topic in many aspects such as definition of privacy and what is the specification require to protect the consumer privacy in web service. However, Web Services Architecture (WSA) document published by the World Wide Web Consortium (W3C) describe the requirement for privacy in Web Service. [21] p. 2. Addressing the issues still open and under investigation for wide field range of technology, and context of web service remain not cover enough. [22] p. 1.

Any solution for privacy issues in web service application needs to preserve the legal, commercial and economic phase avoiding conflict of exist protocol. [23] p. 2. Establish trust relation between client and web service increases corporation, and client will be happy to give permission for organization to access their privacy when they inform about the way of data used for mutual benefit. Furthermore, web service invent secure session to ensure the privacy. [24] p. 1.

Companies are willing to deliver their product to right client. Because of that, they need some information. Some of the information considered private where consumers does not want to share their information with every organization. Organization usually had agreement to accept for providing service and that called exchange deal.

4.3 FACTOR 3: LEGAL

Big Company such as Google and Yahoo play as middleman between web services and advertisers. Advertisers submit their ads, and Web Service offer their deal. Advertisers bid for reserve banner and certain words, and middleman sign deal for high bid for advertiser. [25] p. 1.

However, many companies have doubt and questions about how Google control advertising, and if that is legitimate due to misappropriate content and profits. [26] p. 2. Large companies store data for business purpose and there is some possibility to change the situation of legalization to preserve information. [16] p. 5.

In addition, not only end to end is collecting the data. The Legal Portal System (LPS) is one of its function to manage information and store them, and this is another research topic where it's related with client privacy. That is out of web service control but that make client confused about who is response. [20] p. 1. Because of absence regulation of efficient legal, the risk of fraud in web service ranking and dishonest in competition of advertisement is exist in internet. [19] p. 1.
Might be the idea of services are the same, but the way of delivery should be different from region to another due to different culture and traditional. Besides, the legal of getting the data to study client interest should not be against their privacy.

4.4 FACTOR 4: TARGET

Advertisers look for certain target and they prefer particular procedure to reach their aim. They favor major cities and specific countries, and active time to show ads to users. For instance, they see New York is rich area comparing with another city, and weekday in evening is more users than weekend where people probably outdoor since they know they have certain time for their ads to display. [27] p. 1.

Web commercial agreed to trade their customers' information such as interest and transaction without inform their client for business market. Web Service implant ads banner on web page, and when client click the ads, the network technology developer could read the statistic of consumer interactive with internet advertising. [28] p. 1. Advertiser seek multiple target through one advertisement to achieve, and from one ads represent in different way to match user region and aspect through combination of inputs and outputs. However, DEA allow verity of inputs and outputs to be harmony for efficient measure. [29] p. 1.

Since internet became part of smart phone feature and increase the function of using it more than just for call. Advertisements expand their market too from website page on computer to mobile, which increase the user target. [30] p. 1. Web service and advertisements are significant research topic and they are still having important characteristic uncovered. Researcher are looking for each part from perspective of available resources in the environment. [31] p. 1.

Understanding the market of web service and the users characters and their personality and interest help online advertisement to sale the idea and product in professional way where customers are willing to pay attention.

5 EXPLANATION AND DISCUSSION

The model display the goal of online advertisement and free web service. [32] Factors indicate the idea and the philosophy of advantage and disadvantage from clients' perspective. "There have been many researches on human reaction to product advertisement, but researches applied to mobile phone are not sufficient. [32] p. 1.

6 CONTRIBUTION AND NEW INSIGHT

The model is the summarization of factors, which how they have impact toward the goal. Each factor give different perspective about web service and client making advertising sponsor paying the cost. Some factors related with user directly, and they could make a decision, and other belong committee relevant to user, and users have to submit to committee commitment. [33] Factors can be improved and edited to achieve a good performance. Where online advertisement serve all applying win formal [34] p. 1.

7 CONCLUSION

Most people linked with web service where their business affected via virtual world. Web service existed to serve people needs where service need sponsored to pay the cost. Online advertisement fit in the middle layer to pay the cost of service and deliver market product to customer. As consequence middle layer created issue for client, client lose their privacy and share their information with unwanted party, and sometimes they pay more than what they get which change the formal from win win to win lose. Researchers study many approaches where they could meet advertisement strategy, client right, regulation, web service cost, and upgrade to maintain client's trust to keep their interacting with web service.

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The Association between Profitability and the Extent of Voluntary Disclosure of Financial Information in the Annual Reports: A Study on Listed Banks of Bangladesh

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ABSTRACT: The aim of this paper is to measure the extent of disclosure of voluntary financial information in the annual reports of listed banks in Bangladesh. An effort has also been made to identify the impact of profitability on the level of voluntary disclosure. An unweighted disclosure index with 14 financial items has been used to measure the extent of disclosure. The study reveals that most of the listed banks of Bangladesh are not making satisfactory level of voluntary disclosure with average score of about 42.86%. The findings also show that profitability is not significant in explaining the level of voluntary disclosure of financial information.

KEYWORDS: Finance, profitability, Bank of Bangladesh, voluntary.

1 INTRODUCTION

The demand for company information from the part of the various stakeholder groups is increasing day by day. Corporate financial reporting and in particular annual reports are important avenues for communicating company's financial and non-financial information. All stake holders such as investors, employees, suppliers, customers and creditors are able to access to the company's annual report. It is necessary for the company to provide its information to fulfill their needs and build their own style of company image. Information contained in the company's annual report consists of both mandatory and voluntary information. The company has to follow laws, regulations and accounting standard to provide the mandatory information while voluntary information is depended on management's judgment to be included in the annual report.

It is really mattered what kind of voluntary information the company has disclosed as they have to consider the benefit and risk of providing information to the public. Financial information relate to the decision making of the investors and creditors. With financial information, we can figure out how the company performed by computing the financial ratio. For example, Liquidity ratio is the ratio of current assets to current liabilities. This ratio uses to measure company's ability to pay-off short time obligations. Leverage ratio measure the capital structure of company with the ratio of non-current liabilities to equity which is of interest to creditor and investor. Also, financial history or summary - three or more years are useful for investors to review compared figure and convenient to calculate ratios themselves since they do not have to spend time to summarize figures.

In reviewing disclosure literature, it can be noticed that disclosure practices are affected by several variables. The current study has mainly focused on the impact of profitability on the extent of voluntary disclosure of financial information in the annual reports.

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The remainder of this paper is organized as follows. Section two and three outlines the research questions and objectives of the study. Literature review and hypotheses development are discussed in section four and five. Section six describes research method. Section seven discusses findings of the study. Section eight outlines limitations and section nine makes concluding remarks of the study.

2 RESEARCH QUESTIONS

- To what extent do Bangladeshi listed banks disclose voluntary financial information in their annual reports?
- Is profitability a significant factor responsible for disclosing voluntary information in the annual reports of Bangladeshi listed banks?

3 RESEARCH OBJECTIVES

- To measure the extent of voluntary disclosures of financial information in the corporate annual reports of listed banks in Bangladesh.
- To assess the association between total voluntary disclosure and profitability in the listed banks of Bangladesh.

4 LITERATURE REVIEW

Extensive research has been carried out in the developed and developing countries to measure the corporate disclosure in both financial and non-financial companies. (See for example, Cerf, 1961; Singhvi and Desai, 1971; Buzby, 1974; Kahl and Belkaoui, 1981; Marston, 1986; Wallace, 1987; Cooke, 1989a, 1989b, 1991, 1992, 1993; Malone et al., 1993; Hossain et al., 1994; Ahmed and Nicholls, 1994; Wallace and Naser, 1995; Inchausti, 1997; Craig and Diga, 1998; Hossain, 2000; Hossain, 2001; Haniffa and Cooke, 2002; Akhtaruddin, 2005).

The study of Kahl and Belkaoui (1981) investigated the overall extent of disclosure by 70 banks located in 18 different countries. Their results showed that the extent of disclosure was different among the countries examined, and that there was a positive relationship between size of the bank and the level of disclosure indicated.

Hossain (2001) empirically investigates the extent of disclosure of 25 banks in Bangladesh and associations between company size, profitability, and audit firm with disclosure level. A total of 61 items of information, both voluntary and mandatory, were included in the disclosure index, and the approach to scoring items was dichotomous. The results showed that size and profitability of the banks are statistically significant in determining their disclosure levels. However, the audit firm variable was not significant at conventional levels in the model.

Hossain and Reaz (2007) analyzed voluntary disclosure practices in the corporate annual reports of 38 listed banking companies in India. The researchers also tested the association between corporate attributes and the level of voluntary disclosure of the sample banks. Their results revealed that sample listed banks were disclosing a satisfactory amount of voluntary information and out of corporate attributes only size and assets-in-place were significant factors in explaining the level of voluntary disclosure.

Das and Das (2008) tried to find out the extent of voluntary disclosure by the financial institutions in Bangladesh by examining annual reports of 37 banking and 7 non-banking financial institutions. He replicated the disclosure index constructed by Hossain nad Reaz(2007), which consisted of 65 items under 9 categories. The results showed that voluntary disclosure varied widely within the sample companies. The companies were focusing more on general corporate information, corporate strategy and accounting policy and little focus was placed on financial performance, corporate social disclosure and corporate governance. The authors concluded that sample companies were not very much aware and interested about the disclosure of voluntary information in their annual reports.

5 HYPOTHESIS DEVELOPMENT

Profitability is considered to be one of the most common explanatory variables that have been used in disclosure literature. Banks having higher profitability may be hypothesized to disclose more information in their annual reports than the banks with lower profitability (or losses) for a number of reasons. According to political costs theory, managers of profitable companies are motivated to disclose more information to justify their higher profits (Inchausti, 1997). Based on the signaling theory it can be assumed that profitable companies want to distinguish themselves from less profitable

companies through more disclosure (Inchausti, 1997). Stakeholder theory also supports the idea as profitability is considered to be one of the main information needs of many stakeholders, other than shareholders. However, if the profitability of a company is low, management may disclose less information in order to cover up the reasons for losses or lower profits. On the other hand, in case of low profitability, managers may be motivated to disclose more information to reduce the risk of legal liability and severe share devaluation or loss of reputation (Skinner, 1994). So different theories can predict different direction of the relation between profitability and disclosure.

The prior studies provide contradictory evidence of the relation between profitability and the level of disclosure. While some studies report a significant positive association between profitability and the level of disclosure (Such as Singhvi,1968; Singhvi and Desai,1971; Wallace, 1987; Owusu-Ansah, 1998; Hossain, 1998; Haniffa and Cooke,2002), other studies report a negative association (such as Belkaoui and kahl,1978, Wallace and Naser,1995; Inchausti,1997). On the other hand, Wallace et al. (1994), Raffounier(1995), Meek et al.(1995) reported insignificant association between profitability and the extent of disclosure.

Different measures for profitability have been used in the disclosure literature such as ROE, ROA, ROI, and EPS. A number of studies combine some measure in one measure while others use one measure. However, there is no criterion to choose the best proxy of profitability. The current study measures bank size by total assets.

The following specific hypothesis has been tested regarding profitability.

Hypothesis: There is a positive association between profitability measured by ROE and the level of voluntary disclosure in annual reports of listed banks.

6 METHODOLOGY

Selection of Sample

Out of financial institutions, the study concentrates only on the banking sector in Bangladesh. All the banking companies listed on the Dhaka Stock Exchange are considered to be included in the sample. On December 31, 2012 there are 30 banking companies listed on DSE. Annual reports for the year 2011 have been used for the study.

Scoring of the Disclosure Index

Generally weighted and unweighted disclosure index are used to measure disclosure level in disclosure studies. The weighted approach (Adopted by Barrett,1977; Marston, 1986) provide different weights (Above zero but less than one) to items of disclosed information according to importance given by the researcher. Zero weight is given for non-disclosure of any information item.

Researchers such as Wallace et al. (1994), Cooke (1991&1992), Karim (1995), Hossain et al. (1994), Ahmed and Nicholls (1994) and Hossain (2000 &2001) used unweighted approach in their studies. In unweighted approach the key fact is whether a company discloses an item of information or not. If a company discloses an item of information in its annual report, then '1' will be awarded and if the item is not disclosed, then '0' will be awarded. This convenient procedure is also termed as dichotomous procedure.

As prior experience suggests that the use of unweighted and weighted disclosure index for disclosure in the annual reports can make little or no difference to the findings (Coombs&Tayib,1998). We have chosen the unweighted disclosure index method where all items of information in the index are considered equally important to the average user. The following formula has been used to measure the total voluntary disclosure score:

Where, d= 1 if the item di is disclosed

0 if the item di is not disclosed

n= number of items

The Selection of Voluntary Items

The selection of voluntary items is a subjective judgment. Moreover, such selection depends on the nature and context of the industry and the country (e.g. what industrial sector or sectors is being considered and whether the companies are in a

developing or developed country. A total of 14 items are identified as relevant and expected to be disclosed in the annual reports of Bangladesh Banking companies. The total list of the voluntary items is presented in the Appendix A.

Model Development

The following Ordinary Least Square (OLS) regression model is used in order to assess the effect of independent variable (profitability) on the dependent variable (voluntary disclosure level):

$Y = â0 + â X + e$

Where, Y= Total Voluntary disclosure score for each bank

β0 = The intercept

e= Residual error

7 FINDINGS

7.1 EXTENT OF DISCLOSURE

This section aims to answer the first research question related to the extent of voluntary disclosure in the annual reports of listed banks. Table 1 reports the descriptive statistics of the total voluntary disclosure scores. The panel A in the table 1 indicates that the mean of total voluntary disclosure score is about 42.86%. The table also shows that the extent of voluntary disclosure has a considerable range. While the minimum disclosure score obtained is 36%, the maximum is 71%.

Table 1

Panel A: Descriptive Statistics of Total Voluntary Disclosure (Dependent Variable)

Year	N	Mean	Minimum	Maximum	S.D.
2011	30	42.86	36	71	1.241

Panel B: Frequency of Total voluntary Disclosure Score

Total Voluntary Disclosure Score (%)	Number of Banks	Proportion of Sample (Percent)
< 40	6	20.00
40-49.99	18	60.00
50-59.99	4	13.04
60-69.99	1	3.3
70-70.99	1	3.3
> 80	0	0.00
Total	30	1.00

To shed more lights on the voluntary disclosure practice in the annual reports of the listed banks, Panel B in the table 1 reports the frequencies of total voluntary disclosure scores. In 2011, six banks (20%) disclosed less than 40% items of the disclosure checklist. 60% of the sample banks attained voluntary disclosure score ranging from 40% to 50%f the checklist. Only one bank disclosed over70% voluntary items but no bank disclosed more than 80% of the voluntary checklist.

7.2 DETERMINANTS OF VOLUNTARY DISCLOSURE

This section aims to answer the second research question related to the profitability as a determinant of voluntary disclosure practice in the annual reports of listed banks.

7.2.1 DESCRIPTIVE STATISTICS

Table 2 shows the descriptive statistics for the independent variable in the current study. As indicated in the table, profitability has wide ranges. Profitability ranges from -23.63% to 29.96% with average 15.18%.

Table 2: Descriptive Statistics for Independent Variable

Variable	Mean	Minimum	Maximum	S.D.	Skewness	Kurtosis
Profitability	15.18	-23.63	29.96	9.16990	-2.563	10.814

7.2.2 SIMPLE REGRESSION ANALYSIS

We have used the Variance Inflation Factor (VIF) to test the multicollinearity in the regression model. The VIF in excess of 10 should be considered an indication of harmful multicollinearity (Neter et al., 1989). The Variance Inflation Factors for all independent variables are less than 10. Thus, this confirms that collinearity is not a problem for this model and is unlikely to pose a serious problem in the interpretation of the results of the regression analysis.

The results of the regression analysis of the association between the profitability and the extent of voluntary disclosure in the annual reports of listed banks are documented in the following section.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.370[a]	.137	.106	1.173

a. Predictors: (Constant), Profitability in terms of ROE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.128	1	6.128	4.453	.044[a]
	Residual	38.538	28	1.376		
	Total	44.667	29			

a. Predictors: (Constant), Profitability in terms of ROE

b. Dependent Variable: Voluntary Disclosure

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	5.906	.419		14.079	.000		
	Profitability in terms of ROE	.050	.024	.370	2.110	.044	1.000	1.000

a. Dependent Variable: Voluntary Disclosure

The result shows that the F-ratio is 4.453 (P=.044), which statistically supports the significance of the model. R Square of .137 implies that 13.7 percentage of the variation in the level of voluntary disclosure can be explained by the variations in the independent variable.

Profitability coefficient shows that this variable is not significant and therefore, hypothesis related with profitability is not supported. This implies that profitability does not explain significantly the variation of voluntary financial disclosure level among the listed banks. The result is thus inconsistent with other previous studies such as Singhvi and Desai (1971) Owusu-Ansah (1998), Naser (1998) and Hossain and Reaz (2007).

8 LIMITATIONS

One of the limitations of the present study is that it covers only a single year, a single country and one specific sector. The findings would be more generalized if the study would undertake five or ten years' data and also consider other financial institutions such as insurance, non- the banking financial organizations etc.

9 CONCLUSION AND SCOPE FOR FUTURE RESEARCH

In order to improve disclosure quality and transparency, which is imperative to build up investors' and depositors' confidence, banks of any country need to disclose additional financial information voluntarily in addition to mandatory disclosure requirements. The current study shows that voluntary financial information has been disclosed in the annual reports of the listed banks to a moderate level. The study has considered profitability in assessing its effect on the extent of voluntary disclosure and reaches the conclusion that profitability is not significant in explaining the variations in voluntary disclosure level.

The scope of the study can be expanded by including unlisted banks, non-bank financial institutions, manufacturing companies etc. The study has considered only profitability in measuring their effect on the level of disclosure. Other corporate attributes such as size, age board composition, liquidity, complexity of business can be investigated as determinants of voluntary disclosure.

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APPENDIX A

Voluntary Disclosure Checklist

Serial No.	Items
1	Brief discussion and analysis of a bank's financial position
2	Discussion of the bank's liquidity position and about additional financing
3	Qualitative forecast of earnings
4	Return on equity
5	Net interest margin
6	Cost-to-income ratio
7	Liquidity ratio
8	Loan to deposit ratio
9	Debt-to-equity ratio
10	Dividend per share
11	Remuneration of the Directors
12	Average compensation per employee
13	Performance at a glance-5 years
14	Graphical presentation of financial information

APPENDIX B

Serial No.	Name of The Listed Bank
1	AB Bank Ltd.
2	AL-Arafah Islami Bank
3	Bank Asia Ltd.
4	BRAC Bank Ltd.
5	City Bank
6	Dhaka Bank
7	Dutch-Bangla Bank
8	Eastern Bank Ltd.
9	EXIM Bank of Bangladesh
10	First Security Islami Bank Ltd.
11	ICB Islami Bank Ltd.
12	IFIC Bank
13	Islami Bank
14	Jamuna Bank Ltd.
15	Mercantile Bank Ltd.
16	Mutual Trust Bank Ltd.
17	National Bank Ltd.
18	NCC Bank Ltd.
19	One Bank Ltd.
20	Premier Bank Ltd.
21	Prime Bank
22	Pubali Bank
23	Rupali Bank
24	Shajalal Islami Bank Ltd.
25	Social Islami Bank Ltd.
26	Southeast Bank
27	Standard Bank Ltd.
28	Trust Bank Ltd.
29	United Commercial Bank Ltd.
30	Uttara Bank

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Mathematical Modeling of Degree of Thermal Oxidation of Edible Oil (Sun Flower) as a Function of Induction Time at Fixed Induced Power During Microwave Heating

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ABSTRACT: This is about relating the thermal induction time range from 0-40 minutes for sunflower oil (refined) of definite composition with the change in the thermal oxidation by the models developed by using M S Excel and Statistical Software, Design Expert Software 8.0 with there R^2. And through analysis of prepared model data with their plotted graph.

KEYWORDS: Thermal Oxidation, Peroxide value, Design Expert Software 8.0, M S Excel, Microwave Oven, Modeling.

1 INTRODUCTION

Thermal oxidation of edible oil is an important determination of the quality of edible oil. During processing of food stuffs involving the use of edible oils such as blended oil as a heat transfer medium, the oil owing to high temperature undergoes thermal oxidation over a period of time. Due to the thermal oxidation of edible oils, they become unfit for further use after a period of time. Hence proper control of processing condition is a desirable requirement in order to delay the onset of thermal oxidation of edible oil.

Mathematical modeling is an effective way of representing a particular process. It can help us to understand and explore the relationship between the process parameters. Mathematical modeling can help to understand and quantitative behavior of a system. Mathematical models are useful representation of the complete system which is based on visualizations. Mathematical modeling is an important method of translating problems from real life systems to conformable and manageable mathematical expressions whose analytical consideration determines an insight and orientation for solving a problem and provides us with a technique for better development of the system. Mathematical models in the field of oxidation of edible oils can enable the determination of time of cook of edible oil which would lead to the least amount of oxidation of edible oil during processing using edible oils as a heating medium.

Mathematical models can enable the optimization of frying time at fixed power to reduce the rancidity of frying oils. In light of above considerations the study was conducted in order to attain the following objective

1) To determine the relationship of the Thermal oxidation as function of Induction time of the frying oil at fixed power during microwave cooking

Heating is an important part of many food processing operations. Many desirable changes, as well as undesirable reactions, occur in vegetable oils when they are heated at elevated temperature. However, during heating, vegetable oils are very sensitive and susceptible to quality changes, caused by chemical instability, that are dependent on both chemical composition and environmental factors. Lipid oxidation is one of the major deleterious reactions during heating that

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markedly affects the quality of vegetable oils. This chemical reaction is of primary concern to many researchers in the field of fats and oils. The extensive studies on lipid oxidation have spurred a vast array of findings in the field of fats and oils processing. Today, it is well known that this deleterious reaction leads to the formation of various oxidation products, which may result in the oil and fat products becoming unfit for human consumption. Compositional and/or environmental effects on lipid oxidation can be expressed by a mathematical relationship. However, this relationship applies only to several simple food systems and reactions. More often, oxidative reactions of vegetable oils are more complex and unique in their behavior, and the appropriate model must be derived individually for each product and oil system. Temperature is one of the main environmental factors that influence the rate of quality loss. The dependence on temperature of most reactions in foods can be expressed more precisely by the Arrhenius model.

Shahidi and Spurvey (1996) stated that Autoxidation of oils and the decomposition of hydroperoxides increase as the temperature increases. Velasco and Dobarganes (2002) stated that the formation of autoxidation products during the induction period is slow at low temperature. The concentration of the hydroperoxides increases until the advanced stages of oxidation. Marquez-Ruiz *et al.* (1996) suggested that The content of polymerized compounds increases significantly at the end of the induction period of autoxidation. Yang and Min (1994); Rahmani and Saari Csallani (1998) suggested that temperature has little effect on oil oxidation due to the low activation energy of 0 to 6 kcal/mole. Sattar et al. (1976) stated that light is much more important than temperature in oil oxidation.

2. MATERIALS AND METHODS

2.1 Edible Sunflower Oil composition.

Table 1. [19]Composition of Refined Sunflower used.

Component	*Oil Type*
	sunflower
Main fatty acids (% of peak area)	
Palmitic	4
Stearic	3
C_{20}–C_{22} saturated	1
Monoenoic	34
Dienoic	57
Trienoic	trace
Eicosenoic	–
Trans-unsaturated	0.8
Peroxide value (meq/kg)	0.2
Acid value (mg/g)	0.06
Conjugated dienes (% m/m)	0.6
Polar compounds (% m/m)	0.4
Tocopherols (mg/kg)	
Tocopherol α	373
Tocopherol β+γ	34
Tocopherol δ	14
Total tocopherols	418

2.2 Preparation of samples (reference [19])

2.3 Sample Collection (reference [19])

*Assumptions

a) Surface area exposed to atmosphere is constant or same.

b) No mixing or agitation.

2.4 MEASUREMENT OF OXIDATION

2.4.1 Peroxide Value (PV) Analytical method.

2.4.1.1 Purpose and Scope

This method describes the determination of peroxides values for vegetable oils and fats. The peroxide value is a parameter specifying the content of oxygen as peroxide, especially hydro peroxides in a substance. The peroxide value is a measure of the oxidation present.

2.4.1.2 Principle

The sample treated in the solution with a mixture of acetic acid and a suitable organic solvent and then with a solution of potassium iodide. The liberated iodine is titrated with a standard solution of sodium thiosulphate.

Peroxides and similar products which oxidize potassium iodide under the conditions of the test will contribute to the peroxide value. Variations in procedure may affect the results. Peroxide values are expressed either in milliequivalents of peroxide/kg or millimoles of peroxide/l.

Reaction scheme:

The peroxide value is determined by measuring the iodine liberated from potassium iodide by a peroxide, using sodium thiosulphate solution as the titrant. In the presence of acetic acid, the reaction scheme for hydroperoxides is as follows.

Generation of hydroperoxides:

$R\text{-}H + O_2 \longrightarrow ROOH$ (Reaction I)

Generation of iodine:

$KI + CH_3COOH \longrightarrow HI + CH_3COO^-K^+$ (Reaction II)

$ROOH + 2\,HI \longrightarrow ROH + H_2O + I_2 + \text{starch indicator}$ (Reaction III)

Titration step:

$I_2(\text{purple}) + 2Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + 2\,NaI\ (\text{colorless})$ (Reaction IV)

Reaction of peroxides of the structures R-O-O-R' and

R- CH-O-O-CH -R' follows an analogous pathway. Whilst cyclic peroxides do not react quantitatively under the conditions described here.

Alternatively, the ion reaction is of more of general applicability:

$O_2^{2-} + 2I^- + 4H^+ \longrightarrow I_2 + 2H_2O$ (Reaction V)

$I_2 + 2S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$ (Reaction VI)

2.4.1.4 Procedure

i) Approx. 3.0g of the sample was transfered, accurately weighed, into a 250 ml conical flask.

ii) 25 ml of the appropriate solvent mixture (glacial acetic acid: chloroform, 1:2) and 1 ml saturated potassium iodide solution freshly prepared was added.

iii) Was Allowed to react for 60 sec. and shaking thoroughly during this period. Then 35 ml of distilled water was added.

iv) Then was titrated with 0.001 N sodium thiosulphate solution using 0.5 ml 1%starch solution as indicator.

v) During the titration shaked until the blue color disappeared.

vi) Blank titration was carried under the same conditions.

2.4.1.5 Calculations

S=titration of sample.

B=titration of blank.

SW=weight of sample taken.(gm)

N=normality of sodium thiosulphate used.(0.001)

PV=peroxide value (meq/kg)

PV = (S-B)*N*1000/SW

2.5 Graphical Analysis

The experimental data obtain using the previous procedures were analyzed by plotting Graph and developing Models for various observations for different time.

2.6 Statistical Analysis

The experimental data obtain using the previous procedures were analyzed by the response surface regression procedure using the following higher-order polynomial equations: like, $y = \beta 0 + \sum \beta_i x_i + \sum \beta_{ii} x^2_i$, where y is the response, xi is the uncoded independent variable (factor), and $\beta 0$, β_i, β_{ii} are intercept, linear and quadratic respectively. Design Expert software package 8.0 was used for regression analysis, analysis of variance (ANOVA) and developing of models of different forms by transformation (linear and of higher order) based on above mentioned principles of forming a functions. Confirmatory experiments were carried out to validate the equations using the combinations of independent variable which were not part of the original experimental design but were within the experimental region. Various models were compared for the best fit summary and there R^2 values were compared to choose the best appropriated model for particular data design and selected runs.

3 RESULT AND DISCUSSION

3.1 Below is the graphical trend of peroxide value with respect to time of heating and the drawn trend line by M S-Excel and the equation developed with it R-Square. (data reference 19)

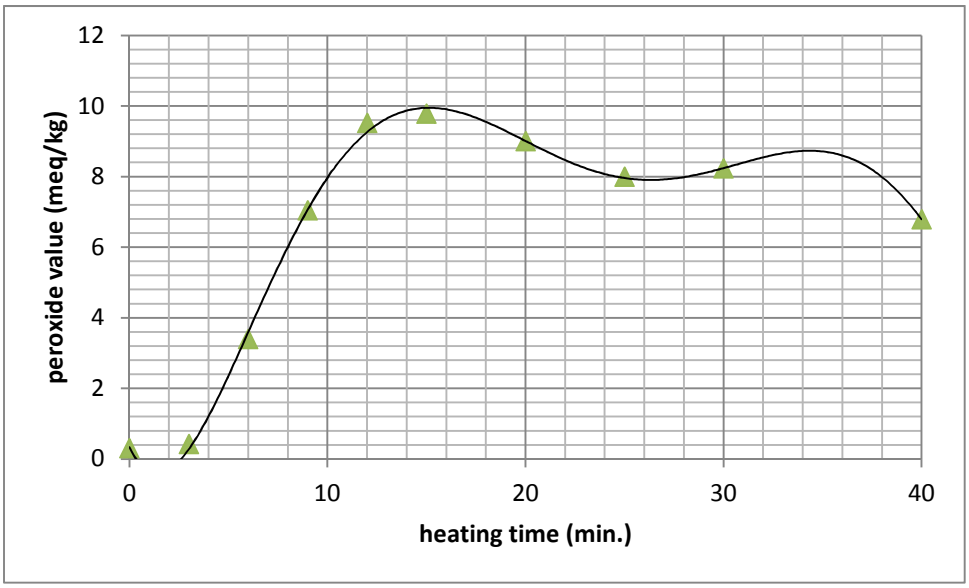

Fig 1. Graph plotted on M S Excel peroxide value Vs Induction Time during Microwave cooking of oil.

Model 1 equation:

$y = 2E\text{-}07x^6 - 3E\text{-}05x^5 + 0.0017x^4 - 0.0447x^3 + 0.4925x^2 - 1.1387x + 0.3323$

where x is time of induction of oil in minutes, and y is the peroxide value at specified induction time

$R^2 = 0.9986$

3.2 The results from Statistical Analysis using Expert Design Software we get

Table 2. Model fit Summary

Model Summary Statistics

Source	Std. Dev.	R-Squared	Adjusted R-Squared	Predicted R-Squared	PRESS	
Linear	3.06	0.3534	0.2726	-0.1958	138.82	
Quadratic	1.61	0.8436	0.7989	0.3600	74.29	Suggested
Cubic	1.37	0.9025	0.8537	0.4740	61.07	
Quartic	1.32	0.9255	0.8659	-18.9449	2315.34	
Fifth	0.32	0.9966	0.9923	-7.8785	1030.69	Suggested
Sixth	0.23	0.9986	0.9959	-12.3528	1550.09	

Table 3. showing P-Value for fit summary

Response 1	PV	Transform:	None	
Summary (detailed tables shown below)				
Source	Sequential p-value	Lack of Fit p-value	Adjusted R-Squared	Predicted R-Squared	
Linear	0.0699		0.2726	-0.1958	
Quadratic	0.0023		0.7989	0.3600	Suggested
Cubic	0.1056		0.8537	0.4740	
Quartic	0.2688		0.8659	-18.9449	
Fifth	0.0008		0.9923	-7.8785	Suggested
Sixth	0.1225		0.9959	-12.3528	

Table 4. Showing Sequential Model Sum of Square

Sequential Model Sum of Squares [Type I]

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Mean vs Total	390.13	1	390.13			
Linear vs Mear	41.02	1	41.02	4.37	0.0699	
Quadratic vs L	56.90	1	56.90	21.93	0.0023	Suggested
Cubic vs Quad	6.84	1	6.84	3.62	0.1056	
Quartic vs Cub	2.67	1	2.67	1.55	0.2688	
Fifth vs Quartic	8.25	1	8.25	83.06	0.0008	Suggested
Sixth vs Fifth	0.24	1	0.24	4.55	0.1225	
Residual	0.16	3	0.053			
Total	506.21	10	50.62			

*"Sequential Model Sum of Squares [Type I]": Select the highest order polynomial where the additional terms are significant and the model is not aliased.

Table 5. showing ANOVA for Response surface Fifth Model

Response 1 PV

ANOVA for Response Surface Fifth model

Analysis of variance table [Partial sum of squares - Type III]

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Model	115.69	5	23.14	232.92	< 0.0001	significant
A-Time	*7.92*	*1*	*7.92*	*79.71*	*0.0009*	
A^2	*0.57*	*1*	*0.57*	*5.78*	*0.0741*	
A^3	*10.70*	*1*	*10.70*	*107.72*	*0.0005*	
A^4	*0.14*	*1*	*0.14*	*1.38*	*0.3052*	
A^5	*8.25*	*1*	*8.25*	*83.06*	*0.0008*	
Residual	0.40	4	0.099			
Cor Total	116.09	9				

The Model F-value of 232.92 implies the model is significant. There is only a 0.01% chance that an F-value this large could occur due to noise.

Table 6. ANOVA analysis table.

Std. Dev.	0.32	R-Squared	0.9966
Mean	6.25	Adj R-Squared	0.9923
C.V. %	5.05	Pred R-Square	-7.8785
PRESS	1030.69	Adeq Precisior	40.434

A negative "Pred R-Squared" implies that the overall mean is a better predictor of your response than the current model.

"Adeq Precision" measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 40.434 indicates an adequate signal. This model can be used to navigate the design space.

Model 2 Fifth degree equation from the Design Expert Software 8.0

Final Equation in Terms of Actual Factors:

$$\begin{aligned} PV = {} & \\ & +0.24316 \\ & -0.74793 * Time \\ & +0.35607 * Time^2 \\ & -0.028012 * Time^3 \\ & +8.27271E\text{-}004 * Time^4 \\ & -8.38166E\text{-}006 * Time^5 \end{aligned}$$

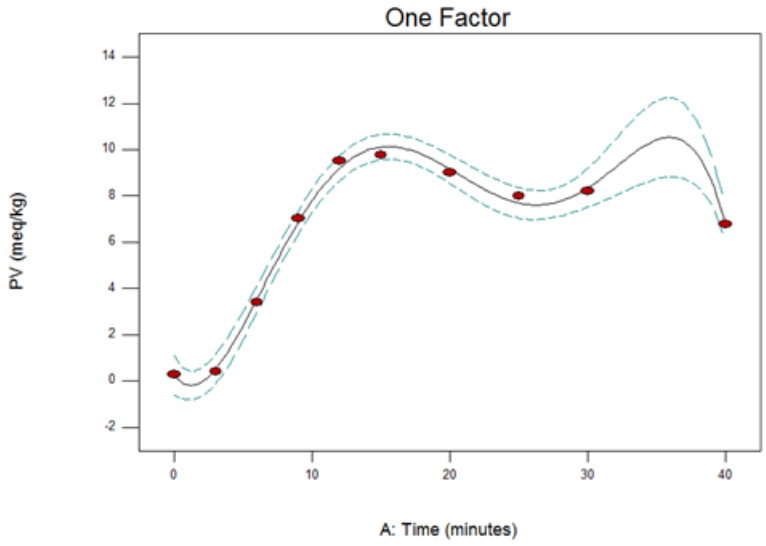

Fig 2. Graph Peroxide value Vs Induction Time by Software for Fifth Model

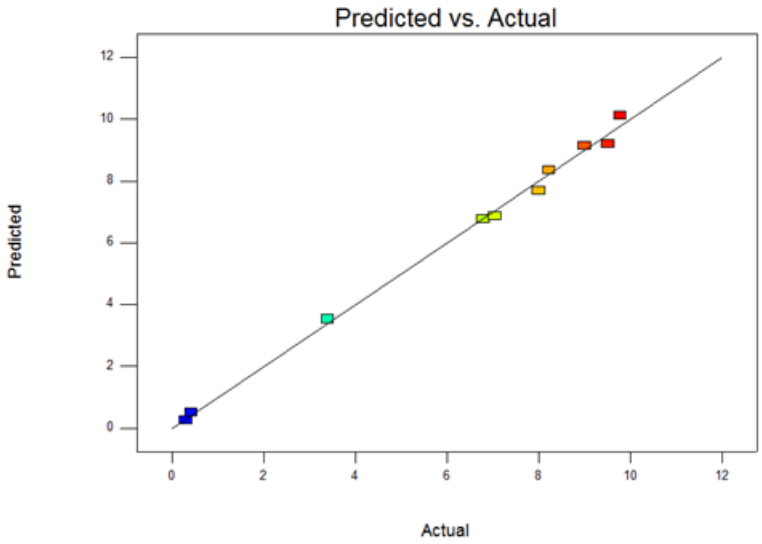

Fig 3. Graph Predicted Vs Actual values of Oxidation for model 2

Table 7. ANOVA for Response Surface Quadratic model

Response 1 PV

ANOVA for Response Surface Quadratic model

Analysis of variance table [Partial sum of squares - Type III]

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob > F	
Model	97.93	2	48.96	18.87	0.0015	significant
A-Time	*30.15*	*1*	*30.15*	*11.62*	*0.0113*	
A²	*56.90*	*1*	*56.90*	*21.93*	*0.0023*	
Residual	18.16	7	2.59			
Cor Total	116.09	9				

The Model F-value of 18.87 implies the model is significant. There is only a 0.15% chance that an F-value this large could occur due to noise.

Table 8. ANOVA Analysis Table for Quadratic Model

Std. Dev.	1.61	R-Squared	0.8436
Mean	6.25	Adj R-Squared	0.7989
C.V. %	25.79	Pred R-Square	0.3600
PRESS	74.29	Adeq Precisior	11.152

The "Pred R-Squared" of 0.3600 is not as close to the "Adj R-Squared" of 0.7989 as one might normally expect; i.e. the difference is more than 0.2. This may indicate a large block effect

Model 3 Quadratic Equation by Design Expert Software 8.0

Final Equation in Terms of Actual Factors:

$$PV = -0.017681 + 0.80836 * Time - 0.016592 * Time^2$$

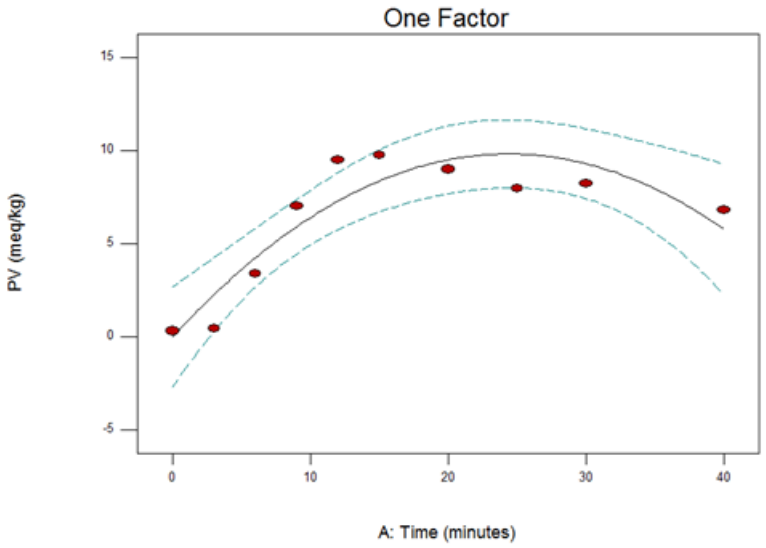

Fig 4. Graph Peroxide value Vs Induction Time by Software for Quadratic Model

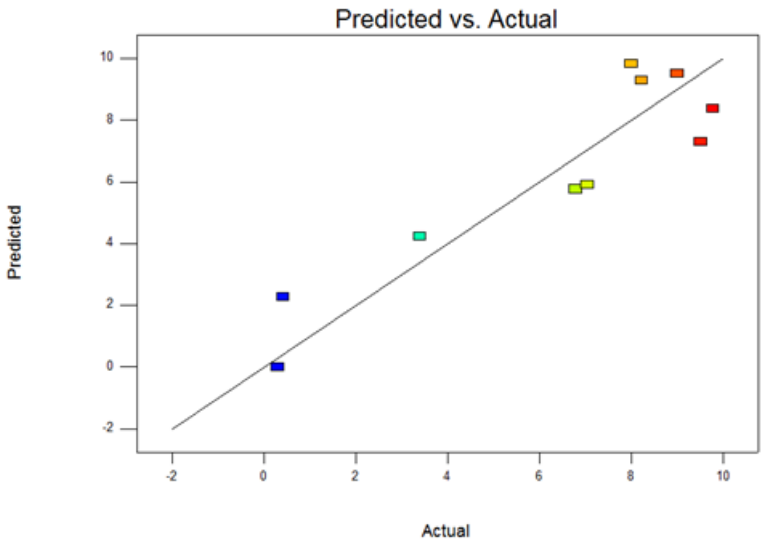

Fig 5. Graph Predicted Vs Actual values of Oxidation for model 3

4 CONCLUSION

We can see there are three equations or model developed which are significant as there R^2>=0.80 for relationship between peroxide value and Microwave heating time duration.

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We are appreciative of the SHIATS University for its continuous support in the development of important technologies for the future use. The effort of higher authorities to promote the technologies has been very valuable in the promotion of new technologies. A special thanks goes to the dean and head of department for believing in our dream to develop new technologies. Many people have contributed either directly or in directly to make this work a reality.

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Modeling of Various Compositional Changes Occurring in the Sliced Chicken Treated with Cold Atmospheric Plasma

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ABSTRACT: Consumers demand for quality of food has triggered the need for the development of a number of non-thermal approaches to food processing, of which Cold Plasma technology has proven to be very valuable. This review and research aims to develop the models for various constituents of sliced chicken undergoing Cold Plasma treatment for increasing the self-life. The models developed are as a function of cold atmospheric plasma treatment for (0-1.5) minutes, by plotting the graph and finding the trend equation with there R^2 on M S Excel.

KEYWORDS: Cold Atmospheric Plasma, Molecular oxygen , Modeling, Ionized gas, M S Excel.

1 INTRODUCTION

1.1 Plasma Science

1.1.1 Plasma- Definition, Physics and Chemistry

In 1922, the American scientist Irving Langmuir proposed that the electrons, ions and neutrals in an ionized gas could be considered as corpuscular material entrained in some kind of fluid medium and termed this entraining medium *"plasma",* similar to the plasma, introduced by the Czech physiologist Jan Evangelista Purkinje to denote the clear fluid which remains after removal of all the corpuscular material in blood. However, it emerged that there was no "fluid medium" entraining the electrons, ions, and neutrals in an ionized gas (Bellan 2006), nevertheless the name prevailed. The term "plasma" refers to a partially or wholly ionized gas composed essentially of photons, ions and free electrons as well as atoms in their fundamental or excited states possessing a net neutral charge. The plasma possesses a net neutral charge because the number of positive charge carriers is equal to the number of negative ones (Kudra and Mujumdar 2009). Electrons and photons are usually designated as "light" species in contrast to the rest of the constituents designated as "heavy" species. Due to its unique properties plasma is often referred to as the fourth state of matter according to a scheme expressing an increase in the energy level from solid to liquid to gas and ultimately to plasma.

1.1.2 Types of Plasma

Two classes of plasma, namely thermal and NTP can be distinguished on the basis of conditions in which they are generated. This classification of plasma is based on the relative energetic levels of electrons and heavy species of the plasma. NTP (near ambient temperatures of 30-60oC) is obtained at atmospheric or reduced pressures (vacuum) and requires less power. NTPs are characterised by an electron temperature much above that of the gas (macroscopic temperature) and consequently do not present a local thermodynamic equilibrium. NTP can be generated by an electric discharge in a gas at lower pressure or using microwaves. Typical illustrations for plasma generation at atmospheric pressure include the corona discharge, Dielectric barrier discharges (DBD), Radio-frequency plasmas (RFP) and the gliding arc discharge. In contrast,

thermal plasmas are generated at higher pressures, require high power, and an almost thermal equilibrium exists between the electrons and the heavy species. Plasma generation at atmospheric pressure is of interest, both technically and industrially for the food industries because this does not require extreme conditions.

1.2 Plasma Sources

Formerly, plasma treatments were carried out under vacuum conditions, but researchers have now developed atmospheric pressure plasma system, resulting in reduced cost, increased treatment speed, and industrial applicability (Yoon and Ryu 2007; Yun et al. 2010). The ability to generate non-thermal plasma discharges at atmospheric pressure makes the decontamination process easier and less expensive (Kim et al. 2011). However, until very recently, most of the cold plasma devices available commercially were developed for research and aimed at biomedical applications. Therefore, for food applications, these devices may need to be customized or tailor made. The barrier glow discharge generated between two parallel electrodes is a widely employed NTP system. In a possible industrial scale set-up, food may be conveyed through the discharge to achieve microbial decontamination. Another configuration is the plasma pen or jet, in which a stream of gases can be directed at the object to be treated. *Biozone Scientific* has developed a new process for the generation of cold oxygen plasma (COP) by subjecting air to high- energy deep- UV light with an effective radiation spectrum between 180 nm and 270 nm. This cold gas plasma is composed of several species like negative and positive ions, free radical molecules, electron, UV-photons and ozone (Terrier et al. 2009). *Duo-Plasmaline* is a linearly extended plasma source excited using microwaves of 2.45 GHz at a pressure <1000 Pa (Petasch et al. 1997) and several other plasma treatment systems have evolved based on this principle. The *Plasmodul* is a microwave sustained low pressure plasma reactor with a modular concept based on the *Duo-Plasmaline* principle which provides an easy upscaling for industrial applications (Schulz et al.). This type of microwave excited plasma sources are well suited for large area plasma treatment (Petasch et al. 1997) and can probably be employed for surface treatment of foods or processing surfaces at industrial scale. More recently, Kim et al. (2010) developed a cold plasma jet operating at 20 kHz Alternating Current (AC) under atmospheric pressure. The most versatile feature of most of the plasma systems is the freedom to select a gas or gas mixture. Improvements in the existing plasma systems and newer equipment directed for treatment of real food systems are likely to draw attention of researchers and engineers in near future. Recently a novel approach which shows significant potential for the treatment of various foods has been reported. The approach is based on a dielectric barrier discharge with the food package in contact with high voltage electrodes. Only 40-50 W of power is needed to ionize air inside a 4 L re-sealable plastic (LDPE) bag (Klockow and Keener 2009). The high voltage process ionizes any gas within the electric field contained within the package. Ionization can generate significant amounts of reactive molecules with little increase in product surface temperature.

Specific treatment times for targeted spore or bacterial reductions are dependent on product loading, packaging material, gas composition and package/electrode configuration. The in-package ionization process has been demonstrated in a number of common packaging materials including cardboard, glass, LDPE, HDPE, PETE, polystyrene, rubber, tygon, and others. Scale-up of the system has facilitated treatment of air filled packages with an electrode gap of up to 10 cm with rapid processing times (Keener et al. 2010).

1.3 Action of Plasma on microorganisms

1.3.1 Action on cell components and functions

The use of sterilizing properties of plasma was first introduced towards the end of 60s, patented in 1968 (Menashi 1968) and first works with plasma made from oxygen were proposed in 1989. Thereafter, considerable research has been performed on the mechanism of microbial inactivation by plasma agents. The plasma agents contribute to the lethal action by interacting with the biological material. Nelson and Berger (1989) have shown that O2 plasma could be a very efficient biocidal against bacteria. Plasma treatment can effectively inactivate a wide range of micro-organisms including spores (Kelly-Wintenberg et al. 1999; Feichtinger et al. 2003; Lee et al. 2006) and viruses (Terrier et al. 2009). Effect of plasma can be quite selective, meaning tuneable between damage to pathogenic organisms without damage to the host, or activation of different pathways in different organisms (Dobrynin et al. 2009). Low-pressure oxygen plasma has been shown to degrade lipids, proteins and DNA of cells (Mogul et al. 2003). The reactive species in plasma have been widely associated to the direct oxidative effects on the outer surface of microbial cells. As an example, commonly used oxygen and nitrogen gas plasma are excellent sources of reactive oxygen-based and nitrogen-based species, such as $O\bullet$, O^2, O^3, $OH\bullet$, $NO\bullet$, NO_2 etc.

Atomic oxygen is potentially a very effective sterilizing agent, with a chemical rate constant for oxidation at room temperature of about 106 times that of molecular oxygen (Critzer et al. 2007). These act on the unsaturated fatty acids of the lipid bilayer of the cell membrane, thereby impeding the transport of bio-molecules across it. The double bonds of

unsaturated lipids are particularly vulnerable to ozone attack (Guzel-Seydim et al. 2004). Membrane lipids are assumed to be more significantly affected by the reactive oxygen species (ROS) due to their location along the surface of bacterial cell, which allows them to be bombarded by these strong oxidizing agents (Montie et al. 2002). The proteins of the cells and the spores are equally vulnerable to the action of these species, causing denaturation and cell leakage. Oxidation of amino acids and nucleic acids may also cause changes that result in microbial death or injury (Critzer et al. 2007). Micro-organisms in plasma are exposed to an intense bombardment by the radicals most likely provoking surface lesions that the living cell cannot repair sufficiently faster. This may partially explain the observations wherein cells are in many cases destroyed very quickly. This process is termed "etching" (Pelletier 1992). The cell wall rupture has been additionally attributed by Laroussi et al., (2003) and Mendis et al., (2002) to electrostatic forces due to accumulation of charges at the outer surface of cell membranes. The morphological changes in *E. coli* cells treated with atmospheric plasma at 75W for 2 min as observed under an electron microscope by (Hong et al. 2009), clearly revealed that the treated cells had severe cytoplasmic deformations and leakage of bacterial chromosome. These observations demonstrate the loss of viability of bacterial cells after plasma treatment. An analogy between plasma and pulsed electric field has also been drawn to explain the action of plasma on the membranes (Pothakamury et al. 1995; Spilimbergo et al. 2003). It is well established that electroporation of membranes is induced by pulsed electric fields and it appears that plasma acts on similar lines inducing perforations in the membranes of micro-organisms (Sale and Hamilton 1967; Pothakamury et al. 1995; Wouters and Smelt 1997). In addition to generating pores, humid air plasma additionally provokes a marked acidification of the medium (Moreau et al. 2005; Moreau et al. 2007).

1.3.2 Role of UV photons and charged particles

The production of UV photons of different wavelengths has been proposed to be involved in dimerizing the thymine bases of DNA including that of spores (Munakata et al. 1991). The role of UV photons in bacterial death when they are submitted to a plasma treatment was reviewed in detail by (Boudam et al. 2006). Recently, by exclusion of reactive particles and spectral fractions of UV radiation from access to the spores Roth et al., (2010) revealed that UV-C radiation is the most effective inactivation agent in the plasma. Ultraviolet (UV) photons play a less important role in atmospheric pressure glow discharge (APGD) because they are easily absorbed by gas atoms and molecules at atmospheric pressure (Vleugels et al. 2005). The role of the charged particles in the bacterial inactivation process was recently investigated by Lu *et al.* (2009). Their work revealed that the charged particles play a minor role in the inactivation process when He/N2 (3%) is used as working gas than when He/O2 (3%) is used. Also, they concluded that heat and UV play no or minor roles in the inactivation process. Similar results were earlier obtained by (Perni et al. 2007) who interplayed bacterial inactivation kinetics with optical emission spectroscopy, and identified oxygen atoms as major contributor in plasma inactivation with minor contributions from UV photons, OH radicals, singlet oxygen metastables and nitric oxide. Thus, a contradiction over the role of UV photons in plasma exists and future studies must be directed to get a clear picture.

1.3.3 Effect of process parameters

The concentrations in which the plasma agents occur in plasma depend greatly on the device set-up (reactor geometry), operating conditions (gas pressure, type, flow, frequency and power of plasma excitation) and gas composition which affect their efficacy in a process when employed. To cite an example, the destructive efficiency of various gas plasma sources and temperatures on *Bacillus spp.* spores were compared by (Hury et al. 1998). This group demonstrated that oxygen-based plasma is more efficient than pure argon plasma. Another deciding criterion is whether the substrate to be sterilized is in direct contact with the plasma (*Direct Exposure*) or located remote from it (*Remote Exposure*) (Moisan et al. 2001; Laroussi 2005; Boudam et al. 2006). If exposed remotely, the quantum of heat transmitted to a sample is reduced, the charged particles do not play a role since they recombine before reaching the sample, and many of the short-lived neutral reactive species also do not reach the sample. Since, the components of the plasma are reactive and self-quenching, with a relatively short half-life, decreased time of flight would be expected to be one of the major factors in antimicrobial efficacy in this case (Niemira and Sites 2008). By varying the process parameters involved in plasma generation, a multitude of mechanisms can be actuated which may act individually or synergistically.

Nevertheless, the details of interaction of the different plasma agents with the different components of bacterial cells or spores are currently very limited. The interactions which occur between plasma agents and biological materials, ultimately leading to sterilization are still under investigation.

1.4 How the technology works

Cool plasma produces (gaseous) activated ions, photons, electrons and free radicals, collectively termed 'plasma', that exert their effects at 30-60°C; hence the term 'cool' or 'nonthermal' (see Figure 1). While it is possible to produce cool plasmas at low pressures, atmospheric-pressure plasma are cheaper to operate and are generally more effective. The plasma can be produced in ambient air, or in gases such as oxygen, helium and argon. The choice of gas and the amplitude and frequency of the power source are used to control the density of the plasma species. The plasma system can be configured to a wide range of geometries, depending on the type of food, and can allow continuous processing.

1.5 Benefits and applications

Cool (or nonthermal) plasma has many potential applications for the food industry, including the dry disinfection of food surfaces (meat, poultry, fish, nuts, fruit and vegetables), powders (dried milk components, flour, herbs and spices) and seeds for sprouting (alfalfa and mung beans). The technology can also be used to disinfect surfaces of processing equipment and packaging materials. The gaseous atoms and ions of plasma are effective against bacteria, viruses, moulds and fungi. The plasma can penetrate cracks and crevices unlike other potential surface treatments such as ultraviolet light. Therefore, the technology functions more effectively over uneven or cracked surfaces such as those found on many foods (seeds, meats etc).

Cool plasma has several advantages over competing preservation technologies such as irradiation, chemical sterilization (e.g. ethylene oxide) or disinfection treatments (e.g. chlorine). These can have detrimental sensory effects on treated food products or they are being phased out because of safety concerns. Although cool plasma technology is not yet used commercially on a large scale in the food industry, it has been successfully used for decades in many other industries, and is readily scaleable.

2 MATERIALS AND METHODS

[26]Sliced chicken were purchased from local market (Benha, Qaliobia governorate, Egypt). All samples were transported to our laboratory food irradiation unit, Nuclear Research Center in ice-box (0°C) and surveyed for microbiological counts for counts of total bacteria, psychrophilic bacteria, spore forming bacteria, total molds and yeasts. Then, sliced chicken samples were packed in tightly sealed polyethylene pouches and divided into seven groups and stored in freezing till irradiation treatments.

2.1 Gamma irradiation treatments Four bags from each of sliced chicken were gamma irradiated at 0, 2, 4, and 6 kGy doses using cobalt-60 gamma chamber (1.367 kGy/h) in Cyclotron Project, Nuclear Research Center Atomic Energy Authority, Inshas, Cairo, Egypt. After irradiation, all samples were stored at 4±1°C.

2.2 Plasma treatments *Character of exposure machine*

The plasma generator consisted of a negative dc source, a Blumlein-type pulse-forming network (E-PFN), and a dynamic spark gap switch. A triggered spark gap switch was used as a closing switch of E-PFN. E-PFN had four stages of LC ladder, which were composed of 5 nF of capacitor and 3 μH of inductor. The characteristic impedance ($2\sqrt{L/C}$) and the pulse width ($2N\sqrt{LC}$) of E-PFN, calculated from capacitance (C) and inductance (L) of the LC ladder, and number (N) of LC ladder stages were approximately 49 Ω and 1.0 μs, respectively.

A charging resistance value of 50 kΩ was chosen in the present case which corresponds to a charging RC time constant of 1 ms, which is 40 times faster compared to the repetition rate of the pulse. A schematic of the pulsed atmospheric-pressure plasma jet (PAPPJ) device for generating high voltage pulsed, cold atmospheric plasma jets is shown in Figure 1. The high voltage (HV) wire electrode, which is made of a copper wire, is inserted into a hollow barrel of a syringe. The distance between the tip of the HV electrode and the nozzle is 0.5 cm. When HV pulsed, DC voltage (amplitudes up to 25 kV, repetition rate up to 25 Hz), was applied to the HV electrode and helium gas was injected into the hollow barrel. This device was made using medical syringe (made out of an insulating material cylinder). The gas was fed into the system via flow meter. The applied voltage to and the discharge current through the discharge chamber were measured using a voltage divider (Homemade), which was connected between the two electrodes, and a current monitor, which can be located upon returning to the ground. The signals from the voltage divider and the current monitor were recorded in a digitizing

oscilloscope (Lecroy, USA) with a 200-MHz bandwidth. The high voltage pulses are applied between the needle electrode positioned inside a dielectric cylinder (a simple medical syringe) and a metal ring placed on the exterior of this cylinder. In order to obtain electric discharges at atmospheric pressure, a high voltage pulses (tens of kV) which have limited duration (hundreds of nanoseconds) and are repeated (tens of pulses per second), in addition to an inert gas (argon) is introduced in the cylinder.

The gas flows were in the range 0.5-10 l/min. The discharge takes place between the metallic needle top and a metallic ring fit on the outer surface of the syringe. Under optimal conditions, plasma is emitted as centimeter-long jets, just millimeters in diameter or even smaller. The working gases are supplied by high-pressure cylinders. Gas pressure regulators are used to reduce the pressure of gases to a workable level. Then, gas flow controllers deliver the gases with the desired flow. For voltage amplitudes of 15-18 kV, the plasma jet is very weak. The plasma jet disappears for voltage amplitudes lower than 15 kV. When argon is injected from the gas inlet and high voltage pulses, 26 kV voltages is applied to the electrode, the plasma jet is generated and a plasma plume reaching length of 21 mm is launched through the end of the tube and in the surrounding air. The length of the plasma plume can be adjusted by the gas flow rate and the applied voltage. Three bags from each of sliced chicken were exposured to plasma at 0.5, 1.0 and 1.5 min in Plasma Physics and Nuclear Fusion Department, Nuclear Research Center, Atomic Energy Authority, Inshas, Cairo, Egypt. After the exposure time of plasma, all samples were stored at 4±1°C.

2.3 Gamma irradiation treatments[26]

Four bags from each of sliced chicken were gamma irradiated at 0, 2, 4, and 6 kGy doses using cobalt-60 gamma chamber (1.367 kGy/h) in Cyclotron Project, Nuclear Research Center Atomic Energy Authority, Inshas, Cairo, Egypt. After irradiation, all samples were stored at 4±1°C.

2.4 Microbial analysis[26]

Colony forming units for total bacterial count were counted by plating on plate count agar medium and incubated at 30°C for three to five days (APHA, 1992). Total molds and yeasts were counted on oxytetracycline glucose yeast extract agar medium according to Oxoid, (1998). psychrophilic and spore forming bacteria count according to (FDA, 2002).

2.5 Statistical analysis[26]

The statistical evaluation of the mean data was compared using one-way analysis of variance (ANOVA) according to Zar (1984). The chosen level of significance was P≤ 0.05.

3 RESULT AND DISCUSSION

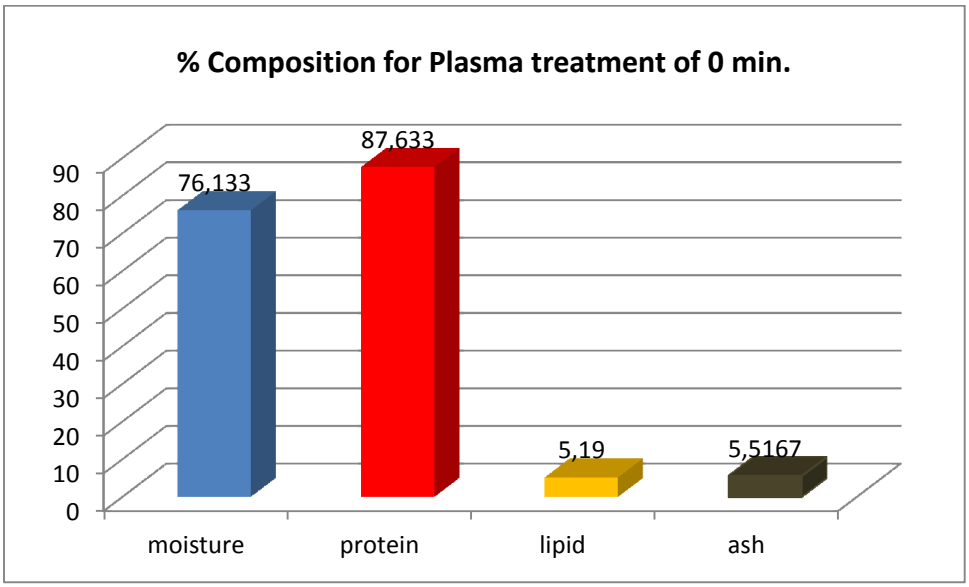

Fig 1. Graph for % composition of sliced chicken treated with CAP for 0 minute.

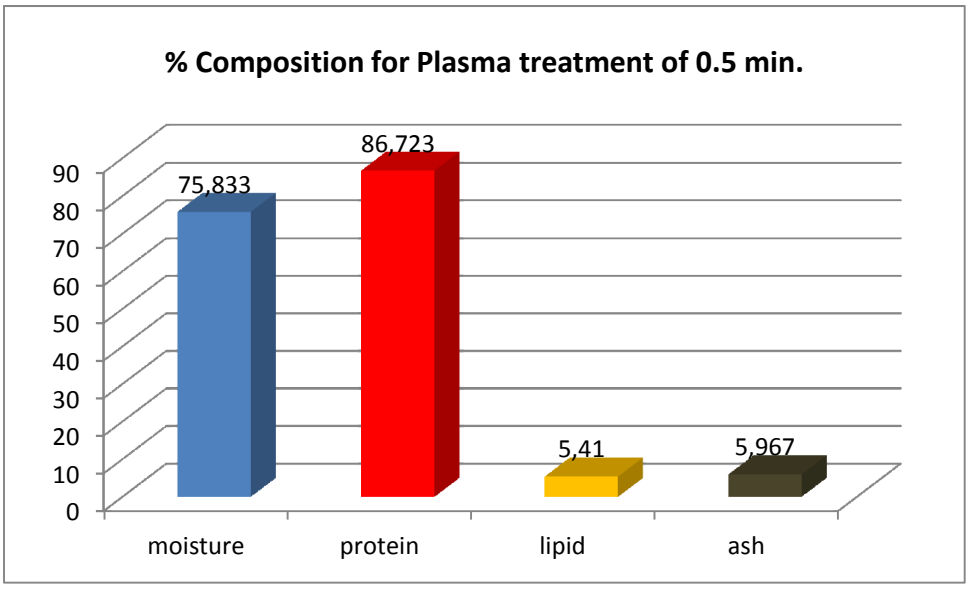

Fig 2. Graph for % composition of sliced chicken treated with CAP for 0.5 minute.

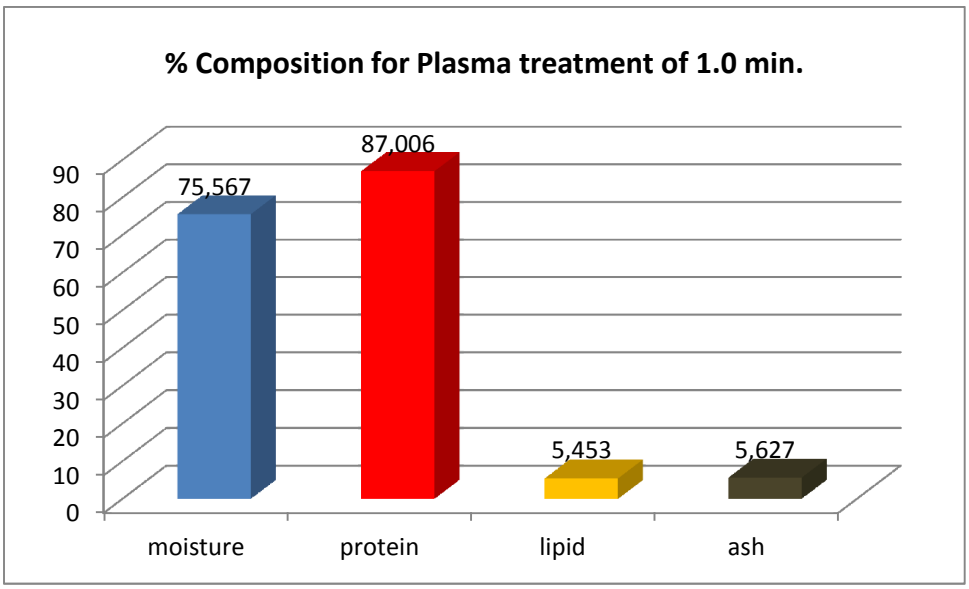

Fig 3. Graph for % composition of sliced chicken treated with CAP for 1.0 minute.

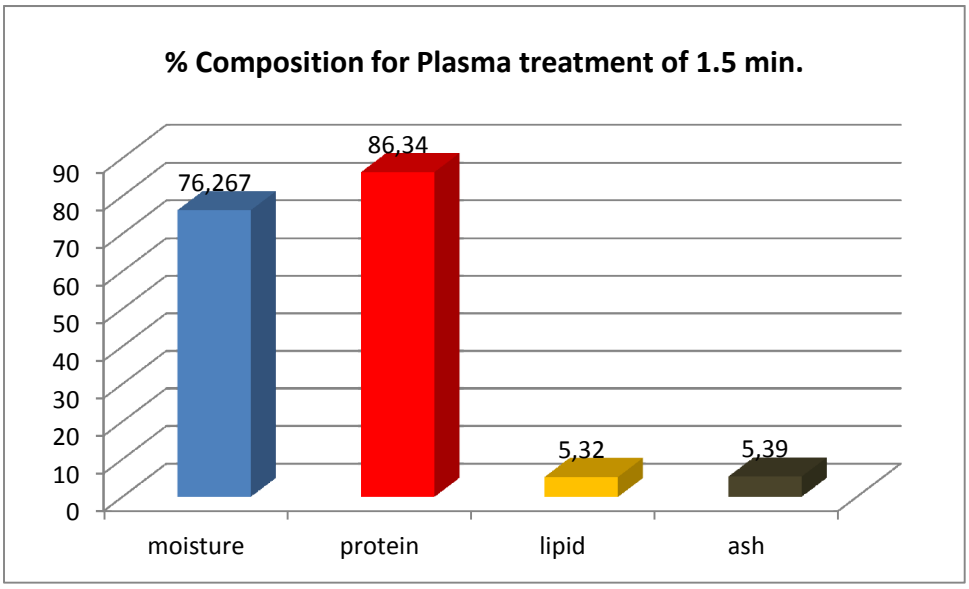

Fig 4. Graph for % composition of sliced chicken treated with CAP for 1.5 minute.

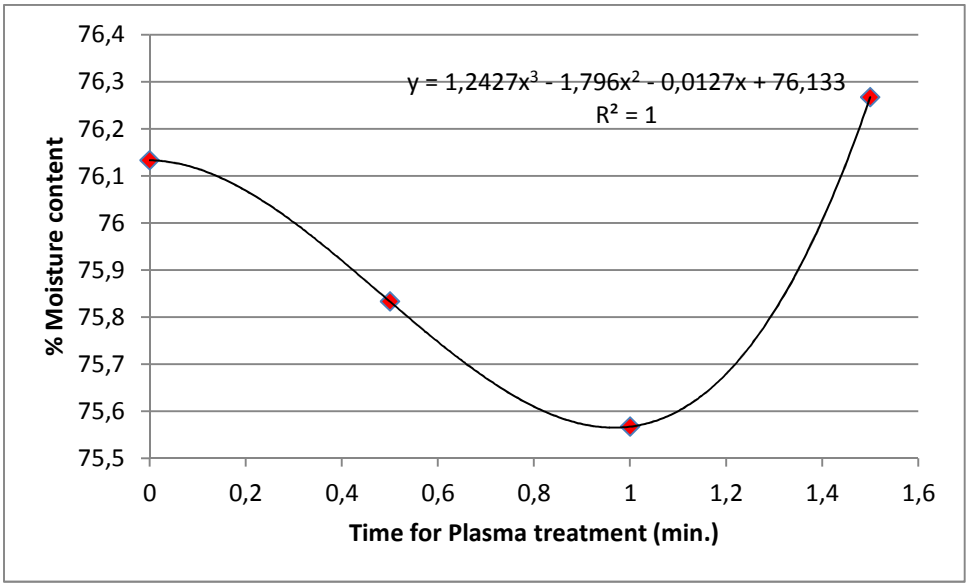

Fig 5. Graph showing the trend line and the modeled equation with R^2 for change in moisture content with the treatment time.

From the above graph one can say that decreases from 0-1 min treatment and then it increases till 1.5 minutes.

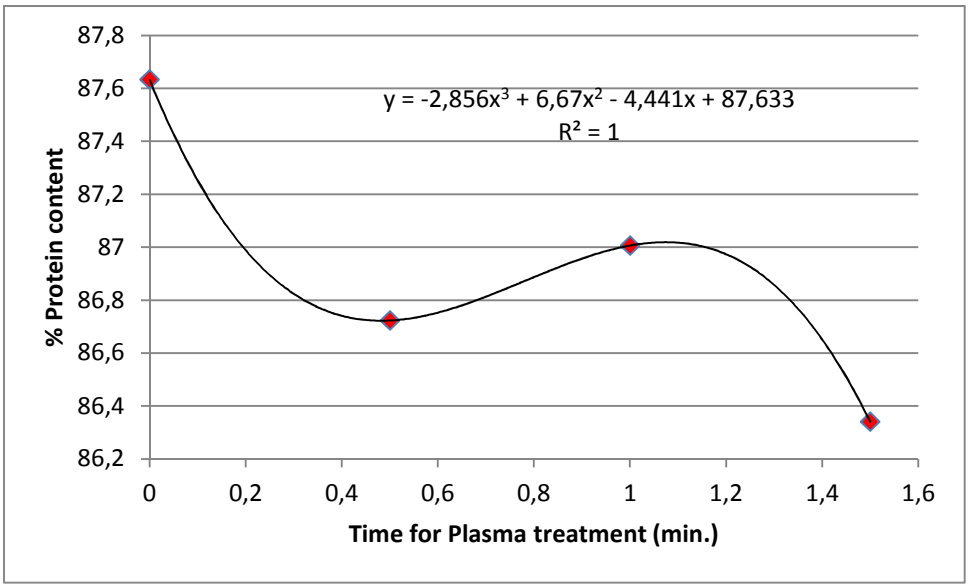

Fig 6. Graph showing the trend line and the modeled equation with R^2 for change in Protein content with the treatment time.

From the above graph one can say that Protein content decreases from 0-0.5 minutes then increases from 0.5-1.1 then decreases from 1.1- 1.5 minutes.

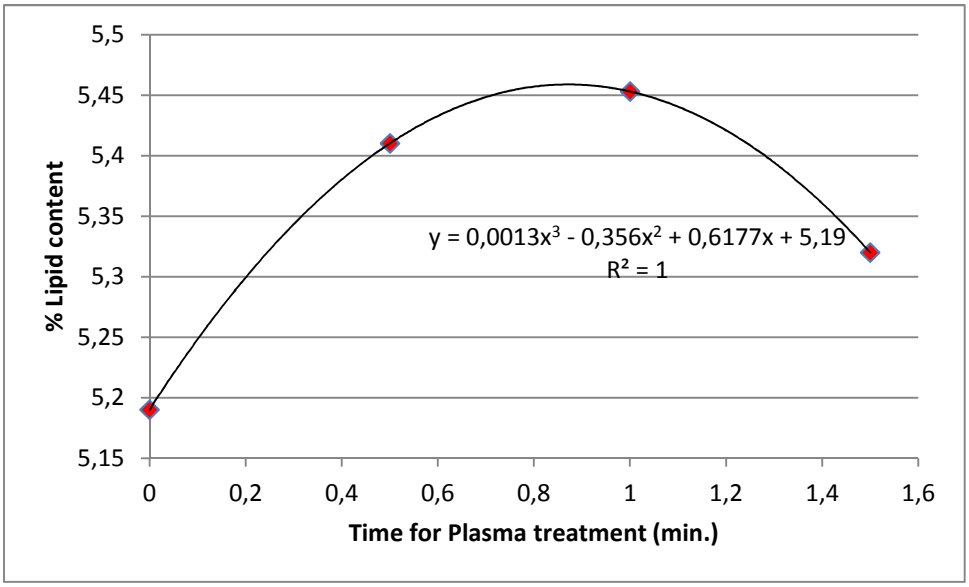

Fig 7. Graph showing the trend line and the modeled equation with R^2 for change in Lipid content with the treatment time.

From the above graph it can be concluded that the Lipid content increases from 0-0.9 minutes and then fall down till 1.5 minutes.

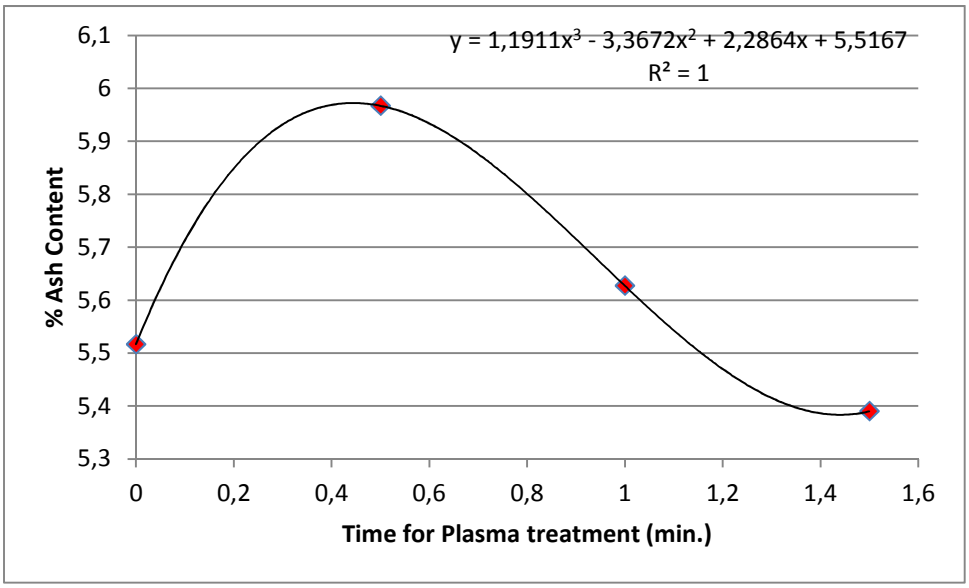

Fig 8. Graph showing the trend line and the modeled equation with R^2 for change in Ash content with the treatment time.

From the above graph it can be concluded that Ash content increases from 0-0.4 minutes of treatment then decreases till 1.5 minutes.

4 CONCLUSION

The effect of Cold Atmospheric Plasma various time interval on the chemical composition of sliced chicken was studied and the data and From above graphs, it could be noticed that the moisture, total protein, lipid and ash contents were tends to change with the CAP treatment of sliced chicken respectively. From the above graphs and model prepared one can make out the changes in compositions of sliced chicken within the plasma treatment of (0-1.5) minutes of the same.

ACKNOWLEDGEMENT

We are appreciative of the SHIATS University for its continuous support in the development of important technologies for the future use. The effort of higher authorities to promote the technologies has been very valuable in the promotion of new technologies. A special thanks goes to the dean and head of department for believing in our dream to develop new technologies. Many people have contributed either directly or in directly to make this work a reality.

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Modeling of Various Compositional Changes Occurring in the Sliced Chicken Treated with Gamma Irradiation

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ABSTRACT: Consumers demand for quality of food has triggered the need for the development of a number of non-thermal approaches to food processing, of which Irradiation technology has proven to be very valuable. This review and research aims to develop the models for various constituents of sliced chicken undergoing Irradiation treatment for increasing the self-life. The models developed are as a function of irradiation dose (0-6)kGy, by plotting the graph and finding the trend equation with there R^2 on M S Excel.

KEYWORDS: Irradiation, Radiation, Modeling, Cobalt-60, Radiolysis, M S Excel.

1 INTRODUCTION

The term "radiation chemistry" refers to the chemical reactions that occur as a result of the absorption of ionizing radiation. In the context of food irradiation, the reactants are the chemical constituents of the food and initial radiolysis products that may undergo further chemical reactions. The chemistry involved in the irradiation of foods has been the subject of numerous studies over the years and scientists have compiled a large body of data regarding the effects of ionizing radiation on different foods under various conditions of irradiation. The basic principles are well understood and provide the basis for extrapolation and generalization from data obtained in specific foods irradiated under specific conditions to draw conclusions regarding foods of a similar type irradiated under different, yet related, conditions. The types and amounts of products generated by radiation induced chemical reactions ["radiolysis products"] depend on both the chemical constituents of the food and on the specific conditions of irradiation.

The principles of radiation chemistry also govern the extent of change, if any, in both the nutrient levels and the microbial loads of irradiated foods.

Factors Affecting the Radiation Chemistry of Foods- Apart from the chemical composition of the food itself, the specific conditions of irradiation that are most important in considering the radiation chemistry of a given food include the radiation dose, the physical state of the food (e.g., solid or frozen versus liquid or non-frozen state, dried versus hydrated state), and the ambient atmosphere (e.g., air, reduced oxygen, and vacuum). The temperature at which irradiation is conducted can also be a factor, with more radiation-induced changes occuring with increasing temperature. Temperature is less important, however, than the physical state of the food. The amounts of radiolysis products generated in a particular food are directly proportional to the radiation dose. Therefore, one can extrapolate from data obtained at high radiation doses to draw conclusions regarding the effects at lower doses.

The radiation chemistry of food is strongly influenced by the physical state of the food. If all other conditions, including dose and ambient atmosphere, are the same, the extent of chemical change that occurs in a particular food in the frozen state is less than the change that occurs in the non-frozen state. This is because of the reduced mobility, in the frozen state, of the initial radiolysis products, which will tend to recombine rather than diffuse and react with other food components.

Likewise, and for similar reasons, if all other conditions are the same, the extent of chemical change that occurs in the dehydrated state is less than the change that occurs in the fully hydrated state.

The formation of radiolysis products in a given food also is affected by the ambient atmosphere. Irradiation in an atmosphere of high oxygen content generally produces both a greater variety, and greater amounts, of radiolysis products in the food than would be produced in an atmosphere of lower oxygen content. This is because irradiation initiates certain oxidation reactions that occur with greater frequency in foods with high fat content.

With few exceptions, the radiolysis products generated in a particular food are the same or very similar to the products formed in other types of food processing or under common storage conditions. These radiolysis products are also typically formed in very small amounts**.** Radiation-induced chemical changes, if sufficiently large, however, may cause changes in the organoleptic properties of the food. Because food processors want to avoid undesirable effects on taste, odor, color, or texture, there is an incentive to minimize the extent of these chemical changes in food. Thus, the doses used to achieve a given technical effect (e.g., inhibition of sprouting, reduction in microorganisms) must be selected carefully to both achieve the intended effect and minimize undesirable chemical changes.

Typically, the dose or dose range selected will be the lowest dose practical in achieving the desired effect. Irradiation also is often conducted under reduced oxygen levels or on food held at low temperature or in the frozen state.

In general, during inactivation of microorganisms on surfaces, the rate of inactivation is inversely proportional to the initial cell concentration (Shintani, 2000). Food irra-diation is being considered an important tool, in ensuring safety and extending shelf-life of fresh meat and poultry (Yoon, 2003). Thus irradiation can eliminate food-borne pathogenic microorganisms in meat. Furthermore, the use of gamma irradiation as a safety techno-logical treatment in food preservation has now become legally accepted in many countries of the world (Abdel-Daium, 2007).

Misconceptions about Irradiated Food

There are misconceptions in the minds of consumers regarding irradiated food. However, scientific research has proved that consumption of irradiated food is absolutely harmless. The safety of food processed by radiation has been examined carefully, both at the national and international levels. On the basis of extensive studies with laboratory animals carried out in different countries including India, FAO/IAEA/WHO Joint Expert Committee has recommended that the food items irradiated up to an average dose of 10 kilo Gray be accepted as safe from the health angle and do not present any toxicological hazards. In fact, the doses of irradiation required for the treatment of commodities are far below this stipulated limit. The committee has further recognized radiation as a physical process like thermal processing and not as a food additive.

The irradiation process involves passing of food through a radiation field allowing the food to absorb desired radiation energy. The food itself never comes in contact with the radioactive material. Gamma rays, X-rays, and electrons prescribed for radiation processing of food do not induce any radioactivity in foods. In comparison to other food processing and preservation methods the nutritional value is least affected by irradiation. Extensive scientific studies have shown that irradiation has very little effect on the main nutrients such as proteins, carbohydrates, fats, and minerals. Vitamins show varied sensitivity to food processing methods including irradiation. For example, vitamin C and B1 (thiamine) are equally sensitive to irradiation as well as to heat processing. Vitamin A, E, C, K, and B1 in foods are relatively sensitive to radiation, while riboflavin, niacin, and vitamin D are much more stable. The change induced by irradiation on nutrients depends on a number of factors such as the dose of radiation, type of food, and packaging conditions. Very little change in vitamin content is observed in food exposed to doses up to 1 kGy. The Joint Expert Committee of the Food and Agriculture Organization (FAO), World Health Organization (WHO), and International Atomic Energy Agency (IAEA), in 1980 concluded that irradiation does not induce special nutritional problems in food. The committee also rejected the possibility of development of chromosomal abnormalities by the consumption of irradiated food.

Mathematical modeling is an effective way of representing a particular process. It can help us to understand and explore the relationship between the process parameters. Mathematical modeling can help to understand and quantitative behavior of a system. Mathematical models are useful representation of the complete system which is based on visualizations. Mathematical modeling is an important method of translating problems from real life systems to conformable and manageable mathematical expressions whose analytical consideration determines an insight and orientation for solving a problem and provides us with a technique for better development of the system.

The objective of the study is to model the changes in various compositions of irradiated chicken meat in respect to the radiation dose given.

2 MATERIALS AND METHODS

[26]Sliced chicken were purchased from local market (Benha, Qaliobia governorate, Egypt). All samples were transported to the laboratory food irradiation unit, Nuclear Research Center in ice-box (0°C) and surveyed for microbiological counts for counts of total bacteria, psychrophilic bacteria, spore forming bacteria, total molds and yeasts. Then, sliced chicken samples were packed in tightly sealed polyethylene pouches and divided into seven groups and stored in freezing till irradiation treatments.

Gamma irradiation treatments[26]

Four bags from each of sliced chicken were gamma irradiated at 0, 2, 4, and 6 kGy doses using cobalt-60 gamma chamber (1.367 kGy/h) in Cyclotron Project, Nuclear Research Center Atomic Energy Authority, Inshas, Cairo, Egypt. After irradiation, all samples were stored at 4±1°C.

Microbial analysis[26]

Colony forming units for total bacterial count were counted by plating on plate count agar medium and incubated at 30°C for three to five days (APHA, 1992). Total molds and yeasts were counted on oxytetracycline glucose yeast extract agar medium according to Oxoid, (1998). psychrophilic and spore forming bacteria count according to (FDA, 2002).

Statistical analysis[26]

The statistical evaluation of the mean data was compared using one-way analysis of variance (ANOVA) according to Zar (1984). The chosen level of significance was P≤ 0.05.

3 RESULT AND DISCUSSION

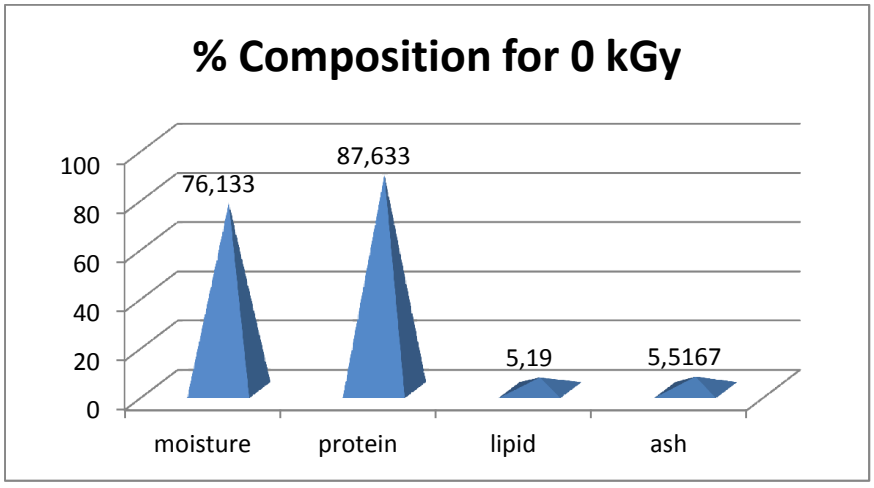

Fig 1. % composition of sliced un treated chicken

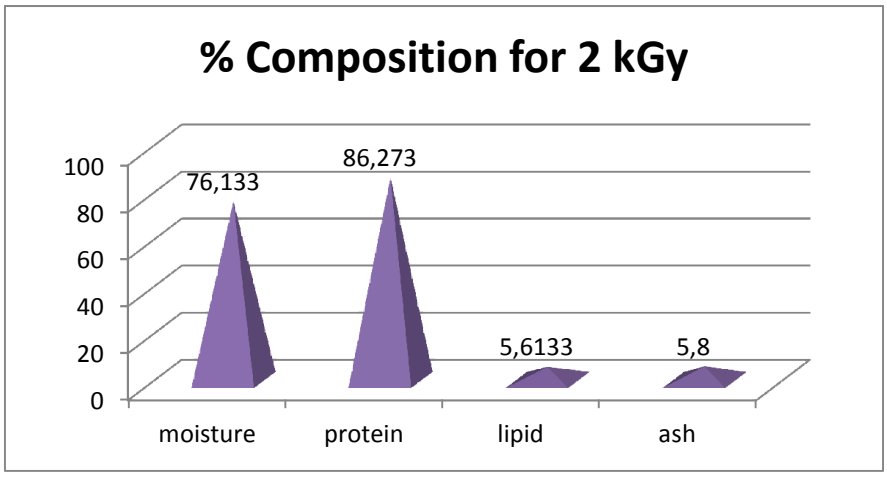

Fig 2. % composition of sliced irradiated chicken for 2 kGy

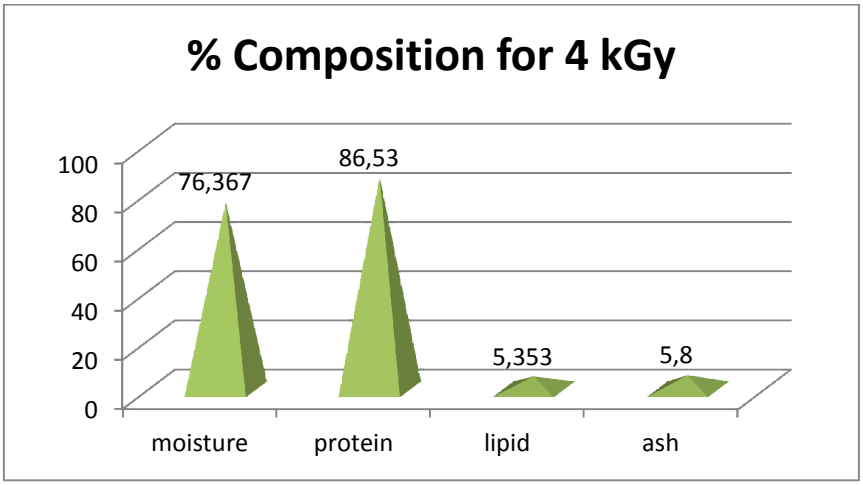

Fig 3. % composition of sliced irradiated chicken for 4 kGy

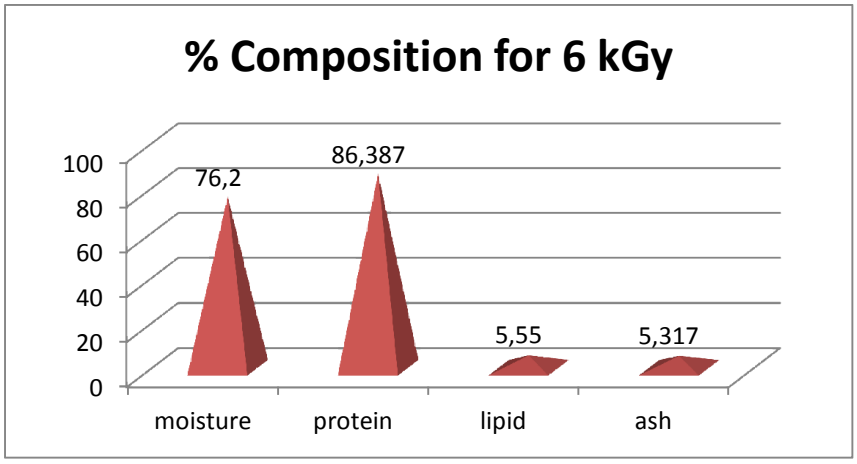

Fig 4. % composition of sliced irradiated chicken for 6 kGy

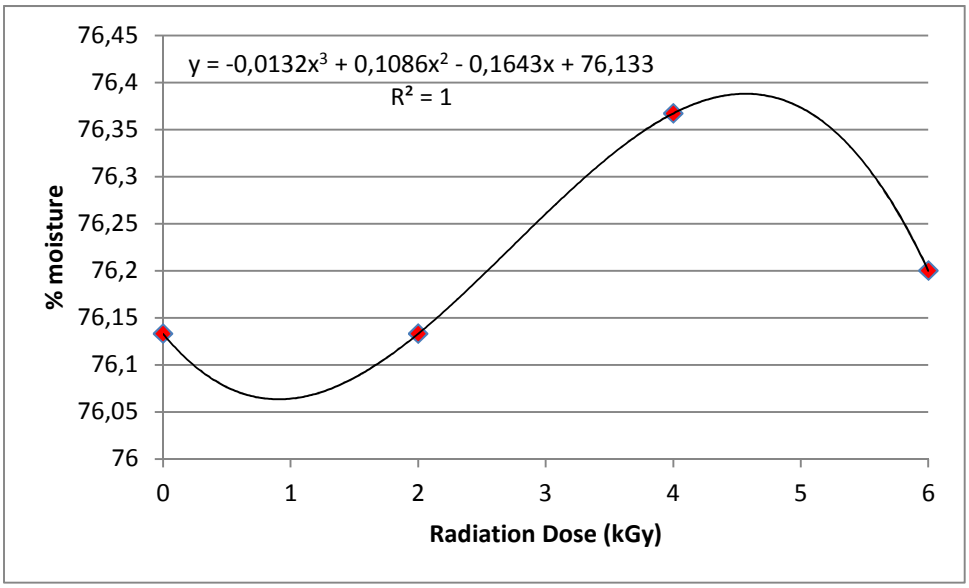

Fig 5. Modeled Graph for % moisture content Vs Irradiation dose

From above graph we can say that % moisture content decreases from 0-1 kGy then rises from 1-4.5 kGy then again decreases till 6 kGy.

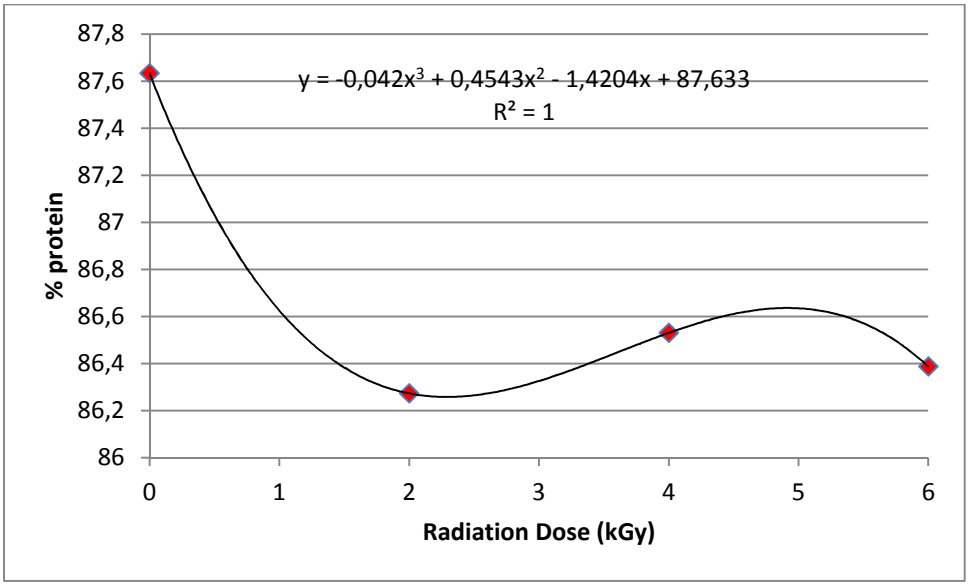

Fig 6. Modeled Graph for % Protein Vs Irradiation dose

From the above graph we can say that first there is decrease in % protein content from 0-2 kGy and then rises from 2- 5 kGy then again decrease from 5-6 kGy.

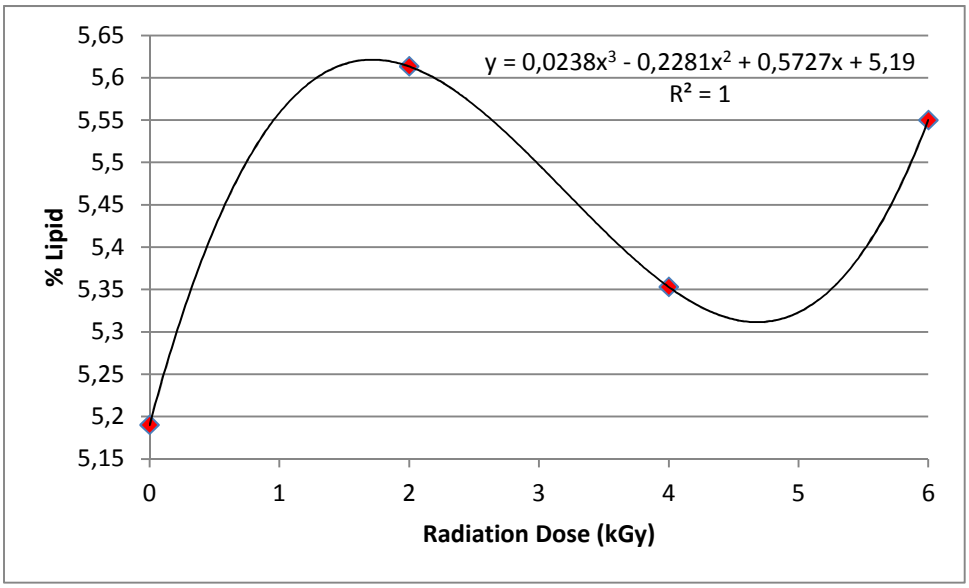

Fig 7. Modeled Graph for % Lipid content Vs Irradiation dose

From the graph above we can make out that there is increase in % lipid content for 0-2 kGy dose of Gamma-irradiation, then it decreases from 2-4.8 kGy and then again abrupt rise till 6 kGy.

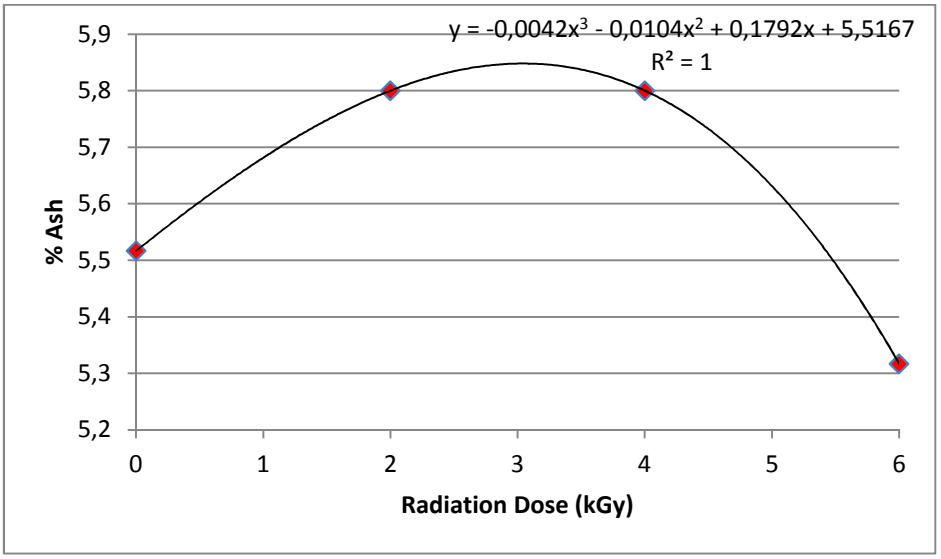

Fig 8. Modeled Graph for % Ash content Vs Irradiation dose

From the above graph it can be concluded that there is rise in % Ash from 0 kGy till 3 kGy then it decreases till 6 kGy.

4 CONCLUSION

The effect of various gamma irradiation doses on the chemical composition of sliced chicken was studied and the data and From above graphs, it could be noticed that the moisture, total protein, lipid and ash contents were tends to change with the irradiation treatment of sliced chicken respectively. From the above graphs and model prepared one can make out the changes in compositions of sliced chicken with the irradiation dose (0-6) kGy of the same.

ACKNOWLEDGEMENT

We are appreciative of the SHIATS University for its continuous support in the development of important technologies for the future use. The effort of higher authorities to promote the technologies has been very valuable in the promotion of new technologies. A special thanks goes to the dean and head of department for believing in our dream to develop new technologies. Many people have contributed either directly or in directly to make this work a reality.

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