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RESEARCH ARTICLE

Studying the Effect of Microwaves Plasma on the Properties of Nano-Curcumin by Texture Analysis

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ABSTRACT

The search aim to prepare Nano-curcumin and enhance its properties by using microwave plasma To characterized the nano- particle two type of analysis is used, scanning probe microscope (SPM) and the textural analysis (first and second order statistical features), the result shows that the diameter of the Nano-curcumin decreased by exposing to the plasma for 25 minte, this means that the properties of the curcumin is enhanced by the plasma the Scanning probe microscope (SPM) is taken before and after the expose to plasma, also the textural features are calculated before and after the expose, the result shows good indication in the features with the plasma expose.

Keywords: Nano-curcumin, curcumin, Nanotechnology, plasma, Scanning probe microscope (SPM)

INTRODUCTION

Curcumin (Curcuma longa) (molecular formula C21H20O6) is also known as diferuloylmethane and first identified by Lampe and Milobedeska in 1910[1]. Curcumin a natural substance, a polyphenolic compound extracted from the rhizome of the spice plant Curcuma longa the yellowish color of turmeric is due to curcumin, has been used extensively for treatment in Ayurvedic and traditional Chinese medicine. Curcumin possesses antidepressant, anti-oxidative, anti-inflammatory and neuroprotective actions and acts through several intracellular mechanisms affecting multiple targets. Curcumin has been proved to be effective for the treatment of different forms of cancer, allergic reactions, asthma, Alzheimer's disease and pathological disorders in which aberrant self-reactivity takes place, such as inflammatory bowel disease, rheumatoid arthritis[2]. Curcumin has also been interesting because of many reasons, one of which is its effectiveness as a chemo-preventative agent, and also it is a chemo-/radio-sensitizer for tumorous cells, while acts as a chemo-/radio-protector for normal functioning organs [3,4,5]. On the other hand, low solubility in water and inadequate oral bioavailability have been the reasons for its restricted use in clinical trials[3]. Turmeric contains 69.4% carbohydrates, 6.3% protein, 5.1% fat, 5.8% essential oils, and 3e6% of curcuminoids; the main

curcuminoids in commercial curcumin arez77% curcumin (curcumin I), z17% demethoxycurcumin (curcumin II), z3% bis-demethoxycurcumin (curcumin III), and cyclocurcumin (curcumin IV) [4]. Curcumin is a hydrophobic, polyphenolic compound, hence insoluble in water at acidic and neutral pH conditions, however soluble in methanol, ethanol, dimethylsulfoxide, and acetone [1].Figure (1) Shown the Turmeric, curcumin and its chemical structure (a) The root of turmeric. (b) Crystallized powder of curcumin. Curcumin is thought to be the main active ingredient derived from the root of turmeric. (c) The enol and keto forms of curcumin are common structures of the drug. The enol form is more energetically stable in the solid phase and in solution [5].

For enhancement the properties of the Nano curcumin it is exposed to plasma. Plasma is a hot ionized gas consisting of approximately equal numbers of positively charged ions and negatively charged electrons [6,7]. There are two type of plasma Thermal and non-Thermal plasma. Microwave plasma or non-thermal plasma is used here. Microwave plasma is a type of plasma that has high frequency electromagnetic radiation in the GHz range. Microwave generated plasma system are choose over other kinds of plasma sources because they are electrodeless plasma, so the task of replacing or cleaning the electrodes and filaments is averted [8,9]. Microwave discharges produce non-equilibrium plasma since the electrons can respond to the oscillations of the electric field whereas the ions are not able to respond due to their large mass. So most of the microwave energy goes preferentially to the electrons, and then produce plasma far from thermodynamic equilibrium [10,11].

Nanotechnology

The intrinsic curcumin is associated with some main drawbacks such as poor absorption, low bioavailability, high metabolic rates and rapid elimination from the body. Therefore, in spite of having multidisciplinary medicinal profits, turmeric has not yet been considered commercially as a powerful helpful agent [1].So Nanotechnology is the science which has developed farming and food production systems [12]. Studies of uncommon characteristics of materials at Nano-metric scale (10^{-9}m) have led to their extensive applications in different industries. Apparatus or substances that are extremely small to the extent of being the same size as big biomolecular, for example, receptors or enzymes, which are considered to be 100 to 10,000 times smaller than the human body cells [13,14,15]. This field is called Nanotechnology which allows us to produce nano-scale apparatus. These devices, can effortlessly go through blood vessel walls, or even insert themselves into most of body cells. [3]And Nanoparticles are easier to pass through cell membranes in organisms and get interacted rapidly with biological systems; Nano-curcumin has been scientifically proven to provide an opportunity to expand the clinical repertoire of this efficacious agent by enabling easier aqueous dispersion [16].

Image

Image can be defined as a 2D function, f(x, y), where x and y called spatial (plane) coordinates, the amplitude of the function at any pair of spatial coordinates (x, y) is the intensity or gray level of the image at point. The field of digital image processing refers to processing digital images by means of a digital computer.
The function f(x, y) must be nonzero and finite [17]
$0 \le f(x, y) \le \infty$….. (1)

The function f represented by two components:
1) The amount of light incident on the scene i(x, y)
2) The amount of light reflected by the objects on the scene r(x, y):
Where $0<i(x, y)<\infty$ and $0<r(x, y)<1$
$f(x, y)= i(x, y) X r(x, y)$……(2)

The equation $0<r(x, y) <1$ shows that reflectance is total absorption by zero and at 1 total reflectance [18].

A digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are called picture elements, image elements, and pixels. Pixel is the term used most widely to denote the elements of a digital image. Pixel is characterizes the color or gray level for black and white photos at a single point in the image [19].

Histogram Processing

The histogram of a digital image with intensity levels is between [0, L-1] where L equal to 256 is a discrete function $h_{(rk)} = n_k$, where r_k represented the the k^{th} intensity value and the number of the pixels with intensity $r_k$is defined as n_k. To normalize the histogram it is convent to dividing each of its components by the total number of pixels, denoted by the product MN, where, as usual, M and N are the row and column dimensions of the image. Thus, a normalized histogram is given by

$p(r_k) = H(i)/MN$ For k = 0, 1, 2, ... , L - 1

$p(r_k)$ the probability of appearance of intensity(r_k) in an image. The sum of each components of a normalized histogram is equal to (1) [8]. The histogram is the presentation of the image. It plots the pixels number with certain level against the brightness level. The dynamic range is on the x-axis,while the y-axis represented the occurrence frequency

Texture

Texture analysis is one of the most important techniques used in analysis and classification of image regions where repetition of fundamental image elements occur. Such characteristics can easily be seen in biomedical images of cells and tissues, or remote sensing images obtained from an aircraft or from a satellite platform. Texture is evaluated by one or more features such as coarseness, granulation, Smoothness, regularity and randomness. Texture features corresponding to human visual perception where they are very useful for parameterization of appearance of object and its subsequent recognition. Textural features can also be used to estimate orientation and depth of object surface. Inan intensity image this roughness is recorded as tonal or intensity variation over a neighborhood. Thus texture analysis and classification also called texture segmentation involve determining the basic pattern. Each of themethods are based on one of the following approaches

1. Statistical approach,
2. Spectral approach, and
3. Structural approach.

Eachis divided into the concepts of first and second order spatial statistics [20].

(i) First-order statistics can be computed from the histogram of pixel intensities in the image. These depend only on individual pixel values and not on the interaction or co-occurrence of neighboring pixel values.First-order statistics measure the likelihood of observing a gray value ata randomly-chosen location in the image.

(ii) Second-order statistics are defined as the likelihood of observing a pair of gray values occurring at the endpoints of random length placed in the image at a random location and orientation. These are properties of pairs of pixel values.

First-Order Statistics Features

The statistical representation of the image features by using properties direct from the histogram these features are.

Energy: it is the sum of squared elements. Its range is from 0 to 1 [21].

$$E = \sum_{i=0}^{G-1} (p(i))^2 .$$

Where p(i) the probability density of occurrence of the intensity, as determined from the histogram with total number of pixels in the image is given as[21].

$$p(i) = H(i)/NM$$

Where:i= 0,1,2……. G-1.

N,M= respectively number of cell in horizontal domain and vertical domain.

G=gray level of an image 255.

Entropy: Measure the randomness of a gray-level distribution. The Entropy is expected to be high if the gray levels are distributed randomly throughout the image. It's inversely proportional to the energy. It is given by[

$$H = -\sum_{i=0}^{G-1} p(i) log_2[p(i)]$$

Mean: supply the mean value of the gray levels in the image. The mean become large if the sum of the gray levels of the image is high.It is given by[21].

$$\mu = \sum_{i=0}^{G-1} ip(i) \quad \ldots\ldots\ldots$$

Variance: The variance is expected to be large if the gray levels of the image are spread out greatly [61]. It is given by

$$\sigma^2 = \sum_{i=j}^{G-1} (i-\mu)^2 p(i)$$

Standard Deviation: standard deviation shows much 'variation' or 'dispersion' exists from the average[].

$$Std = \sqrt{\sigma^2}$$

Skewness: Skewness of the histogram is also called as (third moment). This measure is 0 for symmetric histograms, positive by histograms skewed to the right (about the mean) and negative for histograms skewed to the leftis used to calculate third moment[21].

$$\mu_3 = \sigma^{-3} \sum_{i=0}^{G-1} (i-\mu)^3 p(i)$$

Kurtosis: The kurtosis is the flatness of histogram. Kurtosis is the degree of peachiness of a distribution, defined as a normalized form of the fourth central moment of a distribution[21].

$$\mu_4 = \sigma^{-4} \sum_{i=0}^{G-1} (i-\mu)^4 p(i) \ldots\ldots\ldots\ldots$$

Co-occurrence Matrices

An important and powerful statistical texture analysis algorithm is the co-occurrence matrices. The co-occurrence matrix is a two dimensional histogram, which indicated to number of times that pairs of intensity values occur in a given spatial relationship [19]. The co-occurrence matrices are constructed by considering that every pixel have eight neighbors (horizontally, vertically and diagonally at 45 degrees). It also assumed that the matrix of relative frequencies of gray levels co-occurrence can specify the texture-context information. Some of the texture measures can be obtained from these matrices, (like homogeneity and the contrast) [19]. The texture is specified by the matrix of relative frequencies of co-occurrence p(i,j), which indicate the number of times that each two neighboring pixels of an image, separated by a distance (d), will have gray tone (i) for one pixel and (j) gray tone for the other pixel. Such matrices of gray tone spatial dependence frequencies are the functions of the angular relationship between the neighboring pixels, as well as a function of the distance between them [19]. The co-occurrence matrices are based on the repeated occurrence of the gray level configuration in the considered texture. This configuration varies rapidly in fine textures, more slowly in coarse textures.

Second-Order Statistics Features

Correlation: It measures how a pixel is correlatedto itsneighborhood pixels. Its value lies between (-1 and +1). Its value is (-1) for perfectly negatively correlated image and (+1) for positively correlated image[21].

$$Correlation = \sum_{i,j=0}^{G-1} \frac{i\,p(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y} \quad \ldots\ldots(2\text{-}16)$$

μ_x, μ_y:Mean value in the x and y direction.

σ_x, σ_y: Variance of x,y

$$P_H(i,j,\theta) - \frac{1}{N_\theta} P(i,j,\theta)$$

Homogeneity: It gives the distribution value of the closeness of elements of the gray level co-occurrence matrix. It gives the value between the range of 0 and 1[21].

$$Homogeneity = \sum_{i,j=0}^{G-1} \frac{p(i,j)}{1+(i-j)^2}$$

$$P_D(i,j,\theta) = \frac{1}{N_\theta} P(i,j,\theta)$$

Contrast: It gives the local variations in the gray level co-occurrence matrix. It determines the intensity difference between a pixel and its neighborhood [61].

$$Contrast = \sum_{i,j=0}^{G-1} (i-j)^2 \; p(i,j)$$

Energy: it is the sum of squared elements. Its range is from 0 to 1 [19].

$$E = \sum_{i,j=0}^{G-1} (p(i,j))^2 \text{ . ……}$$

Where p (i,j) the probability density of occurrence of the intensity[21].

MATERIALS AND METHOD

100 g of turmeric, 1000 ml of distilled water ,Vibra -Cell Ultrasonic Liquid Processors device 750 Watt and 20 kHz. Ultrasonic Processors to safely process a wide range of organic and inorganic materials, from 250 microliters to 1 liter. Typical applications include nanotechnology (producing nanoparticle materials and Graphene dispersions), cell lysing, sample preparation, homogenization, ChIP Assay, emulsification, disaggregation and deagglomeration, plus uses in the field of sonochemical processing.

Preparation of Nanocurcumine

To prepare the nanocurcumine 100 g of crushed curcumin is added to 1000 ml of distilled water then the mixture is melted on a low heat and the mixture is dissolved to get rid of the sediment. The solution is distributed in dishes and left to dry for two days, after two days powder is collected from dishes and it weight is 20 g of dried turmeric, then Add 800 ml of distilled water and expose the mixture to the Vibra-Cell Ultrasonic Liquid a device for an hour and a half where the device works 10 seconds and rest for 5 seconds. This procedure continuous for 10 days, Finally Nano-curcumin is obtained.

RESULTS AND DISCUSSIONS

Characterization of Nano-curcumin

To characterized the particle two type of analysis is used to shown the nanocurcumine that is made

Scanning Probe Microscope (SPM)

Is an instrument used for studying surfaces at the nanoscale level. SPMs form images of surfaces they use a physical probe to scan back and forth over the surface of a sample and collect data, typically obtained as a two-dimensional grid of data points and displayed as a computer image during this scanning process, a computer gathers data that are

used to generate an image of the surface. In addition to visualizing nanoscale structures, some kinds of SPMs can be used to manipulate individual atoms and move them to make specific patterns. it used to study the characterized of the nanoparticle and it show according table (1) the average diameter is 82.80 nm and there is 10% the diameter less than 65.00 nm and 50% the diameter is less than 80.00 nm and 90% is less than 95.00 nm It is observed inFigure (2) that the distribution of particles is regular and homogeneous, while figure (3) represented the distribution of particle and homogenous structure of the nanoparticle. Also, it shows how the particle line up following to each other in a way regularly and visibly Figure (4) shows the distribution of particles and the scale show that the particle size from 0 nm to 100.00 nm according to the colure (black to white) is distributed. And some parameter is shows the Surface Roughness Analysis Image and this parameter are listed in table (3):

Figure (5, 6) shows the texture analyses to the image of Nano curcumin from SPM where (5) is color image(inverted color) this help to image is differ from the original (3) where the white color become black and the brown color become blue and (6) in gray color brown color become white and the black remains black. Table (4, 5) contained parameter from first order and second order. We used the colors to get clear of the bright in the picture that can cause interference in the results and we used first order because it depends on the histogram, so we turned the picture because the white color interferes with the result. The table shows that the mean which is give us indicter about the brightness of image and the standard deviation is the distribution of intensity about mean. All parameter are explained in chapter two. The Nano curcumin exposed for 25 min to plasma. Using microwaves-induced plasma system of non-thermal atmospheric pressure operated with frequency 2.45 (GHz), microwave power of 800 W and used argon gas to generate the torch after that (scanning probe microscope) Table (6) shows the range of particle size. Table (7) shows the distribution, accumulation and volume of nanoparticle after plasma. Figure (3-13) shows the histogram distribution of Nano-particle and homogenous structure.

From Figure (7) it's observe that the distribution of nanoparticles is regular and homogeneous after expose to plasma. Figure (8) shows the particle structure distribution Table (6) shows the diameter of the Nano curcumin after exposed to plasma for 25 min. Table (7) shows the distribution, accumulation and volume of Nano-particles after plasma Figure (8) the distribution of particle From Figure (9) according the scale show that the particle size from 0 nm to 100.00 nm according to the colure (black to white) is distributed and some parameter is listed in table (8)
Figure (10,11) shows the texture analyses to the image of Nano curcumin from SPM where (10) is color image this image is differ from the original (11) where the white color become black and the brown color become blue and (11) in gray color brown color become white and the black remains black. Table (9, 10) contained parameter from first order and second order The results show that turmeric is converted into a Nano curcumin and with particle size of 82 nm. The Nano particles are improved by exposure to the microwave plasma for 25 min. The exposure to microwave plasma enhances the properties and reduced particle size to 47, which meant that the cold plasma effect is positive on Nano Curcumin it makes the particle more homogenous and tend to put them in a parallel form. The Roughness Average is 22.1 nm before expose to plasma and become 0.459 nm which gives good result in obtaining the nano particle, the Root Mean Square, Surface Skewness, Surface Kurtosis, Peak-Peak and Ten Poi Height, all these features become less in expose to microwave plasma and the image analysis shows that

CONCLUSION

Nano-curcumin was manufactured in a simple and inexpensive way. The results showed that particles are nanoparticles and can be used in industrial, medical fields and in the treatment of diseases. The microwave plasma can improve the properties of nanoparticles and that showed through the above tables and result. The UV spectrophotometer test shows the same curve before and after exposure to plasma,this means that the material has kept in its spectral properties

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Table (1) shows the diameter of the Nano curcumin.and volume of nanoparticles

Diameter(nm)<	Volume (%)	Cumulation(%)
60.00	2.05	2.05
65.00	5.13	7.18
70.00	7.69	14.87
75.00	12.31	27.18
80.00	11.28	38.46
85.00	15.90	54.36
90.00	14.87	69.23
95.00	15.38	84.62
100.00	11.79	96.41
105.00	3.59	100.00

Table (2) shows the distribution, accumulation

Avg. Diameter:82.80 nm	<=10% Diameter:65.00 nm
<=50% Diameter:80.00 nm	<=90% Diameter:95.00 nm

Table 2. Surface Roughness

Amplitude parameters		
1	Sa (Roughness Average)	22.1 nm
2	Sq (Root Mean Square)	26.2nm
3	Ssk (Surface Skewness)	– 0.25
4	Sku(Surface Kurtosis)	2.08
5	Sy (Peak-Peak)	104 nm
6	Sz(Ten Poi Height)	58.5 nm
Hybrid Parameters		
1	Ssc (Mean Summit Curvature)	(-1 /nm)
2	Sdq(Root Mean Square Slope)	1.54 nm
3	Sdr(Surface Area Ratio)	78.2
Functional Parameters		
1	Sbi(Surface Bearing Index)	4.97
2	Sci (Core Fluid Retention index)	1.37
3	Svi(Valley Retention index)	0.107
4	spk(Reduced Summit Height)	1.41 nm
5	Sk(Core Roughness Depth)	81.2 nm
6	Svk(Reduced Valley Depth)	16.7 nm
7	Sdc(0-5 % height intervals of Bearing Curve)	5.26nm
8	Sdc (5-10 % height intervals of Bearing Curve)	4.25nm
9	Sdc 10-50 (10-50 % height intervals of Bearing Curve)	32.7 nm
10	Sdc 50-95(50-95 % height intervals of Bearing Curve)	47.4 nm
spatial Parameters		
1	Sds (Density of Summits)	0(1/ μm^2)
2	Fractal dimension	2.49

Table (4) First order parameter.

mean	18.3433
Standard deviation	2.2554e+03
Skewness	3.1223e-05
Kurtosis	1.3844e-08
entropy	-0.1118

Table (5) Second order parameter.

Contrast	0.3394
Correlation	0.90745
Energy	0.762
Homogeneity	0.9491

Table (7)the distribution accumulation and Nano-particles after plasma.

Diameter(nm)<	Volume(%)	Cumulation(%)
30.00	1.53	1.53
32.00	2.68	4.21
34.00	4.21	8.43
36.00	8.81	17.24
38.00	4.60	21.84
40.00	3.45	25.29
42.00	8.05	33.33
44.00	5.36	38.70
46.00	4.60	43.30
48.00	9.20	52.49
50.00	6.51	59.00
52.00	5.36	64.37
54.00	3.83	68.20
56.00	5.75	73.95
58.00	3.83	77.78
60.00	6.13	83.91
62.00	4.98	88.89
64.00	5.75	94.64
66.00	3.07	97.70
68.00	2.30	100.00

Table (6) shows the diameter of the Nano curcuminvolume of after exposed to plasma for 25 min

Avg. Diameter:47.92 nm	<=10% nm	Diameter:34.00
<=50% Diameter:46.00 nm	<=90% nm	Diameter:62.00

Table (8) SPM Parameter

Amplitude parameters		
1	Sa (Roughness Average)	0.459 nm
2	Sq (Root Mean Square)	0.529nm
3	Ssk (Surface Skewness)	0.288nm
4	Sku(Surface Kurtosis)	1.86 nm
5	Sy (Peak-Peak)	1.9 nm
6	Sz(Ten Poi Height)	1.9 nm
Hybrid Parameters		
1	Ssc (Mean Summit Curvature)	0.00229(1/nm)
2	Sdq(Root Mean Square Slope)	0.0303(1/nm)
3	Sdr(Surface Area Ratio)	0.0456
Functional Parameters		
1	Sbi(Surface Bearing Index)	3.17
2	Sci (Core Fluid Retention index)	1.65
3	Svi(Valley Retention index)	0.0512
4	spk(Reduced Summit Height)	0.583 nm
5	Sk(Core Roughness Depth)	1.19 nm
6	Svk(Reduced Valley Depth)	0.088nm
7	Sdc (0-5 % height intervals of Bearing Curve)	0.167nm
8	Sdc (5-10 % height intervals of Bearing Curve)	0.11 nm
9	Sdc(10-50 % height intervals of Bearing Curve)	0.859 nm
10	Sdc(50-95 % height intervalsof Bearing Curve)	0.64nm
spatial Parameters		
1	Sds(Density of Summits)	266(1/ μm^2)
2	Fractal dimension	2.47

Table(9)First Order Paramete

	mean	29.3010
Standard deviation	3.9716e+03	
Skewness	1.0686e-05	
Kurtosis	2.6906e-09	
entropy	-0.1507	

Table (10) Second Order Parameter

Contrast	0.33045
Correlation	0.94945
Energy	0.66295
Homogeneity	0.9504

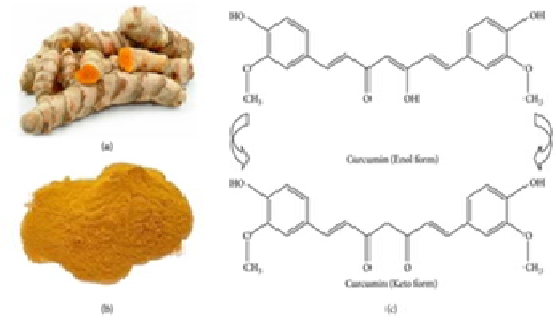


Figure 1. Shown the Turmeric, Curcumin and its Chemical Structure

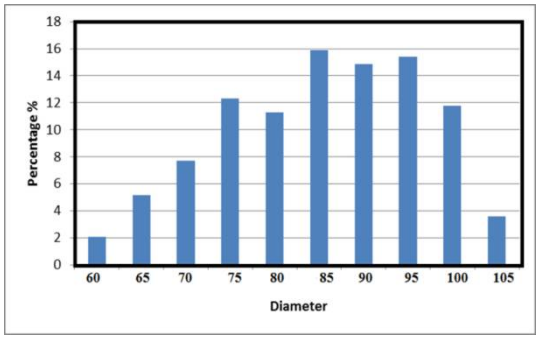


Figure 2. shows the Granularity Accumulation distribution

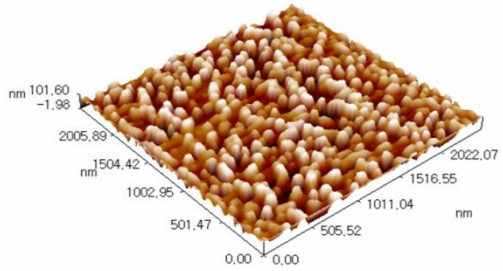


Figure 3. The Distribution of Particleand Homogenous Structure.

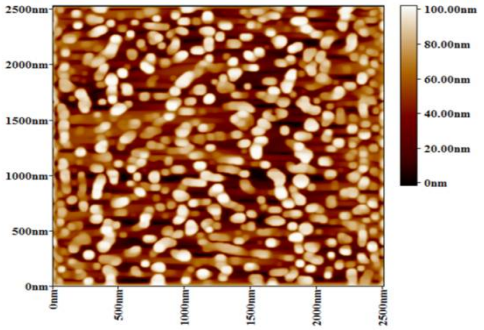


Figure 4. The distribution of Nano-particle

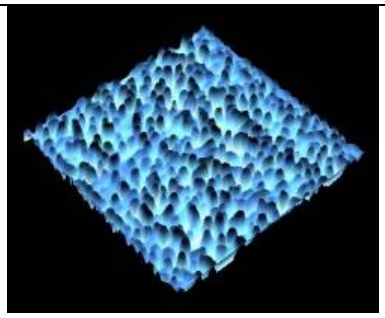


Figure 5. Color Image

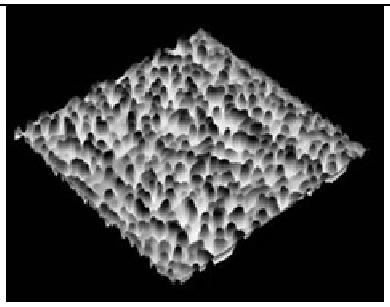


Figure 6. Gray Image

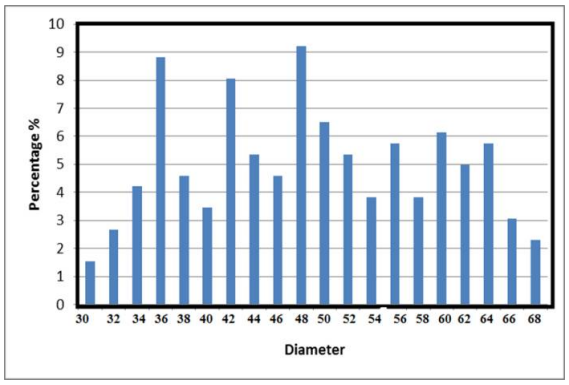


Figure 7. The Distribution of Particle and Homogenous Structure

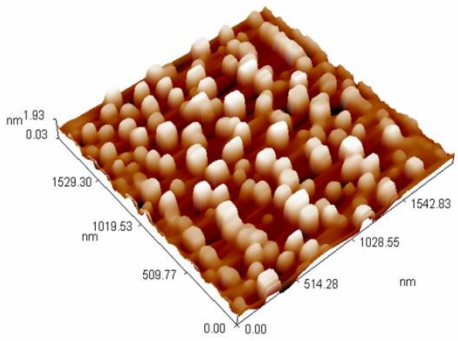


Figure 8. The Distribution of Particle

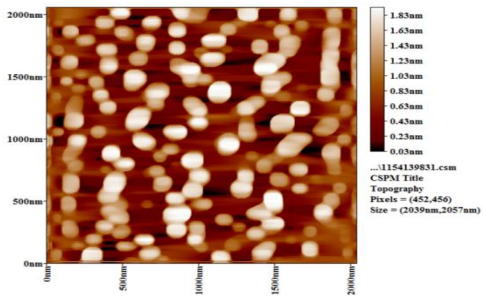
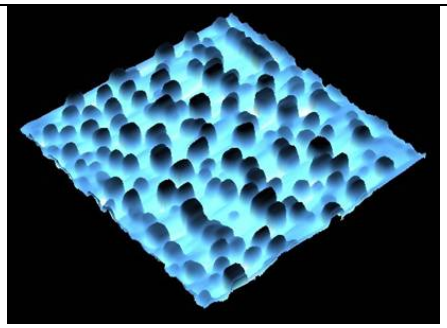


Figure 9. The Distribution of Particle



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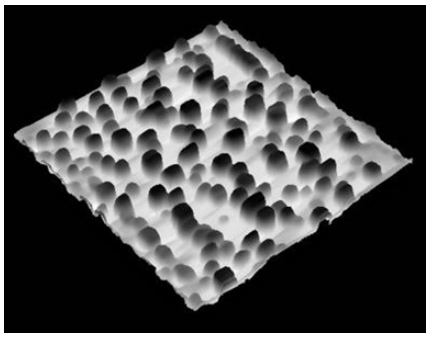

Figure 11. Gray Image

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RESEARCH ARTICLE

Using Epoxy-Phenol Formaldehyde Hybrid Blend as an Alternative to the Materials Used in the Manufacture of the Oil Pan in the Vehicle's Internal Combustion Engine

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ABSTRACT

Phenol formaldehyde resin was mixed with epoxy resin in different weight fraction (0-20) wt. %to formation hybrid blend which used as a new part in engine oil tank of the cars. The properties of the new blend were studied and included: Impact strength, tensile strength, compressive strength, Shore D Hardness and bending resistance. Results showed improved properties of epoxy resin after adding phenol formaldehyde.

Key words: Hybrid blend, Properties, Phenol formaldehyde resin, Epoxy resin.

INTRODUCTION

Technological development depends heavily on progress in materials. The design should therefore be resistant to heavy loads and conditions. Composite materials have been used in many areas, whether in the field of automobiles, aircraft or space. Composite materials are made by combining two or more materials that often have properties quite different from the original material, so that the material is mixed together to give unique properties [1-3]. Electrical, thermal, technological and environmental applications have a wide range of composite materials, where composite materials are typically improved to achieve a certain balance in the properties of a particular set of applications. Because of the wide range of uses of composite materials, their uses are difficult to limit, yet they contain a continuous matrix component that binds together and provides a reinforced and enhanced form of particles that improves the properties of composite materials [4-6]. The mechanical and physical properties of composite materials determine the use of these materials. Therefore, the study of these characteristics under the influence of forces and loads at different conditions is of great importance to determine the suitability of those materials. Use a combination

of epoxy resin with phenolic formaldehyde resin and different mixing ratios for the purpose of preparing test samples for mechanical properties and analyzing them and comparing them with the mechanical properties of the original mold.

EXPERIMENTAL PROCEDURE

Materials

Epoxy resin (LEYCO-POX 103), Phenol formaldehyde (resole) resin.

Samples Preparation and Calculation Properties

Table (1) shows the mixing ratios for samples made of epoxy resin and phenol formaldehyde resin known as risol. Tensile strength samples were manufactured according to ASTM D 638 (Figure 1 - samples of all mixing ratios). The tensile test used the universal testing device (Figure 2). (ASTM D790) while hardness samples (25mm) in diameter and (10mm) were used to test for hardness shore D (Figure 3). The Charby durability tests were in accordance with ASTM E23 (Figure 4). Deeply choked (0.5mm) and radius of the bead (0.25mm). A simulation program was used, where the composite materials used in the research were tested and compared to the original alloy for which the part was manufactured (Figure 5) for the purpose of replacing them with composite materials for the purpose of weight reduction and improvement of properties.

RESULTS AND DISCUSSIONS

Tensile characteristics are the most widely reported mechanical properties of any material. Tensile strength is the maximum load that the sample will carry before breaking under a slowly applied gradually increasing load during a tensile test [7]. As for tensile strength, resin is considered a brittle materials. Its resistance to tensile strength is very low. But when adding resole, its tensile strength will improve significantly. The tensile strength of the composite material because it is characterized by its low elasticity. Tensile strength is increased by increasing the added weight ratios as they occupy more space within the resin allowing better load distribution (Figure 6).

Bending test is the main purpose of the bending test is to identify the linear behavior or so-called "Hooken Behavior" of the material under the influence of the vertical-mounted bearing at the surface level. That the deflection is directly proportional to the updated pregnancy when the elimination of the effect of the load of the material recover the first case, and concludes that the article is subject to the law (Hook's Law) [8]. In the light of the results of this test, it is noted that the bending test occurs in two types of stress, compression in the first face (front) and tension or Tension (Tension) in the face (back). It is known that brittle materials have a small plastic deformation area that is not non-existent. The elasticity coefficient values increase with the increase in the ratio of the hardened material due to the increase in the density of cross-link density, which significantly affects the elasticity of the chains, so that the material becomes solid with low voltage rates, which increases its elasticity coefficient (Figure 7 & 8).

The shore D hardness values for the blends, as for the hardness properties, the resins are considered to be non-solid materials, which are low, but when adding the recoil material to it, the hardness characteristic will improve clearly. Hardness of composite material [9]. The hardness is increased by increasing the added weight ratios as they occupy more space within the resin allowing better load distribution. The increase in the percentage of additive leads to a decrease in the hardness of the material due to the generation of pores caused by the increase in proportion, which in turn weakens the properties of the substance. The decrease in the ratio of the base material means weakness in the strength of cohesion (Figure 9).

The impact strength is generally low for resins because of its brittleness. After mixing, the value of the impact strength increases. This is due to the fact that the mixing materials will bear the bulk of the impact energy exerted on the composite material which improves this resistance. The failure of the non-reinforced resin material under the shock test results in the breakdown of the bonds or forces in the polymer by the growth of the initial cracks that are created for the effect of the shock stresses. In fact, these cracks grow and multiply rapidly towards the interfaces between the polymer chains because the forces between these polymer chains are (Vander - Waal), which require a small amount of energy to overcome them, and the slits extending in a vertical direction on the direction of the polymer chains to break those chains during the propagation process, and it is worth mentioning that this requires greater energy overcome those responsible for linking the structural units of covalent bonds (Figure 10).

CONCLUSIONS

1. Tensile strength is increased by increasing the added weight ratios.
2. The elasticity coefficient values increase with the increase in the ratio of the hardened material due to the increase in the density of cross-link density.
3. The increase in the percentage of additive leads to a decrease in the hardness of the material due to the generation of pores caused by the increase in proportion.
4. Cracks grow and multiply rapidly towards the interfaces between the polymer chains because the forces between these polymer chains are (Vander - Waal).

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Table 1: Composition of Epoxy- Phenol Formaldehyde Hybrid Blend.

Sample No.	Composition
E0	(Epoxy/Resole) (80/20)%
E1	(Epoxy/Resole) (85/15)%
E2	(Epoxy/Resole) (90/10)%
E3	(Epoxy/Resole) (95/5)%
E4	(Epoxy/Resole) (100/0)%

Table 2: Testing of Epoxy with Resole at Different Ratios.

Ratio	Tensile Test		Bending Test		Impact Energy (Joule)	Shore D Hardness
	Stress (Map)	Strain	Stress (Map)	Strain		
0%	25.40985	3.378	0.21684	34.31733	0.37	68
5%	26.01369	1.7106	0.2597	33.60467	0.15	70.2
10%	24.26089	3.0093	0.30076	41.04733	0.133	64.6
15%	11.12752	2.168	0.10888	35.772	0	62.8
20%	1.27556	2.0626	0	0	0	42.4

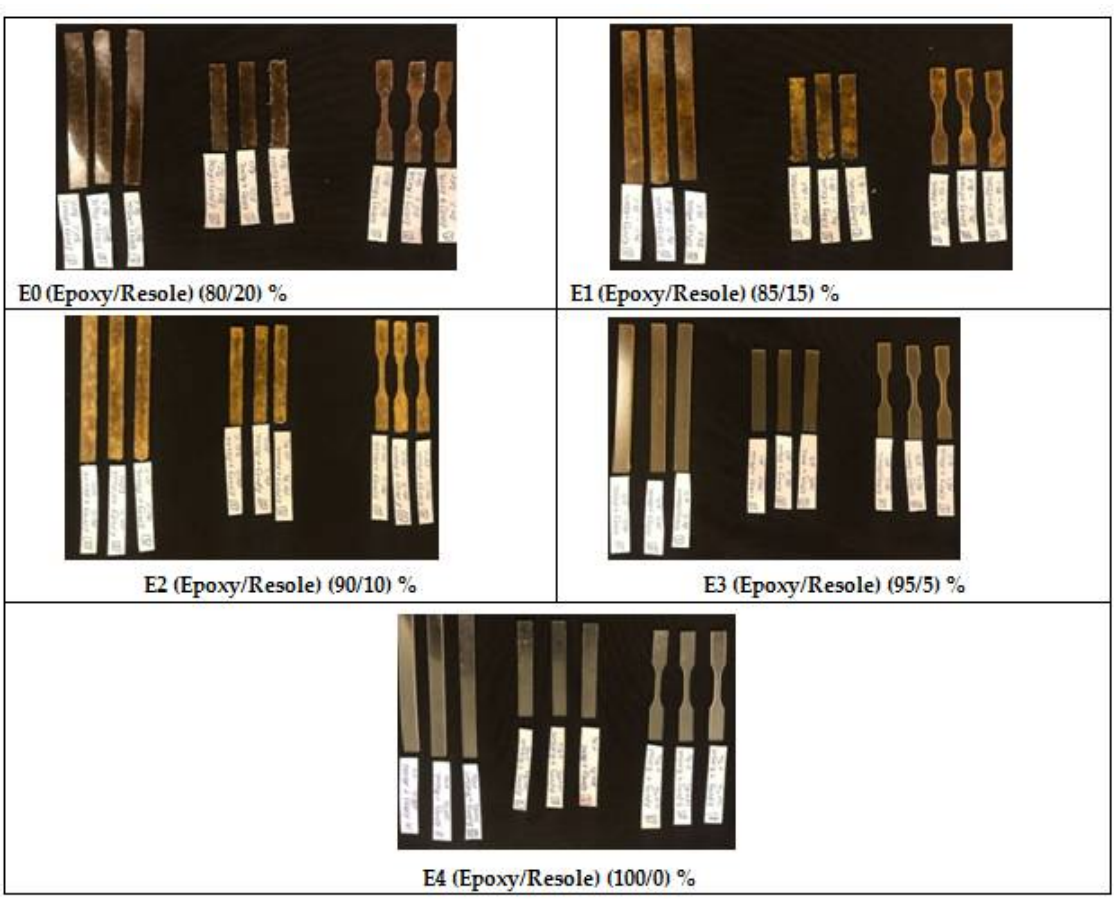


Figure 1. Tensile Test Specimens

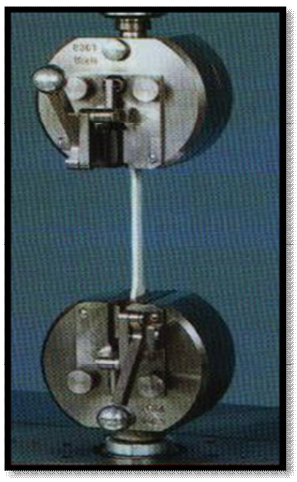
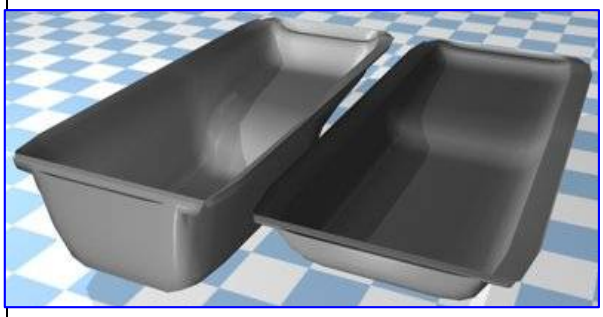


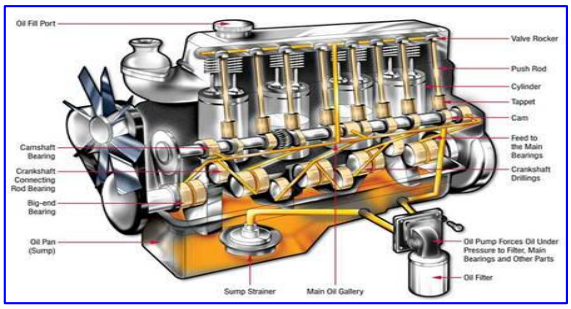
Figure 2: Tensile test instrument

Figure 3: Hardness test

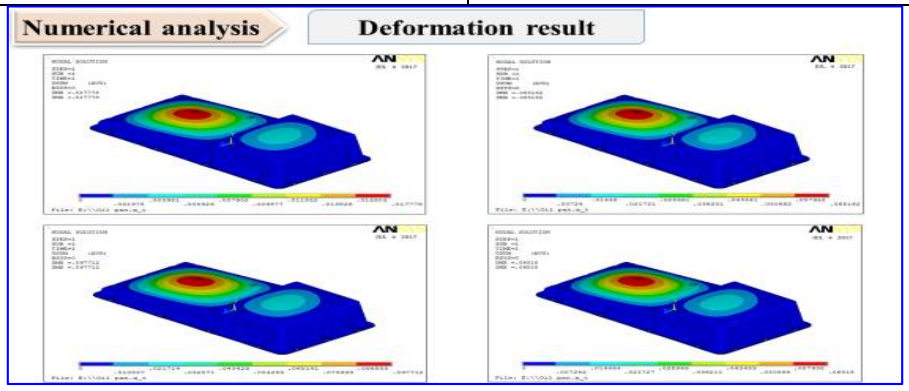
Figure 4: Impact test instrument



(a)



(b)



(c)

Figure 5-(a,b,c): Oil pan in the vehicle's internal combustion engine

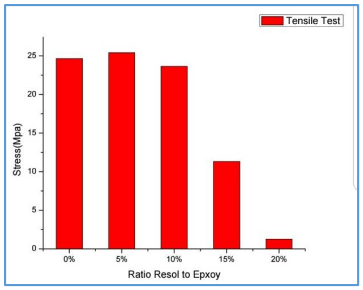


Figure 6: Tensile stress values by mixing ratio

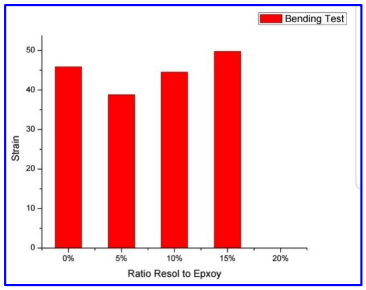


Figure 7: Bending strain values by mixing ratio

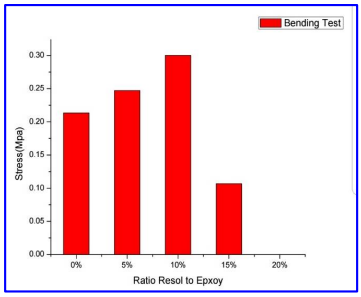


Figure 8: Bending stress values by mixing ratio

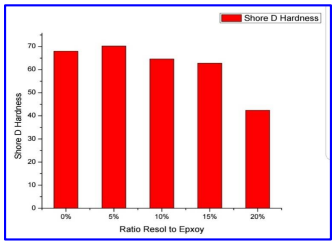


Figure 9: Hardness values by mixing ratio

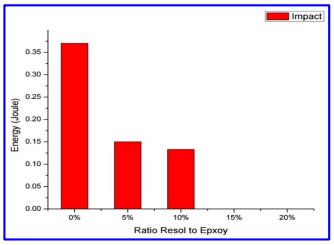


Figure 10: Impact test values by mixing ratio

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RESEARCH ARTICLE

A Corpus-Based Analysis of EFL Learners' Errors in Written Composition at Intermediate Level

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ABSTRACT

The aim of this study was to know about what type errors were committed by the students in their composition at intermediate level. For this purpose, a corpus of essays written by 70 intermediate level (Grade-12) students from a district in central Punjab, Pakistan was developed. For analysis, 13 major category codes were developed which included the errors of insertion, preposition, deletion, sentence structure, spelling errors, word choice, confusing sentences and unclear expressions, article, noun, punctuation, verb form, word form, (connective word, definitive statement and linking words' errors). The corpus was analyzed by using Antconc 3.4.4.0. Results revealed that the learners committed the error of spelling more frequently while the wrong use of verb was the second most frequent error. In addition, the selection of appropriate word and correct use of punctuation was found to be a major problem for the said learners. In conclusion it can be said that intermediate level learners commit errors frequently which might be the result of the lack of grammatical knowledge.

Keywords: error analysis; EFL learners' errors; errors in composition; categories of errors;

INTRODUCTION

Committing errors in English language, specifically while knitting lengthy essays is common among writers but surprisingly, it is not usual for language teachers in Pakistan to help the learners find and eradicate these errors in writing. Yet, this practice is forged in 2nd language classrooms at global levels, proving to bring about substantial results. A study based on 2nd language acquisition conducted by Rod Ellis in 2008 explains the significance of error analysis and recommends it as a tool for the eradication of errors in L1. Error analysis is extensively beneficial for English Language Teaching (ELT) instructors, specifically in bilingual learning environments (Corder, 1973) like that of Pakistan. According to Lott (1983), not only can the facilitators spot out deficiencies through error analysis, but also suggest relevant techniques for the enhancement of learners' skills and planning remedial lessons. In other words, error analysis is based upon teaching out the errors and addressing them appropriately. The errors, according to Lott (1983), conformed to a limited number of types, (articles, collective nouns, propositions, etc.). However, since the curriculum is stretched and time restricted, it is practically impossible to obtain and maintain data at an extensive and intensive level. Therefore, only few or more elements of grammar can be catered to at an instance (Biber, Conrad & Leech, 2010). Granger (2003), through his expert opinion, demonstrates how 'Error Tagging' is an advantageous technique in this regard. His analysis of English Teaching requires a comprehensive error collection in the corpus followed by a thorough scanning defined by a standardized system; he calls 'Error Tags'. In related studies on 'Negative Transfer', it has been stated that 'Interference' is rather a negative image of L1 on L2.

In the context of Pakistani languages, it is common for the errors to occur during language learning. Based on my out-stretched knowledge of English language teaching in Pakistan, errors mostly occur in past and present tenses. These are further categorized into two broader categories by Lott (1983), namely; intra-lingual or inter-lingual errors, Overextension of analogy and the transfer of structure. However, the purpose of the study is to find out the different types of errors committed by the learners in their written composition at intermediate level and also to find out the frequency of these errors. The study also aims to suggest the improvements to minimize these errors. To be more focused, this study limits itself to the following questions:

1. What types of errors the learners commit at intermediate level?
2. Which types of errors are most frequently committed by the learners at intermediate level?

Since, the sample (only 70 students) and population (students from one district only) of this study are limited therefore; its results cannot be generalized to the whole population. For this purpose, another study on a large-scale would be required.

Literature Review

Error analysis in essay writing is a technique to identify and classify the unacceptable forms of writing jotted down by any foreign language learner. As Crystal (2003) argues it to be systematically interrupting the unacceptable forms using any of the principles and procedures provided by the linguistics, James (1998) delimits it as a way to determine the incidence, nature, causes and consequences of unsuccessful language. Keshavarz, (2012) puts it as a procedure used by researchers which involves the collection of language samples used by the learners to identify errors and afterwards to classify them as per their nature and causes. The four main steps followed in error analysis are identification, description, explanation and evaluation (Ellis, 1997). He further goes on to differentiate between errors and mistakes i.e. errors reflect gaps in a learner's knowledge and the mistakes reflect occasional lapses in performance. Most English text books used in Pakistan are literary works which lack those particular tactics focused at developing L2 competence. Thus, it is natural to commit errors in an L2 writing because the learners at that particular moment of making errors are going through a process of learning. Unlike L1, L2 is mostly used in offices and other fields related to education. In this context, proficiency in written English is the key to success and passport to privilege. Rahman (2003, 2005) states that it is a continual exposure and hypothesizing upon which all language

learning is based; including the ideas, they are rooted in. Error analysis highlights the errors that occur in the process of achieving efficiency in the TL. Pit Corder's article 'The significance of Learner Errors' (1967) talks about the error analysis in a new way by giving the answers of those questions which talk about the learning process of L1, L2 and also their similarities and differences during the process of learning. In Corder's proposal, the same process is used for L1 and L2 acquisition. For, humans are born with an innate predisposition to acquire language. If one doesn't use the mechanism by puberty (Lenneberg), he/she loses the ability to acquire that skill. If however, one does use the mechanism for L1 acquisition, it will be available for L2 acquisition as well.

If we get into depth then tense relates to time and they are present, past and future whereas, aspect deals with internal structure of the action which may occur at any time. Four aspects are: simple, progressive, perfect and perfect progressive (Murcia, 1999). It was in 1974 when Corder elaborated five major steps involved in error analysis: (1) selection of the corpus of language; (2) identification of the errors in the corpus; (3), classification of the errors; (4) explanation of the errors and (5) evaluation of the errors Corder (1967) catches the notion of Chomsky's 'competence versus performance' in which he aims to explain what are the mistakes causing failure in performance as well as tries to highlight the mistakes which cause incompetence. It shows the mistakes which occur in competence and performance due to the lack of learners' inability of utilizing its knowledge of Target Language (TL). An error may occur as a result of infringement of the decided rules in TL which ultimately make a grammatical deviation. When there is a lack of competence, different kinds of errors can occur. It is easy to point out the errors of a language for native speakers whereas L2 learners need to understand competence of TL.

As writing is an essential ingredient of language in academics. It supports the learners in taking notes, writing repots, essays, making up stories and assisting in home and school tasks, etc. This is probably why writing justifies a special role in curriculum as well (Sawalmeh, 2013). Bear in mind, writing in a second language has an influence by the learner's L1 cultural and linguistic conventions, structure of written discourse, topic as well as audience and register (Richards & Schmidt, 2002). Contrastive rhetoric in this regard has an influence on different theories as on applied linguistics and relativity, discourse types of genres, text linguistics, literacy and translation (Connor, 1999). The study of contrastive rhetoric in this research in relation to applied linguistics has been used especially pertaining to patterns of first language transferred to L2 writing. As a whole, a combined form of contrastive analysis, inter-language analysis and error analysis approaches has been studied in this study. It has tried to identify the patterns of L1 which interfere at the sentential and lexical levels of the written compositions of the students.

According to Corder (1967), occurrence of errors in writing is a common practice while dealing with L1 and L2 and it is unavoidable. This is a proof that writing is one of the most difficult strands of language acquisition. Coming back to writing discrepancies, there is a reasonably pessimistic response to essay writing phobia. As Brain and Wilson (1981) call it out, 'script phobia' or writing phobia otherwise, Johnson, Shenoy and Gilmore (1982) refer to it as irrational fearing related to writing in front of the other people. Previously it was related to the outcome of 'academic work' showed in writing. While essay writing phobia evidently is phobic in character and arises in immature writers, with whom irrefutable issue is to setup; fear, in contrast, does not report essential or usual feature of the writer's block. It can occur in specialized persons with huge experience of writing as well. To help out, two students from the student Counseling Service at Hull University complained about an issue after referral by the behavioral treatment of the counselors. Menks (1979) said that he was very anxious to face the problem which he had not earlier met; neither in practice nor in the literature, and Harris (1974) was of the stance that he was traced by literature on the writer's block even though the issue he faced was surely common.

On the commencement of the interview, it emerged that their ideas and written work as per standard required not much of work; reason being, the compositional skills in the opening part of any essay or report before writing on any paper were slightly insufficient. Now, because of fear of shame in making errors in the work makes the students blank when they sit for writing, any document despite of their efforts do not produce good enough results. To draw this information, a chance was taken to explain the lack of realism of their phobias. It was seen that undergraduates were not capable enough to fulfill expectations for producing qualitative results. It was commonly observed that the first writing draft was full of mistakes even in the experienced writers' works but this was not much significant since

there is always a room for improvement, consequently removing the fears of shame in writing. This encouraged any writer to pen down his/her opinions without feeling any sense of fear or shame and served as a basis for the further drafts. As far as English teaching in Pakistan in concerned, since the time English language has been declared as the official language of Pakistan, the students have been educated in a dual mode (Ahmad, Farukh & Ismail, 2018). They, from the very start of their educational career are familiarized to L1 and L2. However, despite all of the intensive exercises from childhood to graduation, the students continue to commit errors at all levels (Ahmad, Farukh, Ismail & Sarwar, 2018), which in one way or the other indicated their growing need of error correction and seeking professional help.

When a comparison of the four major strands of English is carried out, the most difficult to comprehend and furnish is considered to be writing. In Tangpermpoon's context (2008), writing is difficult because it's a merger of syntactic and lexical knowledge and also because the principles of L2 organization are difficult to comprehend. In prominent contexts of Pakistani writing practices, Haider (2012) suggests that the country essentially needs a better infrastructure for writing. The learners lag behind to a great extent when it comes to penning down their opinions which is deeply rooted in unprofessional and conventional systems of education. Also, because the facilitators are unaware of the pedagogical advancements and thus fail to put into practice new ways of skill enhancement, the students naturally are not designed to become better writers (Gopang et al, 2017). Studies suggest that Communicative Language Teaching (CLT) is a suitable approach to be adopted in order to gain proficiency in language teaching and obtaining substantial results. Now, coming back to error commitment and their amendment while dealing with L1 and L2, a study conducted by Javed, Juan and Nazli (2013), which included a detailed research on writing skills of learners belonging to rural and urban areas concluded that students of urban areas are more proficient in writing comparatively.

Khan (2011) in Punjab carried out a study magnifying teachers who indulged the learners in drafting a creative writing. The basic component in focus had been the Board of Examination trivializing the effect of better use of vocabulary and creativity. The use of text book; confined syllabi, where is an essential, it has become difficult for the learners to write on any given topic. They have been groomed in a way which involves cramming textbook content and not crossing the borderline of what has already been defined for them. However if a leaner did add additional content, nothing like positive feedback existed. Neither was there any encouragement nor discouragement. Ijaz, Mehmood and Ameer, (2014) claimed that Pakistani learners made eight types of common errors in their writings that were the errors of verb tense, punctuation, spelling, articles, capitalization, subject verb agreement, preposition and double negation. Verb tense errors are at the top out of all these errors which show that the hard area for Pakistani learners of English is tenses. The main cause of these errors seems to be the lack of practice in grammar and the ignorance of the rules of restriction.Ahmad, Amin and Qureshi (2016) found major types of errors made by the learners in their written compositions. According to them the error made by the L2 learners in their written composition are the errors of spelling, agreement, word choice or contextual errors. Other types of errors to which they named miscellaneous group of errors were the errors in which preposition, possessive noun, capitalization, abbreviations, articles and adverbs are included.

Mehmood, Furrukh and Ahmad (2017) conducted a research on the error analysis of English composition at intermediate level in which they attempted to find out the errors of Pakistani learners that were common and most frequent. The results revealed that the students made various types of errors i.e. the errors of subject-verb agreement, plurality, word order, auxiliaries, spellings, prepositions, articles and verb form. The researchers found that due to intra-lingual factors, student made the errors of spelling most frequently. Findings of the study also showed that a large number of grammatical errors were made by Pakistani male learners of English as second language at intermediate level which were due to the reason of inter-lingual and intra-lingual transfer. The major factor behind these errors was the inter-lingual and intra-lingual interference. Ahmad, Furrukh, Ismail & Sarwar (2018) conducted a study on the errors committed by the learners at graduation level with an aim to know their study needs. The researchers found various reasons of this problem. The study states that there are some problems with the methodology of teaching due to which the students commit serious errors in their compositions.English language

is the compulsory subject from the very beginning of the educational career of the students but even then they commit errors. The study recommends that there is a dire need to: (1) bring changes in syllabus, (2) improve the learning environment, (3) enhance teachers' capability, (4) create students' interest in the learning of English language and (5) improve education system. Previously, Haider (2012) conducted a research about the current situation in Pakistan. According to him there is a great need of changing an unprofessional and conventional model of teaching of writing. Our students are far behind not because of ability but due to approaches of inadequate pedagogy. Another research that was conducted in Pakistani public colleges by Imran et al. (2016) concluded that intermediate level students in public colleges felt it hard to identify major parts of speech i.e. verb and noun.

METHODOLOGY

Data Collection

Data was collected from the essays written by the students of intermediate level (Grade-12) studying in public sector colleges in a district in central Punjab, Pakistan. After collecting these essays, the researcher compiled all of these hand written essays in an MS Word file. (Essays written by students were written as they were and while writing these essay "auto correct" option of MS Word was off). Then all of this data was converted into a notepad file for Antconc processing.

The Coding Scheme

This study adopted the coding scheme from Divsar (2017) who adopted this scheme from Chuang and Nesi (2006), Dagneaux et al. (1998) and Hou (2016). Chuang and Nesi (2006) and Dagneaux et al. (1998), in their study, used an error system of tagging which was hierarchical: error tags consisted of one main category code and a series of sub-codes. There were seven main category codes i.e. lexical-grammatical, formal, grammatical, register, lexical, word redundant/word missing/word order and style. In Hou's (2016) study, major category codes were preposition error, article error, noun error, word form, verb form, spelling, word misuse, punctuation, insertion and deletion.

Based on the learner corpus, the system of coding in this study was developed based on the mixing of these systems and contained 13 major error category codes: insertion, preposition, deletion, sentence structure, spelling, word choice, confusing sentences and unclear expressions, article, noun, punctuation, verb form, word form, (connective word, definitive statement and linking words errors). The table below shows the classification of the errors which was utilized in this study as the coding scheme.

Corpus Analysis

In order to analyze the corpus, a three-stage process was followed. First, the texts were turned into text files. Secondly, this text was uploaded on Antconc software and provided codes to indentify the errors. Thirdly, the researcher noted the frequency. Errors included main writing variables that were lexical knowledge, discourse (cohesion and coherence), grammar, mechanics (punctuation and spelling) and content richness. The categorization and `classification of errors was based on the error coding scheme. The corpus was prepared from 70 essays.

RESULTS

In the table above it can be traced out that .2% of the errors are insertion errors while preposition errors are about 6.5% and deletion errors are 2.7%. About 4% of the students faced problem in the use of sentence structure. Appropriate use of vocabulary seems to be one of the major problems due to which more than 15% percent of the students committed errors in this area. The percentage of the spelling mistake is at a higher level that is about 25%

while only 5% of the students committed the errors of unclear expression. 10% of the students are those who have the problems to use punctuation properly whereas 7.5 percent of the students feel problems in the use of article. Similarly, 3% of the students felt problem in the in the use of noun or pronoun. Another major problem which the students felt was in the use of verb i.e. 20% of the total errors. Word forms and connectives errors were the minimum and these were 0.7% and 0.1% respectively. As far as the maximum frequency of errors is concerned, the errors of spelling were more frequent than any other type of error. Secondly, the errors of verb are highest in number after spellings. A lot of students felt problem in the use of verb. Similarly, students were confused in the selection of appropriate vocabulary to communicate their thoughts. Another problem that was faced by the learners was the use of article. Many students used article in an inappropriate manner.

DISCUSSION

The main purpose of this study was to find out the common errors committed by the English language learners at intermediate level in their compositions. Identification of errors play an important role to find out the problems faced by the learners at any level and this can lead further towards the eradication of these problems by adding different strategies in the process of teaching. Errors can be helpful in three ways as proposed by Corder (1981): Firstly, they provide information to the teachers about progress in the process of language learning and they come to know which part of the language needs more emphasis. Secondly, these errors offer the researchers with the process and strategies of learning foreign language. Thirdly, these errors prove helpful for the learners when they use these errors as a tool for further learning. Moreover, the classification of errors can be helpful for language learning development of the students. The present research identified 13 different aspects based on the analysis of learners' errors in their written composition and the researcher calculated how frequent was each error for the identification of the errors committed commonly by the learners in their writing.

Examples of Insertion Errors

i. My health is very good because I walk exercise[I] daily.
ii. I recite to[I] Holy Quran daily.

In the first example, the student has committed the error of insertion because the student should use only one word in this part of the sentence that may be walk or exercise. But the student has used both of the words that show he has confusion and as a result he commits error. Similarly in the second sentence, the student used preposition "to" while there was no need to use any preposition. This example falls in the categories of both preposition and insertion.
Examples of Deletion Errors

i. I like[D] very much. ii. I am a [D]and my family is very poor.

If we analyze the deletion errors committed by the students in the above sentences, we can see that in the first sentence the student missed one word that is "him" in the sentence "I like…very much. While in the second sentence, object of the first clause of the sentence is missing. Examples of Sentence Structure Errors

i. I like not politation.[S S]. ii. I am daily traveling 20miles[S S].

As far as the errors of sentence structure are concerned, a lot of students feel problem in it. In the above sentences, there is error of sentence structure. For example, the first sentence should be "I don't like politicians" while the student wrote, "I like not politicians". Similarly, in the second sentence "I am daily traveling 20 miles", there is also the error of sentence structure. Examples of Prepositional Errors

i. I am a student[P] 3rd year. ii. I recite to [P] Holy Quran daily.

In the above examples, the students committed the error of preposition. In the first sentence, preposition "of" should be used but the student did not used any preposition that's why he committed the mistake of preposition. While in the second sentence, the student used preposition "to" while there was no need to use any preposition. This example falls in the categories of both preposition and insertion.

Examples of Word Choice Errors

i. I am a smallest boy.[W C].
ii. I live in a village. Who's[W C] name is 92/6-R[Pun] Sahiwal.

In the above mentioned sentences, there is the error of wrong choice of words. In the first sentence, instead of the word "smallest" the word "youngest should be used. Similarly, in the second sentence, the word "who" is used for human being while the student committed the error by using it for village. Examples of Spelling Errors

i. My faverate[S] game is cricket. ii. I like vegitables[S] and fruits.

Spelling error is one of the major errors that can be noticed in the written composition of the students. In the two examples given above, the spellings of both of the words of favourite and vegetables are incorrect and thus can be counted in the category of error. Example of Confused Expression and Unclear Sentences Errors

i. Something better and nothing.[C U]
ii. I like is student I hell the poor boys.[C U]

Some of the students feel confusion in the use of vocabulary and sentence structure and as a result of that they produce unclear sentences that suffer not only from the problem of cohesion but also of coherence. We can notice this error in the example given above in which the students produced unclear sentences. In the first sentence "something better and nothing" it is not clear what is communicated to the reader. Similarly, second sentence "I like is student I hell the poor boys" the students has produced confused expression that cannot be understood. Examples of Punctuation Errors

i. I read in Imamia college[Pun] sahiwal. ii. I am 17 years old[Pun]

While teaching most of the teachers don not bother to ask the students to practice punctuation. This is the reason why students usually commit the error of punctuation in their writing as can be cited above that there should be "comma" between college and sahiwal and "full stop" at the end of the sentence "I am 17 years old". Examples of Article Errors

i. I like the[A] meat. ii. I belong to a[A] sahiwal.

Another error that was committed by the students in their writing was wrong use of article. In the first sentence "I like the[A] meat", there was no need to use article "the". Similarly, in the second sentence "I belong to a[A] sahiwal", there is wrong use of article. This type of wrong use of article can also be included in the list of insertion because in both sentences, there was no need to use article. Examples of Noun-Related Errors

i. I like professor Zafar. ii. They are a good teacher.

There were a few students who made wrong use of noun/prnoun. In the above given sentence, "I like professor Zafar. They are a good teacher" the student used the word "They" instead of "He" due to mother tongue interference because the word "aap" is used in Urdu for the reverence of elders and respected ones and it is also used for the plural. Examples of Verb-Related Errors

i. My college[V] beautiful. Ii. I belongs[V] to a respectable and good family.

More than 20% out of total 911 errors committed by the students were the errors of verb in their written composition. This shows that the students feel confusion in the use of verb. In the first sentence, "My college[V] beautiful" the student missed the verb "is" and as a result committed error. Purpose of the study was to find out the different types of errors committed by the learners in their written composition at intermediate level and also to find out the frequency of these errors. The main focus in this study was on grammatical errors such as punctuation, spellings, preposition, verb, word choice, sentence structure and conjunction.

As far as the answer of the first question of the research is concerned it has been found that the students commit the errors of preposition, deletion, insertion, sentence structure, word choice, spelling, confusing statements and unclear expressions, punctuation, noun, article, verb, noun and connectives. Similarly, so far as the frequency of errors is concerned, the errors of spelling are more frequent than any other error. Secondly, the errors of verb are highest in number after spellings. A lot of students have been observed to feel problem in the use of verb. Similarly, students seem confused in the selection of appropriate vocabulary to communicate their thoughts. Another problem faced by the learners is the use of article. Many students use article in an inappropriate manner.

Therefore, it shows that majority of the errors committed by the learners belong to grammatical category of errors resulting from the process of Inter-language inter-ferences. Though, the learners have been taught rules of grammar of the target language for the last 12 years but due to the lack of positive feedback and poor practice create hindrance in the way of the development of their proficiency in English language. Similarly, errors projecting redundancy depict the lack of target language lexicon. There are some errors that indicate learners' carelessness in their writing which is the indication of the lack of motivation for target language. This phenomenon is very common that L2 students often feel lack of motivation and negative attitude is developed towards the target language. This is the result of teachers' traditional role of correcting the students' errors overly and treating these errors as an object of undesirable thing. Another reason that can be account for demoralization is that since, language learning is a cognitive activity, most of the times second language learners in our culture undergo a psychological distance between the target culture and themselves. As far as the pedagogical implication of this study is concerned, results of the study show that the students needs a lot of practice of many aspect of language especially in the correct use of verb, article, punctuation and preposition. Language teachers should pay special attention on grammar and parts of speech.

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Table 1. The Coding Scheme of the Present Study Type of error Code Definition of the error

Insertion	I	Any error involving extra words
Prepositional Error	P	Any error involving missing or wrong preposition
Deletion	D	Any error involving missing words or sentences
Sentence structure error	S S	Any error involving wrong sentence structure
Word choice	W C	Any error involving a wrong choice of word
Spelling errors	S	Errors in spelling
Confusing sentences and Unclear expressions	C U	
Punctuation	Pun	
Article error	A	Any error involving missing or wrong article
Noun Error	N	Error involving singular/ plural confusion of a noun
Verb Form	V	Errors in verb tense and verb inflections
Word Form	W F	Correct lexeme but wrong suffix
Connective word, statement statement and linking words	O	Inappropriate use of connective word, definitive and linking words errors

Table 2: Frequencies of Errors

Sr. No.	Codes of Scheme	Frequencies	%age
1	I	2	0.2195
2	P	59	6.4764
3	D	25	2.7442
4	SS	36	3.9517
5	WC	138	15.148
6	S	223	24.479
7	CU	47	5.1592
8	Pun	93	10.209
9	A	69	7.5741
10	N	28	3.0735
11	V	183	20.088
12	WF	7	0.7684
13	O	1	0.1098
Total		**911**	**100**

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RESEARCH ARTICLE

Effect of Cold Plasma on the Fracture and Osteoporosis in Long Bone Rabbits using Textural Analysis

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ABSTRACT

This paper is aim to find the effect of cold plasma on the fracture and Osteoporosis of rabbits bone using textural analysis of the x- ray images. Surgery has been made to fracture the long bone of the rabbits, and the Osteoporosis,then the rabbits is exposed to the cold plasma, the exposure microwave plasma has voltage "175v" and the gas flow is" 2" at the room temperature after two weeks the rabbit bone shows response to the cold plasma. the textural features which are calculated from the gray level matrix has been calculated to improve the effect of cold plasma on the bone by obtaining the four features Contrast, Correlation, Energy and homogeneity, the process has been done on the x-ray images. as the x-ray images are dark and the information is difficult to obtained, the histogram equalization is used to enhance the appearance of the image details, and the threshold is used to isolated the bone from the dark background.

Keywords: Bone Osteoporosis, Bone fracture, Microwave plasma, Texture analysis

INTRODUCTION

The direct application of plasma in medicine is to understand the physical, chemical and biological mechanisms of direct non-thermal plasma interaction with living tissue. Engineering research has resulted in many advances in health care. Ionizing radiation and laser are examples of technological breakthroughs that have created diagnosis and new treatments for the disease [1,2]. Non-thermal plasma medical techniques also have important therapeutic effects and lead to new medical diagnostic tools. Some of these factors include deactivating pathogens, stopping bleeding without damaging healthy tissue, promoting wound healing and treating cancer[3,4]. The fracture on the long bone of the rabbits is treated with plasma to improve effect of cold plasma on healing the boneDigital image processing is the use of computer algorithms to conduct image processing and is considered a form of input processing (medical images), and can avoid problems such as noise accumulation and signal distortion during processing, this techniques

of image processing were used to modify X-ray image of bones in order to improve it or to take information out of it or to reduce its size [5,6]. The histogram equalization is used to enhanced the x-ray images because it manly dark with low contras Histogram Equalization is the image enhancement which improves thequality of the images. it is used to enhance the contrast of the image. It is one of the easiest, simplest and less complex methods for quality image enhancement [6].The Fracture of the bone: It is broken or cracked in the bones because of the strength exerted against the bone stronger than the bone resistance, which destroys the structure and strength of bone and leads to loss of the function of the main bone and leads to pain, sometimes bleeding, and the most common sites for fractures of bones are the wrist, ankle and hip [7,8].

METHODOLOGY

Osteoporosis

Osteoporosis is a disease that affects the bones of women after menopause (reduction in the hormone of the female). Studies indicate that more than one of the women over the age of fifty will suffer from the breakout result of osteoporosis (bone porous), resulting in a decrease in bone material Such as loss of calcium[6], Figures(1) shows that x-ray image for control (Osteoporosis group),figure(2) x-ray image for Infected (Osteoporosis group) and figure(3) x-ray image for treated case (Osteoporosis group).

Fracture Bone: After make surgical un-complete fracture on the long bone of the rabbits occurs, take X-ray imaging Weakley for the treated fracture bone with cold plasma daily ,the un-treated fracture bone is taken as (negative control), the image of the un-complete transverse fracture in left hand shows the recent fracture,the clear fracture line appearblack with sharp end of the fragment in the un-complete fracture line.After one weak the bone become completely fracture and the dislocate between the two pieces of the bone cause influmentry in site of the fracture, figure(5) x-ray image for control (Fracture group), figure(6) x-ray image for infected (Fracture group) and figure(7) x-ray image for treated case Fracture group.Figure (7) shows the bone after one week of plasma treated the un-complete fracture appear as smooth and very closed, edges begin disappear and more healing faster than negative control rabbit without any influnentry and the rabbits can move very normally.

Image Processing for X-Ray Image

Image Analysis andEqualization: The Analysis of Image is to study the pixel values and grayscale values from the selected image. Histogram equalization usuallyincreases the global contrast of the processing image. This method is useful for the images which are bright or dark.8 bit grayscaleimage, there are 256 different possible intensities so the histogram will graphically display 256 numbers showing the distributionof pixels amongst those grayscale value. For a given image X, the probability density function $P(X_k)$ is defined as[10].

$P(X_k) = \frac{N_k}{n}$ (1)Where, $(0 \leq K \leq L-1)$

For k = 0, 1… L – 1, where represents the number of times that the level (X_k) appears in the input image X and n is the totalnumber of samples in the input image. Note that $P(X_k)$) is associated with the histogram of the input image which represents thenumber of pixels that have a specific intensity. In fact, a plot of vs is known histogram of X. is tells us that what is the probability of occurance of a pixels having intensity value equal toX(k).L is the total number ofgray levels in the image(256), N is the Total number of pixels in the image, is the total number of pixels with the same intensitylevel. Consider the discrete grayscale input Image X=x(i,j) with the L discrete levels, where x(i,j) represents the intensity levels of theimage at the spatial domain (i,j) . Based on the probability density function, the cumulative density function is defined as[11].

$CDF(x_i) - \sum_{i=0}^{k} P(x_i)$ (2)

Thresholding: Thresholding is a significant technique in image segmentation applications. The basic idea of thresholding is to choose an optimal gray-level threshold rate for separating objects of interest in an image from the background based on their gray-level distribution [12]. The image is composed of light object on a dark background by creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. If *g*(*x, y*) is a threshold version of *f* (*x, y*) at some global threshold *T*, is equal to zero if *G* (*x*) <*T* and 1 otherwise [12]. Points with G(x) < T belong to background ,other points belong to object [13,14]

G (x) = 0 if G(x) <T (3)
1 otherwise
x represents the gray level.
T represents the threshold value

Textural Features

1) Contrast: it is the intensity between the pixel and its neighbor in the sub Image, the contrast will be small when the image isstable while highest value reached in the random intensity image. The equation of the contrast is as follows [15]:

$$C = \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} (i-j)^2 \, p(i,j) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$p(i,j)$is a histogram of a digital image with levels of intensity [0, Ng-1] where Ng is the value of gray level it is from(0-255 or from 1 to 256).

2) Energy: It gives indication about the number of gray level in the image, high energy value when the number of gray level is low otherwise it is less.The equation of the contrast is as follows [15]:

$$Energy = \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} [p(i,j)]^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

3) Homogeneity: it measure the distribution of gray level number if the matrix has low number of gray level its value will be very small approach to zero and if otherwise it approach to on, it can be represent as follows [16].

$$Hom = \sum_{i=0}^{Ng-1} \sum_{j=0}^{Ng-1} \frac{p(i,j)}{1+|i-j|} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

- Correlation : it represent the relation between the two neighbor pixels, the greatest value is one when the neighbor pixels are highly correlated and (-1) when there is no relations [17].

$$cor = \sum_{i=1}^{N_x} \sum_{j=1}^{N_y} \frac{(i,j)p(i,j) - \mu_x \mu_y}{\sigma_x \sigma_y} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

RESULTS AND DISCUSSION

Osteoporosis group: The result of statistical features for x-ray image shown in table (1) for osteoporosis group (control, infected and treated) for the long bone, the control group shows low contrast,since the bone has no defect and the tissue are pure the number of gray level in the image are less than that for the infected and treated this

indicate that the tissue is healthy. The correlation for the control and treated are nearly close to each other while , for the infected the value are higher comparing with the other groups. The correlation for infected group are higher than that for the control and treated,this means that the infected group pixel are similar in there intensity. The energy of the control and the treated are nearly close to each other and have high value comparing with the infeacted one. Since, the energy gives information about the regularity of the tissue and the number of gray level in x-ray image, high energy means low number of gray level and this means the bone tissue is pure and no defects are in it. The homogeneity for the infected are lower than that for the control and the treated,the homogeneity gives information about the purity of the tissue so,the infected tissue has low homogeneity. table(1)and figure(4) shows the statistical features of the x-ray image for long bone tissue Osteoporosis group.

Fracture group: The result of statistical features for x-ray image shown in table (3) for fracture group (control, infected, treated and Un-treated) for the long bone, the control and treated groups shows high contrast,since the bone has no defect and the tissue are pure the number of gray level in the image are less than that for the infected and un-treated this indicate that the tissue is healthy. The correlation for the control and treated are nearly close to each other while, for the infected and un-treated the values are higher comparing with the other groups.The correlation for infected and un-treated groups are higher than that for the control and treated,this means that the infected and un-treated groups pixel are similar in there intensity. The energy of the control and the treated are close to each other and have high value comparing with the infeacted and un-treated. Since, the energy gives information about the regularity of the tissue and the number of gray level in x-ray image, high energy means low number of gray level and this means the bone tissue is pure and no distortion are in it. The homogeneity for the infected and un-treated are lower than that for the control and the treated,the homogeneity gives an explanation about the purity of the tissue so,the infected and un-treated bone tissue has low homogeneity Table(2) and figures (8) shows the statistical features for the x-ray image for long bone fracture.

CONCLUSION

The result of the x-ray shows that there is good effect of microwave plasma on the on the bone with fracture and with Osteoporosis the treated bone reach the normal one in the textural value homogeneity, correlation, enrages and contrast for the fracture group, for the Osteoporosis the textural value of the feature for the treated group approach the normal group. This result gives good indication about the treatment with the microwave plasma for the fracture and osteoporosis bone.

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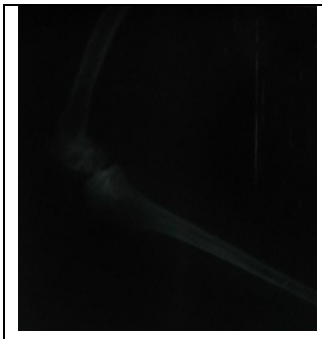
18.

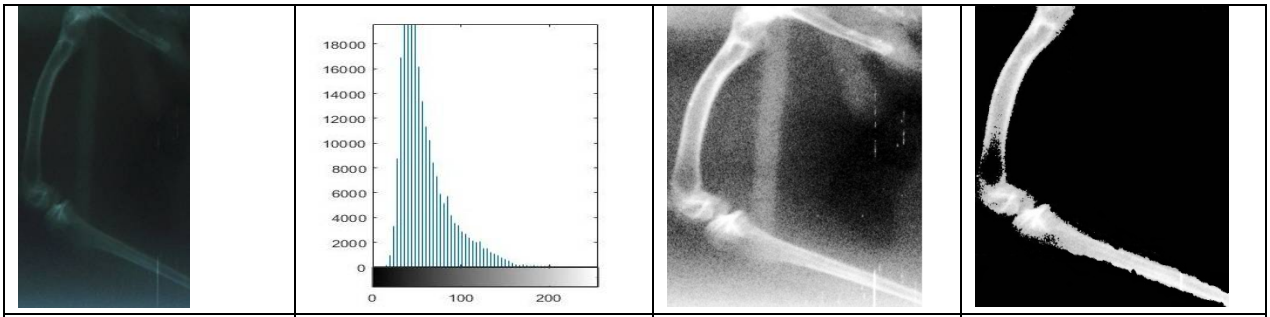
x-ray image	Histogram Equalization	x-ray image after equalization	Threshold image T=230

Figure 1: X-ray image for control (Osteoporosis group).



x-ray image	Histogram Equalization	x-ray image after equalization	Threshold image T=220

Figure 2. x-ray image for Infected case (Osteoporosis group).

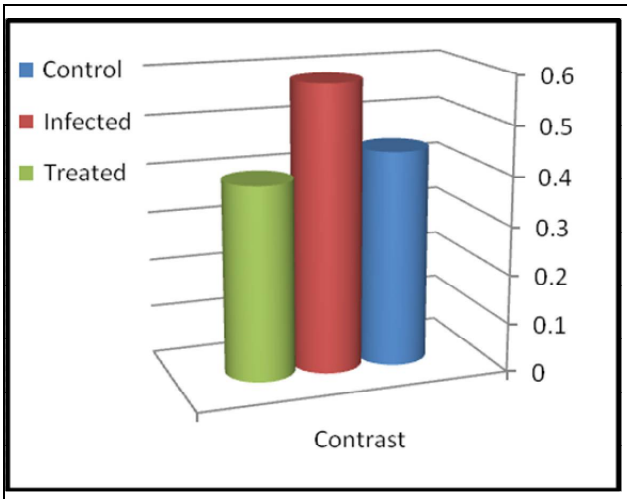


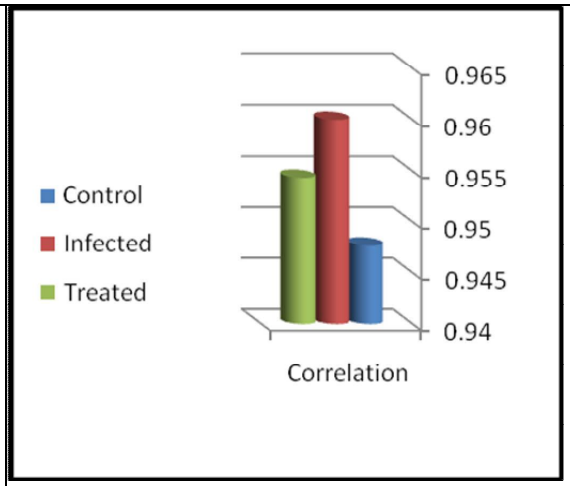
x-ray image	Histogram Equalization	x-ray image after equalization	Threshold image T=220

Figure 3: X-ray image for treated (Osteoporosis group).

Table 1: The Value of the Statistical Features for the Second -Order of Osteoporosis X-ray Image

Osteoporosis group	*Statistical Features*			
	Contrast	**Correlation**	**Energy**	**Homogeneity**
Control	0.44055	0.94765	0.747	0.98275
Infected	0.5838	0.96	0.7272	0.96855
Treated	0.3942	0.95435	0.74066	0.97245





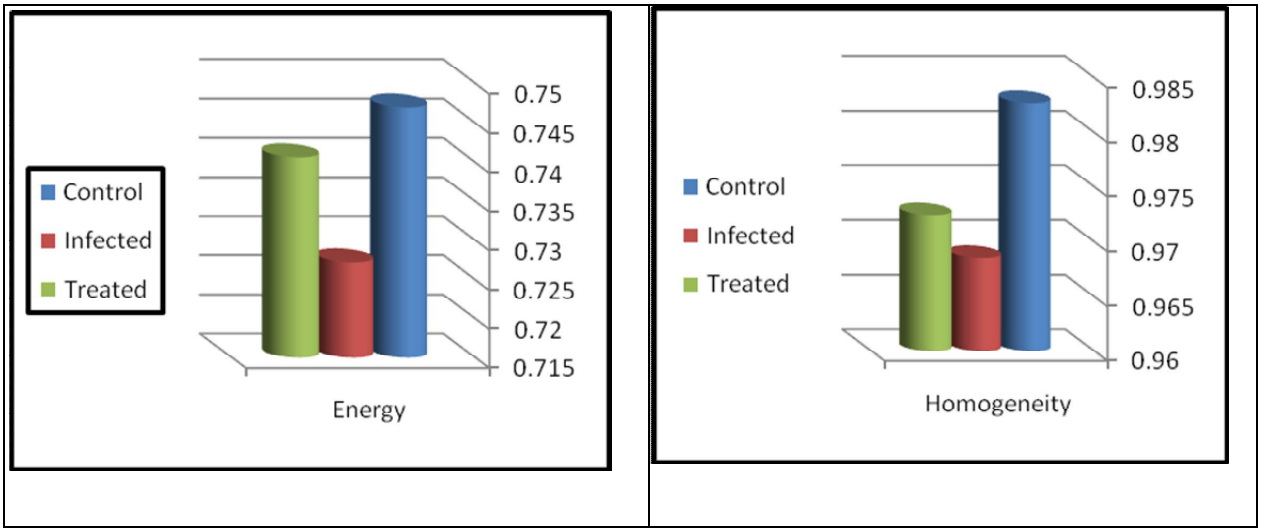
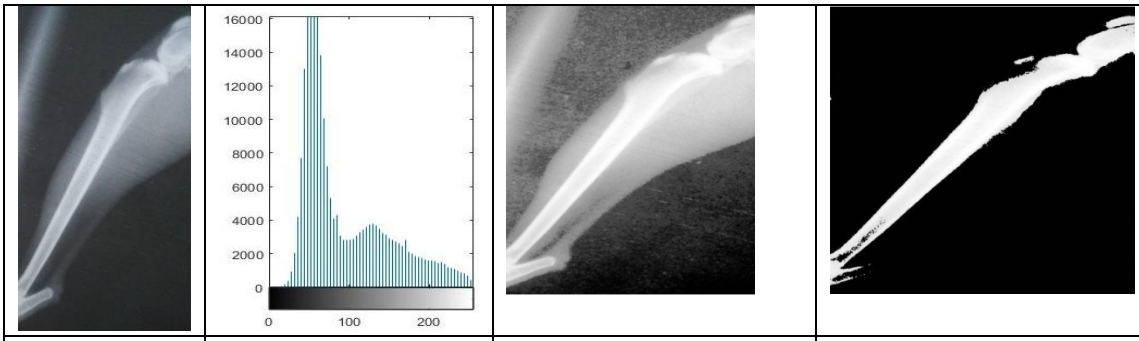


Figure 4.Levels for Statistical Features of Second order to Osteoporosis X-ray Image.

Table 2.Value of the Statistical Features for the Second -Order of Fracture X-ray Image.

Fracture group	***Statistical Features***			
	Contrast	**Correlation**	**Energy**	**Homogeneity**
Control	0.4634	0.9551	0.76355	0.98275
Infected	0.36005	0.9685	0.7285	0.9788
Treated	0.45745	0.9546	0.76315	0.98005
Un-Treated	0.36005	0.96	0.7285	0.9788



x-ray image	**Histogram Equalization**	**x-ray image after equalization**	**Threshold image T=220**

Figure 5. X-ray image for control case (Fracture group).

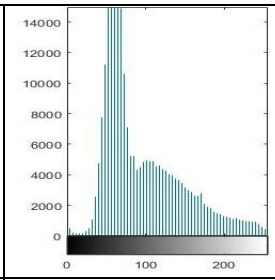
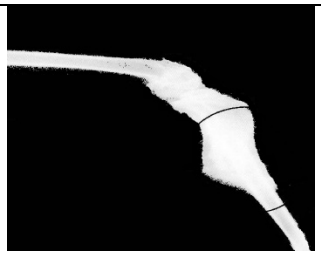
			
x-ray image	**Histogram Equalization**	**x-ray image after equalization**	**Threshold image T=200**

Figure 6. X-ray image for infected case (Fracture group).

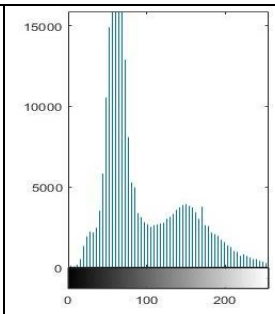
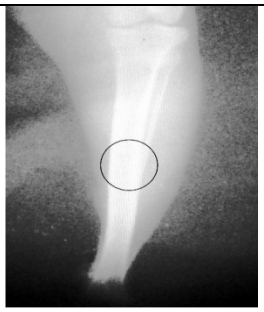
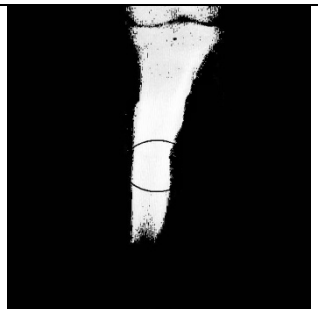
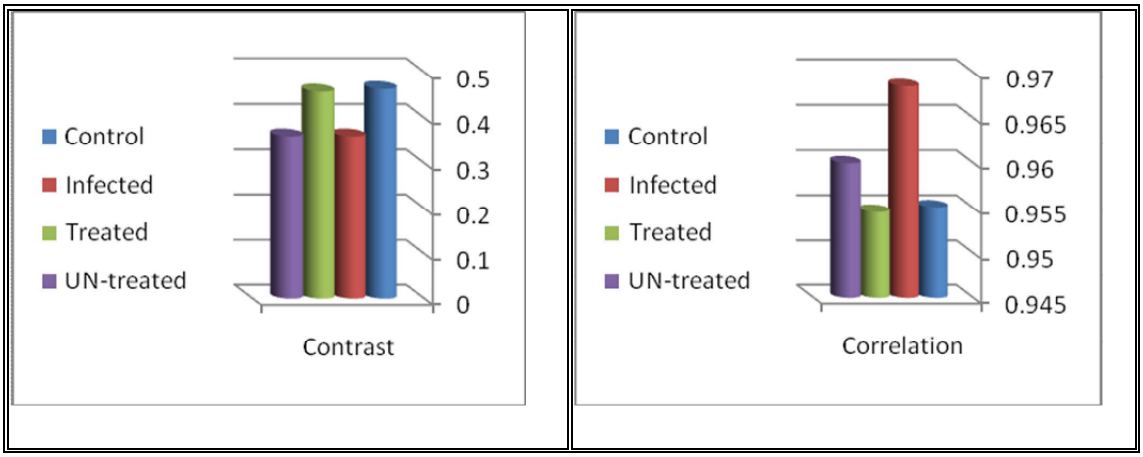
			
x-ray image	**Histogram Equalization**	**x-ray image after equalization**	**Threshold image T=220**

Figure 7. X-ray image for treated case Fracture group.



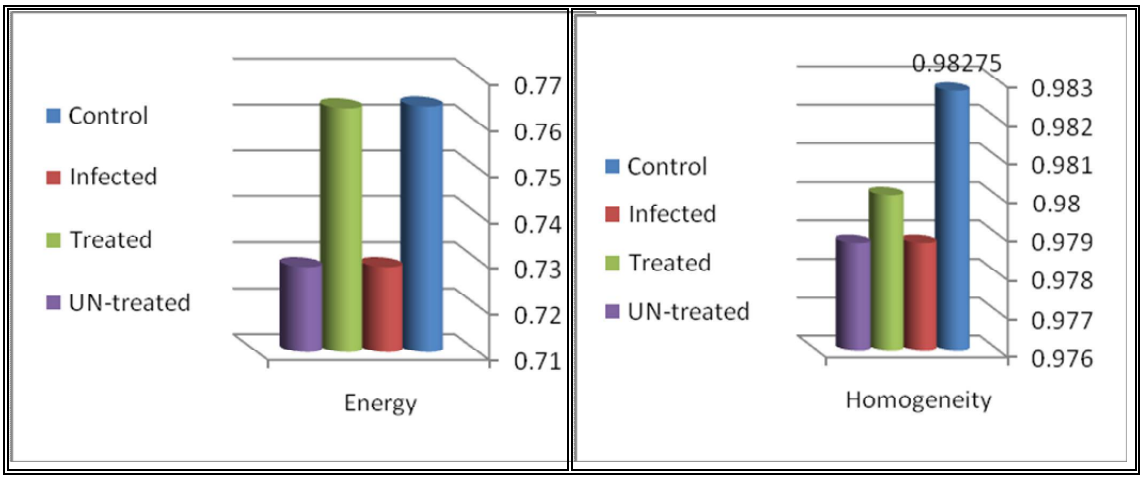


Figure 8.Levels for Statistical Features of Second order to Fracture X-ray Image .

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RESEARCH ARTICLE

The Histopathological Effect of Rotavirus in Small Intestine of Mice Isolated from Wasit Province

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ABSTRACT

A total of 100 stool samples of infants with acute gastroenteritis were collected from December 2015 to April 2016. Their ages ranged between one week to three years. Rotavirus were detected with three detection kits as well as tissue culture .our study gave us 56(56% **)** positive using screening chromatographic immunoassay, 38(38%) positive using Elisa test and 36(36%) positive when we used molecular detection (PCR).our results in histopathological changes in small intestine of mice at 3days post infection showed irregular slant villi and all the goblet cells in the mucosa are enlarged with mucus secretion.

Keywords: stool samples, Rotavirus, chromatographic immunoassay, histopathological.

INTRODUCTION

Rotaviruses were identified as a significant enteric virus and essential reason of acute diarrhea in infants and young children of many mammalian species particularly human and calves (1). Enteritis linked to rotavirus is a main trouble in domestic animals, particularly in young calves (2).Rotaviruses, belong to the *Reoviridae* family - subdivided into the sub-families of the Sedoreovirinae and the Spinareovirinae in which Rotavirus is one of 15 genera and have a genome including eleven segments of double-stranded RNA enclosed in capsid of three layers (3, 4). Several techniques have been developed for diagnosing rotavirus in feces. The detection of the viral agent was performed by electronic microscopy, polyacrylamide gel electrophoresis (PAGE), immunofluorescence, radioimmune assay, reverse passive hemagglutination, enzyme immunoassays (EIA), chromatographic immunoassay, and more recently by reverse transcriptase with polymerase chain reaction. Among these assays, chromatographic immunoassay was reported as a being easy to perform in a short time, for diagnosis and control of the disease caused by rotavirus in

humans (5). the infection percentage of rotavirus in some province of Iraq in the period between 2015 to 2018 were, at 2015 the positive cases were 470 from 644(72.7%),2016were 510 from 582 (87%),2017 were 130 positive cases from 224 (57.6%) and 2018 were 120 positive from 214 (57.6%), according to statistic from ministry of health in Iraq Baghdad from 15 centers sites in Iraq .The aim of this research is to study the histopathological effect of rotavirus isolated from infant and childreen in small intestine of mice.

MATERIALS AND METHODS

A total of 100 stool samples of infant with acute gastroenteritis were collected randomly from December 2015 to April 2016 at one of the Iraqi governorates (Wasit). By rectal stimulation made for household diarrheic infants with age ranged from one weeks to 3 years in order to collect stool. The stool were collected directly into sterile disposable plastic containers then stored in a cool box and transported to the laboratory, where we added each sample to specimen collection tube with extraction buffer that we used in chromatographic immunoassay. After centrifuge the feces for 5 minute to remove particulates at 8000 rpm, we stored the supernatant at -20^{o}C until the assay day.

Rotavirus diagnosis

The qualitative Rotavirus assay was performed with chromatography one step rotavirus test device kits (Abon Biopharm, Germany) , ELISA kit from (Cusabio Biotech Co., Ltd, China),were done to confirm the results obtained from the chromatography one step rotavirus by using a microtiter plate pre coated with specific antibody of rotavirus antigen. the calculation of results were compared with control according to the following equation:

Cut-off value=average value of OD negative +0.01

Then we took the positive samples from ELISA test and made molecular detection by polymerase chain reaction (PCR) using (AccuPower PCR Premix of Bioneer Corporation) evaluated the performance of the PCR from Republic of Korea. All assays were performed according to the manufacturers' instructions. The primers were performed depending on the Manual of rotavirus detection (6).

Experimental design

Albino male mice laboratory animals supplied by the Biotechnology Research Centre at Alnahrain University, were employed in carrying out the experiments of the study. Their age at the start of experiment was 8 weeks, and their weight was 25-30 grams. They were divided into 2 groups, and each group was kept in a separate plastic cage, also every group was consisting of 10 mice, the total number was 20 mice. First group was control group that administrated with normal saline only, while the second group was infected with virus particles that obtained from stool human samples. Each mice was infected with (0.2 ml) of isolated virus and then they were left in their cage for the one to two days until the symptom has appeared. The animals were kept at a temperature of 20-30 C, and they had free excess of food (standard pellets) and water throughout the experimental work.

Histopathological examination

After the clinical signs have appeared to all mice,5 of them were dead and the others were killed by the inhalation of concentrated formalin in closed jar. The samples were collected from vital organs of experimental animals which included intestine that stored in 10% formalin solution for fixation. The histopathological examination was conducted in the Biotechnology Research Center according to the recommended procedure of the Histopathology Laboratory(9).

RESULTS AND DISCUSSION

Rotavirus diagnosis

A total of 100 stool samples were collected from infants and children their ages ranged from one weeks to 3 years.chromatographic immunoassay method were done for detection of rotavirus antigen and gave us56(56%) positive specimens and when we used ELISA method to confirm the results it gave us 38(38%) positive specimens. While when we used PCR technique for detection of the two outer layers proteins VP4 and VP7 the results gave us 36(36%) positive specimens.as it shown in table 1.Chromatographic Immunoassay and ELISA are the simple and good standard methods for detection of rotavirus. These methods, however, require low cost equipment and simple experience, which is available in many laboratories. Some researchers for detecting rotavirus infection have used ELISA and PCR. These methods are expensive and require long time if they have been used together (9). Chromatographic immunoassay Rotagen, ELISA kit, and PCR Premix was evaluated for rotavirus detection in stool samples. Chromatographic immunoassay, ELISA and PCR rotavirus are useful detection methods to detect the rotavirus. The samples had been collected from 100 infants and childes their age ranged from one weeks to 3 years.

The histopathological changes

After the clinical signs have appeared, the samples were collected from vital organs of experimental animals which included small intestine that stored in 10% formalin solution for fixation. The histopathological changes in intestine at 3 days post infection showed congested diluted blood vessels with inflammatory cells particularly neutrophils and mononuclear cells and edema in submucosa in addition to necrosis of crypt and hypertrophy of goblet cells. (10, 11) The current study demonstrated that rotavirus induced pathological lesion in the examined organ of 2nd group of mice, thus, this virus is highly virulent and have ability to produce toxic nonstructural protein and overcome of the host defense mechanism. This result match the observation investigated the functional NSP4 enterotoxin peptide secreted from rotavirus-infected cells where they found that the NSP4, a secreted fragment of NSP4, or appropriate NSP4 peptides have an activity similar to that of toxin and stimulate diarrhea when injected into mice (12).Group 1: the mice infected with only normal saline. The histopathological changes demonstrated that no lesion was found in mice intestine (figures 1). Group 2: the mice infected with rotavirus that isolated from stool samples (figures 3, 4, 5 and 6).

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Table 1: The results that have been obtained from three testing method for Rotavirus in 100 childes stool samples

SITE	Chromatographic Immunoassay (%)	ELISA (%)	PCR (%)
Wasit	56	38	36
Positive	56 (56%)	38 (38%)	36 (36%)
Negative	44 (44%)	62 (62%)	64 (64%)

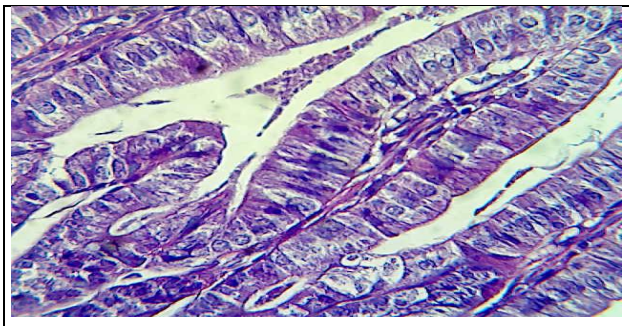

Figure 1: Section of normal animal shows no lesion (H&E stain 400X)

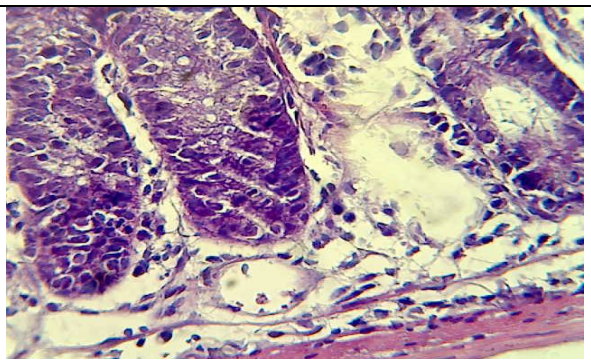

Figure 2: showed infected animals expressed congested dilated blood vessels ,with inflammatory cells particularly neutrophils and mononuclear cells and edema in submucosa in addition to necrosis of crypt of Lieberkuhn .

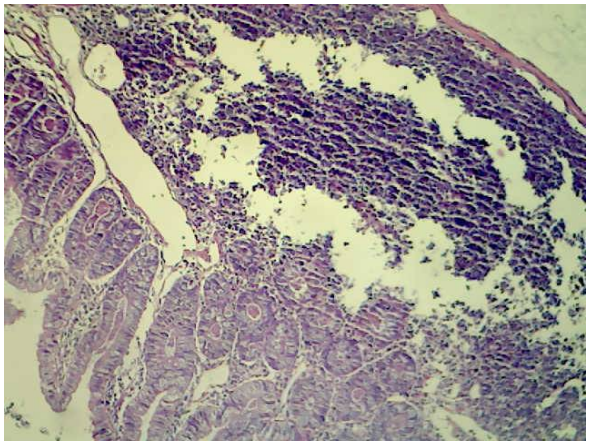

Figure 3: section in the intestine in animal post infection with rotovirus shows depletion of lymphoid tissue ↔ (H&E stain 400X)

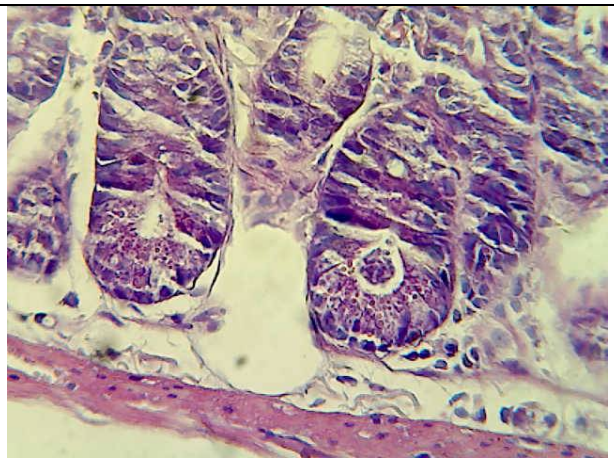

Figure 4:section in the intestine in animal post infection with rotovirus shows congested dilated blood vessels , with inflammatory cells particularly neutrophils and mononuclear cells and edema in submucosa in addition to necrosis of crypt of Lieberkuhn and hyperatrophy of goblet cells (H&E stain 400X).

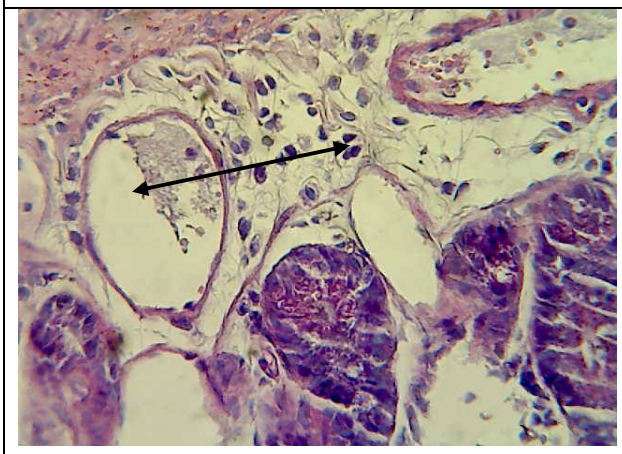

Figure 3: Section in the intestine of animal at 2 days post infection with rotavirus shows congested dilated blood vessels with inflammatory cells particularly neutrophils , mononuclear cells, edema in submucosa, in addition to necrosis of crypt of Lieberkuhn (H&E stain 400X).

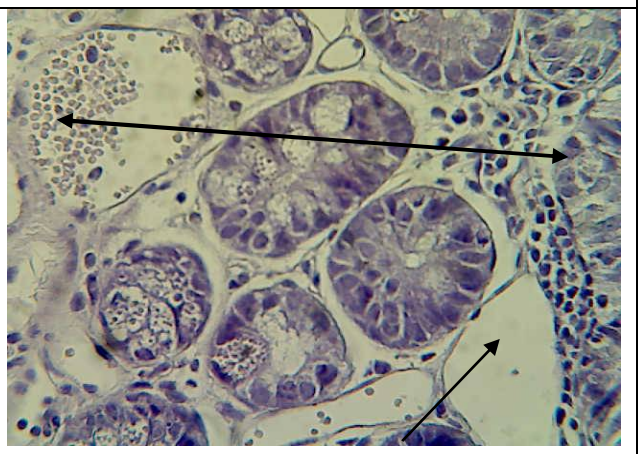

Figure 4: Section in the intestine of animal at 2 days post infection with rotavirus shows inflammatory in congested dilated blood vessels with inflammatory cells particularly neutrophils, mononuclear cells, edema between mucosal glands, in addition to necrosis and degeneration of intestinal glands and dilated of lymphatic vessels (H&E stain 400X).

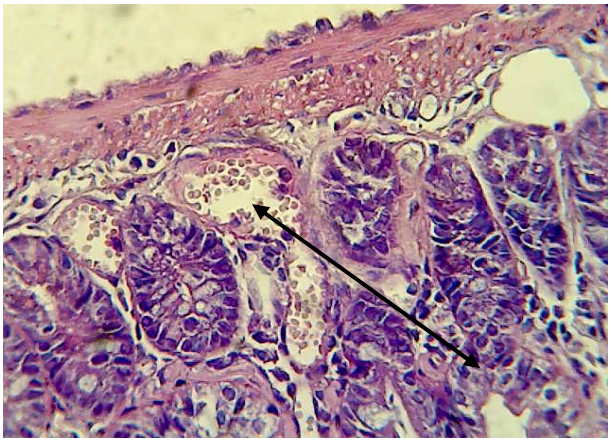

Figure 5: Section in the intestine of animal at 2 days post infection with rotavirus shows congested dilated blood vessels, with inflammatory cells particularly neutrophils, mononuclear cells and edema in submucosa, in addition to necrosis of crypt of Lieberkuhn and hyperatrophy of goblet cells (H&E stain 400X)

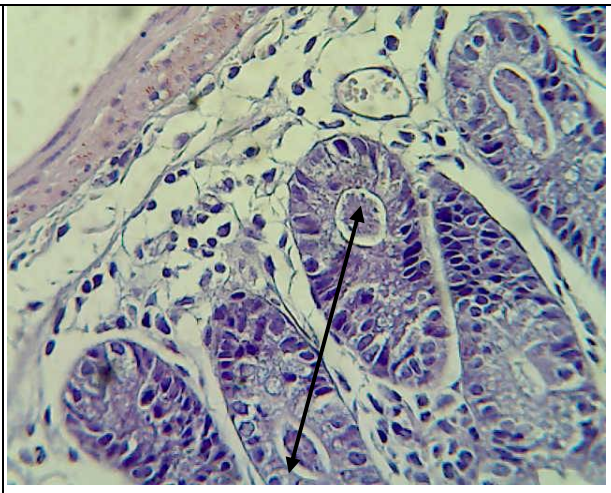

Figure 6: Section in the intestine of animal at 2 days post infection with rotavirus shows congested dilated blood vessels with inflammatory cells particularly neutrophils, mononuclear cells and edema in submucosa, in addition to cellular debris in the lumen of crypt of Lieberkuhn (H&E stain 400X).

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RESEARCH ARTICLE

Seepage and Stability of Zoned Earth Dam during Rapid Drawdown of Water in Reservoir

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ABSTRACT

The rapid drawdown is knownas one of the most dangerous conditions for the upstream slope. When the counter vailing upstream water pressure is lowered, it results in distress to the upstream slope. Soils within the dam body remain saturated, and flow commences towards the upstream slope. Seepage inaddition to hydrodynamic pressures generates downward forces that act on the upstream slope. These forces act adversely to the stability and generate a critical condition in the upstream slope. In this study, the finite element method is used to study seepage through the body of an earth fill dam. For this purpose, the software Geostudio 2012 is usedthrough its subprograms SEEP/W and SLOPE/W. The water levels on the upstream and downstream sides, the properties of materials and boundary conditions of the dam were input variables and the water flux, exist gradient, and pore water pressure were the targetoutputs. Al-Adhaimdamin Iraq has been chosen for analysis for the original period of drawdown the dam reservoir and emergency periods. Some points in the dam downstream may be affected by negative pore water pressure during the period of water drawdown which indicates that the water level becomes below these points. When the period of reservoir drawdown is long ($\backsim$ 11 days), the values of exit gradient are reduced to very low values ($\backsim$ 0.05) within this period whilefor short periods (1 to 3 days), the exit gradient values are greater. When the periodof reservoir drawdown is long ($\backsim$ 11 days), the rate of flow is greater than that in the case of short periods (1 to 3 days). When the countervailing upstream water pressure has disappeared.It was concluded that the factor of safety against sliding of the dam slopes decreases slightly within the short period after the start of rapid draw down of water in the reservoir where it reaches 1.571 and 1.523 in case of 11 days and 3 days of drawdown respectively, then starts to increase. This is caused by dissipation of excess pore water pressure with time which leads to increase the effective stresses in the soil and henceincrease its shear strength. The saturated weight of the slope produces the shearing stresses while the shearing resistance is decreased considerably because of the development of the pore water pressures which do not dissipaterapidly.

Keywords: upstream, water, pressure, pore, downstream, countervailing.

INTRODUCTION

When the phreatic line (free surface) falls slowly or remains almost at the same position, it is considered as "rapid‟ drawdown. The lag of the phreatic line or the rate of drawdown depends on four factors: permeability coefficient of the dam fills, drawdown rate, pore active volume, and upstream slope gradient. The case in which the water has to be quickly lowered for the special purpose of rehabilitation,or material of the dam slope is impermeable so the phreatic line does not fall so much even if this drawdown has lastedforseveralmonths,isacommonproblem in the reality (Abadjiev,1994).Zomorodian and Abodollahzadeh (2010) investigated the influence of horizontal drains onupstream slope of earth fill dams in the condition of rapid drawdown using limit equilibrium and finite elements methods. Development of pore water pressure, outpouring rate of flow and safety factor were inspected. The amount of water leakage and seepage in the dam was investigated by using the SEEP/W software and the static slope stability analysis by using the SLOPE/W software.Fredlund et al. (2011) and Hassan I. &K.N.Kadhim, 2018compared the Duncan (1990) three-stage procedure for analysis of rapid drawdown conditions to a combined slope stability analysis and transient flow. Limit equilibrium methods was adopted in the analysis of slope stability taking into account saturated and unsaturatedpore-waterpressures.Analysesofsome typical cross-sections were taken intoconsideration to determine the potential effect of geometry. The aim of the study was to prepare scenarios under which the Duncan (loc. cit.) procedure produces results similar to those of a more rigorous analysis.

Chugh (2013) examined the stability of a circular earth dam for radial cracking potential and static slope stability using continuum mechanics-based three-dimensional numerical models. Comparisons of numerical model results for a circular watertank with vertical walls and different radii with their analytical counterparts are included to support the validityoftheideasandtheirimplementationinthe continuum mechanics-based computer program used. Effects of sloping wall faces and Poisson‟s ratio on computed deformations and stresses are also included. The same numerical models were used to assess stability of a circular dam in termsof factor of safety and associated failure surface. Three-dimensional slope stability analysis results were compared with continuum based two-dimensionalslopestabilityanalysisresultstoassess the magnitude of 3D effects. Example problemsare included to illustrate the use of ideaspresented.The need to study the slope stability ofearth fill dams during drawdown is necessary and imperative not only for the existing dams, but also for the design and construction other earth fill dam projects in the region. In this paper, the rapid drawdown condition is investigated by the finite element method for Al-Adhaim dam. The stability of the dam slopes is traced during the change in water level.

For the aim of slope stability analysis, the safety factor is calculated as the ratio of the total available shear strength of the soil to mobilised shear stress to maintain equilibrium along apotential surface of sliding.For loading condition at the end of construction, excess pore pressures may develop in impervious zones of the earth dam or its foundation since these soils cannot complete consolidation entirely during the period of construction. If effective shear strength parameters are adopted in the analysis, then excess pore pressures affect the factor of safety considerably. A minimum safety factor of 1.3 can be adoptedto be adequate if pore pressures are controlled during construction. However, if the effective shear strength parameter is adopted without any fieldi nspection of pore pressures,the minimum factor of safety must be 1.4 minimum to decrease uncertainties caused by excess pore pressures,For thes teady-state flow condition under active conservation pool, a minimum safety factor of1.5 must be verified to account for the uncertainties implemented in material strengths, pore pressures in impervious material, and also in long-term loading. Additionally, the downstream slope failure under a steady-state flow condition is more likely to cause a catastrophic release of water; this definitely demands a higher margin of safety than for the end of construction orrapid drawdown conditions. For the condition of the rapid drawdown from maximum reservoir surface (after a probable maximum flood) to active conservation pool, a safety factor of 1.2 is suitable taking into account the short period of the flood pool surcharge before the normal pool is maintained. For the rapid drawdown below the active

conservation pool, a value of1.3 is applied to the minimum factor of safety. This work is devoted to studying the stability of a dam under the condition of rapid drawdown and its effect on the seepage through a zoned earthdam.Thefiniteelementmethodisusedas atoolforanalysis. The computer program Geo- Studio (2012) package is used for this purpose through its sub-programs named SEEP/W and SLOPE/W.

METHODOLOGY

Case Study: Al-Adhaim dam is an earth dam locate data distance of(1.5km)intherear of the place in which Tuz Jay and the river Al- Adhaim merge, which is considered as seismically active region in Iraq. It consists of embankment with length of (3.1 km) from the helmofa major cross-rivervalley (whereitism) high and go through or underneath spending and channel spillway, and the payment of the wings in the left and right and up the embankmentmajor backson the left and right where appropriate height is less because of high natural land there. Al-Adhaim dam is a fill soil with sloping core; its architecture has been developed initially by Bennie and Partners company. The soil of the foundation consists of sloping layers from sand stone and marl uneven thickness **(Final Report** of Al-Adhaim Earth Dam, 1994). Figure (1) shows section of the dam, which has a base level of about 70 m above the sea level, and the level at the top of dam is 146.5m.

In the following sections, the dam section is analysed for different conditions of rapid draw down.There servoir is assumed to be emptied within 11 days and 3 days. The reservoirs period of evacuation have been chosen based on many cases whichare:

- The period of reservoir emptying of 11 days is the designedperiod.
- Theperiodofreservoiremptyingof3daysis the theoretical assumption for emergencies.

RESULTS AND DISCUSSION

Reservoir drawdown within 11 days

According to the properties of each material, the phreatic line will be drawn as shown inFigure 2 which illustrates the geometry of the dam and the path of the phreatic line through the shell, core and filters depending on the geometry and properties of materials. In addition, Figure 2 shows the distribution of the pore water pressure and the value of water flux through the flux section at time 0 for a period of reservoir drawdown of 11 days.Table 3 presents the change of pore water pressure values at selected points shown in Figure 2 as a result of drawdown. The effect of rapid drawdown on the pore water pressure values at different locations is illustrated in Figure 3. When the reservoir is rapidly evacuated and drawn down, pore water pressures in the dam body are reduced in two ways. There is aslower dissipation of pore pressure due to drainage, and there is an immediate elastic effect due to the removal of the total or partial water load. Figure 3 shows the variation of pore water pressure with time after the start of adrawdown in the reservoir at points 1 to 5 (Fig. 2). It can be seen that the pore water pressure at all points decreases linearly withtime.In order to trace the critical points in the dam, the xy-gradients have been estimated at points 6, 7 and 8 (Fig.2) at different times after the start of water drawn down as shown in Table 2 and Figure4.

In Table 3, the values of water flux for selected points (6-8) which are located in the downstream of the dam are presented. Figure 5 reveals that the rate of flow at points 6,7 and 8 decreases with time; this is caused by the rapid flow of water caused by drawdown the reservoir in a short period. The exact mechanism of this phenomenonis as follows:It is assumed that the reservoir has been maintained at a high level for asufficiently long time so that the fill material of the dam is fullysaturated and steady seepage established. If the reservoir is drawn down at this stage, the direction of flow is reversed, causing instability in the upstream slope of the earth dam. The "instantaneous"

drawdown is a hypothetical condition that is assumed, and pore pressures along the sliding surface are determined by inspection of "instantaneous" pore water pressure at different points in the finiteelement mesh. The most critical condition of sudden drawdown means that while the water pressure acting on the upstream slope at "full reservoir" condition is removed, there is no appreciable changeinthewatercontentofthesaturatedsoil within thedam.

The slope stability of the dam is one of the important elements that should be studied in analyzing dams. Fluctuations in reservoirwater level may cause the upstream face stability to become critical mainly due to the removal of the supporting water. During the rapid drawdown,the stabilizing effect of the water on the upstream face of the embankment is lost, but the pore-water pressures within the embankment may remain high. As a result, thestability of the upstream face of the dam canbe much reduced. The dissipation of pore-water pressure in the embankment is largely influenced by the permeability and the storage characteristic of the embankment materials. Highly permeable materials drain quickly during the rapid drawdown, but low permeability materials take a long time todrain (GEO-SLOPE International Ltd,2012).

In this section, the stability of upstream face of the dam during rapid drawdown condition is studied because it is the criticalslope during the rapid drawdown. The results of this case are examined in Figure 6 which represents a section of Al-Adhaim dam after the analysisby the Program SLOPE/W using Bishop's method of slices. The critical sections were selected at the time of a minimum factor of safety for each method in case of reservoir drawdown during 11days. The values of a factor of safety at different times estimated by three methods are listed in Table4.

The saturated weight of slope produces the shearing stress while the shearing resistance is decreased considerably because of the development of the pore water pressures which donot dissipaterapidly (Gopal and Rao, 2005). Therefore, it was considered very important that such an analysis be carried out and included in this research. Figure 7 traces the variation of the factor of safety withtime. It can be noticed that the factor of safety decreases slightly during the first (120) hours afterstartingofreservoirdrawdown, the nstarts to increase rapidly. This is caused by dissipation of excess pore water pressure with time which leads to increase the effective stresses in the soil and hence increase its shear strength

From Figure 7 and the values of Table 4, the minimum factor of safety in Morgenstern-Price method equals 1.571 which was achieved at time 7 days during reservoir draw down within 11 days and this result matches with the minimum factor of safety in Bishop's method which takes place at time 7 days and is equal to1.564 but the minimum value is equal 1.523 in Janbu's method at time 8 days.

The stability of slopes under drawdown conditions are usually analysed considering two limiting conditions, namely slow andrapid drawdown.Intheslowdrawdownsituation,the water level within the slope is assumedto equalize the reservoir level at any time. In the case of rapid drawdown, which represents the most critical condition, it is assumed that the pore water pressure within the embankment continues to reflect the original water level.The lag of the phreatic line depends on factors such as permeability of soils, drawdown rate and slopegradient. Aminimum factor of safety of 1.3 would also be adequate when the analysis is carried out regarding undrained shear strength. However, if an undrained shear strength envelope is used, the laboratory testing performed to define the envelope must satisfactorily model the pore pressure behaviour and state of stress anticipated under field loadingconditions.

Reservoir drawdown within 3 day

In this section, the reservoir drawdown is considered to be conducted within 3 days. Figure 8 presents the change of pore water pressure values as a result of drawdown. Many points have been selected as history points to study the effect of rapid drawdown on the pore water pressure values, but in this case, the drawdown period is 3 days. Figure 9 represents the reduction in the values of XY-gradient for the points (6-8) which are located in the downstream of the dam. Figure 10 displays values of water flux at points (6-8) which are located in the downstream of the dam for a

period of reservoir drawdown of 3 days. A comparison between Figures 10 and 5 shows that when the periodof reservoir drawdown is long (11 days), the rate of flow is greater than that in the case of the 3- day drawdown period.Figure 11 presents a section of Al- Adhaim dam after analysis by the Program SLPOE/W using Morgenstern-price's method, selected at the time of a minimum factor of safety in case of reservoir drawdown within 3 days From Figure 12 ,the minimum factor of safety in Morgenstern-Price method equals 1.523 which was calculated at time24hrduring reservoir drawdown of 3 days and this result matches with the minimum factor of safety in Bishop'smethodattime24hrwhichisequal to 1.568, but the minimum value equals 1.5594in Janbu's method at time 24hr.

CONCLUSIONS

1. During rapid draw down, the pore water pressure at all points within the dam body decreases linearly which indicates that steady state flow takes place. Some points in the dam downstream may be affected by negative pore water pressure during the period of water draw down which indicates that the water level becomes below thesepoints.
2. The exit gradient at the dam downstream almost decreases during the period of water draw down which means that the factor of safety against boiling increases with time. When the period of reservoir drawdown islong ($\backsim$ 11 days), the values of exit gradient are reduced to very low values ($\backsim$ 0.05) within this period while for short periods (1 to 3 days),the exit gradient values aregreater.
3. The rate of flow at the dam downstream decreases with time; this decrease is caused by the rapid flow of water caused by drawdown the reservoir in a short period. Generally, thewater flux decreases linearly with time and with the water level in the reservoir which indicates that the rate of flow in the whole body of the dam shows almost uniformchange.
4. The factor of safety against sliding of the dam slopes decreases slightly with in the short period after the start of rapid draw down of water in the reservoir, then starts to increase. This is caused by dissipation of excess pore water pressure with time which leads to increase the effective stresses in the soil and hence increase its shear strength. The saturated weight of the slope produces the shearing stresses while the shearing resistance is decreased considerably because of the development of the pore water pressures which do not dissipate rapidly.
5. When the period of reservoir drawdown is long($\backsim$ 11days),the rate of flow is greater than that in the case of short periods (1 to 3 days). When the countervailing upstream water pressure has disappeared, it causes a danger to the upstream slope. Soils inside the dam body remain saturated, and seepage commences from it towards the upstream slope. Seepage and hydrodynamic pressures create downward forces acting on the upstream slope. Those are adverse to the stability and create a critical condition to the upstream slope.

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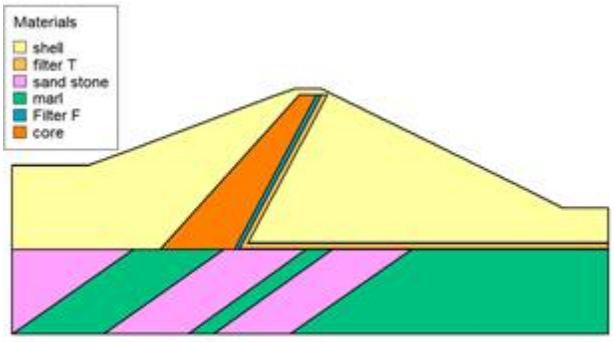

Fig. 1: Typical Cross Section of the Al Adhaim Dam

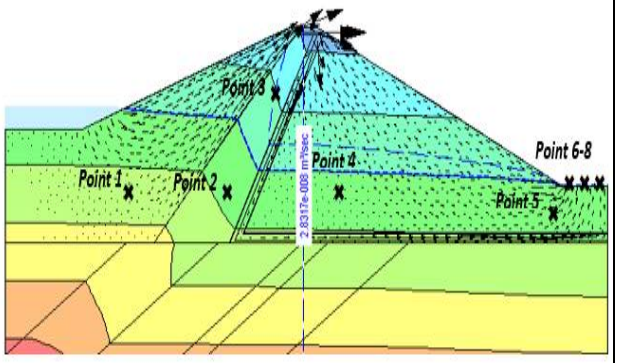

Fig.2: Pore water pressure and the flux value of 2.83*10^{-8} m^3/sec, immediately (0 hrs) after the start of rapid drawdown

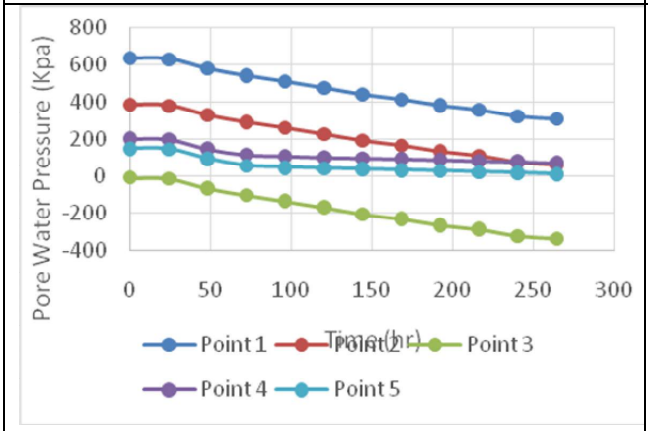

Fig. 3: Change in pore water pressure during rapid drawdown for a period of reservoir drawdown of (11 days) of Al-Adhaim dam.

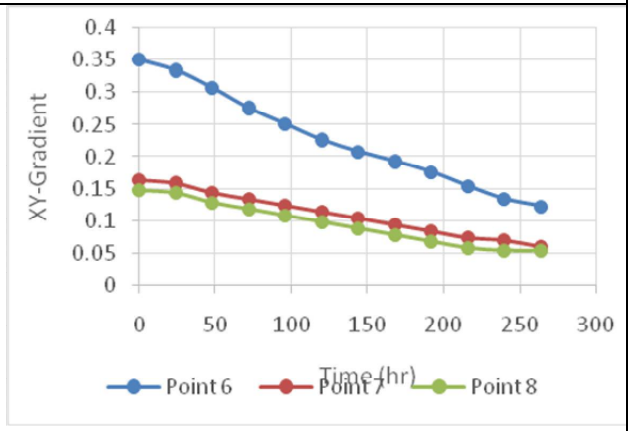

Fig. 4: Change in XY-gradient during rapid drawdown for a period of reservoir drawdown of (11 days).

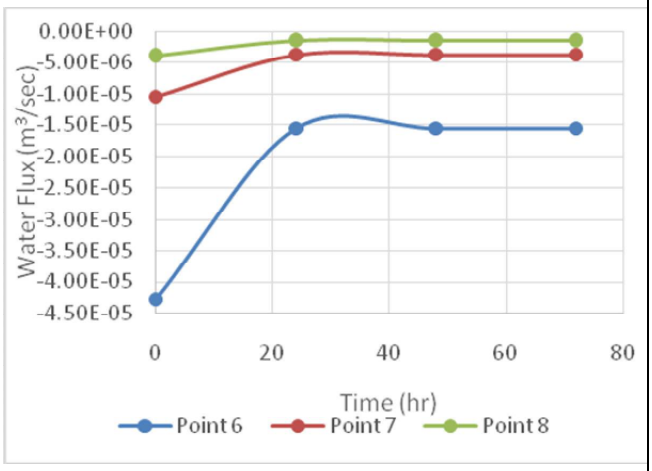

Fig.5: Change in the quantities of water flux at points (6-8) during rapid drawdown for a period of reservoir drawdown of 11 days.

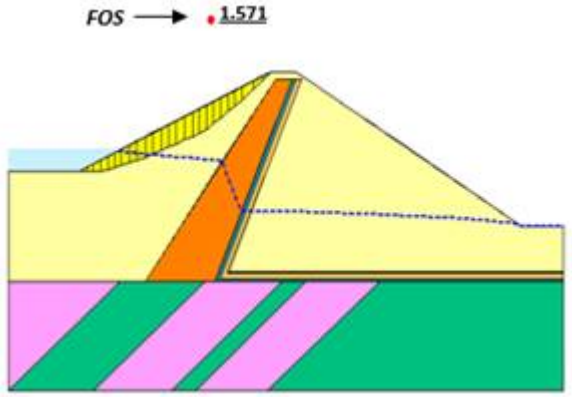

Fig.6: The minimum factor of safety and slip surface in Al-Adhaim dam (at the time of 7th day) during rapid drawdown for a period of reservoir drawdown of 11 days using Morgenstern-Price method of slices.

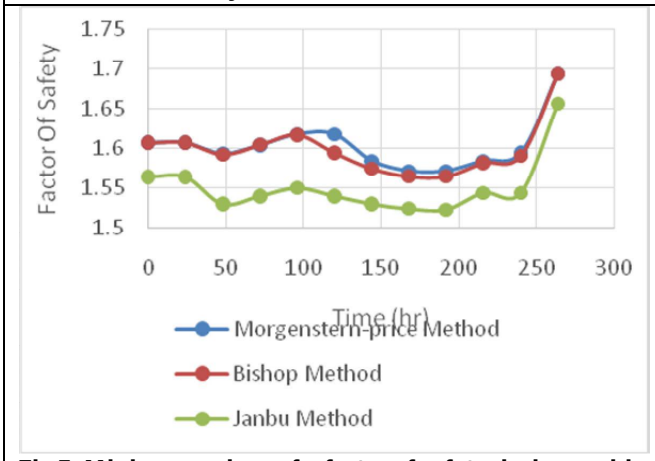

Fig.7: Minimum values of a factor of safety during rapid drawdown for a period of reservoir drawdown of 11 days in Al-Adhaim dam.

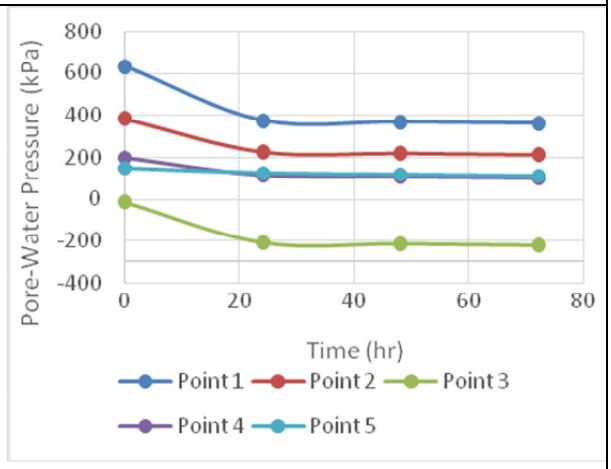

Fig. 8: Change in pore water pressure during rapid drawdown for a period of reservoir drawdown of (3 days) of Al-Adhaim dam

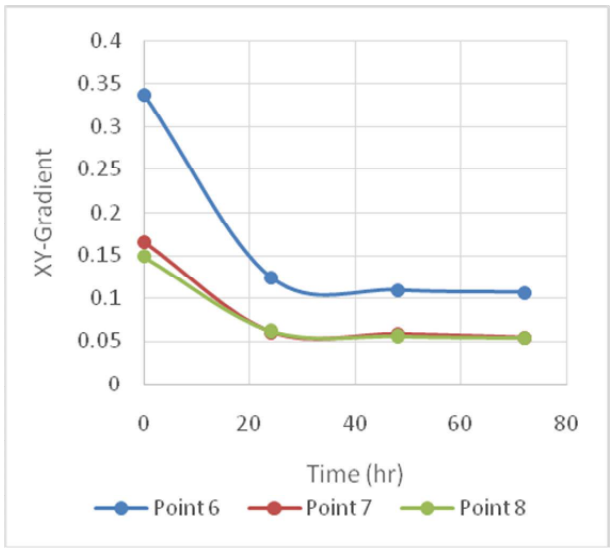

Fig.9: XY-gradient during rapid drawdown for a period of reservoir drawdown within 3 days in Al-Adhaim dam.

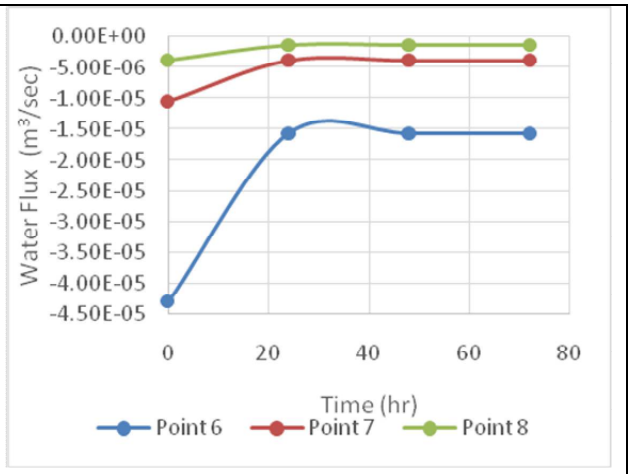

Fig.10: Change in the quantities of water flux at points (6-8) during rapid drawdown for a period of reservoir drawdown of 3 days.

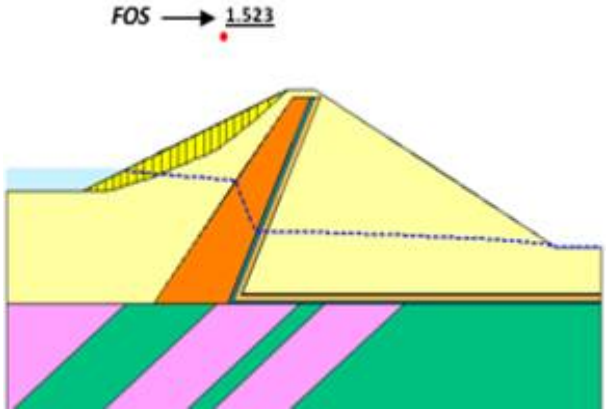

Fig.11: The minimum factor of safety and slip surface in Al-Adhaim dam (at the time of 1st day) during rapid drawdown for a period of reservoir drawdown of 3 days using Morgenstern-Price method of slices

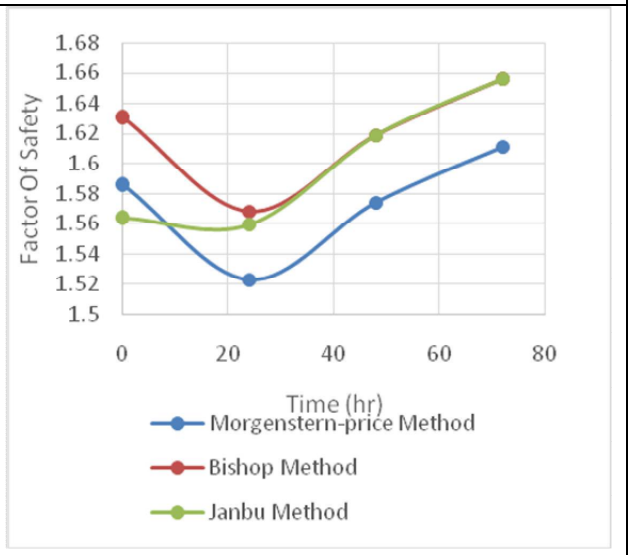

Fig. 12. Variation of the minimum factor of safety of the dam slope with time calculated by three methods for a period of reservoir drawdown of 3 days in Al-Adhaim dam.

Tab. 1. Pore water pressure in (kPa) with time for a period of reservoir drawdown of 11 days in Al-Adhaim dam.

Time (hr)	Point 1	Point 2	Point 3	Point 4	Point 5
0	635.14	388.02	-10.06	203.83	150.57
24	631.14	384.02	-14.06	199.83	146.57
48	578.91	331.79	-66.29	147.6	94.34
72	541.56	294.44	-103.64	116.34	56.99
96	510.34	263.22	-136.86	108.93	48.36
120	476.85	229.73	-170.35	102.14	42.94
144	440.61	193.49	-206.59	98.17	38.15
168	415.32	168.2	-231.88	93.58	33.49
192	381.94	134.82	-265.26	88.85	28.43
216	359.33	112.21	-287.87	83.47	23.11
240	324.64	77.52	-322.56	78.64	18.14
264	310.74	63.62	-336.46	71.66	11.17

Tab. 2. Values of XY-gradient in Al-Adhaim dam at selected points for a period of reservoir drawdown of 11 days.

Time (hr)	Point 1	Point 2	Point 3
0	0.35	0.164	0.147
24	0.334	0.159	0.143
48	0.307	0.144	0.128
72	0.276	0.136	0.118
96	0.2514	0.125	0.107
120	0.2263	0.114	0.098
144	0.208	0.106	0.082
168	0.1931	0.094	0.078
192	0.1762	0.083	0.069
216	0.1541	0.078	0.058
240	0.134	0.07	0.054
264	0.123	0.06	0.054

Tab. 3: Values of water flux in Al-Adhaim dam at selected points (m^3/sec) for a period of reservoir drawdown of (11 days).

Time (hr)	Point 1	Point 2	Point 3
0	$-3.90*10^{-6}$	$-4.28*10^{-5}$	$-1.05*10^{-5}$
24	$-3.50*10^{-6}$	$-3.80*10^{-5}$	$-5.90*10^{-6}$
48	$-3.20*10^{-6}$	$-3.00*10^{-5}$	$-4.90*10^{-6}$
72	$-2.89*10^{-6}$	$-2.20*10^{-5}$	$-4.80*10^{-6}$
96	$-2.50*10^{-6}$	$-1.80*10^{-5}$	$-4.70*10^{-6}$
120	$-2.30*10^{-6}$	$-1.60*10^{-5}$	$-4.60*10^{-6}$
144	$-2.00*10^{-6}$	$-1.55*10^{-5}$	$-4.30*10^{-6}$
168	$-1.84*10^{-6}$	$-1.50*10^{-5}$	$-4.10*10^{-6}$
192	$-1.66*10^{-6}$	$-1.45*10^{-5}$	$-3.89*10^{-6}$
216	$-1.43*10^{-6}$	$-1.40*10^{-5}$	$-3.60*10^{-6}$
240	$-1.43*10^{-6}$	$-1.40*10^{-5}$	$-3.58*10^{-6}$
264	$-1.43*10^{-6}$	$-1.35*10^{-5}$	$-3.34*10^{-6}$

Tab.4:Variation of the factor of safety with time during the rapid drawdown in Al-Adhaim dam for a period of reservoir drawdown of 11 days

Time (hr)	Morgenstern-Price method	Bishop's method	Janbu's method
0	1.607	1.607	1.564
24	1.607	1.607	1.564
48	1.593	1.592	1.53
72	1.604	1.604	1.54
96	1.618	1.617	1.55
120	1.618	1.594	1.54
144	1.584	1.574	1.53
168	1.571	1.564	1.524
192	1.571	1.564	1.523
216	1.584	1.581	1.544
240	1.594	1.59	1.544
264	1.694	1.694	1.657

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RESEARCH ARTICLE

Effect of Vermicompost on the Growth and Yield of Brinjal (*Solanum melongena* L.)

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ABSTRACT

India is a country of villages and our economy largely depends on agriculture. In the past, the agriculturists employed the natural organic manure for the improvement of soil fertility, health and agriculture sustainability. In today's era, heavy doses of chemical fertilizers and pesticides are being used by the farmers to get a better yield of various field crops. These chemical fertilizers and pesticides decreased soil fertility and caused health problems to the consumers. The present study was conducted to evaluate the effect of vermicompost on the growth and yield of Brinjal. Physico-chemical properties of the soil in both control and plots were studied and interrupted with results. Plant growth (height), number leaves per plant, number of flower and fruits were also recorded. 50:50 ratio vermicompost and vermicompost rubbish applied plants showed increased growth, number of leaves, flower and fruits when compared to control other ratios (40:60 and 60:40) of vermi end products. Significant yield was recorded on vermicompost applied plants than vermicompost rubbish, that vermicompost is more favorable for vital production of brinjal. The vermi end products can be economically and environmentally suitable and also maintenance of agricultural soil environment.

Keywords: Earthworm, Vermicompost, Vermicompost rubbish, Brinjal, Soil health and Nutrition.

INTRODUCTION

In organic farming the application of organic manure especially vermicompost derived from earthworm is recommended. The earthworms are known as "Farmers friend", "Nature's best fertilizer", "Natural ploughmen" and "Intestine of the earth" plays an important role in the production of vermicompost. Earthworms act in the soil as aerators, grinders, crushers, chemical degraders and biological stimulators. Their utilization and importance have

been stressed by renowned works of various scientists (Darwin, 1881). The role of earthworms in the recycling of nutrients, soil structure, soil productivity and agriculture, and their application in environment and organic waste management is well understood (Edwards *et al*., 1995). Vermicompost plays a major role in improving growth and yield of different field crops, vegetables and flower and fruit crops (Waters, 1951). Gajalakshmi and Abbasi (2004) expressed that plant height, number of leaves, root length, total biomass, number of flowers and fruits, length of inflorescences and quicker onset of flowering of the plants such as lady's finger (*Abelmoschus esculentus*), brinjal (*Solanum melongena*), cluster bean (*Cyamopis tetragonoloba*), chilli (*Capsicum annum*) and tomato (*Lycopersicum esculentum*) have been found to have significant increase than the control plot when they were exposed to various percentage of water hyacinth vermicompost. In view of the above facts an attempt has been made to study the growth and yielding pattern of brinjal by using Vermicompost, vermicompost rubbish and vermiwash. In view of the above facts an attempt has been made to study the growth and yielding pattern of brinjal by using Vermicompost and vermicompost rubbish.

MATERIALS AND METHODS

Fresh cow dung and organic waste collected from Vadugapatti village (10° 45' to 30° 16' N and 78° 70' to 27° 38' E), Musiri Taluk, Tiruchirappalli District, India. they spread over clean terrain and allowed for 10 to 15 days, they thoroughly mixed with one another and mixture was prepared in three different concentrations *i.e.,* 40:60 (40% cow dung and 60% organic wastes); 50:50 (50% cow dung and 50% organic wastes) and 60:40 (60% cow dung and 40% organic wastes) and control (cow dung only) also maintained and kept in clean shadow place, water sprinkled every day to keep maintain the moisture. After decomposition, they filled in separate cement tanks size (Size 3 m x 6 m x 3 m) in triplicates and 50 number of adult *Eudrilus eugeniae* was inoculated. After 4 weeks, endproduct collected and sieved by 3 mm mesh. The separated vermicompost and vermicompost rubbish (sieved out matter) were collected and stored in cool and dry place for further experiments. pH, Electrical Conductivity (EC), Moisture, Organic Carbon, determined as suggested by Tandon (2005), Total Nitrogen determined by Micro Kjeldahl method, Total Phosphorous determined by Spectrophotometric method, Total Sulphur estimated as suggested by Tandon (2005). Determination of Total Sodium and Total Potassium by Flame Photometric Method, Estimation of Total Calcium and Magnesium by Versenate method.

Experiment was conducted at wet lab in Arignar Anna Government Arts College, Musiri, Tamil Nadu, India. Experimental plot was design 5m x 5m area, the unwanted plants were removed, soil nutrients were analysed before and after cultivation of crops. Control plot was maintain for brinjal crop. In experimental plot the selected vegetable crop namely, Brinjal was planted in each 20 numbers both in control and each experimental plots, experimental plot I (40:60 vermicompost), experimental plots II (50:50 vermicompost), experimental plot III (60:40 vermicompost) and experimental plot IV (40:60 vermicompost rubbish), Experimental Plot V (50:50 vermicompost rubbish), experimental plot VI (60:40 vermicompost rubbish), experimental plot VII (vermicompost control). Experimental Plot VIII (vermicompost rubbish control).

RESULTS

In the present study, vermicompost and vermicompost rubbish prepared from cow dung and leaf litter at different concentrations *i,e.,* 40:60, 50: 50, 60:40 and control, were quantified. The result showed harvested vermicompost quantitatively higher than the vermicompost rubbish and they presented in table 1.

Physico-chemical parameters of vermicompost, vermicompost rubbish and vermiwash nutrients were analyzed and presented in table 2. In vermicompost the pH was recorded with slightly acidic condition in the ratio of 40:60 and control. Higher electrical conductivity (0.52±0.02) and moisture content (25.93±0.49) were observed in the ratio of 50:50 than the control, the percentage of the total organic carbon, total nitrogen, total phosphorous, total potassium, total sodium, total calcium and total magnesium were higher in 50:50 ratio over the control. The sulphur content was significantly higher in control when compare to other ratios. Percentage of total calcium and total magnesium were observed maximum in the ratio of 50:50. In vermicompost rubbish the pH was recorded with slightly acidic condition in the ratio of 40:60 and control. Higher electrical conductivity and moisture content were observed in the ratio of 50:50 than the control, the percentage of the total organic carbon, total nitrogen, total phosphorous, total potassium, total sodium, total calcium and total magnesium were higher in 50:50 ratio over the control. The sulphur content was significantly higher in control when compare to other ratios. Percentage of total calcium and total magnesium were observed maximum in the ratio of 50:50. In vermiwas the p^H was recorded with slightly alkaline condition in the all concentrations. Higher electrical conductivity was observed in 60:40 concentrations, the percentage of the total organic carbon, total nitrogen, total phosphorous, total potassium, total sodium, total calcium and total magnesium were higher in 50:50 concentration. The sulphur content was significantly higher in 60: 40 concentrations. Percentage of total calcium and total magnesium were observed maximum in the ratio of 50:50.

Brinjal plants were grown with vermicompost and number of leaves was recorded at different interval days, maximum number of leaves was recorded in 50:50 ratio compared with other ratio, when plant height was recorded at different interval days, maximum height was observed in 50:50 ratiothan other ratios, number of flowers were recorded at different interval days, maximum number of flowers were recorded in 50:50 ratio compared with others, number of fruits was observed at different days interval and the maximum number of fruits were recorded in 50:50 ratio when compared with others, weight of the fruits were recorded at different days interval, *i.e.,* 0, 30, 60 and 90 days, maximum weight of fruits were recorded in 50:50 ratio and the were presented in Fig.1. Growth and yielding pattern of brinjal plant by the application vermicompost rubbish during plantation of sapling was recorded and presented in Fig. 2. Brinjal plants were grown with vermicompost rubbish and number of leaves was recorded at different days interval, *i.e.,* 0, 30, 60 and 90 days, maximum number of leaves were recorded in 50:50 ratio, maximum plant height was recorded in 50:50 ratio, number flowers was recorded in 50:50 ratio, maximum number of fruits were recorded in 50:50 ratio and maximum weight of fruits were recorded in 50:50 ratio compared with other ratios. Brinjal plants were grown with vermiwash and number of leaves were recorded at different days interval, *i.e.,* 0, 30, 60 and 90 days (Fig.3), maximum number of leaves were recorded in 50:50 ratio, maximum plant height was recorded in 50:50 ratio, maximum number of flowers were recorded in 50:50 ratio at 60 and 90 days compared with other ratio, maximum number of fruits were recorded in 50:50 ratio at 60 and 90 days, maximum weight of the fruits were recorded in 50:50 ratio at 90 days only.

The physicochemical properties of available nutrients in the soil before and after cultivation of brinjal plants were recorded and presented in Table: 3. Nutrients such as pH, Electrical conductivity (dSm^{-1}), Moisture, Organic Carbon, Nitrogen ,Phosphorous, Potassium, Sodium, Sulphur, Calcium, Magnesium and C:N ratio were increased in all three experimental plots (40:60,50:50 and 60:40) after cultivation, compared with control plot. Among these three concentrations, the nutrient level was observed significantly high in 50:50 concentrations. The range of nutrients was pH (7.3±0.15), Electrical conductivity (0.11±0.00), Moisture (75±4.29), Total Organic Carbon (9.95±0.36), Total Nitrogen (0.81±0.07), Total Phosphorous (0.41±0.04), Potassium (0.69±0.04), Total Sodium (1.07±0.15), Total Sulphur (1.45±0.18), Total Calcium (0.48±0.07), Total Magnesium (1.68±0.14) and C:N (9:1).

DISCUSSION

In the present investigation, Physico-chemical analysis of vermicompost, vermicompost rubbish and vermiwash were showed significant level in all ratio. These findings are agreed with recent reports, Manyuchi (2013) reported that the

vermicompost and vermiwash had a neutral pH, particularly the electrical conductivity was 21% higher in the vermicompost. The nitrogen and potassium content was 57% and 79.6% richer in the vermicompost respectively compared to the vermiwash. However, the vermiwash was 84% richer in phosphorous as compared to vermicompost. Furthermore, the vermiwash was 89.1% and 97.6% richer in Ca and Mg respectively and was 97.8% richer in Na salts compared to the vermicompost. The earthworms also enhance the nitrogen levels of the substrate by adding their excretory products, mucus, body fluid, enzymes and even through decaying tissues of dead worms in vermicomposting sub-system (Suthar, 2007). (Atiyeh *et al*, 2001 and Klock, 1997) reported that electrical conductivity of planting media substituted with vermicomposts increased in the range of 1.3 to 2.8 times over those untreated control. Since most of the mineral nitrogen in vermicompost is usually in the nitrate form (Atiyeh *et al*., 2001; Orozco *et al*., 1996), it was not surprising that amounts of nitrates in the planting media increased with the increasing vermicompost concentrations (Atiyeh *et al*., 2001). The results associated with Kaviraj and Sharma (2003), acid production during organic matter decomposition by the microorganisms is the major mechanism for solubilisation on insoluble P and K. Therefore, the presence of large number of microflora in the gut of earthworm might play an important role in increasing P and K content in the process of vermicomposting. The P content also a direct action of earthworm gut enzymes and indirectly by stimulation of the microflora (Satchell and Martein, 1984) due to bacterial and faecal phosphate activity of earthworms that probably lead towards mineralization and mobilization of phosphorus (Edwards and Lofty, 1972). Other micronutrient elements which are required by plants in very low concentrations for adequate growth and reproduction. Despite their low concentrations within the plant tissues and organs, micronutrients are of equal important to macronutrients for the nutrition of plants that are essential for the growth and development (Kirkby and Romheld, 2004).

The earthworms also enhance the nitrogen levels of the substrate by adding their excretory products, mucus, body fluid, enzymes and even through decaying tissues of dead worms in vermicomposting sub-system (Suthar, 2007). The observed pattern for nitrogen enhancement in casts appears to be related with quality of the substrate used for worm feed. Flegel and Schreder (2000) demonstrated a significant correlations of the enzymes activities (dehydrogenases, acid and alkaline phosphomonesterase; indicating microbial decomposition in worm's gut) in the earthworm casts with their organic C and total nitrogen content. They observed that activities of these enzymes were influenced by the food, which affects the specific nutrient status of the casts (Oyedele *et al*., 2005). It is also suggested that the chemistry of plant residues can also influence the decomposition and mineralization rate in vermicomposting system. Elvira *et al*. (1998) concluded that Total Kjeldhal Nitrogen increased significantly by the end of the vermicomposting period, probably because of mineralization of the organic matter. However, the amount of N accumulated in earthworm casts indicates the quantity of total N content in substrate used for worm feeding (Kale *et al*., 1982). According to Lee (1992), the passage of organic residue through the gut of earthworm, results in phosphorous converted to forms, which are more available to plants. The release of phosphorous in available form is performed partly by earthworm gut phosphatases, and further release of P might be attributed to the P-solubilizing microorganisms present in worm casts. Le Bayon and Binet (2006) observed earthworm-mediated phosphatase enhancement in soils. According to Barois and Lavelle (1986), the earthworm primes its symbiotic gut micro flora with secreted mucus and water to increase their degradation of ingested organic matter and the release of metabolites.

Earthworms also have a great impact on nitrogen transformations in manure, by enhancing nitrogen mineralization, so that mineral nitrogen may be retained in the nitrate form Atiyeh *et al*. (2000). However, in general the final N content of compost is dependent on the initial N present in the waste and the extent of decomposition (Crawford, 1983; Gaur and Singh, 1995). Earlier reports, Earthworms play in the important role for recycling of nutrients, soil structure, soil productivity and agriculture, and their application in environment and organic waste management is well understood (Edwards *et al.,* (1995); Tomlin *et al.,* (1995); Shuster *et al.,* (2000); Ansari and Ismail, (2001a, b) stated that a large fraction of organic matter in the initial substrates was lost as CO2 (between 20 and 43% as total organic carbon (TOC) by the end of the vermicomposting period. It is suggested that the body fluids and excreta secreted by earthworms (e.g. mucous, high concentration of organic matter, ammonium and urea) promote microbial growth in

vermicomposting sub-system. The results observed in this study are consistent with previous work (Kale *et al*., 1982; Elvira *et al*., 1998; Suthar, 2007) that reported significant decline in organic C content after worm inoculation. Moreover, in this study, there was a significant difference among feed mixtures for organic matter decomposition rate; possibly due to different rate of enzyme activity related to carbon mineralization. The activities of enzymes related to the organic matter decomposition in vermicomposting system is directly related to the food quality (Flegel and Schreder, 2000) used as feed for worms. Carbon/nitrogen ratio of substrate material reflects the organicwaste mineralization and stabilization during the process of composting or vermicomposting. The loss of carbon as carbon dioxide through microbial respiration and simultaneous addition of nitrogen by worms in the form of mucus and nitrogenous excretory material lowered the C:N ratio of the substrate.

Soil analyses after the vermicompost applications showed marked improvements in the overall physical and biochemical properties of the soil. A surface application of vermicompost derived from grape marc, spread under grape vines covered with a straw and paper mulch increased yields of a grape variety Pinot Noir by 55%. The increases in yields included large increases in both bunch-weights and bunch numbers and no losses in flavor. (Buckerfield and Webster, 1998). Venkatesh *et al* (1998) reported that yields of Thompson Seedless grapes were significantly greater when vermicomposts were applied. Seyval grapes produced greater marketable yields, more fruit clusters per vine and bigger berry sizes after applications of food waste and paper waste vermicomposts at rates of 2.5 t/ha or 5 t/ha supplemented with inorganic fertilizers. Reddy and Reddy (1999) reported significant increases in micronutrients in field soils after vermicompost applications compared to those in soils treated with animal manures. In other experiments, amounts of soil nitrogen increased significantly after incorporating vermicomposts into soils (Sreenivas *et al*, 2000; Kale *et al*, 1992; Nethra *et al*, 1999) and the amounts of P and K available also increased (Venkatesh *et al*, 1998). Goh and Haynes (1977) reported that plant growth is generally optimized when the p^H is between 5.0 and 6.5. The vermicomposted pig solids had a p^H of 5.3, whereas the food waste vermicompost and all the composts used had an alkaline pH (between 6.8 and 8.1). It is possible that the high pH of these materials have raised the p^H of the container medium to a degree proportional to the amount of vermicompost or compost incorporated (Gallardo-Lara & Nogales 1987), resulting in a reduced plant growth as compared to that in media with vermicomposted pig wastes.

Gupta *et al*., (2013) reported in his study, the best growth and yield of both chilli, brinjal and tomato plants were recorded under the treatment 'vermicompost + farm yard manure' treatments which reveals that the use of vermicompost can effectively minimize the use of chemical fertilizers (This finding is in accordance to Atiyeh *et al*. (1999, 2000), Kolte *et al*. (1999) and Rafi *et al*. (2002) who have reported that substitution of vermicompost with inorganic fertilizer or ready made potting media results in the highest vegetation growth and yield. Kolte *et al*. (1999) reported higher uptake of micronutrients by the tomato plants provided with 'vermicompost + FYM' and found significantly higher amounts of total soluble salts and ascorbic acid in tomato fruits obtained from the above treatment. Adhikary and Gantayat (2012) have been reported, among organic fertilizers, vermicompost showed significantly higher vegetative growth and bimolecular content. The pot experimental studies suggest the possibility of using vermicompost as source for crop improvement and also three organic fertilizers viz. vermicompost, cow dung compost and leaf compost enhanced significantly all the parameters (chlorophyll content, carbohydrate and protein content of leave) over control in the chilli plant. Hirumani and Kumari (2004) on protein content of leave in chilli.

Bio-fertilizers (Vermiwash and vermicompost) contribute macronutrients and micronutrients in amount that is required by plants. According to (Lalitha *et al*., 2010), applications of organic fertilizers have an emphatic effect on plant growth and production. The soil enriched with vermicompost provides additional substances that are not found in chemical fertilizers (Kale, 1998, Ansari, 2008). The various aspects of study such as germination percentage, Hypocotyl length and radical length were done in the petriplate grown seeds of *Phaseolus aureus* and *Hibiscus sabdarif*a. Studies on germination were done to determine how vermiwash affects the germination rate and brings about enhancement of seedling growth (Fathima and Sekar, 2014).

Earthworm lives in moist soil, if by chance water logged condition exists around them, simply through body wall water enters into the coelomic cavity due to integumentary, pharyngeal and septal nephridia which have osmoregulatory and excretory functions. Such excluded and excess water released with organic, inorganic materials, symbiotic gut bacteria and fungi along with pullets is vermiwash. Vermiwash provided all essential inputs to mango crop for metabolism and growth which has resulted in increase in size, test and luster of the fruits and finally the production of fruits both qualitatively and quantitatively (Sathe and Patil, 2014). According to Patil *et al*, (2008) vermiwash acts as plant tonic, because it contains microorganisms, actinomycetes, enzymes, hormones and multi nutrients. These characteristics increased 15% vegetative and reproductive growth in fruit trees and flowering plants which resulted in increase 40% to 80% yield of the crops. Vermiwash increased disease resistance capacity in many agricultural crop plants against various bacterial, vital and fungal diseases. Patil *et al*, (2007) also reported that if vermiwash is used in nursery for mulberry cutting and grafting layering affects 80% or more. Vermiwash is very good foliar spray which prevents detachment of flowers, helps in fruit setting.Using vermiwash and vermicompost may attribute the significant increase in nitrogen of the soil by using vermiwash and vermincompost due to the presence of nitrogen fixing bacteria, which increase the nitrogen content of the soil (Lalitha *et al*., 2000; Ansari, 2008a). In conclusion, the results of this study indicate that incorporation of vermicompost, vermicompost rubbish and vermiwash enhanced the plants growth and yielding. This study also indicates that vermiwash and vermicompost could be utilized effectively for sustainable plant production at low input-basis.

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Table 1. Harvesting and quantification of vermicompost and vermicompost rubbish

S. No.	Name of the end product	Ratio	Quantity of end product from 1000 kg
1	Vermicompost	Control	864 kg
		40:60	876 kg
		50: 50	838 kg
		60:40	841 kg
2	Vermicompost rubbish	Control	118 kg
		40:60	108 kg
		50: 50	111 kg
		60:40	102 kg

]

Table 2: Physico-Chemical nutrient analyses of vermicompost, Vermicompost rubbish and Vermivash

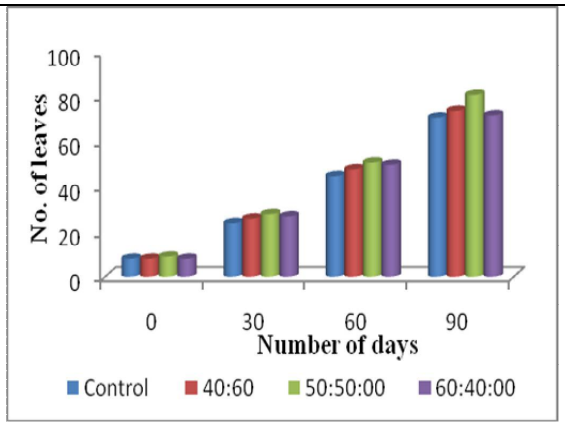
Name of the parameters	Different ratio of vermicompost				Different concentration of vermicompost rubbish				Different concentration of vermiwash		
	Control	40:60	50:50	60:40	Control	40:60	50:50	60:40	40:60	50:50	60:40
p^H	6.8±0.16	6.66±0.24	7.06±0.32	7.13±0.47	6.42±0.14	6.81±0.16	7.02±0.17	7.31±0.18	6.73±0.16	7.19±0.16	7.11±0.23
Electrical conductivity(dSm^{-1})	0.49±0.01	0.52±0.02	0.52±0.02	0.51±0.01	0.21±0.01	0.21±0.01	0.23±0.02	0.24±0.02	0.51±0.00	0.47±0.01	0.57±0.01
Moisture (%)	21.7±0.41	23.5±0.52	25.93±0.49	24.86±0.53	23.5±0.35	24.6±0.46	26.85±0.46	25.74±0.47	3.29±0.43	3.53±0.06	3.28±0.05
Total Organic carbon (%)	12.33±0.28	13.34±0.35	13.38±0.41	13.02±0.32	12.43±0.18	13.83±0.7	13.89±0.27	13.16±0.2	1.64±0.06	1.80±018	1.72±0.08
Total Nitrogen (%)	1.630±0.07	1.72±0.03	1.84±0.02	1.81±0.02	1.21±0.07	1.65±0.05	1.73±0.08	1.36±0.06	1.31±0.06	1.54±0.05	1.53±0.14
Total Phosphorous (%)	1.21±0.06	1.35±0.08	1.75±0.02	1.48±0.03	1.21±0.03	1.06±0.04	1.43±0.05	1.41±0.02	2.14±0.08	3.53±0.02	2.98±0.03
Total Potassium (%)	0.97±0.00	1.23±0.03	1.64±0.34	1.45±0.04	0.93±0.01	1.27±0.06	1.40±0.06	1.35±0.02	3.03±0.04	3.21±0.02	2.82±0.07
Total Sodium (%)	1.37±0.08	1.54±0.04	1.78±0.02	1.42±0.07	1.39±0.05	1.45±0.06	1.64±0.04	1.38±0.07	2.28±0.03	2.32±0.07	2.41±0.12
Total sulphur (%)	2.61±0.29	2.18±0.25	2.34±0.28	2.42±0.31	2.59±0.14	2.13±0.15	2.26±0.09	2.37±0.08	2.46±0.03	3.60±0.07	3.32±0.02
Total Calcium (%)	1.34±0.04	1.46±0.03	1.79±0.07	1.72±0.02	1.21±0.07	1.35±0.06	1.74±0.04	1.69±0.02	2.81±0.04	3.26±0.02	3.15±0.03
Total Magnesium (%)	1.56±0.03	1.46±0.04	1.75±0.02	1.75±0.03	1.34±0.05	1.48±0.03	1.82±0.07	1.41±0.01	1:3	1:3	1:3
C:N ratio	12:1	13:1	13:1	13:1	1:12	13:1	13:1	13:1			

Values represent mean ± S.D of three replications

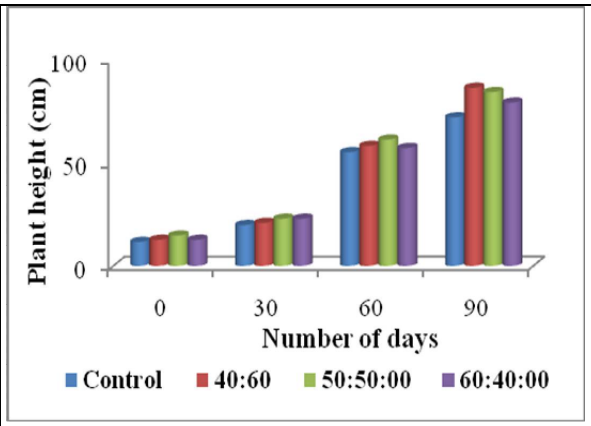
Table 3 : Physicochemical properties of cultivated plot soil before and after cultivation of brinjal plant

Name of the parameter	Before the application of the vermi compost	After apply the vermicompost				Before apply the vermi compost rubbish	After apply the vermicompost rubbish			
		Control	40:60	50:50	60:40		Control	40:60	50:50	60:40
pH	6.3±0.02	6.5±0.12	76.9±0.03	7.3±0.15	7.2±0.17	6.3±0.17	6.5±0.36	6.9±0.25	7.2±0.38	7.1±0.32
Electrical conductivity(dSm^{-1})	0.11±0.00	0.11±0.00	0.11±0.00	0.11±0.00	0.11±0.00	0.12±0.00	0.12±0.00	0.12±0.00	0.13±0.00	0.12±0.00
Moisture (%)	62±3.54	71±5.02	74±4.15	75±4.29	75±2.38	59±4.22	67±4.29	72±6.25	73±4.37	73±4.93
Total Organic Carbon (%)	7.21±0.57	7.87±0.19	9.32±0.21	9.95±0.36	9.37±0.24	6.34±0.52	7.32±0.45	8.38±0.32	9.21±0.64	9.11±0.38
Total Nitrogen (%)	0.31±0.05	0.53±0.03	0.69±0.04	0.81±0.07	0.73±0.02	0.31±0.06	0.43±0.05	0.58±0.07	0.72±0.04	0.68±0.05
Total Phosphorous (%)	0.15±0.03	0.23±0.05	0.32±0.06	0.41±0.04	0.35±0.06	0.17±0.01	0.24±0.06	0.32±0.05	0.38±0.06	0.36±0.11
Total Potassium (%)	0.49± 0.05	0.53±0.06	0.62±0.07	0.69±0.04	0.68±0.03	0.43± 0.03	0.53±0.04	0.64±0.02	0.71±0.07	0.62±0.03
Total Sodium (%)	0.86±0.15	0.92±0.09	0.98±0.18	1.07±0.15	1.03±0.31	0.83±0.16	0.82±0.15	0.86±0.13	0.87±0.09	0.87±0.06
Total Sulphur (%)	1.24±0.17	1.39±0.23	1.43±0.17	1.45±0.18	1.42±0.21	1.17±0.14	1.30±0.39	1.43±0.25	1.52±0.27	1.66±0.38
Total Calcium (%)	0.31±0.03	0.37±0.04	0.41±0.04	0.48±0.07	0.39±0.04	0.31±0.02	0.36±0.04	0.41±0.05	0.44±0.02	0.39±0.03
Total Magnesium (%)	1.47±0.11	1.49±0.13	1.53±0.19	1.68±0.14	1.62±0.18	1.53±0.15	1.45±0.36	1.56±0.42	1.62±0.31	1.74±0.24
C:N ratio	7:1	7:1	9:1	9:1	9:1	6:1	7:1	8:1	9:1	9:1

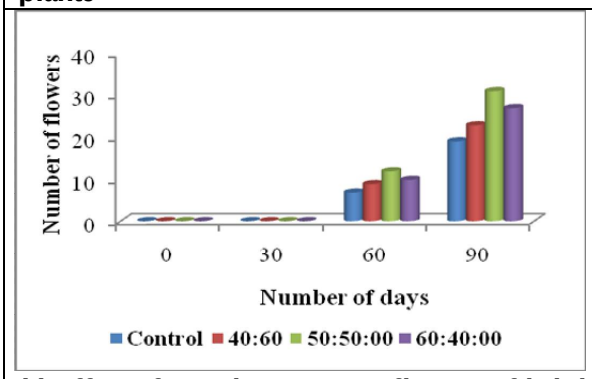
#Mean and standard deviations were obtained from 3 replicates



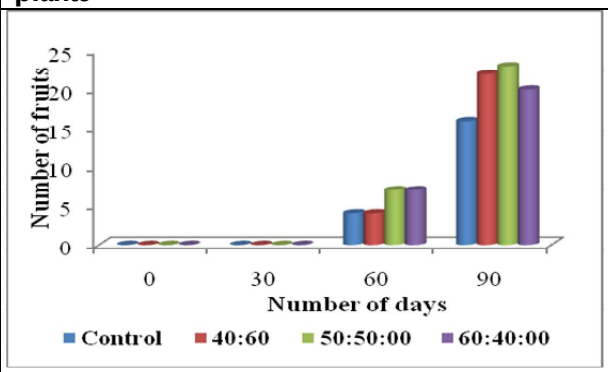
(a) Effect of vermicompost on leaves of brinjal plants



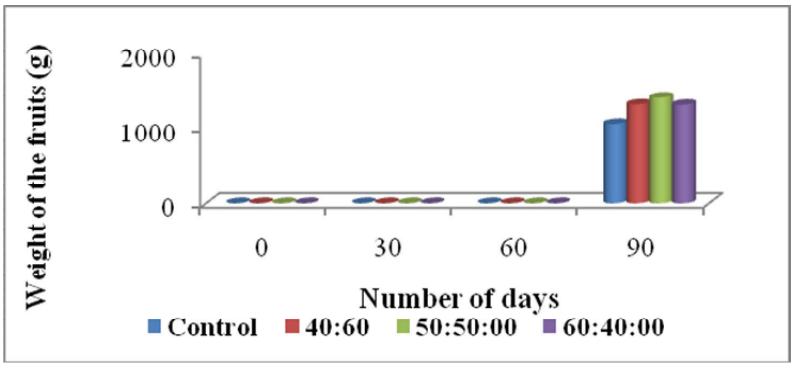
(b) Effect of vermicompost on height of brinjal plants



(c) Effect of vermicompost on flowers of brinjal plants

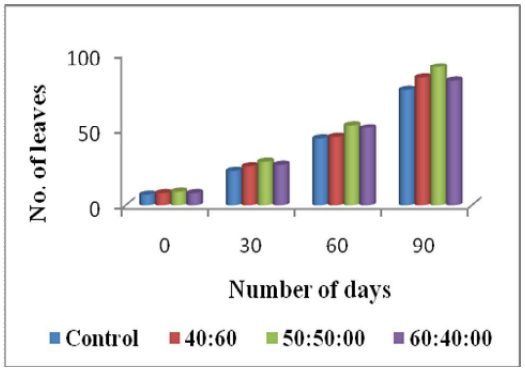


(d) Effect of vermicompost on fruits of brinjal plants

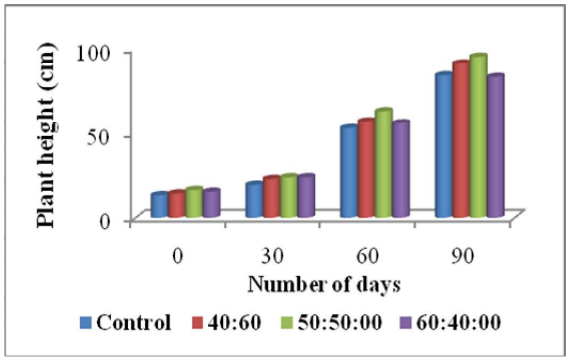


(d) Effect of vermicompost on fruits (weight) of brinjal plants

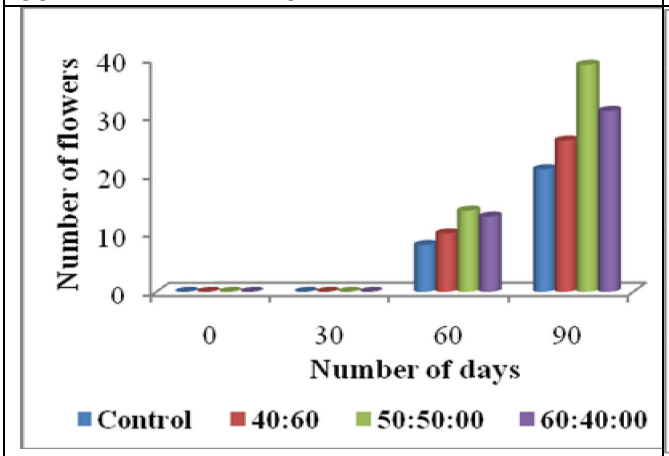
Figure 1.



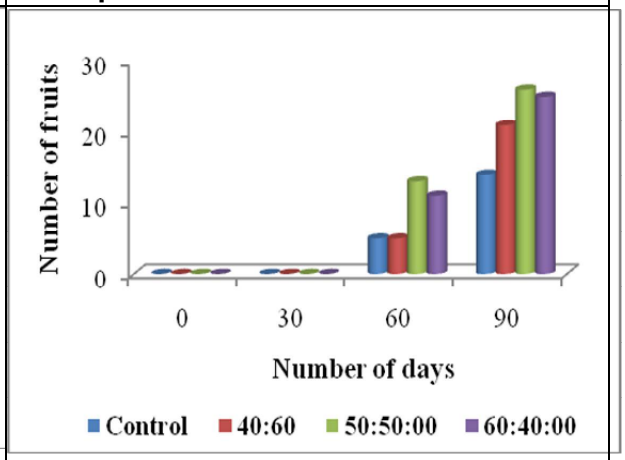
(a) Effect of vermicompost rubbish on leaves



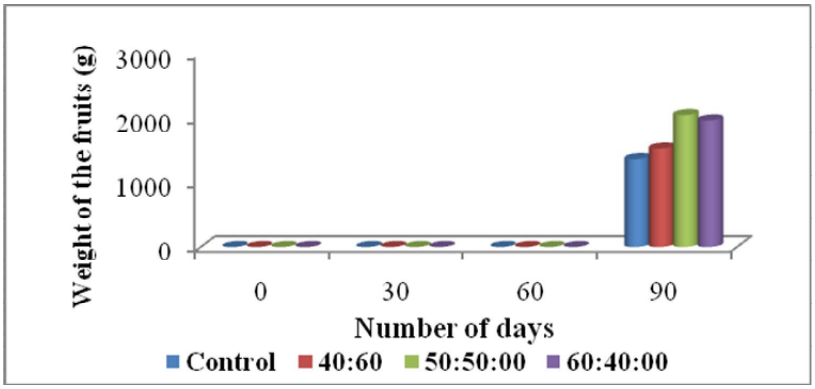
(b) Effect of vermicompost rubbish on height of the plants



(c) Effect of vermicompost rubbish on flower

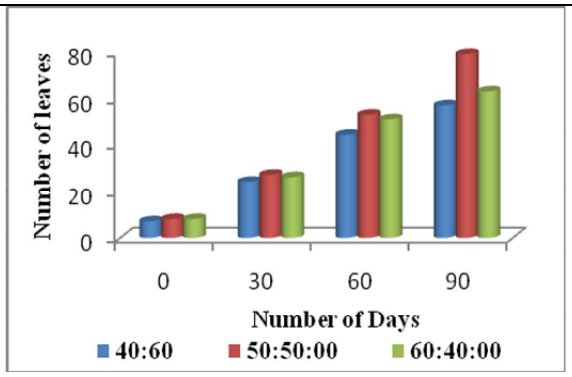


(d) Effect of vermicompost rubbish on fruits

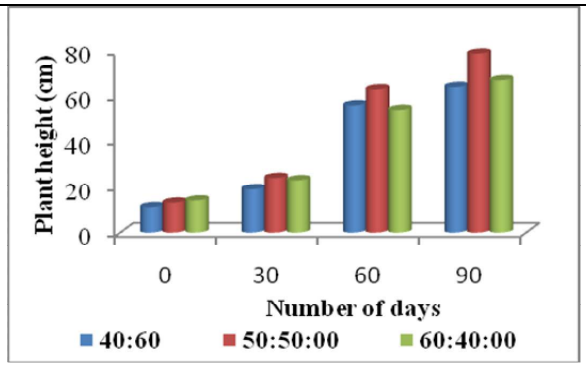


(e) Effect of vermicompost rubbish on fruits (weight) of brinjal plants

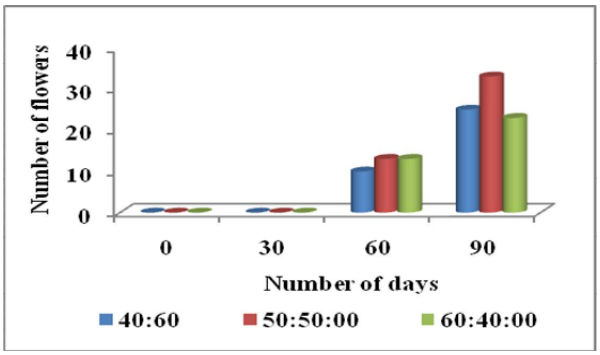
Figure 2.



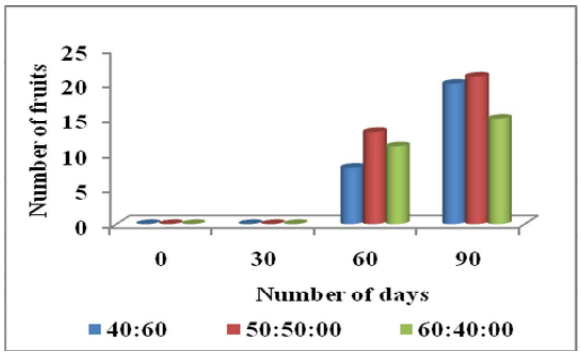
(a) Effect of vermiwash on leaves of brinjal plants



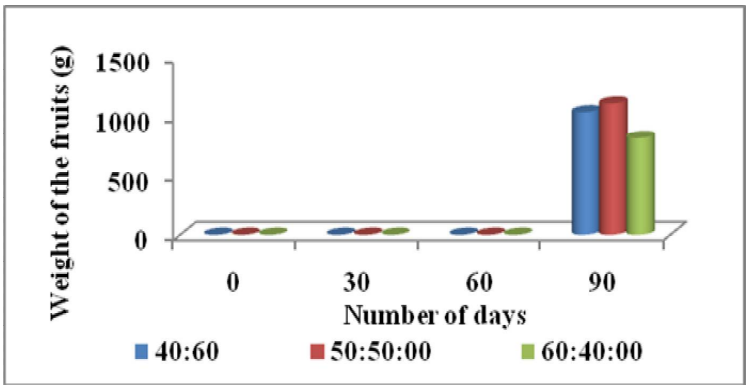
b) Effect of vermiwash on height of brinjal plants



c) Effect of vermiwash on flowers of brinjal plants



d) Effect of vermiwash on fruits of brinjal plants



e) Effect of vermiwash on fruits of brinjal plants

Figure 3.

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RESEARCH ARTICLE

Performance of Underwater Wireless Optical Communication System under Salty Water

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ABSTRACT

In this research, texts were sent using underwater wireless optical communication (UWOC) system with 9.6kb/s over (1) m channel length in laboratory using pulse width modulation for clear water and clear water with different concentration of salt sodium chloride (NaCl) from (0.125) g to (1) g. In this study the laser source of wavelength (650) nm was used with power of (80) mw. The signal was modulated by pulse width modulation PWM and transmitted through clean and salty water. The salt of sodium chloride added to water with different concentration. The results showed that when the salt concentration increased, the received power and signal to noise ratio (SNR) would decrease, the symbol error rate (SER) and attenuation coefficient (α) were increased.

Keywords: Underwater Wireless Optical Communication System, Sodium Chloride,Pulse Width Modulation, Signal to Noise Ratio, Symbol Error Rate.

INTRODUCTION

UWOC has recently been introduced to meet a number of demands in various underwater applications due to its scalability, flexibility, and reliability. As opposed to its traditional counterpart, namely acoustic communication, optical transmission has higher bandwidth, better security, and lower time latency. This enables UWOC as a powerful alternative for the requirements of high-speed and large-data underwater communications such as imaging, real-time video transmission, high-throughput sensor networks, etc. [1–5]. Optical transmittance in an underwater medium such as clear, ocean, turbid and harbor or other types will show big variation when examined versus the wavelength. The large information bandwidth available at visible wavelengths has also opened the possibility for high-speed, wireless communications in the underwater environment. Unfortunately, the propagation of light underwater is affected by both absorption and scattering [6].

The coefficient of beam attenuation α (λ) is a measure of the decay of the unscattered light and can be expressed the Beer–Lambert law as [7]:

$$P_R(\lambda) = P_T e^{-\alpha(\lambda) r} \quad \text{..... (1)}$$

Where $P_T(\lambda)$ is the transmitted optical power, $P_R(\lambda)$ is the received optical power, and r is the path length in the water. The transmittance of an underwater beam can determine as the following expression [7]:

$$T(\lambda) = \frac{P_R(\lambda)}{P_T(\lambda)} \text{..... (2)}$$

Therefore, $\alpha(\lambda)$, can be written in terms of the transmittance as [7]:

$$\alpha(\lambda) = \frac{1}{r} \ln \frac{1}{T(\lambda)} \quad \text{..... (3)}$$

Where $\alpha(\lambda)$ varies with water depth and temperature. The corresponding expression will be [7]:

$$r(m) = \frac{1}{\alpha(dB/m)} 10 \log_{10} \frac{P_T}{P_R} \text{..... (4)}$$

The relation of signal power to the noise power is referred as signal to noise ratio (SNR). It has calculated in terms of voltages or powers [8]. In order to calculate it in term of powers, equation is used [9]

$$SNR = 10 \log_{10} \left[\frac{P_S}{P_n} \right] \quad \text{..... (5)}$$

Where P_s is the average symbol power, P_n is the average noise power.

EXPERIMENTAL SETUP

The experimental establishment of an underwater wireless optical communication system depends on a directly modulated laser diode of (650) nm wavelengthas illustrated in figure (1, 2). At the transmitter side, the electrical signal has obtained from a PC to Arduino which controls pulses width of the data transmitted bit stream. The data rate was 9.6kb.s which modulated over laser by pulse width modulation. The applied voltage of the laser is (6) V to adjust optical power of the utilized lasers equal to (80) mW for (650) nm. In order to perform the modulation process of a semiconductor laser diode, the signal has used a laser driver circuit; it is an electronic circuit supplies the signal by a higher switching speed and receiver by slot synchronization transmitted signal for each singlepulse. The optical signal has transmitted through water tank of dimensions (1× 0.3× 0.4) m length, width and height respectively which contained (60) litters of clear water. The minimum available thickness of glass was (3) mm.The transmitted signal passing through water tank, the information has acquired by photoresistor (LDR) to detect the signal and convert the optical to electrical signal and analysis the received signal that reaches to an Arduino in order to demodulate the electrical signal in which converted by photosesistor then received to PC as received message.The sodium chloride (NaCl) was added to the clear water channel at specific mass rates (0.125, 0.25, 0.5, 0.75, and 1) g.

RESULTS AND DISCUSSION

Figure (3) shows the received power for various concentration of NaCl in clear water channel.The maximum received power (32)mW when the concentrations of NaCl were (0) and (0.125) g in clear waterchannel. Reception power drops from (32) mW to (13) mW.The receiving power fell when the concentration of NaClwasincreased in clear water channel.This because that attenuation which arises from absorption and scattering along water channel, absorption is the dominate phenomena in attenuation. SNR for different concentration of NaCl in clear water channel as demonstrated in figure (4).Maximum SNR was (24.637) dB when the concentrations of NaCl were(0) and (0.125) g in clear water channel. SNR dropped from (24.637) dB to (20.725)dB when the concentration of NaCl was raised from (0) to (1) g in clear water channel. As illustrated the signal to noise ratio was directly proportional to received power. Figure (5) appears the SER for different concentration of NaCl in clear water channel. SER is the relation of the number of received error symbols to total number of received symbols.The value of SER is (0) when the concentration of NaCl ranges from (0) to (0.5) g in clear water channel, but it is (0.114) when the concentration of NaCl is (1) g in clear water channel. SER value increased due to excessed concentration of NaCl above mass rate (0.5) g in clear water channel.

Fig. (6) appears the calculated attenuation coefficient for different concentration of NaCl in clear water channel. It has increased from (2.216) dB/m to (8.75) dB/m when the concentration of NaCl range from (0) to (1) g in clear water channel. However, the maximum attenuation achieved at high concentration of NaCl is (1) g which was (8.75) dB/m. The attenuation of the absorption coefficient is dominant which is caused by the presence of NaCl in clear water channel.

CONCLUSION

In this paper, an experimentally system was examined to assess the performance of UWOC under clear and salty water. The system used PWM to modulated signal over laser diode with 650 nm. To test the quality of the system, a different metric used such as received optical power, SNR, SER and attenuation coefficient. The results show that the increasing the salinity of water lead to decreasing in the received optical power and increases in SER.

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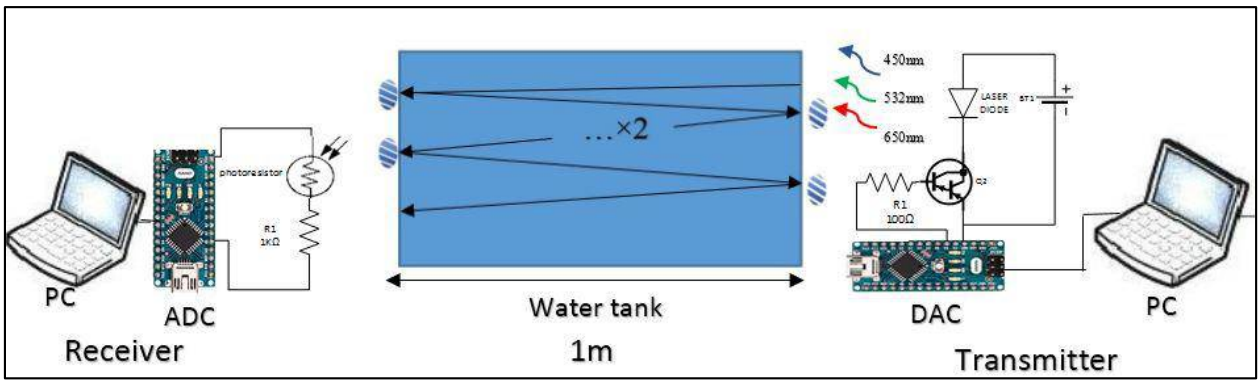

Figure 1. Schematic diagram of an UWOC system:computer (PC), digital to analog sconvertor (DAC), laser diode (LD),water tank,photoresistor (PR), analog to digital convertor (ADC).

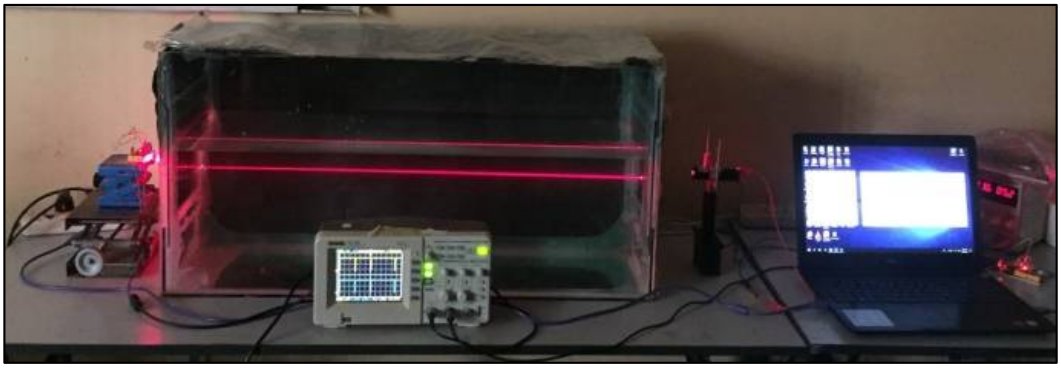

Figure 2. Experimental setup of an UWOC system using laser diode source (650) nm.

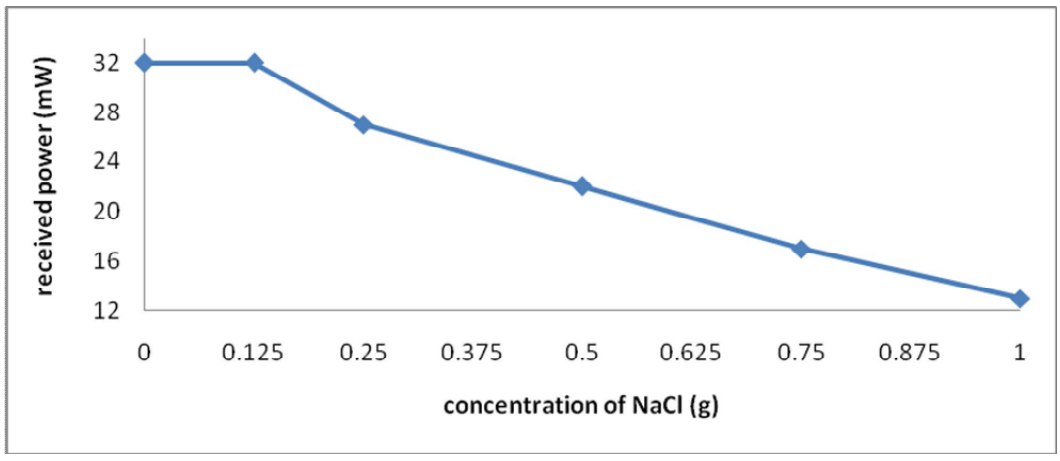

Figure 3. The received power vs.concentration of NaCl

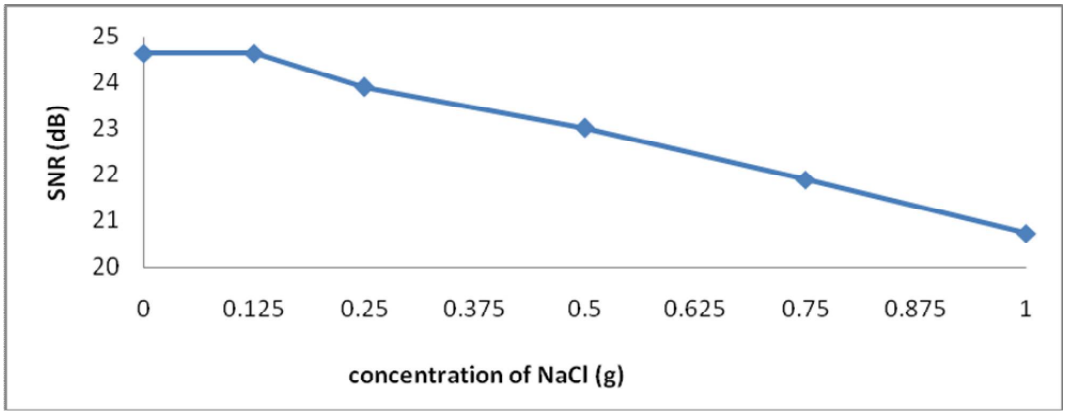

Figure 4. SNR vs. concentration of NaCl.

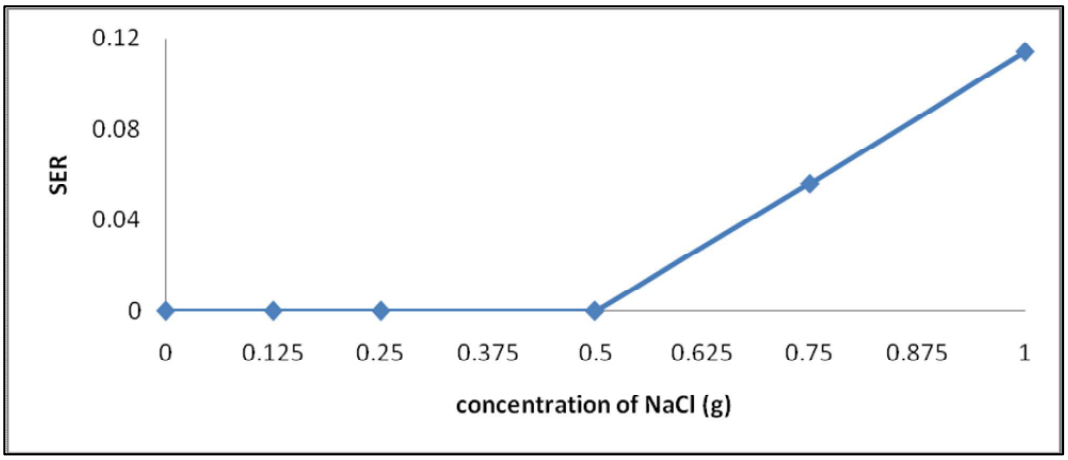

Figure 5. SER vs. concentration of NaCl.

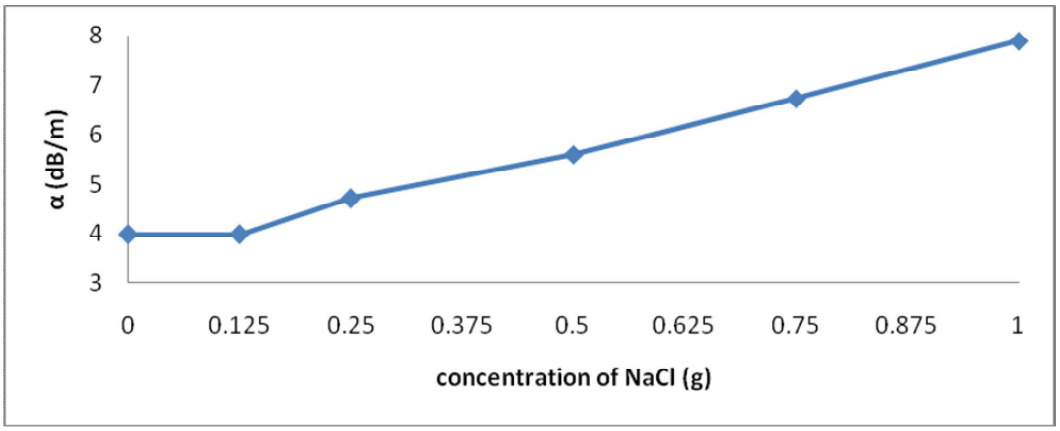

Figure 6. Attenuation coefficient vs. concentration of NaCl.

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RESEARCH ARTICLE

The Effect of Magnetic Water on the Performance of Al-Awassi Sheep Breed

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ABSTRACT

This study was conducted in orderto determine the effect of magnetic water on performance, biochemical and some milk composition of ewes.For that purpose, twelve ewes were used. These ewesdistributed randomly into three equal groups (4 ewes per each group). The first grouptreated witha tap water and considered as control group. Second group treated by a magnetic-treated water with 250gauss. Finally, third group received magnetic–treated water(250 gauss) mixed with molasses (250 g/20 litters).All groups were fed by the same ration during the experiment. The experiment was lasted for about 6 weeks. The results indicate that the administration of magnetic–treated water mixed with molasses resulted in a significant increase($P<0.05$) of live body weight. Furthermore, it also leads to enhance some biochemical parameters (total protein and glucose) and some of milk compositions (protein, fat and NSF). However, our results showedthat there was no significant differences were found in cholesterol, creatinine, AST and ALT during use of magnetic–treated water mixed with molasses.

Keywords: Ewes, magnetic water, milk composition.

INTRODUCTION

Water is essential for life of almost all living organisms.Water is very important for all vital functions and biochemical reactions in the living body. It regulates the transfer of all nutrients to cells, removing toxins and waste from the body and as well as regulation of the biological processes of a living cell like digestion and absorption (Ohno and Reminich (2001).The composition of water become more accurate when the water is passaged through a magnetic field which leads to increasing the liquidity and acquisition of the magnetic properties. This enhancesthe ability of water to dissolve minerals and vitamins and increases the speed of delivery materials to all parts of the body (Kronenberg, 1985).The principle of magnetic technology is based onthe fact of moving electric charge by the

ion form the magneticfield (Lin, 1989).The water is continuously passaged through a permanent magnet for a considerable time which produceswater that has magnetic charges and magnetic properties. Such magnetically treated water can decrease microbial burden and improve the immunity (Lam M, 2008). Following exposing water to strong magnetic field, the minerals contents of water are affected and its effects depended on the strength of magnetic field and exposure time. To date, the using of magnetic field to improve water quality becomes more frequent worldwide due to a lowcost comparing to chemical and physical treatments. In this context, it has been proposed that exposing water to a magnetic field led to increase the solubility of calcium salts which avoids the lame-scale deposition in pipes and cleans the water pipes from any lame-scales that were deposited in the past (Verma, 2011). The research which have conducted on a normal water indicated that the normal (untreated) water have negative changes following sterilization. Therefore, it called as a dead water. Therfore, magnetizingthe water would transfer the property of the water from dead to live (Batmanghelidj, 2005). By this view, this study is aimed to determine the ability of magnetized water (250 Gauss) in enhancingthe performance of the lambs and study the effects of that water on some biochemical traits.

MATERIALS AND METHODS

This study used 12 lambs aged 2-3 months in the field ofAl-Qezwenyaregion at Al-Najaf province duringMay 2012.Lambs were distributed equally into three groups (4 lambs/group) according to age and weight of each ewe.These eweswere numbered to beeasily distinguished. Administration of magnetically treated water for the animals was continuing for 46 days (01/05/2012 till 15/06/2012).The first group(control group) irrigatedwith tap water available in the field.The second group irrigated with magnetic water (250 Gauss) while the third group irrigated with magnetic water (250 Gauss) in addition to molasses (250 g/20 liter). Administration of magnetically treated water was performed by a water magnetizing equipment (Anticalcaire magnetigue RBM, Italy). Filling the water containers for each group was applied twice per day, at morning and at evening. Water changing was applied twice per day as well. All groupswere fed withabasal diet (table 1).

Blood collection and analysis

Blood samples were collected from the jugular vein of all ewes within each group once per week in the morning using the EDTA tubes.Serum samples were collected by centrifugation of the whole blood at 4000 rpm for 20 minutesand stored at -18°C. Blood serum samples were analyzed for determination of total protein% as described by Armstrong and Carr (1964), albumin (Doumas et al., 1971), glucose (Siest et al., 1981), cholesterol (Raltiff and Hall, 1973) and serum ALT (Alanine transaminase) and AST (aspartate aminotransferase) (Reitman and Frankel 1957). Globulin and albumin/globulin ratio were calculated.

DISCUSSION

Live weight

The treatment of (Magnetic water 250 gauss and molasses) in the last four weeks resulted in high rates of significances compared to the magnetic water or the tap water (Table 2). This seems to be as a result of the possibility that the magnetized watercouldenhance the growth rate of the treated animal and thus increasing the total animal weight compared to using the ordinary tap water (Bellokossy, 2000). Magnetic water also seems to be able to overstimulate the pituitary gland by increasing the secretion of thyroxin hormone from the thyroid gland. The thyroxin has multiple roles like: increasing the metabolic rate in the tissues and organs of the animal, increasing the absorption of monosaccharaides and fatty acids and increasing the metabolism of proteins. Therefore, this mechanism leads to increased weight in the body (Oba and Kimura, 1980; Santwani, 2000). Additionally, the molasses may stimulate the pancreas to secret the insulin which could lead to increase the appetite.

Blood serum

The magnetic water also seems to besignificantly (P<0.05)increased the concentration of total protein and glucose levels in the second, fourth, fifth and sixth weeks (Table 3). Remarkably, the magnetic water treatment produced better results comparedto both control and the magnetic water with molasses treated groups. However, the magnetic water and magnetic water with molasses treatmentsboth have no effect on cholesterol levels.The reason for the increased concentration of the total protein level may be due to the fact that the total protein is an indicator for a good growth in the animal total bodyweight.Therefore, the increases in the serum protein concentration could indicate that the animals are growing well and gaining more weight(Kaplan and Larsen 1985).The glucose was also increased in the serum of the animla of the second group. This result is compatible with the fact that the magnetically treated water increases the concentration of glucose in the blood (Goodmanand Blank 2002). Furthermore, these results also completely in agreement with (Shamsaldain and Al Rawee, 2012)who indicated that the use of magnetic water led to a significant increase in total protein levels and globulin. Finally, Table 4 shows no significant effect in Creatinine, AST and ALT respectively.The results of ALT and AST are considered as an indication fora healthy effect of magnetic water on the treated ewes.

Milk composition

It was observed that the magnetic water and the magnetic water and molasses both cause a significant (P<0.05) increases in most of the chemical components of milk (Table 5). The reason for the high fat content in milk may be due to the fact that magnetic water improves the general productivity of animalsincluding the tissues of udder (Bellokossy, 2000). It has been observed that using of magnetic water as a drink water for eighty-four dairy cows for seventy dayswas resulted in a significant increase in the milk fat level from 4% to 5.5% (Bellokossy, 2000). It is possible that the high levels of milk protein of the second and third groups is due tofact that the amount of milk protein is a proportional to the total amount of the produced milk (Sargolzehi *et al,.* 2010). However, the high percentage of milk proteincould be also due to the improvement of raw protein digestion.This is based on the ability of the magnetized water to enhance and increase the movement of the small intestine and improve and increase digestion and absorption of the diet(Barrett, 2002).In fact, most of milk components retained into the curd and whey protein. However, some of lactose and minerals are strained into the whey. Therefore, the higher NSF, fat and protein of magnetic groups owed to their higher content in milk. These results are compatible to those reported by (Mehana et al. 2004) and (Ibrahim et al. 2013).

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Table 1. Formulation of concentrate feed mixture and proximate analysis of the basal diet (BD).

Ingredients (g/kg of animal weight)	Control ration
Barley grain	69.0
Wheat bran	14.0
Soybean meal	14.6
Calcium Carbonate	1.3
Sodium Chloride	0.5
Calcium Phosphate	0.5
Trace elements & Vitamins	0.1
Dry matter % (DM)	88.55
Organic matter % (DM)	
Ash %	5.45
Crude protein%	13.60
Either extract %	4.66
Crude fiber %	8.40
Nitrogen free extract (NFE)%	67.89

The animals were weighted every week morning and normalized to the normal weight (50kg).

Table .2. Effect of magnetic water and molasses on the weight of Al-Awassi ewes.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Control	21±3.12	21±4.02	22±4.19 b	23±5.03 b	24±5.22 b	24±5. 35 b
Magnetic water 250 gauss	24±3.19	24±5.67	25±5.90 ab	27±6.08 ab	28±6.19 ab	30±8.12 ab
Magnetic water 250 gauss and molasses	25±9.06	25.7±8.22	29.5±7.78 a	32.5±10.04 a	32.8±9.29 a	33±12.14 a

Differences in the same Colum with different superscripts are statistically significant at P<0.05.

Table 3. Effectof magnetic water and molasses on some biochemical parameters.

	Control			Magnetic water 250 gauss			Magnetic water 250 gauss and molasses		
	Cholest (Mg/dl)	**T.P (g/dl)**	**Glucose (mg/dl)**	**Cholest (Mg/dl)**	**T.P (g/dl)**	**Glucose (mg/dl)**	**Cholest(Mg/dl)**	**T.P (g/dl)**	**Glucose (mg/dl)**
W1	128.3± 22.1	0.3± 0.10	121.9± 0.44	132.3± 27.1	0.4± 0.05	128.5± 0.34	62.8± 13.9	0.4± 0.02	162.8± 0.23
W2	125.2± 27.3	0.4± 0.05	133.8± 0.25 b	129.7± 31.0	0.3± 0.06	140.1± 0.29 ab	139.5± 29.4	0.5± 0.05	159.3± 0.19 a
W3	130.8± 28.3	0.4± 0.09	138.4± 0.22	148.4± 39.2	0.4± 0.02	134.8± 0.51	122.3± 18.1	0.4± 0.03	154.1± 0.33
W4	120.6± 34.1	0.3± 0.03	124.7± 0.38 ab	136.5± 32.3	0.5± 0.01	122.2± 0.28 b	124.5± 19.0	0.4± 0.08	169.3± 0.45 a
W5	145.2± 76.1	0.4± 0.03 b	131.9± 0.33 b	121.6± 22.8	0.5± 0.01a	136.8± 0.20 ab	132.9± 24.2	0.5± 0.09 ab	147.5± 0.23 a
W6	138.3± 55.2	0.4± 0.07 b	129.0± 0.32	166.6± 49.6	0.6± 0.04 a	157.8± 0.34	127.1± 21.4	0.5± 0.05 ab	140.8± 0.34

(Differences in the same row with different superscripts are statistically significant at P<0.05.)T.P: Total protein Cholest: cholesterol

Table 4. Effect of magnetic water and molasses on some liver and kidney function.

	Control			Magnetic water 250 gauss			Magnetic water 250 gauss and molasses		
	Creatinine	**AST**	**ALT**	**Creatinine**	**AST**	**ALT**	**Creatinine**	**AST**	**ALT**
W1	0.7± 0.01	1018.3± 12.22	889.3± 31.32	0.9± 0.12	989.4± 27.08	996.0± 25.67	0.11± 0.22	1022.1± 24.00	967.4± 21.30
W2	0.7± 0.00	1012.7± 10.01	943.4± 22.08	0.7± 0.00	1002.3± 19.02	881.2± 33.27	0.9± 0.13	991.5± 29.11	882.2± 37.22
W3	0.8± 0.05	1009.2± 11.23	931.5± 26.78	0.8± 0.04	1014.1± 13.12	919.7± 27.54	0.8± 0.06	1012.2± 14.99	979.0± 30.70
W4	0.7±	1027.1±	892.1±	0.7±	998.9±	904.3±	0.9±	995.3±	918.3±

	0.01	16.03	29.80	0.02	25.01	28.06	0.12	23.02	26.44
W5	0.9± 0.11	1016.8± 18.09	898.2± 30.01	0.6± 0.00	992.8± 19.06	965.6± 26.67	0.9± 0.11	1008.2± 26.34	890.1± 29.78
W6	0.8± 0.06	998.4±2 1.02	901.4± 31.05	0.9± 0.12	1003.5± 20.01	971.8± 28.39	0.7± 0.01	1013.5± 19.09	977.9± 25.38

(Differences in the same row with different superscripts are statistically significant at P<0.05).

Table 5. Effect of magnetic water and molasses on some composition of milk.

	Control			**Magnetic water 250 gauss**			**Magnetic water 250 gauss and molasses**		
	protein%	Fat	NSF	protein%	Fat	NSF	protein%	Fat	NSF
W1	4.2± 0.04	6.2± 0.85	9.1± 0.03	4.3± 0.05	5.8± 0.78	9.0± 0.05	4.1± 0.03	5.4± 0.69	8.5± 0.13
W2	4.5± 0.05	4.3± 0.73	7.4± 1.09 b	4.4± 0.05	6.1± 0.90	10.2± 1.11 a	4.7± 0.07	7.1± 0.99	9.4± 0.18 ab
W3	4.9± 0.06	7.3± 0.89	10.2± 1.16	4.9± 0.04	7.4± 1.04	9.8± 1.22	5.1± 0.08	8.2± 1.10	10.0± 1.11
W4	4.0± 0.08 b	5.2± 0.81 b	9.3± 0.28 b	5.8± 0.09 a	6.9± 0.98 ab	10.7± 0.92 ab	5.7± 0.06 ab	8.4± 1.09 a	11.4± 1.02 a
W5	4.6± 0.03 b	5.9± 0.90 b	11.3± 1.23	5.5± 0.06 ab	7.5± 1.02 ab	11.1± 1.18	5.9± 0.05 a	9.1± 1.03 a	10.8± 1.30
W6	4.6± 0.04 b	6.3± 0.93 b	9.3± 1.21 b	5.4± 0.06 ab	8.1± 1.12 ab	10.6± 0.94 ab	5.4± 0.06 ab	7.9± 1.02 a	11.5± 1.04 a

(Differences in the same row with different superscripts are statistically significant at P<0.05)
NSF: non solids fat

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RESEARCH ARTICLE

Effect of Special Exercises Associated with P.N.F in Electrical Activity (EMG) of the Femoral Straight Muscle of Volleyball Players

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ABSTRACT

The importance of the use of special exercises and associated with the system of sensory receptors (PNF) in the benefit of the development of special strength and reflections caused by the prolongation and the occurrence of reflective actions performed through both spindles muscle and Collegi members of the string and respond to the change in the length of the muscle, especially during the processes of arousal And the suppression within the muscle groups where at the same time the player can be transformed from the defense to the state of attack and the effects of a relaxed muscle group and changed to a tight muscle group to meet the requirements of technical performance of skills and be more Economic success in performance and this is what can be supplied through the sensory nerve muscle receptors (PNF).The purpose of the research is to: Prepare special exercises accompanied by PNF in the development of some physical abilities and electrical activity (EMG) for the most important working muscles and accuracy of the beating performance of volleyball players, as well as to recognize the effect of special exercises associated with PNF in the development of some physical abilities and electrical activity (EMG) for the most active muscles.

Keywords: P.N.F,Electrical activity,Rate,Special exercises,Muscles

INTRODUCTION

The great scientific and technological developments witnessed in the sports fields imposed new horizons in all directions, including sports sciences such as sports training, which is witnessing a great development based on the foundations and theories of modern, especially after the overlap of science among them and the fall of the computer and the Internet, which contributed greatly to the flow of information that Many of the specialists and researchers in this field have benefited from this development. Volleyball is one of the collective games that require high physical abilities and compatibility between these abilities and this compatibility is not achieved until after the training is

integrated and scientifically informed and a solid basis, which is related to the development of the performance of players with muscle strength and here is the focus on the muscle strength of the type of specialized activity Which is the achievement of high achievement and decisive games where the skill is overwhelming beating of the most important skills through which to achieve victory, which requires the staff and experts in this area to adopt the curricula and plans of this modern training on the one hand, The skills of the players and their abilities in the requirements of the game specialized (physical, functional and skill), which allows to recognize the rates of development, and the skills of volleyball, which is the interval in winning the skill of beating overwhelming, which requires high physical capabilities in addition to the skill and is considered explosive power and flexibility is the basis that Adopt the skill of beating overwhelming because of the specificity of performance, which requires that there is a great interest in the development of training curricula to train these skills as well as the use of methods and methods or methods of training are in this direction, and these methods of exercise Ash accompanying exercises Neurological facilities muscle (P.N.F).

Strength and flexibility play an important role in the technical performance of the overwhelming beating skill, which depends on special requirements in the technical performance, as the lack of flexibility leads to difficulty and slow when performing some of the skills of motor and the large number of injuries in the performance and in volleyball shows the importance of flexibility significantly And especially effective in the performance of offensive skills in the (joints and muscles of the main performance through the flexibility of the spine and shoulders and hip joint and the arm's dynamic range). The exercise is very important and focuses on the muscles most used in the activity of specialization, the development of special power and access to the maximum is one of the requirements necessary to reach high achievement, and volleyball is one of the most important at all, as the nature of the performance of the skill of beating overwhelming is a This requires the development of certain muscles in the body according to the nature of the game and its skills, and highlight the importance at the moment of jumping up and hit the ball as in the skill of beating overwhelming, and this requires the player to develop muscle The most overlapping Participate in the performance of the skill of the urgent need to complete it in the skill of the crushing blow of the ball flight.

The PNF method of muscle neuron facilities for the receptors of the deep sense gives strength to the muscles during fatigue, leading to muscle lengthening. The importance of using the sensory receptor system is to benefit from the reflex actions caused by lengthening and the occurrence of reflex actions performed by both the muscle spindles and the members Which respond to the change in the length of the muscle, especially during the processes of arousal and suppression that are within the muscle groups where at the same time the player can be transformed from the case of defense to the attack situation and the effects of a relaxed muscle group and change to M (PNF), as well as exercises on the contraction and expansion of both the working muscles and the antibody and this leads to a nervous response to simplify "Many researchers have been able to confirm that PNF is the most effective in increasing motor range, flexibility and strength, especially if these exercises are given when the muscle is in the T Severe fatigue or accumulated fatigue after exercise of strength "(1).

Hence, the importance of research by using special exercises and accompanying them with the exercises of neuro-muscular facilities for the deep sense receptors (PNF) as the special exercises and the flexibility of the musculoskeletal muscles are collected in the training module and developed together is an advanced training method for the development of physical abilities and thus its reflection on the achievement of this skill and reach it Level through which the objective of this study is achieved.

Problem Search

Volleyball is an activity that requires the use of force at different levels and flexibility plays a large role. The more flexible the player is, the higher the level of strength and through the field observation of the researcher to the training curricula prepared by the trainers in the clubs of the province. Nerve muscle relaxation facilities (PNF) in the training modules as well as the separation between the special strength exercises and the neuromuscular flexibility

and non-mixing between them to obtain a training method for the development of strength and the motor range of muscles and joints The performance of the skill is not in the typical form in which it is possible to achieve what is the mechanism of the training process as the weakness of power and lack of access to an effective result of the separation between exercises strength and flexibility, where this is These two qualities complement each other in the implementation of overwhelming beating because the performance of skill requires the arrival of some parts of the body to the maximum extent possible to achieve the strength and accuracy of the high skill.

The use of muscle flexibility exercises in general is dependent on some of the trainers at times that the researcher believes are incorrect, since their importance is not taken into account according to the stages of physical preparation, as they are used in the same proportions at all stages of physical preparation as well as not giving them importance and neglecting them in large numbers. Given in the course of the training module, they are given only in the preparatory part as exercises to warm up or in the closing part as exercises calm the muscles and simple while you should take a lot of space in the main part, after exercises strength or speed and when the muscles tired to lead to the formation The parts responsible for the sense of muscles and joints that have a key role in increasing the range of motor and flexibility and strength of the joints and tendons and muscles working on it.

The lack of interest in the exercises of neuro-muscular facilities for the receptors of deep sense (PNF) and not to mix them with exercises strength, despite being one of the pillars, which is very important to reach the higher levels in the skill of the player and keep pace with progress in this game is the point initiated by The researcher to study the number of exercises according to the basis of modern training depends on the majority of developed countries in this game the mainstay of the combination of special exercises and psychological facilities (PNF) and benefit from this training method in combining the strength and flexibility during the training module.1-3

Research Objectives

1 - Preparation of special exercises associated with the method (P.N.F) in the development of some physical abilities and electrical activity (EMG) of the most important working muscles and accurate performance of beating overwhelming volleyball players.
2 - to identify the effect of special exercises associated with the method (P.N.F) in the development of some physical abilities and electrical activity (EMG) of the most important working muscles.
3- To understand the effect of the special exercises associated with the method (P.N.F). to develop the accuracy of the performance of the skill of beating overwhelming volleyball players.

Assuming research

1 - There are significant differences between the tests of tribal and remote control and experimental groups in some physical abilities and electrical activity (EMG) of the most important working muscles and accurate performance of beating overwhelming volleyball players.
2 - There are significant differences between the tribal and remote tests of the control and experimental groups in the remote tests in some physical abilities and electrical activity (EMG) of the most important working muscles and the accuracy of the performance of beating overwhelming volleyball players

MATERIALS AND METHODS

Method of operation or performance of a technique (P.N.F): Is the exchange of constant muscle contractions with negative prolongation through a series of specific movements called in the German language (P.N.F) means the stimulation of the musculoskeletal system and the use of more than the athletes at the upper levels and through the following steps ().

- Extend and extend the muscle group that is intended first to the end.
- constriction of the same muscle group constriction fixed for 10 (6) first.
- Relaxation of the same muscle group after contraction for 3 seconds.
- extend and extend the same muscle group for 10 seconds.
- Maintain this lengthening for 10 seconds.

Statistical analysis

The results were statistically analyzed by using the statistical program for social science 13 (SPSS 13) by finding (mean ± SD), and the results are significant if the value of P-value is less than 0.05 ($P \leq 0.05$) (12).

RESULTS

Table 1 shows the data extracted for the two experimental control groups, showing the differences in the mean and the standard deviations in the tribal and remote tests. Similar to the nature of the tests of the research sample, in the tribal tests of the right femoral right-thigh indicators of the experimental group,) And a standard deviation (100.24), whereas in the remote tests, the mean of the same variable (842) and the standard deviation (114.28) were reached. The experimental mean of the experimental group was in the tribal tests for the rectal rectal muscle index (267.5) and the standard deviation of (32.10), while the mathematical mean for the post-test (456.6) and the standard deviation (98.42). From the above table, the experimental mean of the left femoral muscle group of the top index (416.8) and the standard deviation (49.91) were reached, whereas in the remote tests, the mean of the same variable (624.6) and the standard deviation was 139.69.

The experimental mean for the experimental group was in the tribal tests of the left hip rectal index (219) and the standard deviation of (48.74) while the mathematical mean for the post-test (378.3) and the standard deviation (63.50). Table (5) shows the tribal and remote tests of the control group of the right muscle index, where the mean index of the femoral right top index (532) and the standard deviation (87.44) in the tribal tests, while the mean of the same variable in the remote tests (574.16) and the standard deviation (117.13) The mean of the control group in the pre-test for the right femoral straightening muscle (292.83) and the standard deviation (62.69), while the mathematical mean of the post-test (334.16) and the standard deviation (77.24) were reached. The above table shows the tribal and remote tests of the control group of the left femoral femoral index, where the mean index of the top index (372.66) and the standard deviation (87.94) in the tribal tests, while the mean of the same variable in the remote tests (472.16) and the standard deviation (63.99).

The control mean of the control group was in the tribal test for the rectal femoral and left rectal index (239.83) and the standard deviation (67.12) while the mathematical mean for the post-test (277.33) and the standard deviation (48.81). The results in Table (2)Table (2) shows the difference in the computations of the tribal and remote tests of the experimental group of the top right thigh muscle index (279.16) and the standard deviation (159.93). The calculated value (t) was 4.275 while the error level (0.008) Indicating the significance of the differences between the tribal and remote tests at the level of significance (0.05) in front of the degree of freedom (5) and in favor of the post-test. The mean difference was 78.95 and the calculated value was 5,869 while the error level was 0.002, indicating the significance of the differences between the two tribal tests. (0.05) in front of the degree of freedom (5) and in favor of the post-test. The difference in the computational parameters in the tribal and remote tests of the experimental group of the index of the femoral femoral group (207.8) and the standard deviation (105.05), the calculated value of (4.846), and the error level (0.005) The differences between the tribal and remote tests at the level of significance (0.05) in front of the degree of freedom (5) and in favor of the post-test. The difference between the experimental and remote tests of the experimental group of the left hip rectal index (159.3) and the standard deviation (65.94), the calculated value (t) 5.919, and the error level (0.002), indicating the significance of differences between the two tribal tests (0.05) in front

of the degree of freedom (5) and in favor of the post-test. Table (18) shows the difference in the computational parameters in the tribal and remote tests of the control group of the upper right femoral femoral index (42.16) and the standard deviation (38.39). The calculated value (t) was 2.690 while the error level (0.043) Indicating the significance of the differences between the tribal and remote tests at the level of significance (0.05) in front of the degree of freedom (5) and in favor of the post-test.

The difference in the computational parameters in the tribal and remote tests of the control group of the right hip rectal muscle index (41.33) and the standard deviation (38.74), the calculated value (t) (2.613), and the error level (0.047) The differences between the tribal and remote tests of both muscles at the level of significance (0.05) in front of the degree of freedom (5) and in favor of the post-test. From the table above, we can see the difference in the computational parameters in the tribal and remote tests of the upper femoral group (58.50) and the standard deviation (51.44). The calculated value (t) is 2.758 while the error level (0.039) The differences between the tribal and remote tests at the level of significance (0.05) in front of the degree of freedom (5) and in favor of the post-test. It is also clear to us that the difference of the computational classes in the tribal and remote tests of the control group for the femoral and left straight femoral muscle index was 37.5 and the standard deviation was 35.43, the calculated value (t) was 2.592 while the error level (0.049) The differences between the tribal and remote tests of both muscles at the level of significance (0.05) in front of the degree of freedom (5) and in favor of the post-test.

DISCUSSION

The Results in Table (1,2) (1) and (2), there were significant differences between the pre-test and the post-test. The researcher attributed the reason for this development to the exercises used by the research sample (experimental and control) which were undoubtedly aimed at To develop the performance of the player according to the considerations and the scientific foundations of the training courses established according to the experiences of the coach and its logical analysis, which focused on the lower and upper limbs according to the need of the skill of beating overwhelming, and what distinguishes the exercises used by (experimental sample) (1,2) and the specialization trend, which is evident through the differences in table (1,2) where the goal is to upgrade and develop the performance force to the maximum extent possible to achieve the highest possible momentum and minimum time It is possible that the nature of the exercises used by the researcher is characterized by the nature of the impact on the rapid responses to the muscles and by exerting the maximum possible force in the shortest possible time, which works positively on the development of explosive power in addition to the exercises of muscle extension of the deep sense receptors (PNF) Increase the production of rubber power by increasing the efficiency of the physical acts The muscles of the reflex of the muscle suspensions and these exercises reflected positively on the increase in strength, which was clear through the index of electrical activity of the muscles of the top and rate variables and the extent of increase in them, where he (Abda Aziz Tiger, NarimanKhatib 2017) that increasing the range of movement in the joints and muscles

working on it can The muscles produce greater strength during the range of motion because the muscles that are lengthened are highly efficient and produce a certain amount of strength as a result of the reduction of elastic energy in muscle tissue during the lengthening phase and release during the shortening period following the lengthening. The researcher also attributes the evolution of electrical activity variables to the moment when players make maximum effort to advance to the highest point, which requires a very high correlation between the outputs of the various forces, which are carried out through several areas of the body members that effectively participate in the professional performance of the skill to reach the dynamic The movement of the force requires a very important thing, which is the balance of kinetic "in the transfer of power between the approximate steps, especially the last step (Wathba), which plays the And the main and important in achieving harmony and flow to increase the output of power to move the body the path and the right direction and appropriate, which ensures the greatest speed of the body to get the highest and the best momentum (2) The scientific sources also pointed out that " The physical exercise

of several days, weeks and months, through the printing of the body and muscle organs to the optimal performance of those exercises, in other words, the effect of physical exercise researcher to stimulate muscle cells to print, making them more economical in the performance of pregnancy intensity " Of evolution m The researcher attributed the reason for the high electrical activity of the muscles in the experimental test to the experimental group for the effect of the exercises he prepared, as the training has led to increased electrical activity and make it more regular and far from random, because the muscles The signal is high when exposed to a high effort and a long time of training to achieve the goal of reaching the stage of adaptation and muscle development. On the Caliphate, neurological adaptations depend on the amount of nerve impulses contained in the muscles, and then the height of the peak index (ie the height of the electrical activity wave of the working muscles). Komi (1992) emphasized that muscle adjustment requires more time, Training and its quantity, we note an improvement in muscle strength in a short time and this increase in achievement was the result of the compatibility between the working muscles due to neurological adaptations, which started at the beginning of the increase in the number of nerve cells. The researcher also attributed the cause of the gradual increase of the electrical signal of the top variable and the rate to the type of muscle fiber. (3)"The muscle fibers produce a higher rate of strength than the muscle fibers (slow red), but they get tired faster and faster, so slow fibers have an excitatory characteristic to recruit in low-intensity jobs with higher muscle tension requirements. The fast fiber begins to work. The muscle fiber (ft) takes about 50 milliseconds to reach its maximum muscle contraction. It is responsible for generating strong and rapid contraction. Stable fibers are characterized by slow contraction and low strength compared to white This fiber takes up D being notified of approximately 115 milliseconds to reach the maximum muscle contraction of her. Studies of the anatomy of muscle fibers indicate that fast fibers are related to large motor fibers while slow fibers are often associated with small motor neurons. The nature of the exercises, which were of a distinct nature, have an effective role in increasing the force and their reflection on the index). Through special exercises and neuropsychological facilities of the deep-sense receptors (PNF), the ability of muscle fiber contraction increased due to the development of flexibility and strength, which led to a balance or reduction of the differences between the working muscles and the antibody during the performance of the motor duty. Strength and labor are restricted in the case of a weakness in the compatibility between the contraction process (muscular)(5).

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Table 1. Shows the computational and standard deviations of the right and left femoral right and left and right test and experimental and control groups

the group	N	Muscle	Indicators	Tribal	Post
				M± SD	M± SD
Experimental	1	Right femoral rectum	the top	**100.24±562.8** A	114.28±842 B
			the average	**32.10±267.5** A	98.42±456.6 B
	2	Left femoral rectum	the top	**49.91±416.8** A	139.69±624.6 B
			the average	±48.74**219** A	63.50±378.3 B
Control	1	Right femoral rectum	the top	532±87.44 A	574.16±117.13 B
			the average	±62.69**292.83** A	77.24±334.16 B
	2	Left femoral rectum	the top	±87.94**372.66** A	63.99±472.16 B
			the average	**67.12±239.83** A	48.81277.33± B

Table 2. Shows the difference in the computation, its standard deviation, the calculated value of t and the difference between the results of the pre and post tests in the tests of the right and left femoral right and right index of the variables (top and mean) and experimental and control groups

The group	N	Muscle	Indicatos	Measruing unit	M ±SD	Value (t(Calculated	SIG
Experimental	1	Right femoral rectum	the top	Microvolt	279.16±159.93	4.275	0.008
			the average		189.16±78.95	5.869	0.002
	2	Left femoral rectum	the top		207.8±105.05	4.846	0.005
			the average		65.94±159.3	5.919	0.002
Control	1	Right femoral rectum	the top		42.16±38.39	2.690	0.043
			the average		41.33±38.74	2.613	0.047
	2	Left femoral rectum	the top		58.50±51.44	2.758	0.039
			the average		37.5±35.43	2.592	0.049

- Equals tabulation: (2.571) * Degree of freedom (5).
- At the level of significance (0.05) if the error level او or = (0.05)

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RESEARCH ARTICLE

Knowledge Management as a Source of Innovation in Public Sector Organizations

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ABSTRACT

The rapid growth of technological, economic, sociological and political systems, around the globe generates challenges and problems for Public Sector Organization (PSO) and requires them to respond in a very sophisticated manner. Without effective and efficient response, their progress and development will remain in a continuous threat from modern global environment. Solution to these problems lies in proper and regular innovation in organization, which can be obtained through Knowledge Management. Innovations should be made in PSO in order to face the modern world. This paper explores the role of Knowledge Management in Innovation in PSO keeping in mind, the contemporary challenging and competitive environment; and focuses on three main areas (Policy, Products and Procedures) of innovation which have a strong or full impact over the performance of PSO. As management of high quantity of information requires a lot of efforts and procedures for enhancing the performance of organization, this study develops a comprehensive and short framework for the meaningful use of KM in innovation. A knowledge Management approach, comprises of Knowledge Acquisition, Knowledge Distribution, Knowledge Analyzing and Knowledge Application is designed for the advancement of Policy, Products and Procedures in PSO. The study demonstrates that innovation is the only solution of the modern challenges and can made through KM process. The study also adds a very comprehensive knowledge to the process of KM by more emphasizing on the analysis of knowledge than it was ever thought before.

Key words: Knowledge Management (KM), Innovation (I), and Public Sector Organization (PSO)

INTRODUCTION

"Changes call for innovation, and innovation leads to progress". Public sector organizations around the globe face a common challenge of survival and better performance from the changing nature of business and environment, which

can be transformed to opportunities and success through nonstop innovation. Economic growth and performance have been increased by innovation worldwide and the product life cycles have been reduced. Modern market demands have compelled organizations to adopt such business strategies which ensure innovations for their competitive advantage. The behavior of customers, speed of technological advancement and remarkable competition have made innovation further complex (Cavusgil et al., 2003) and agent for better performance. In addition, the complexity has also been maximized by the extensive amount of knowledge and information availability for innovation. It's important to be noticed here that innovation is completely dependent on knowledge availability, therefore "the right knowledge for the right innovation by the right person" must be ensured for successful innovation (Adams and Lamont, 2003; Shani et al., 2003). Organizations either acquire knowledge from its own environment or from the outside world. Both inside and outside knowledge further advance the assets of knowledge and lead to the modification of knowledge (Hung et. al., 2010; Andreeva and Kianto, 2011).

KM process positively impacts the competence of an organization and also enhances its innovation's capabilities (Chen and Huang, 2009). Sharing and transferring etc of knowledge between employees of organizations increases learning and the modification of knowledge which ultimately leads to innovation (Hung, et. al., 2010; Liao and Wu, 2010, Sayed Fayaz Ahmad, 2011). Similarly, finding solution of a specific organizational problem by the application of knowledge and converting knowledge to new services and products is directly linked with innovation (Chen and Huang, 2009; Huang and Li, 2009). Therefore knowledge requires to be used and shared strategically suitable for the innovation process (Sayed Fayaz Ahmad, et al, 2015). Some researchers also supposed knowledge as an intangible asset (Jantunen, 2005) which is one of the strategic sources of innovation in organization (Chen and Huang, 2009; Chung-Jen, et. al., 2010; Darroch, 2005; Huang and Li, 2009; Liao and Wu, 2010). (Sayed Fayaz Ahmad, et al, 2015) believe that not the knowledge itself gives innovation but it's properly management is the cause of innovation along with other outcomes.

Due to the irrevocable importance of KM in modern day market environment, it becomes one of the fast growing areas of research and has subjected to management of almost all types of organizations. Many researchers have presented KM as a significant element for organizational performance which is obviously the result of innovation (Zack et. al., 2009; Zaim et. al., 2007). It should be noted that the association between KM and innovation is supported by a large number of studies and is well established. Many other academic researchers have also found a significant and positive relationship between KM and innovation. (Chung-Jen et. al., 2010; Darroch, 2005; Huang and Li, 2009; Jiang and Li, 2009; Liao and Wu, 2010; Mei and Nie, 2007).The objective of the study is to develop a conceptual model for converting knowledge ideas to innovation according to the need and vision of an organization. As the today's market environment is changing day by day, highly competitive and full of knowledge, there is a need to design a framework for the efficient use of knowledge management in innovation.

Knowledge Management

This is the era of knowledge. Knowledge has been playing a critical role in the development of businesses and economic growth more than it ever did before (Mosconi & Roy, 2013). And if truth be spoken, the globalization has made knowledge as intangible resource for competitive advantage (Ikujiro & Hiroshi, 2013) which is one of the causes of intellectual capital generation and profitability of organization (Kristandl & Bontis, 2007). In order to perform better in current changing environment, PSO require to extract knowledge from domestic and foreign sources to ensure greater market involvement and innovation (Morgan & Berthon, 2008). Knowledge of any organization is studied under the title of Knowledge Management. KM is the process in which the experience, knowledge and expertise of an employee is formalized and accessed in such a manner that creates new competencies, enhances performance and ensures innovation (Gloet and Terziovski (2004). Some authors describe KM as a comprehensive process of knowledge creation, usage, valuation, mapping, transport, storage, distribution and sharing (Augier & Teece, 2009, Sayed Fayaz Ahmad, Khalil Shahid, 2015). The development of modern technology and internet have influenced the usage and transfer of knowledge to a greater extant (Davenport, 1994). As KM

integrates strategies, techniques, policies and procedures (Davenport, 2013), it has a very strong alignment with corporate strategy and adds value to the firm's outcomes (M. H. Zack & Singh, 2010). KM also influences positively the organizational atmosphere, profitability and sustainability (Darvish & Nazari, 2013). KM has a widespread role in organization as it impact financial resources, technological advancements, cultural change etc. (Edvardsson & Durst, 2013). Many studies have also analyzed the impact of KM on innovations in various organization (Cavaliere, V., & Lombardi, S. (2015). And many have also proposed further work on the relationship of KM and organizational performance (Price, Stoica, & Boncella, 2013). Although KM is necessary for both small and large organization, many scholars have carried out researches on KM in large organizations (Roxas, Battisti, & Deakins, 2014). And there is a need of further researches to find out how the knowledge should be created, transferred and used to overcome the problems of converting knowledge into innovations and performance (C. Lin, Wu, & Yen, 2012). This research is focused on the KM and Innovation in PSO. It is an addition to the concept that KM and its application to innovation in PSO as it analyzes the relationship between them in the context of PSO. Keeping in mind the global market competition and other challenges, it is mandatory to explore the strategic factors that affect PSO to a greater extant. The study will also find out the method of managing the knowledge for better innovations.

The Process of Knowledge Management

KM came into being from the conceptual perspective based on the work of Cohen that focuses on the absorptive capacity of workers (Cohen & Levinthal, 1990) and concentrates on extracting information and knowledge from market, competitors, technology and investment in R & D which enhances organizational productivity (Caragliu & Nijkamp, 2012). Organizations can obtain or extract knowledge either from their inside environment or from outside (Nonaka and Takeuchi, 1995). Here the inside environment includes employee's experience, product specifications, technology etc. and outside environment includes the products of the competitors, market information and any other agency which has an impact over the organization. This theory also states that workers at each level can add to the process of KM and can enhance competitive advantage (Porter, 2011). Some researchers have divided knowledge into tacit and explicit categories. And they believe that explicit knowledge is the source of innovations and productivity enhancement (Hansen & Tierney, 2005). Explicit knowledge is the knowledge which can be transferred/shared in codified, verbalized form and can be accessed. It can be stored in the form of books etc. or any other media (Harris, R., McCausland, I., & Reid, R. (2013). Explicit knowledge is collected by organizations through databases, books, websites, presentations, e-reports and social networks from inside and outside sources, which support the required changes to products, processes and procedures (Chen & Huang, 2012).

Some researchers believe that tacit knowledge is the main source of achieving organizational goals (Scarbrough & Swan, 2001). Tacit knowledge is that type of knowledge which cannot be transferred or propagated by means of verbalizing and writing i.e. in any codified form. Knowledge comes from experience is an example of tacit knowledge. As tacit knowledge is purely based on the intellectuality and experience of workers, market environment, customer's response and suppliers and can be obtained from both inside and outside environment. It gives intellectual value to an organization and helps to create innovative concepts (Nonaka et al., 2014). So it becomes clear that KM is a process of acquiring, sharing and using of knowledge and information for the enhancement of organizational performances (Augier & Teece, 2009), and has a supreme importance for organizational value (Battistella, De Toni, & Pillon, 2015). It also encourages objectivity in the process, enhances the capabilities of employees and is goal oriented (Davenport, Thomas, & Cantrell, 2012). There is also evidence that large organizations have been adopted the KM since the beginning (J. F. Cohen & Olsen, 2015). In the light of the above literature review it can be concluded that from the beginning KM existed in organizations but with the passage of time and modern day challenges, the process has been developed and given importance. The role of KM in the progress and performance of any organization is accepted by almost all researchers and was given a very significant role in business and government sector organizations. This research intends to present the process of KM with the objective of its association with innovation in PSO. As KM is a vast field, this study will only focus on the sub-parts of KM which is most necessary for innovation.Knowledge resources have a significant role in innovation and specify

the capacity of an organization to innovate (Ben Zaied et al. (2015). Likewise another study also define innovation as the transformation of knowledge/information into processes, practices and new products or services (Wilson., 2007) and there is a well-structured relationship between KM and innovation in literature. Previous researches believe that KM influence the process of innovation through knowledge acquisition, sharing and application (Lin & Lee, 2005), this study adds knowledge Analysis to the process of KM which leads to innovation in the PSO is structured in the following way.

1. Knowledge Acquisition
2. Knowledge Distribution
3. Knowledge Analysis
4. Knowledge Application

Knowledge Acquisition

Knowledge acquisition is defined as the process during which an organization capture or acquire knowledge that is available somewhere (Lin & Lee, 2005). Organization can obtain knowledge either from its records and other documents or from the people internally. Organization also obtains knowledge externally by employing workers for the required information or knowledge and by buying the required knowledge assets in the shape of research documents and patents (Wong and Aspinwall (2004). Close customer relationship may also influence the knowledge flow to the organization and is very helpful for improving the organizational capability of acquiring knowledge. It also gives knowledge about the competitors and other market trends (Wong & Aspinwall, 2004, Sayed Fayaz Ahmad, M. Khalil Shahid, 2015). Acquisition of knowledge increases the knowledge assets of an organization which is necessary for the modification of existing knowledge and leads to innovation (Hung, et. al., 2010). As a firm acquires knowledge from an external source, the operating principle changes and the organization becomes able for making an amendment (Chang and Tzeng, 2010). There exist a well-defined agreement that effective knowledge acquisition is a crucial job and its positive impact is irrevocable on innovation (Hassan, & Shaukat, 2014).

Knowledge acquisition increases the capacity of employees and makes them much better to generate new ideas (Chen & Huang, 2009). Hence, the relationship of knowledge acquisition and innovation is clear; and it is an essential task that should be performed continuously for advancement in operations or other innovations. Without knowledge acquisition, organization cannot understand the whereabouts of market requirements and innovation. It gives organizations knowledge and shows the direction in which innovation is to be made. The correlation between knowledge acquisition and innovation was also find out positive and significant by Mafabi in his research (Mafabi et al. (2012).

Knowledge Sharing

It is a routine activity of any organization and is defined as the exchange of ideas, experiences, skills and knowledge among the employees of an organization (Lin, 2007). Management and other workers of organization share and exchange ideas regarding the offering and services of organization according to their level. Often, the process increases with the participation level of employees and their responsibilities about a particular innovation (Chen & Huang, 2009). Distribution of knowledge adds to organizational learning of employees and leads to modification; and subsequently knowledge leads to learning and knowledge modification, which consequently enhances innovations (Liao and Wu, 2010). Knowledge if not shared properly will not give benefits to an organization and its distribution is directly linked with innovation (Huang and Li, 2009). When organizations obtain knowledge from a source, the amount of knowledge increases and organizations take advantages to innovate opportunities through its sharing and produce novel and fresh ideas, which ultimately leads to innovation (Huang & Li, 2009). Furthermore the affiliation of knowledge sharing, application and innovation was also found in the research of Zhang, which states that knowledge acquired from business partners affects creation of knowledge and gives innovation through sharing among team members or any other group responsible for innovation (Zhang, Shu, Jiang, and Malter (2010).

The literature review shows that the sharing of knowledge is also one of the most important stages in KM and is directly or indirectly linked to innovation. This shows that after obtaining knowledge, organizations need to share it with the experts and analysts for better utilization.

Knowledge Analyzing

Analysis of knowledge is also a part of KM process. Knowledge analyzing is the stage of KM process during which information and knowledge is analyzed for finding relationships of knowledge and objectives and the most suitable set of knowledge for solving a problem in hand. Usually the analysis is done by an expert or a team of experts, well experienced and intelligent (Sayed Fayaz Ahmad & Muhammad Khalil Shahid, 2015). After analyzing a knowledge set, reports are created which are combined together for deriving goal oriented concepts. After analyzing the knowledge, organization uses that specific set of knowledge for decision making and innovation (Sayed Fayaz Ahmad & Muhammad Khalil Shahid, 2015; Knowledge Management Concepts). Different researchers have defined KM differently for different organizational or operational structure. KM is the identification and analyzation of knowledge that is necessary for achieving organizational goals (Chawla and Joshi (2010). Analysis of knowledge in the process of KM was also accepted as one of the main stages by Kiessling in his research, which examined KM as a practice of acquisition, storage, understanding, distribution and application of knowledge, which leads to the development of strategies and decisions for achieving objectives of the organizations (Kiessling, Richey, Meng, & Dabic, 2009). According to another study, KM is an effort of exploring knowledge and its conversion into assets that are necessary for making decisions (Bhatti and Qureshi (2007).

Analysis of knowledge has a main role in finding the gaps between current and desired offerings and presents a foundation for innovation. Therefore, knowledge after distribution among experts and team members needs to be analyzed for the creation of new ideas. A small set of knowledge can be used by organization more effectively and efficiently as compare to larger set of knowledge. Analyzing of data gives birth to new ideas and thoughts which is a base for innovation through its application.

Knowledge Application

Knowledge application is the use of knowledge to make suitable decisions and to respond positively to the challenges or requirements of market. It is one of the most necessary stage of KM (Alavi & Tiwana, 2002). Consequently, innovative and novel activities in any organization are initiated and stimulated through knowledge application; and there is evidences in the literature that there exist a significant and positive relationship between them (Xu, Gardoni et al., 2010). Therefore the process of KM determines the process of innovation in PSO through the use of knowledge. Another research also confirmed the importance of KM especially of knowledge application regarding innovation and developments (Amalia and Nugroho, 2011).Product innovation is also strongly correlated with knowledge acquisition, sharing and application and their effectiveness, which further clarifies the importance of knowledge use in innovation (Mhosen & Khadem's, 2010). Many other researchers have also found positive relationship between innovations and KM application in small and medium size industry (Alegre, Lapiedra et al., (2011) and this statement was further tested and proved by other researchers in large organizations (Stoica, and Boncella (2013). Therefore it is concluded that many research scholars and academicians are confident about the role of knowledge application in the process of innovation. They believe that knowledge application is the core activity of KM process and is connected directly with innovation. This study also assumes positive relationship between knowledge application and innovation and summarizes that without proper utilization and application of ideas and knowledge PSO cannot innovate. In the race of developments and in the bombardment of challenges, the application of knowledge is very useful and important for organizations to survive and satisfy the demands of stake holders. Without efficient use of knowledge, PSO will lose the trust of people and will ultimately disappear in the problems and challenges of modern day market.

Innovation

Innovation has attracted a significant attention both in practice and academia due to its linkage with competitive advantage. (Huang and Li, 2009; Taddese and Osada, 2010). Innovation is defined as the process of converting an idea into a process, product, design or service in a very intelligent manner to ensures or exceeds customer's expectations (Kuhn and Marisck (2010) or any improvement to management system (Crossan and Apaydin (2010).Due to its immense role in success of an organization in modern changing environment, a considerable research has been conducted to find out the factors that have an expressive impact on innovation and among them KM is the one, attracted many eyes from scholarly researchers towards itself (Hung et. al., 2011). Organizations which want to be competitive in modern changing environment are recommended to bring innovations continuously (Darroch (2005) and many studies confirmed the role of KM in obtaining innovation (Warrier (2009). KM in the shape of knowledge creation, knowledge sharing and knowledge application plays a significant part in the process of organizational decision making to enhance the capability of innovation (Nonaka (2007). Knowledge if managed sophisticatedly in organization leads to the creation of unique attributes and so boosts innovations (Leal-Rodríguez et al. (2013). Another study also found that the best KM practices increase sales through the development of new products and strategies, come from innovation (Nawaz et al. (2014). The research carried out in banking sector revealed the positive impact of KM on innovation which leads to the overall organizational performance (Nawab et al. (2015). The same results were confirmed in telecommunication industry by Alrubaiee (Alrubaiee et al. (2015). KM also enhances the customer relationship, as the knowledge an organization obtains from its customers is one of the most important input of innovations and the innovation for the satisfaction of customer (Sayed Fayaz Ahmed, 2015).

Innovation in Public Sector Organizations

The definition of Public Sector Organizations (PSO) varies from country to country. Generally, they are the organizations which provide any governmental service according to the governmental structure of a country. In many countries, it is the combination of many business organizations along with health, safety, education, telecommunication etc. Politician, bureaucrats, scientists or any other employee of a PSO who take part in organizational decision making are required be conscious from the global environment and its challenges (What is the Public Sector? 2016). These challenges in the form of financial, political, sociological and technological problems usually exert negative pressure on PSO and push them into a severe challenging position (The Center for Responsive Politics 2017). And this is crucial to face these challenges and crises in such a manner, either to convert them into opportunities or at least to ensure the protection and safety of a PSO and its services. Decisions are required to solve public problems and enabling its economic growth. In addition to international problems, most of the countries inside their boundaries, have the challenge of high unemployment, entrenched inequalities and unavailability of social needs, which compels people to question the existing ways of managing the public offices and resources (Lloyd G. Nigro, 1984, Sayed Fayaz Ahmad, 2011). These problems raise the following questions on PSO.

1. How to make PSO responds according to the need of people and country.
2. How to make the PSO capable of finding solutions to national problems?
3. How to make the PSO capable of converting the challenges into opportunities.
4. How to add advancement to the financial, political, sociological and technological growth.

All of the above question could be answered with one word and that is "Innovation". It is the necessity of any PSO to ensure efficient and effective governance according to the need of global scenario. Many researchers believe that any crises and problem could be faced and removed through innovation (David G. Carnevale (2002). The social and financial crises intensively demands innovations in PSO including administrative system and bureaucratic system (Jan-Erik Lane, 1985). Innovation in is unavoidable in all public sector organizations due to uncertainty and complexity of global environment."*It is the implementation by a public-sector organization of new or significantly improved*

*products, services or ways of doing things, either within the structure of the public sector itself or in the way in which public services are provided" (*Innovation Policy Platform*).*

This study focuses on the following three types of innovations in PSO.

1. Policy Innovation
2. Process Innovation and
3. Products Innovation

Policy Innovation

Policy is defined as a set of principles framed for providing guidance of decisions and attaining outcomes (Althaus, Catherine; Peter; Davis, 2007). Policy guides various actions necessary for achieving a desired goal. Executive orders, privacy policy, employment policy, human resource policy, regulatory policy are all examples of an organizational policy and differs from organizational rule, which is an organizational law compelling or prohibiting various behaviors of management and workers in the organization (Kellow, Aynsley., 1988). It also refers to the organizational making process, involving the identification of priorities, selection among different alternatives on the basis of their importance and outcomes and can be political, financial, administrative, managerial, technological, sociological etc, purely depend upon the organizational goals (Howard, Cosmo., 2005). Now it is necessary to know the creation of a policy. Policy creation includes the stage of agenda, policy formulation, decision making, implementation and evaluation (James E. 1974). According to another study its creation consists of eight stages including issue identification, policy analysis, consultation, instrument development, building coordination, program design, implementation and evaluation (Althaus, Catherine; Peter; Davis, 2007). Policy is planned to affect the process of decision making and to provide guidelines for attaining the organizational objectives (Theodore J., 1972).

Policy innovation is a process during which an organizational policy is analyzed in a strategic manner for finding the faults or flaws and making modification/refinement to it in order to achieve organizational objectives (Heckathorn, 1990). PI bridges the gap between the actual statuses of an organization to the strategic suitable decisions (Young, John, 2009). PI is a regular need for bringing creative procedures into policy-making and for concentrating on the creation of valuable outcomes not only for public but for organization itself (Smith, K. B. 2002). Through the process of PI, new ways of thinking, knowing, exploring and planning can be introduced and is not easy for weak organizations (Robert T. Nakamura, 198). In short, PSO needs to regularly innovate their policies in order to fulfill the demands of the people. In order to face the modern day's challenges and solve the problems they must find out the weaknesses in their policy and modify it in a goal oriented manner. This will not only modifies the decision making process in a PSO but will also create knowledgeable and updated work environment for the management and workers. Any policy which needs to be innovated must be discussed with the subject experts, academicians and with all necessary stake holders and their consultation must be acknowledged. In modern world, without strong and strategic policy, any PSO could not make any progress in sociological, technological, economic and political sectors.

Process Innovation

The application of new technology or method for the production of something that makes organization competitive and meet customer needs (Maranville, S., 1992). In the context of PSO, it is the redesigning of production process or the application or introduction of new ways or technology to any existing process (Schoeman et al. 2012). In other words it is the enhancement in quality and efficieny of any exteral and internal process (Walker, R.M. 2014). It is strongly linked to any organizational reform moment (Pollitt and Bouckaert 2011), the advancement in the form of government like electronic government (Bekkers and Homburg.,2005) and declining role of a government in modern societies (Lowndes and Pratchett., 2012). Through the process innovation, the government organizations can respond well to uncertainty and could introduce stable and advantageous routines (Bason, 2010). Process innovation usually takes place for the solution of an existing problem or for making improvement in existing process and creates

benefits to the workers and to the people who rely upon the process (Strumsky, D., 2010). So it becomes clear that all PSO must innovate the processes according to the requirements of global environment and challenges. In addition they are required to enhance the life standards of both workers and the people associated with them. Through process innovation, PSO can bring positive technological, economic, political and sociological change in the society; and can respond to the severe global problems in an effective manner. Therefore it is crystal clear that process innovation is very important and must be carried out by PSO on regular basis.

Product Innovation

The development, modifications in design or the use of new inputs in manufacturing of any established product is known as product innovation *(*Policy Studies Institute., 2010*).* With the passage of time and need of people, organization introduces new products, enhances the quality of already established products or modifies the existing products in order to fulfil the market demand *(*Hoang, Paul., 2010*)*. Two main categories of product innovation are radical and incremental innovation (Wong, S.K.S., 2014). It is the duty of PSO to ensure public safety, education, security, health and living standards. And almost all type of services any PSO is responsible for, are in a continuous attack from national and international challenges. Many scholars believe that innovation is necessary for finding a solution to many modern day problems (Sayad Fayaz Ahmad, 2011, Walker 2014). There is a need to run with these challenges and face these modern day problems, PSO must innovate its services and products. (Damanpour and Schneider., 2009). In any PSO innovations is unavoidable to be made in the style of management and the products it offers to the public. They are duty bound to provide new and acceptable products/services to the people in order to enhance their living standards and facilitate them up to the mark (Pärna and Von Tunzelmann., 2007). Although all PSO are required to innovate their products and services and make sure their availability to the general public, some most important are the products and services of health organizations, educational organization, public administration and safety or security organization as they are directly correlated with the people (Kuipers, B.S., M. Higgs., 2014).

Product innovation is not only necessary for the people but it has a very significant relationship with the PSO itself (Chron. 2014.). It gives competitive advantage, expands business and provides economic growth. It also attracts customers and compels them to trust on the PSO (Investopedia. 2014). Therefore it becomes clear that product innovation is very important in PSO. Either these organizations control those private organizations which produce products or services; or themselves responsible for the production of products and services. These organization should innovate in such a way to ensure economic growth of their country and economic status of the people. Without efficient product innovation it is impossible for any PSO to face the challenges of modern world, to satisfy the people needs and to solve the problems they and their operating societies are facing. Sharing

Conceptual Model

(Insert Figure 1) Knowledge Management as a Source of Innovation in Public Sector Organization

DISCUSSION

Advancement of technology and global political scenario are continuously appealing for the proper KM in PSO. Innovation is needed all over more intensively as it was ever felt before in PSO. The society wants to be provided with better health care today than it was yesterday, advancement in education, strengthen in defense sector, better environment, development in telecommunication technologies, power and better services from all other PSO. The boundary of PSO differs from country to country depending on their governmental structure and execution of public power.

Now the question is: How PSO will perform better in such uncertain and challenging global environment? It has one word answer: "INNOVATION". Any problem can be solved by finding a solution and any challenge can be faced with a proper strategy. Therefore, innovation is necessary for finding a solution to a contemporary problem and proposing a strategy. But it again leads to another question: How an innovation can be made? The answer is "through proper Knowledge Management". Knowledge Management is the conversion of knowledge into organizational objectives, solely depend upon the size, structure and goals of an organization. Every organization acquire knowledge in the form of tacit and explicit knowledge from both inside and outside sources. Quantity and quality of knowledge is determined by the management of PSO as they feel the most suitable for organizational performance. Gathering or obtaining knowledge is not an easy task but needs to be performed by knowledge experts so that precise and exact knowledge regarding the problems/challenges or as the case may be comes in hands. "Better knowledge gives better results" must be the slogan of organization during knowledge acquisition.

After obtaining knowledge, knowledge must be distributed among the people responsible for making innovation and who knows knowledge quality. In this stage a big set of knowledge will be reduced to a small set of useful and accurate knowledge for a problem or for a challenge in hands. The activity requires to be performed by KM experts so that proper knowledge must be distributed and shared with proper decision makers. "Right person for the right knowledge" policy must be followed during this phase.Here comes knowledge analysis, the third stage of KM in our conceptual model. Like other activities, knowledge analysis is also very helpful and one of the fundamental activities of KM process. This study slightly differs from previous studies, by more emphasizing on this activity in KM than the previous scholars did. Although some researchers discussed analysis of knowledge in KM process but they had not given such a greater importance, this research exerts more stress on the analysis of knowledge. Knowledge must be analyzed by skilled and experienced employees for better results and for a solid contribution to the solution of an issue. "Right knowledge for the right use" must be the objective of this activity.

Knowledge application is the use of knowledge for finding a solution. It is the application of knowledge for fulfilling an organizational need. Knowledge in this phase is ready for its application and use in any advancement, solution or in any strategy formulation. As any advancement in technology, finding new ways for a problem solution and formulating a strategy for better performance, all come under the umbrella of innovation; KM through knowledge application is exclusively responsible for it. "Right use of knowledge for the right problem/challenge" policy must be adopted for the performance enhancement of PSO. Performance of PSO is increased by properly facing the challenges of modern global environment. All most all problems and challenges of PSO can be overcome by innovation; through proper policy, proper products/services and through proper procedure. To make PSO capable of facing the global environment, innovation must be made on regular basis in the above three elements. First of all organizational policy needs to be beneficial and worthy; and must be capable of facing the modern day challenges. Even the best policy of today may not be of good use tomorrow. Therefore policy needs to be innovated and its advancement is inevitable. Appropriate and consistent modification to policy is a solution for enhancing PSO performance and proper tool for facing the global dynamics.

Secondly, naturally humans are more attracted towards new products. Organization are in continuous struggle for attracting more customers by offering new and unique products. Therefore PSO also needs to develop and innovate their existing products and services according to the demands of people and behavior of market. Product/service design, quality, attributes etc. must be made according to the requirements of market or society. Performance of PSO is also strongly linked with the procedure of doing something. Modification or advancement to procedure of an organizational activity must also be made regularly, according to the global standards and laws. Technology in all government sector organizations plays a vital role in facing the contemporary issue and for the enhancement of organizational performance. Therefore innovations in policy, products/services and procedure is the only way for increasing PSO performance.

CONCLUSION

We have explored the involvement of Knowledge Management in Innovation in Public Sector Organizations. Our analysis has produced novel perceptions about the importance of KM and its breakdown into four stages; knowledge acquisition, distribution, analysis and application, in the process of innovation. The study considers innovation as the combination of policy innovation, products/services innovation and procedural innovation in any PSO. Our theoretical findings demonstrate that innovation which plays a vital role in PSO can be made through the KM model we developed. Armed with this hypothetical understanding of policy, products and procedural innovations through the process of KM as proposed in the research; politician, scientists and bureaucrats may be more able to face the challenges and enhance PSO performance.

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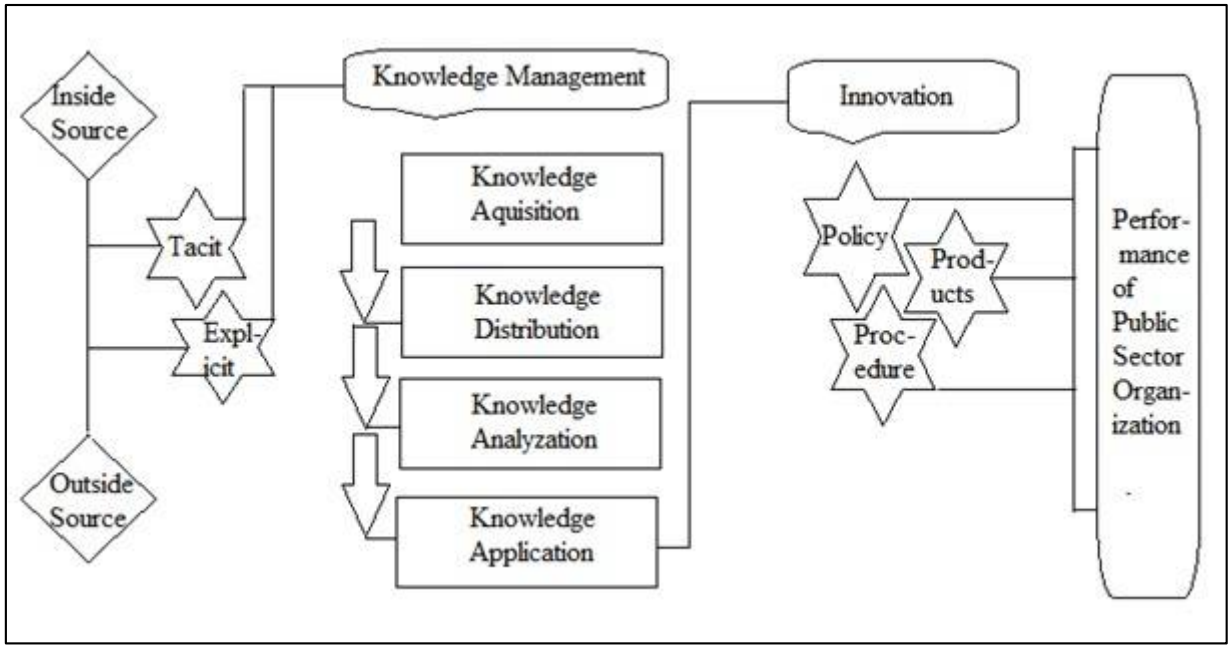

Figure 1. Knowledge Management as a Source of Innovation in Public Sector Organization

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RESEARCH ARTICLE

Using Dual Polarimetric SAR Data to Investigate the Cultural Heritage Remnants in Ukhaidir Fortress Southwest Karbala City, Iraq

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ABSTRACT

Iraq is one of the countries that contain many important archaeological sites and manifestations of varied cultural heritage belonging to ancient civilizations, and several archaeological sites and cultural heritage are disappeared as a result of neglect. In this study, Synthetic Aperture Radar data was used to extract information regarding potential archaeological remains in Ukhaidir site, southwest of Karbala city, which is considered to be a good and new contribution in the field of archaeological sensors utility applied by space-borne radar. ALOS PALSAR (L-band) image was used to identify and detect the ground anomalies due to the presence of near-surface archaeological structures. Advanced image processing and classification were applied depending on the intensity bands (HH and HV) including texture analysis by application of the GLCM algorithm and unsupervised classification using the K-means algorithm to nominate potential archaeological sites. The results led us to identify twelve sites, seven of them were excluded because they were not covered and clearly visible in the recent high-resolution image and in the field observation, which appears as hills containing scattered stone remains and brick walls. The five sites nominated (P1, P2, P3, P4 and P5), were completely covered with loose sand, and its areas are ranging between 873-3774 km^2 approximately. The sites P1 and P2 are located northeast of the fortress and P4 and P5 sites in the southwest, while P3 is located about 380 m in the southeast. Potentially, they might be represented remains of structures for houses or rooms used for military purposes or secret caches connected to the fortress through tunnels.

Keywords: ALOS PALSAR,Texture analysis, Clustering,Potential archaeological sites.

INTRODUCTION

During the last century, the techniques of Remote Sensing (RS) have proven to be a powerful tool and a great potential in archaeological prospecting [1-4]. The use of RS techniques have an honorable history in archaeological studies by utilizing space-borne sensors, where it showed its potential at the end of 1800.It is characterized by being able to estimate and calculate surface and subsurface parameters without direct contact. This is considered of great importance in archaeological surveys because they are non-destructive techniques[5,6]. However, RS techniques are usually used in combination with other methods in archaeological investigation such as geophysical methods and Geographic Information System (GIS) as well as collecting historical information about the site by traditional methods. Synthetic Aperture Radar (SAR) data in the early 1980s showed capabilities in archaeological studies, especially after the availability of spatial resolutions better than 30 meters. Moreover, long-wavelength radar data in arid environments are capable of penetrating the surface of soil and loose sand to near-surface targets[7-11].Another useful feature is the backscatter from SAR instruments which depends on the soil moisture [12], surface roughness [13], the incidence angle [14], the geometry of targets [15],the frequency and polarization [16], these properties may be suitable to detect various features of buried archaeological structures. The depth of penetration of SAR is based on the wavelength and frequency of the sensor in addition to the conductivity and dielectric permittivity of soil[17-19],where the penetration depth decreases with increasing frequency of the sensor and soil moisture content during the capture time.

The possibility of discerning and detecting of the buried archaeological remains, in addition to the availability of multi-platform with high-resolution data, encouraged the scientists' community to use orientation space-borne SAR data in this field[20]. Among space platforms so far released, ALOS PALSAR (advanced land observing satellite phased array type L-band synthetic aperture radar) of 1.27 GHz center frequency is one of the best SARs used in the field of archaeological investigation[21]. Due to the availability of high-resolution (up to 10 m), multi-temporal and polarimetric archival data, many researchers have used ALOS PALSAR in this fieldlike [20-25].In spite of the development of modern technology and software with the availability of good quality data, the processing and interpretation of SAR data is still complex and also relies on the nature of the site of study. Therefore, the choice of the appropriate location is the first stage of interpretation. It is preferable to be within a geographical area with appropriate climatic conditions, large enough for the spatial resolution and located within the elevated area of sediments and not previously flooded, in addition to its historical and cultural significance.

The identification of the buried archaeological structures,based on SAR data is insufficient as these structures cannot be distinguished if they are buried or visible on the surface. Thus, it is necessary to use another type of data have featured surface images for comparison and illustration[22]. The aim of the current study, in light of previous investigations and excavations at the site of Ukhaidir, is to follow an approach that includes the processing and interpretation of ALOS image based on the texture analysis of the intensity of HH and HV bands, and to compare the results with the present high-resolution image, 3D image view andthe field observations to ensure that the potential archaeological structures are fully covered.Finally,the selecting of potential archaeological sites and the excavation at these potential sites lead us to new discovery sites, which contributes to the identification of the constructor of the fortress and its lost history.

THE STUDY AREA

Site Description

Ukhaidir is the name of the enormous ancient fortress which is still existing so far in a historically great location situated between latitudes 32° 25'-32° 26' North, and longitudes 43° 35'-43° 36' East as shown in Figure 1. At this location, trade caravan routes were meeting, joining Iraq to the Arabian Gulf, Arab Sea and the Mediterranean Sea

and Aleppo, and rest stops were established for passengers and trade caravans at different distances. Ukhaidir fortress locates 50 km southwest the city of Karbala and around 192 km southwest of Baghdad[26]. The fortress is surrounded by a great solid wall with a height of nearly 21 m built in the shape of a rectangle with sides of 175 x 169 m, and in the middle of each four sides, there is a wide entrance. On each of the four corners of the wall, there is a round tower of 5 m diameter. Currently, the wall is 17 m high and about 4.50 m thick. On the top of the wall, there are vertical and horizontal turrets to shoot arrows and throw fire on enemies[27]. An outer adobe-brick wall also surrounds the fortress, supported by semicircular towers from its four sides to repulse the enemy attacks [28]. The climate of the region is considered an arid climate (Desert climate), which includes a hot dry summer and cold dry winter. Topographically, the fortress is located at a height of 38 m above sea level, surrounded by a simple topography, with gentle slope terrain oriented to the northeast toward Wadi Al-Abyadh (white valley).

Archaeological History

The Mesopotamian architecture was clearly of interest and focus of many researchers and archaeologists, especially Ukhaidir fortress. They differed in determining the date of its construction and by whom it was constructed. Most studies referred to that it was constructed at the outset of Abbasid Caliphate, most likely in the era of second Abbasid caliph Al Mansoor Billah (754 – 775 AD). Bell's article in 1910 [29]was the first published on the site of Ukhaidir, which attempted to describe and date this remarkable structure[30]. As some thought, it is dated back to Sasanian period according to the shape of ancient arches and vaults which are similar to the great arch of the Taq-iKisra (The famous arch of Ctesiphon), it is one of the earliest surviving examples employing simple brickwork designs inside a series of horizontally aligned blind arches[31,32].In addition, the arches present at Ukhaidir fortress confirm that it must be Islamic in the era of Umayyad or Abbasid [33], where it was noted that the width of the arch and opening were smaller than the width of the arch of the Sasanian period[30]. On the other hand, the fortress has a similar arrangement of Qasr-iShirin in the palace of KhusrauParvèz (590-628 AD) were Iwan and its flanking chambers have become much deeper, and in the front of them is a portico of three arches and where passages at the side lead into a court at the back. The analogy is so great that one could recognize that the Abbasids followed the Sasanian tradition [34]. Herzfeld believed that it was constructed about 21s AH (890 AD) depending on the similarity between Ukhaidir and the edifices of Abbasid Samarra, whereas Bell [35],tended to believe that it was situated at the location (Dogat Al-Hira) near AinTamir which was built by the Arab prince Al-Yazeed Bin Abdulmalik, i.e. within the Umayyad Era.

In order to determine the exact date of the fortress, the Atomic Radiation Test of Carbon 14 was carried out on wooden pieces that were used as ribbons between the walls at Kokushikan University in Tokyo by the Japanese Archaeological Mission in Iraq. The result of the test pointed out that the history of the fortress is determined by the year 580 AD plus or minus 90 years. Therefore, the study of the era of the construction of the fortress requires a period of 180 years starting from 490 to 670 AD. This period dates back to the pre-Islamic rule of Iraq more than 140 years and extends to the Umayyad Era. Thus, it is unlikely that the fortress constructed within the Abbasid period[36]. An aerial photograph of the Ukhaidir site was taken in 1935 by KLM British Company (Fig. 2) demonstrated the internal and external walls (sur) and many dwelling houses; it also revealed the presence of water supply channels for the fortress (Kheriz). During the period from 1934 to 1986 AD, many maintenance and excavation campaigns were carried out by the Iraqi Archaeological Foundation inside and outside the fortress[36]. In spite of all these maintenances, the site of Ukhaidir remains neglected and needs urgent maintenance and a large project to preserve the palace's features to prevent it from being affected by the weather conditions, whose effects appeared in most parts of the palace. Excavations that included the digging of several trenches (in the East, Northeast and Northwest) resulted in important discoveries, most notably the appearance of two brick doors, six towers and brick-built walls, in addition to the appearance of complete building units of rooms and facilities built of bricks (seven rooms of different size). Some of the foundations of the walls were built of burnt stones were exposed in the Northern side of the Wadi Al-Abyadh [26].

MATERIALS AND METHODS

Remotely Sensed Dataset

Dual Polarization (HH and HV) of SAR data have been used to extract the information regarding potential archaeological remains in Ukhaidir site, it was a Single Look Complex (SLC) of ALOS PALSAR images (ALOS L1.1), which were being operated during the period 2006–2011 by the Japan Aerospace Exploration Agency (JAXA). The ALOS PALSAR image was acquired on 21 June 2007 [37], with an incident angle of 34.3^0, and a spatial resolution of 12.5 m (intermediate resolution) with 4-8 GHz frequency range and 3.75–7.5 cm wavelength range. SRTM 1 Arc-Second DEM (approximately 30 m) was used to the terrain correction of ALOS PALSAR images. The high-resolution (2 m) Bing satellite image (Fig. 1c) was used as a basemap to test the accuracy of the interpretation, which provides high spatial resolution optical information. Global Digital Surface Model (DSM) "ALOS World 3D – 30 m (AW3D30)" [38] is used to precise 3D map of Ukhaidir site by orthorectification of DSM with Bing satellite image by using ArcScene 10.2 (Fig. 3), where the DSM represents the ground topography of the earth's surface and all objects on it, which considered an elevation model that includes the tops of everything, including buildings, treetops, and ground where there is nothing else on top of it. The digital 3D maps which consist of DSM have been used in various applications, that need to represent land terrains with 5 meters in spatial resolution and 5 meters in height accuracy [39]. In spite of the geometric distortion of the archaeological structure, the map was useful in showing the topography and distinguish the prominent archaeological and hills containing scattered stone surrounding the fortress.

Processing and Interpretation

The processing and interpretation involve the application of three major steps on the ALOS data, Pre-processing, Spatial Texture Analysis (STA) and unsupervised classification (cluster analysis). In this context, the results are evaluated by comparison to optical and historical aerial images as well as field observations.

Pre-Processing

Pre-processing operations include five major processing steps that are applied on the ALOS Level 1.1 using Sentinel Application Platform (SNAP) Software to represent the images as geometrically similar as possible to the real world. These major processing steps are radiometric calibration, multilook, speckle filtering, deskewing and terrain correction, respectively. The radiometric calibration was applied to each intensity band in order to convert the values of the digital number to backscattering coefficient values. Multilooking processing is used to produce a product with a nominal image pixel size, which improves the radiometric resolution of the ALOS image and contain less noise [40]. Speckle filtering is used to reduce the speckles "salt and pepper" from ALOS image thatis caused by random constructive and destructive interference of the de-phased that makes the interpretation more difficult. Deskewing processing will result in adjusting each pixel to a more zero doppler geometry, as well as filling the gaps using digital elevation model (DEM) a type of SRTM 1 Arc-Second. Finally, terrain correction will geocode the image by correcting the distortions of ALOS PALSAR geometric using DEM and producing a projected image (Fig. 4).

Spatial Texture Analysis (STA)

The texture analysis is performed on each band of ALOS image after completing the pre-processing step using gray level co-occurrence matrices (GLCM). The GLCM matrix is considered one of the best statistical matrices used, which was proved strongly in providing vital information from SAR images [41]. In addition, extracting ground features by monitoring land cover, texture measures represent the spatial distribution of the grey-level value and its frequency relative to another one for a specific displacement (x, y) and orientation (0^0, 45^0, 90^0 and 135^0). From a sub-image of a

given window size I (x, y), the GLCM is a matrix P with size GL x GL (GL: the number of gray-levels) whose P (i, j) element ($1 \le i \le GL$; $1 \le j \le GL$) contains the number of times a point with gray-level gi occurs in a set of positions relative (based on the displacement and the angle mentioned before) to another point with gray-level gi[42].The textural features of matrix P are calculated by the following equations:

$$Contrast = \sum_{n=0}^{G_l-1} n^2 \left\{ \sum_{\substack{i=1}}^{G_l} \sum_{\substack{j=1 \\ |i-j|=n}}^{G_l} P(i,j) \right\} \text{..... (1)}$$

$$Dissimilarity = \sum_{i,j=0}^{G_l-1} P_{i,j} \left(-\ln P_{i,j}\right) \text{..... (2)}$$

$$Homogeneity = \sum_i \sum_j \frac{1}{1+(i-j)^2} P(i,j) \text{..... (3)}$$

$$Angular\ Second\ Moment\ (ASM) = \sum_i \sum_j [P\ (i,j)]^2 \text{..... (4)}$$

$$Energy = \sum_{i=0}^{G_l-1} \sum_{j=0}^{G_l-1} P(i,j)^2 \text{..... (5)}$$

$$Entropy = \sum_i P \log\ (P(i,j)) \text{..... (6)}$$

where p (i, j) is the (i, j)-th entry in a normalized grey-tone spatial dependence matrix P(i, j)/R; R is the total sum of P; $p_x(i) = \sum_{j=1}^{G_L} P(i,j)$ is the i-th entry in the marginal probability matrix obtained by summing the rows of p(i, j)[43].

Unsupervised Classification (Cluster Analysis)

Unsupervised classification is considered an effective procedure of dividing remote sensor image and extracting land-cover category based on the spectral signature. Generally, the unsupervised classification employs clustering routines in order to create the number of classes depending on the pixels' similarity, and then assign the identities of the classes after processing. Cluster analysis, also called data segmentation, has a variety of goals, all relating to grouping or collection of objects into clusters, such that those within each cluster are more closely related to one another than objects assigned to different clusters. Among the clustering techniques proposed, K-means technique, which is provided by MacQueen 1967 [44],is considered one of the most prominent statistical analysis techniques. K-means method works to find clusters and cluster centers in a set of unlabeled data. The clustering process is accomplished by reducing distances between objects and the center of the cluster; it requires firstly assigning the number of clusters (k) and iterations. The steps of the algorithm are as follows:

- Identify K centroids for clusters randomly
- Calculate the distance between each point and all centers using the Euclidean distance.

The Euclidean distance is given by the following equation:

$$dij = \sqrt{\sum_{k=1}^{n} (x_{ik} - x_{jk})^2} \text{..... (7)}$$

where$d_{ij}$is theEuclidean distance, n represents thenumber of data points. Then X_{ik}representsthe coordinates of the K property of point i and X_{jk}representthe coordinates of the K property of point j (usually the coordinates of the center).

RESULTS AND DISCUSSION

Among the statistical methods, GLCM considered as a widely used process in many applications to extract the texture features from an image. This method is a square matrix characterizes values of neighboring pixels and describes the relative frequencies depending on the angular relationship between neighboring pixels and on the distance between them. To extract the main features from SAR image, these features must be separated from the background of image by selecting the appropriate displacement angle, window size, quantization level, and the right texture feature [45]. GLCM calculates how often a pixel with gray-level value occurs either horizontally, vertically, or diagonally. Frequently, most of the literatures use all angles to extract the texture features, particularly, in case of unavailability of the ground information and lack of high-resolution image. It is preferable to choose an intermediate window size to suppress noise of SAR image, as applying a small windows size (3x3) may smooth the image too much and result in noisy texture characteristics, whereas increasing windows size (more than 7x7) tends to increase the anisotropy factor [46]. Hence, the choice of the appropriate windowsize is very necessary and depends on the intended application and image resolution. Increasing the quantization level leads to increases in the signal-to-noise ratio. [47,48]. In processing of SAR image, the selection of the quantization level depends on the resolution of the image, when using low quantization level (16 and 32), the anisotropy factor in the image will be higher than when using higher levels. Furthermore, the increases in the number of the quantization level (64, 128, and 256), cause the features to become more pronounced. Although the increasing of levels greatly affects the signal-to-noise ratio.Also, the higher quantization levels tend to focus more in larger structures, whereas the use of lower quantization levels may be more suitable for the interpretation of subtle features [46].

In this work, GLCM used to characterize the textures of ALOS image by applying six common textual features (Contrast, Dissimilarity, Homogeneity, ASM, Energy and entropy), employing all angles (0, 45, 90, 135) with 5x5 window size as shown in the Figure 5. Probabilistic quantizer technique is applied by using a 64-quantization level and one unit of displacement distance to reach the most accurate classification. The analysis of these features exhibit various scattering characteristics. The contrast is the difference in visual perception of the neighboring pixels of the image seen simultaneously or successively. The increase of dissimilarity works linearly instead of increasing exponentially. Contrast gives higher values than does dissimilarity, which is expected since contrast values are larger for every pixel more than one off the diagonal. According to [49], thecontrast and dissimilarity measures pertain to the degree of texture smoothness. The contrast and dissimilarity features (Fig. 5a, 5b) represents the local variations and show the texture fineness in an image, where the coarse texture values are concentrated near the main diagonal, sothey refer to the variation in intensity among neighboring pixels.

A high value of variance indicates a large variation in intensity, which is marked by yellow color and the structures that appear on the surface in addition to the areas where the scattered stone and a texture with low variance has small variation like the barren soil. Homogeneity is one of the important measurement that depicts the local texture feature of image and distinguish different targets [50], it returns a value that measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal. Therefore, it is considered as an indication of how much the texture of image is homogeneous. Figure (5c) point out a homogenous texture in the region with good isolation of anomalies that believed to have different textures. Angular Second Moment (ASM) is the measure of the grey smoothness of the image. High values of ASM occur when image shows coarse texture, as noted in the marked areas(Fig. 5d) and areas where the bricks (scattered stone) are located near the fortress. The energy feature returns to the sum of squared elements in the GLCM matrix, the higher the energy feature value is the more concentrated the distribution of the matrix elements. The results in Figure (5e) show that the increase in energy values reflects the high backscattering values of the targets. The entropy gives a measurement of image randomness content, which describes the image complexity and is considered more suitable to identify the buried or inundated area. The entropy achieves its highest value when the values of GLCM matrix are equal. On the contrary, the inhomogeneous areas have less entropy value [51]. The results (Fig. 5f) reveal that entropy is low in areas with coarse texture, which represent high

backscatter areas and reflecting the non-uniformity of the texture of the image. The textile analysis is identified several potential targets, but the subject has not been definitively resolved. Therefore, a second classification is required. The K-means method is applied, which works to find clusters and cluster centers in a set of unlabeled data. Four of classes (clusters) and five iterations were specified as essential inputs to classifying ALOS image for this study (Fig. 6). The first class represents the barren soil, which has the least spectral signature, and the second class represents the partially covered rocks in the region, while the third and fourth classes represent the uncovered rocks and the archaeological areas. This overlap is due to the fact that the archaeological structures were built from the white valley rocks, which as a result, had a similar spectral signature. The yellow color (class 4) reflects the density of the rock and the structures built in the area. Applying clustering classification, the archaeological structures and uncovered rocks areas put up very strong backscatter; partially covered rocks puts up medium backscatter; barren soil puts up smooth surface and low backscatter. In some areas (west and southwest of fortress), the increase surface roughness of soil (see Figures 1c and 3) caused by scattered stones has led to a high backscatter, while the areas marked with a circuit put up a strong backscatter. It is probable that these areas are likely to be subsurface archaeological remains based on the similarity of their texture with the texture of the fortress.

The results of the two classifications led to the identification of twelve sites, the coordinates of these sites were verified on the field using the application GPS mobile (Fig. 7). Seven sites were excluded because they were uncovered archaeological structures, some of them were clearly visible (see figures 1c and 3) like V1, V2, V3, and V4. Whilst the other three sites (V5, V6 and V7) are diagnosed through field observation in the shape of hills containing scattered stone remains and brick walls. The remaining five sites (P1, P2, P3, P4 and P5) were completely covered with loose sand, their areas are ranging between 873-3774 km^2. P1 and P2 are located northeast of the fortress and P4 and P5 sites in the southwest, while P3 is located about 380 m in the southeast. Potentially, they might be remains of structures for houses or rooms used for military purposes or secret caches connected to the fortress through tunnels. In spite of the discoveries made by the traditional excavations (e.g.-excavated trenches) at Ukhaidir fortress, many excavated sites did not produce any encouraging results [26], which is considered as a major loss of money, effort and time. From our point of view, the results of SAR will be a significant addition to support archaeologists in providing valuable information for documentation of sites and landscapes, the identification of potential areas and management of the future excavation operations.

CONCLUSION

The results of this study show that the potential and the ability of dual polarimetric ALOS PALSAR data to identify the cultural heritage remnants and subsurface archaeological features in the site of Ukhaidir fortress even covered by sand, due to the climate conditions (mainly dry conditions). ALOS L band image represent a non-destructive tool to identify different buried features by analysing backscattering anomaly of the subsurface cultural features, we emphasized significance to exploit in archaeological excavation. The integrated use of the different remote sensing data is an effective and useful tool in the investigation of the buried archaeological structures remains that have an important historical and cultural significance in arid and semi-arid environments, in addition to their low cost compared to traditional methods of archaeological excavation. Although SAR and different remote sensing data cannot substitute ground-based measurements of the traditional methods, it can provide a valuable information of the expected features, and significantly helps to narrows the scope areas of archaeological excavation, especially in large archaeological sites that are difficult to completely excavated.

The approach of using the texture analysis by GLCM and K-Means algorithms allowed a good classification of ALOS image without using the threshold proceedings. The results of GLCM demonstrate well sorted of the anomalies based on the roughness of the texture, whereas K-Means classified the image into four class depending on the intensity of backscattering, and provided better interpretation with supporting of field observations and visual images. However, both of algorithms led to detect both of surface and buried archaeological features. Therefore, the

field observation and the Bing satellite image played an important role in the results of interpretation. The results of the two classification methods yielded to the identification of five anomalies as potential archaeological sites high backscattering values, their areas are ranging between 873-3774 km^2, recommend that they be considered in future excavation operations.

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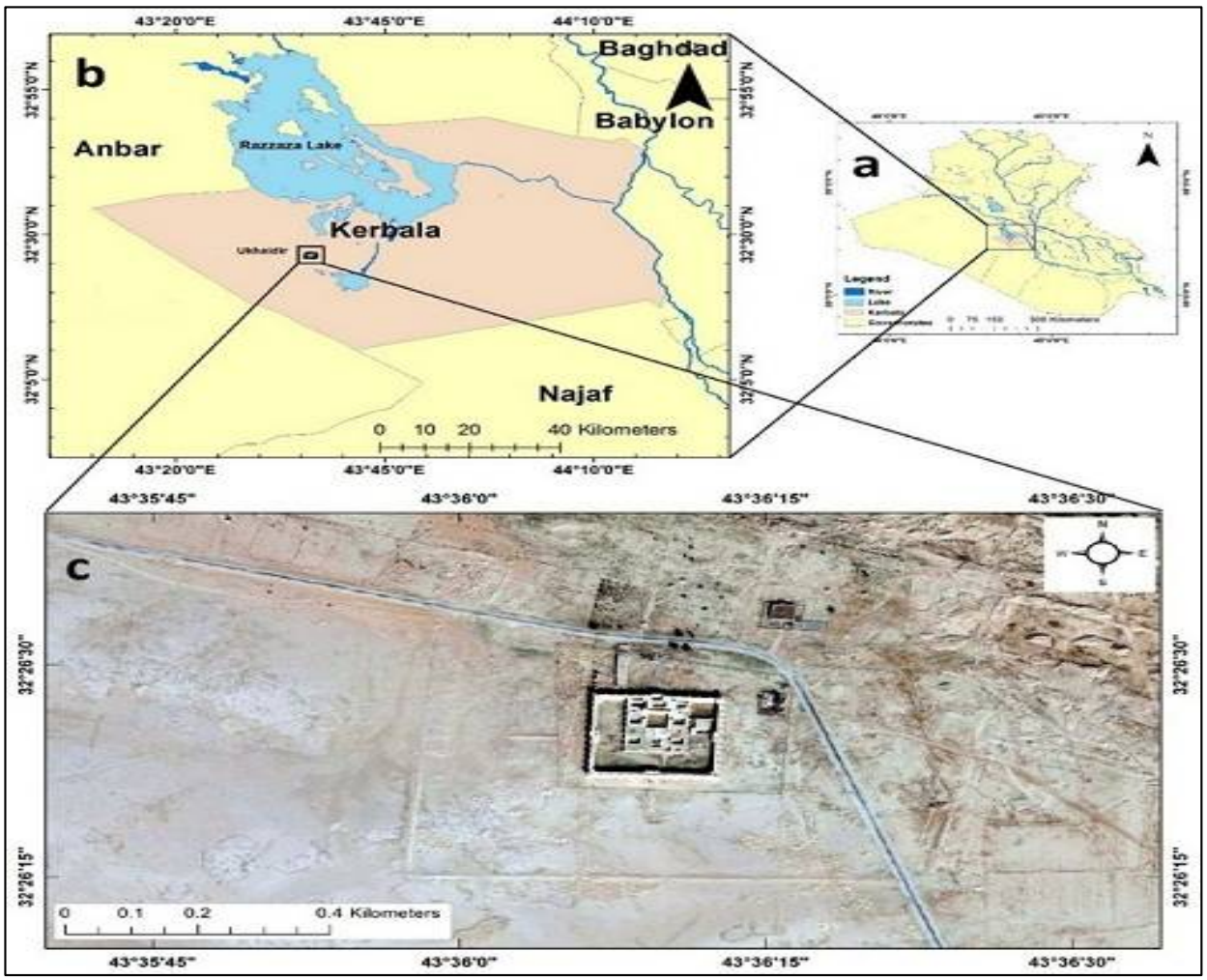

Figure 1. Location of study area: a- Iraq map showing the location of the Karbala Governorate; b- Karbala governorate map showing the location of Ukhaidir fortress; c- High-resolution Bing satellite image of Ukhaidir site

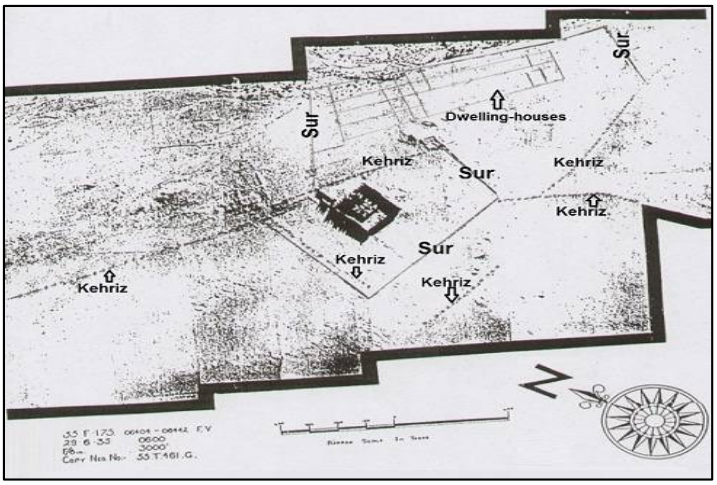

Figure 2. Aerial photograph of the Ukhaidir site demonstrating the internal and external walls (sur), dwelling houses and water channels (Kheriz) [52].

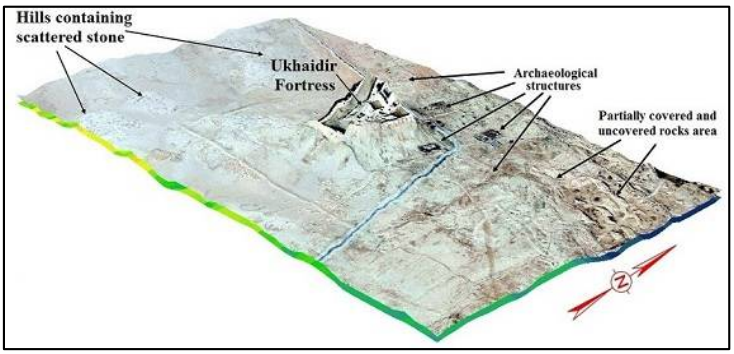

Figure 3. 3D image view illustrates the topography and the landscapes of Ukhaidir site

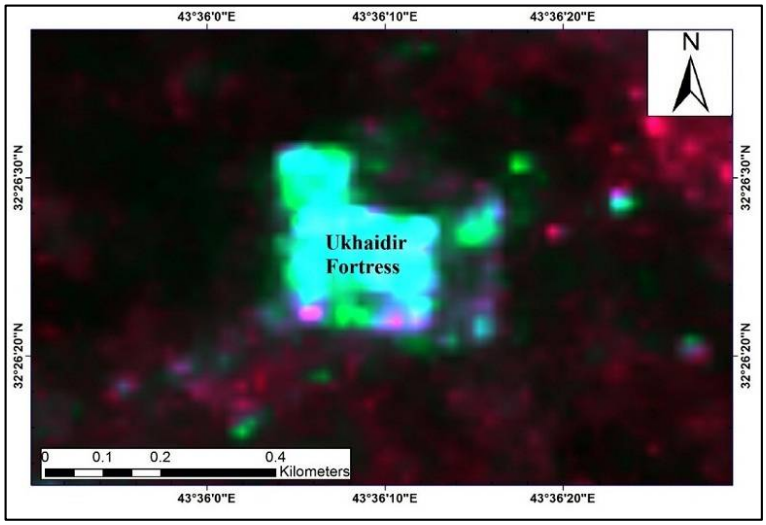

Figure 4. ALOS image after Pre-processing steps, demonstrated the areas that have high backscattering value

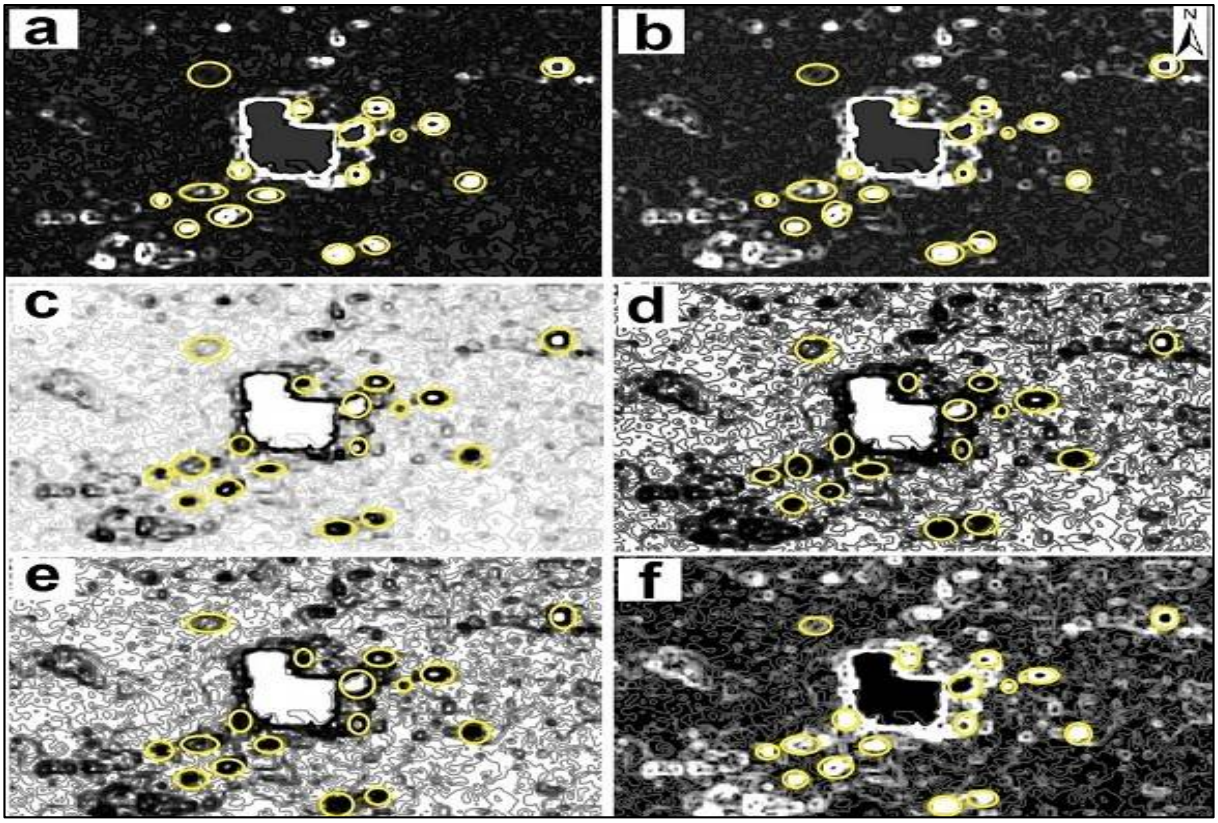

Figure 5. Textual features of GLCM matrix: a- Contrast, b- Dissimilarity, c- Homogeneity, d- ASM, e- Energy and f- Entropy

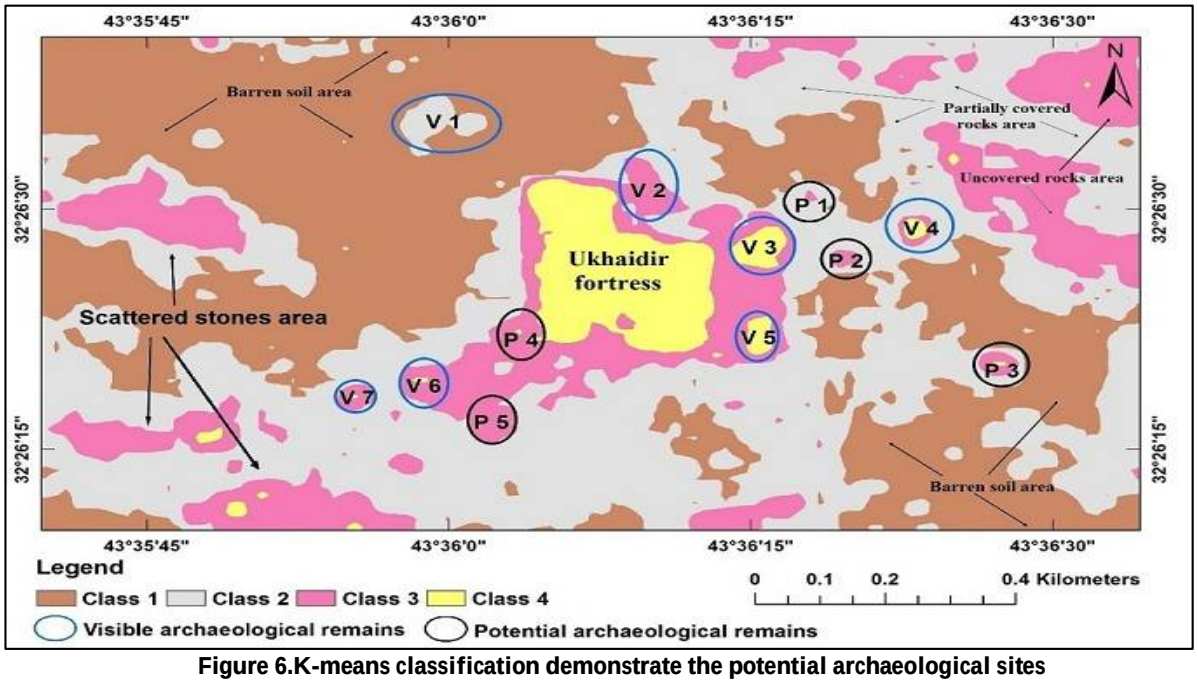

Figure 6.K-means classification demonstrate the potential archaeological sites

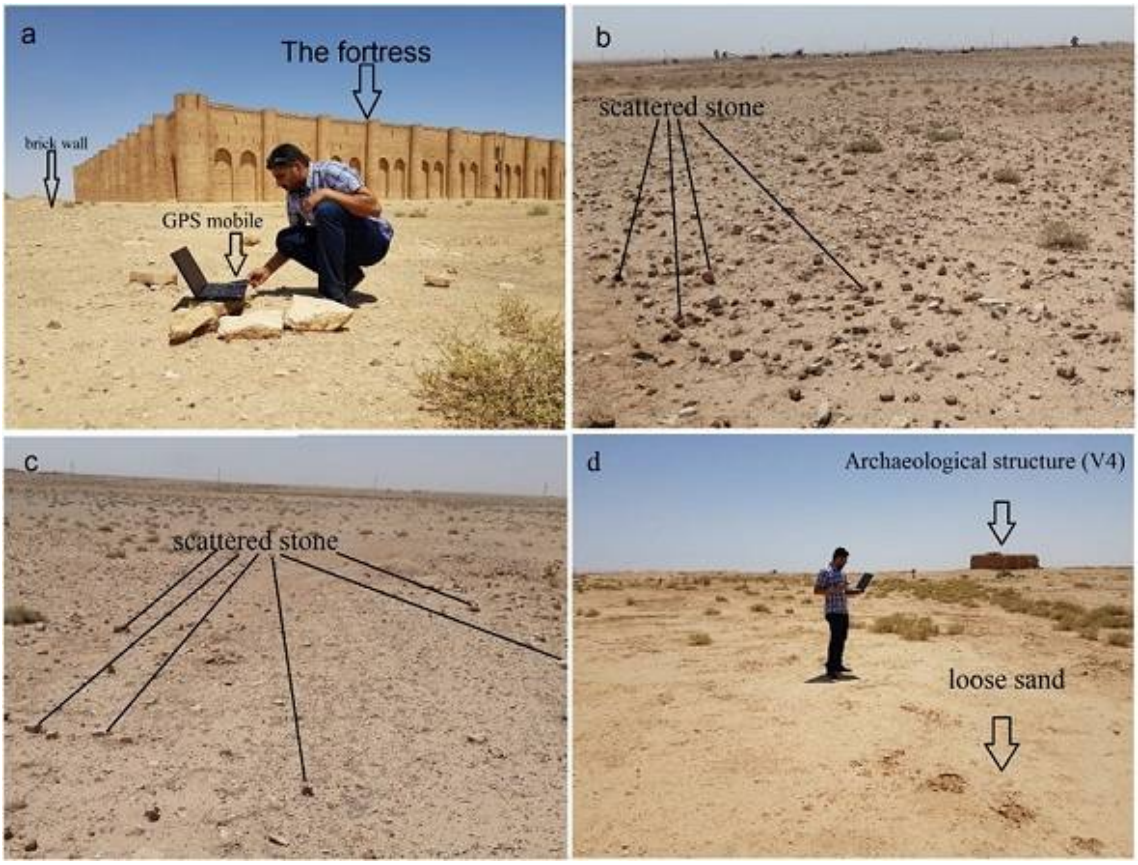

Figure 7. The verification of the coordinates of sites on the field using the application GPS mobile. a- show the brick walls in site V5; b and c- show the scattered stone remains in the site V6 and V7 respectively; d- show the loose sand in site P1 and the archaeological structure in site V4

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RESEARCH ARTICLE

Groundwater Quality Evaluation of Dammam Aquifer, West of Karbala Governorate

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ABSTRACT

The study area located within Karbala and Anbar governorate. The topography elevation ranges from (27-355m a.s.l), and the estimated total area is approximately (9315 km^2). The chemical analysis of (12) groundwater samples included the determination of the concentrations of inorganic constituents and expressed as ions comprise the cations and the anions. Also involved the salinity (TDS), electrical conductivity (EC) and acidity (pH). Comparing the quality of groundwater with the standards of different uses showed that it is unsuitable for drinking and industrial purposes, but it is suitable for livestock, building and almost suitable for irrigation purposes.

Keywords: Chemical Analysis, Dammam aquifer, groundwater quality.

INTRODUCTION

Groundwater plays a vital role in regional water resources, especially when there is a political challenge about surface water, and this is what is happening now with the neighboring countries of Iraq, so it was supposed for researchers and specialists in hydrology and hydrogeology to assess and monitor groundwater quality continuously, Thus, the management of resources is essential to ensure its quality and quantity for a long period [1].The selected area lies within the eastern part of the Iraqi Western Desert; it was studied in various subjects, such as geological, hydrological, hydrogeological, hydrochemical, and geochemical studies. According to their importance in terms of water resources for the scarcity of rainfall.Many foreign and Iraqi companies also university theses had been carried out on this region, and many types of research were published to achieve the excavations for groundwater. Many foreign such as, Parson [2], made a comprehensive regional study of the western desert, taking into consideration the hydrogeological condition of water resources including overall climatic and geologic information of the region. Ingra,

[3] studied the water resources of the western desert. The study has added greatly hydrological and geological information about the region. It had documented the information about hydrogeological and hydrological conditions in the western desert. Water Development Projects Consortium, [4] a group of Yugoslav companies worked in this area as a part of their hydrogeological work in the western desert. The study was included a detailed hydrogeological evaluation of the area and the promising zones for future utilization.In Iraq, there are several types of research which developed groundwater quality such as AL-Furat Center for Studies and Designs of Irrigation projects, [5] completed a national

geological and hydrogeological study of western desert covering the study area, which included hydrogeological and geophysical section, analysis of well logging. Al-Fatlawi, [6], prepped a Ph.D. thesis on the hydrogeological study for Um Rdhuma formation, and he showed that Dammam and Um Rhuma formations are the main aquifers in the area, and he classified the quality of both aquifers. AL-Ghanimy, [7] prepared a M.Sc. thesis of The hydrogeology of Dammam aquifer in the west and southwest of Karbala city, he determined the origin, sources and the age of groundwater on both sides of Abo Jir Fault. AL-Shamari [8], evaluates groundwater quality in both sides of Tar Al-Sayyed. The results of these studies and researchers were aimed to focus about the quality and quantity of groundwater in this region, so the aim of this research to define the quality of groundwater in the area and its reliability for various purposes. The study area is considered important region, because of the availability of different economic activities, i.e. industry, agriculture, domestic uses, livestock breeding for pastoral purposes and artificial lakes for fish breeding. Ground water regards the only source in the area and all different economic activities are depended on groundwater by drilling wells [8]. Dammam Formation which regarded as the main aquifer in the area, water-bearing beds which belong to Dammam aquifer are of confined, for that reason, recharge from rain to groundwater is restricted to the formation exposures within the area. In addition to the subsurface inflow coming from the recharge regions located in the west and south-west of the area [8]

The study area

It located within Karbala and Anbar governorate, it extends from south of Al-Razaza Lake to Ain AL-Tamur sub-district in the north, within Karbala province and bounded from the west by Al-Nukhaib sub-district within Anbar province, from the east by Karbala city and from the south by Al-Najaf province, between the longitudes (42° 10' to 43° 50') East and latitudes (31° 30' to 32° 38') North, (Fig. 1). The topography elevation ranges from (27-355m a.s.l), (fig.2) and the estimated total area is approximately (9315 km^2) (calculated by GIS program), which in turn is considered as a portion of the drainage area of Al-Razzaza lake basin

Geology of the study area

The Outcrop formations are configured from the oldest to the youngest by Um ErRadhuma, Al-Dammam, Jill, Euphrates, Nfayil, Injana, Zahra and Dibdibba Formations as well to the Quaternary deposits (Pleistocene - and Holocene) which appear in different parts of the area, represented by Aeolian deposits, Depression Fill Deposits, Habbariya gravel and Inland Sabkha deposits, (Fig. 3)

Groundwater Hydrochemistry

Natural water is never pure; it always contains a small amount of dissolved gases and solids, so in any evaluation of groundwater resources the quality of water is almost of equal importance to its quantity. The type and concentration of salt in groundwater depend on the environment, movement, and the source of the groundwater. Ordinarily, the higher concentrations of dissolved constituents are found in the groundwater than in the surface water because of the greater exposure to soluble materials in geologic strata [10]. The chemical analysis of groundwater includes the determination of the concentrations of inorganic constituents, and expressed as ions comprise the cations (positively

charged ions), and the anions (negatively charged ions), and those contributing to alkalinity which are usually expressed in terms of an equivalent amount of carbonate, and bicarbonate, [11]. Also involves the salinity in term of total dissolved solids (TDS), electrical conductivity (EC) and acidity (pH). A total number of (12) samples were gathered from different wells distributed in the area, (Fig. 4). The distributions of the sampled points were selected according to field survey

Accuracy

The accuracy of the results of water samples analyses can be specified from the results of reaction error test uncertainty (U) or relative difference (R.D), by calculating the absolute difference between the total of cations and anions concentration on the total amount of these concentrations in (epm) units, as percentage [10], and according to the following equation:

$$R.D.\ \% = 100 * |(r\ \Sigma Cat - r\ \Sigma Ani)/(r\ \Sigma Cat + r\ \Sigma Ani)| \quad \ldots\ldots\ldots (1).$$

$$A\% = 100 - R.D.\ \% \quad \ldots\ldots\ldots (2).$$

Where: R.D %: Relative Difference, also defines as En% = Electro neutrality
rΣCat.: Summation of positive ions concentrations in (epm) unit.
rΣAni.: Summation of negative ions concentrations in (epm) unit.
r: (epm) equivalent per million.
A: Accuracy or certainty
According to [12] accuracy and relative difference are classified in the table (1). When (R.D ≤ 5%) the results could be accepted for interpretation, but if (5% ≤ R.D ≤ 10%), then the results are acceptable with risk but if the value (R.D% > 10%) cannot be depended on the results in hydrochemical interpretation [13]. By using the above formula, accuracy for the analyzed samples was calculated for the twelve selected wells, table (2).

METHODOLOGY

All samples are taken in April 2018; they were collected immediately after purging; all information concerning the samples was noted. All sample bottles were filled completely capped labeled and the sealed sample containers were put into containers packed with ice and transported to analytical laboratory. Electrical conductivity (EC) and the degree of acidity (pH) were measured by using a portable apparatus of HANNA /pH/EC/TDS meter type, model (HI 9811). The measuring of (TDS) total dissolved salts was done also by the same device, in addition to the measured water temperature, (Table-3).

RESULTS AND DISCUSSION

It is necessary to evaluate groundwater suitability for the different uses. This evaluation is normally carried out by comparing its hydrochemical parameters with some standard limits, set for the different purposes as follows:

Groundwater suitability for human drinking

For the purpose of evaluating the suitability of groundwater for human drinking, Iraqi standard [14] and World Health Organization standard [15] were used to determine its suitability as drinking water for human drinking purposes, table (4). The results confirm that the groundwater is unsuitable for direct consumption as human drinking water.

Groundwater Uses for Livestock

The analyzed samples result are evaluated for livestock and poultry purposes, by using classifications proposed by Altoviski [16], and Ayers and Westcot [17] are shown in table (5), and table (6) respectively, when compared with table (4), It is clear that all water samples are: -

- Very good for animal drinking according to Altoviski [16] classification.
- Very satisfactory for all types of livestock and poultry, according to the classification given by Ayers and Westcot [17].

Groundwater suitability for industrial purposes

The results of the analyzed samples are evaluated for industrial purposes, by using classification suggested by Hem [13], is shown in table (7), when compared with table (4), it is clear that all water samples are not suitable for industrial purposes, because of high values of hardness and high salts concentrations, as well as it exceeded the permissible limits, wherein the case of suitable one's element, another element is not suitable

Groundwater suitability for building purpose

Suitability of groundwater is evaluated for building purposes, by using classification proposed by Altoviski (1962), as shown in the table (8). According to his classification and when compared with table (4), it is clear that all water samples are suitable for building purposes.

Groundwater suitability for agriculture and irrigation purposes

The kind and amount of salts present in the water and their effects on crop growth and development will be limited to Use the water for agricultural and irrigation purposes. The plants tolerance difference for total dissolved solids and electrical conductivity [10], (Table, 9), when comparing EC of groundwater, table (4) with those standards (specifications), it is clear that the groundwater is suitable for all kind of crops according to Todd [10] classification. Many classifications were suggested for specifying the suitability of water for irrigation. They depend on several variables including the cations, anions, EC, TDS, pH, sodium adsorption ratio (SAR) and soluble sodium percentage (Na %) as follows:

Ayers and Westcot, [17] classification depended on five groups that represent the hydrochemical changes including the salinity; cations and anions concentrations measured by (epm) unit, nutrients which measured by (ppm) unit and the influence of other miscellaneous materials.Don [18] classification depended on (EC, TDS, SAR, and Na%). Ayers and Westcot [17], table (10) and Don [18], table (11), classifications were applied to evaluate the suitability of groundwater for irrigation purposes. The comparison of these parameters values of the groundwater samples, (table 4) with the classifications tables (11) is given below:

• (EC): According to Ayers and Westcot, [17] classification, all samples of wells are within the permissible limits and water is suitable for irrigation, except well (w23, w26, w27 and w34). While according to Don [18] classification, the samples of wells are doubtful for irrigation and did not exceed the permissible limits.
• (TDS): According to Ayers and Westcot, [17] classification, all samples of wells are within the permissible limits and water is suitable for irrigation, except of well (w23, w26, w27, w34 and w38). While according to Don [18] classification, the samples of wells are Unsuitable for irrigation.
• Cations: When comparing the values of (Ca^{2+}, Mg^{2+}, and Na^{+}) concentrations of groundwater samples of the study area, all samples regarding (Ca^{2+}) and (Mg^{2+}) have exceeded the usual range, while (Na^{+}) concentrations for all samples of wells are within the permissible limits.

• Anions: all groundwater samples lie within the permissible limits, except well (w23, w26, w27, and w34)
• Nutrients: NO3: All groundwater samples are within the usual range.
• Potassium: All groundwater samples are within the usual range, except well no. (w28, w34 and w39).
• Miscellaneous:
- pH: According to Ayers and Westcot, [17] classification, all the groundwater samples are within the usual range. While according to Don [18] classification, the samples of wells are doubtful for irrigation.
• Sodium Adsorption Ratio (SAR): SAR is an important parameter for determination of suitability as irrigation water. The sodium hazard is typically expressed as the sodium adsorption ratio (SAR). This index quantifies the proportion of sodium (Na+) to calcium (Ca++) and magnesium (Mg^{++}) ions in a sample. It calculated according to the following equation [10]:

$$\mathbf{SAR} = \frac{rNa}{\sqrt{(rCa + rMg)/2}} \quad \text{..... (3)}$$

Where:
SAR: Sodium Adsorption Ratio.
rNa^{+}, rCa^{+2}, and rMg^{+2}: Concentration of Ions by (epm) units.

The comparison of SAR values of groundwater samples, table (12), with tables (10) and (11) showed that all samples within the usual range, and from the averages of SAR values, the water quality was Excellent.

The Na% values

The Na% values of groundwater samples, table (12) were compared with the suggested limits in the table (11) showed that the samples of wells no. (w23, w26, w27, w28, w34 and w38) lie in the good limit, wells no. (w39, w42, w43 and w44) which falls in the permissible limit, well no. (w41) which fall in Doubtful limit and well no. (w40) which fall in the Unsuitable limit.

CONCLUSION

Comparing the quality of groundwater with the standards of different uses, shows that it is unsuitable for drinking and industrial purposes, but it is suitable for livestock, building and almost suitable for irrigation purposes.

Recommendations

On the basis of the conclusions drawn above, a number of recommendations are given below:
1- Establish a monitoring station network of groundwater levels in the study area to measure the water level fluctuations, in order to evaluate the conditions for different purposes.
2- Collecting seasonally hydrochemical analysis for wells to determine the changes in water quality with time.
3- Examine the quality of the soil and the amount of vertical penetration of irrigation water, due to the expansion of agricultural activities in the study area
4- Limiting the random and unscientific well drilling by private companies for water well drilling via activating the monitoring role of the relevant authorities.
5- Study the heavy metal, organic and bacteriologic pollution of the groundwater in the area to make sure that water is not contaminated with these elements.

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Table 1. Classification of accuracy and relative difference [12]

R.D. %	A %	Acceptability
R.D. %≤ 5%	A% ≥ 95	Certain
10 % ≥R.D.% ≥5 %	90% ≤ A% ≤ 95%	Probable certain
R.D.% > 10 %	A% < 90%	Uncertain

Table 2 Accuracy of ground water samples in study area

Well No.	A%	R.D.%	Acceptability
W23	98.56	1.44	Certain
W26	98.74	1.26	Certain
W27	98.55	1.45	Certain
W28	95.93	4.07	Certain
W34	96.1	3.9	Certain
W38	98.95	1.05	Certain
W39	97.22	2.78	Certain
W40	97.39	2.61	Certain
W41	96.65	3.35	Certain
W42	96.23	3.77	Certain
W43	96.37	3.63	Certain
W44	96.43	3.57	Certain

Table 3. Physiochemical parameters for the water samples

Sample ID	Ca	Mg	Na	K	HCO_3	SO_4	Cl	TDS	EC	pH	NO_3	T.H
w23	437	126.1	122.2	7	64.12	1422	210.1	2786	3440	7.9	1.1	1607.8
w26	521	85	161	4	152	1467	220	2950	3665	7.4	0.5	1648.5
w27	460	80.9	163.1	5	147.3	1388	238.1	2910	3412	7.65	0.15	1481.6
w28	320	84	167.4	15	192	751	342	2100	2780	7.25	1.8	1143.4
w34	317	126	240	18	189.3	1055	340	2440	3320	7.15	2.3	1309.9
w38	240	112	191	10	232	745	365	2190	2710	7.13	0.8	1059.1
w39	229	106	196	15	249	742	292	1925	2650	7.41	0.5	1006.8
w40	190	72	319	2	240	660	370	2081	2710	7.25	7.5	769.85
w41	193	78.4	259.4	7.2	176.6	638.6	341.4	1985	2530	7.6	3.2	802.59
w42	195	89	220	10	163	610	350	1945	2460	7.14	1.3	852.13
w43	174	125	190	8	170	630	350	1815	2510	7.2	3.2	947.71
w44	212	87	235	6	214	578	384	1822	2610	7.44	2.1	886.21
Max	521	126.1	319	18	249	1467	384	2950	3665	7.9	7.5	1648.5
Min	174	72	122.2	2	64.12	578	210.1	1815	2460	7.13	0.15	769.85
Avarage	299	97.8	207.52	9.0	178.7457	909.4	314.05	2265.2	2923	7.3	2.3	1138.1
Stdv	120	20.18	52.88	4.8	50.5	345.4	61.2	420.4	429.7	0.2	2	313.3

*** Ec in (µs/cm), and all other parameter in (ppm)**

Table 4. Comparison of Water Samples with WHO [15] and IQS [14] Standard for Drinking Water

Parameter	IQS 2009	WHO 2007	Water Samples		Exceeding limits
			Range	Average	
Ec	1500	1530	2460-3665	2923	Exceed
TDS	1000	1000	1815-2950	2265.2	Exceed
pH	6.5-8.5	6.5-8.5	7.13-7.9	7.4	Not Exceed
T.H.	500	-	769.85-1648.5	1138.1	Exceed
Ca	150	75	174-512	299	Exceed
Mg	100	125	72-126.1	97.8	Not Exceed
Na	200	200	122.2-319	207.2	Exceed
K	-	12	2-18	9	Not Exceed
Cl	350	250	210.1-384	314	Exceed
SO_4	400	250	578-1467	909.4	Exceed
NO_3	50	50	0.15-7.5	2.3	Not Exceed
* Ec in (µs/cm), and all other parameter in (ppm)					

Table 5. Specifications of waters for Livestock consumption purposes [16]

Elements& Parameters	Very good Water	Good Water	Acceptable Water for use	Can be used	High limits
Na^+	800	1500	2000	2500	4000
Ca^{+2}	350	700	800	900	1000
Mg^{+2}	150	350	500	600	700
Cl^-	900	2000	3000	4000	6000
$SO_4^=$	1000	2500	3000	4000	6000
TDS	3000	5000	7000	10000	15000
T.H	1500	3200	4000	4700	54000
Unit (ppm)					

Table 6. Specifications of water suitable for animal consumption according to Ayers and Westcot, [17]

Water Salinity (EC) (µs/cm)	Rating	Remarks
< l500	Excellent	Usable for all classes of livestock and poultry.
1500 - 5000	Very Satisfactory	Usable for all classes of livestock and poultry. May cause temporary diarrhea in livestock not accustomed to such water: watery droppings in poultry.
5000 - 8000	Satisfactory for Livestock	May cause temporary diarrhea or be refused at first by animals not accustomed to such water.
	Unfit for Poultry	Often causes watery faces, increased mortality and decreased growth, especially in turkeys.
8000 - 11000	Limited Use for Livestock	Usable with reasonable safety for dairy and beef cattle, sheep, swine and horses. Avoid use for pregnant or lactating animals.
	Unfit for Poultry	Not acceptable for poultry.

11000 - 16000	Very Limited Use	Unfit for poultry and probably unfit for swine. Considerable risk in using for pregnant or lactating cows, horses or sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, poultry and swine may subsist on waters such as these under certain conditions.
> 16000	Not Recommended	Risks with such highly saline water are so great that it cannot be recommended for use under any conditions.

Table 7. Water Quality Standards for Industrial Uses [13]

Parameters	Textile	Chemical pulp and paper		Wood chemicals	Synthetic rubber	Petroleum products	Canned, dried frozen fruits and vegetables	Soft-drinks bottling	Leather tanning	Hydraulic cement manufacture
		Unbleached	Bleached							
Ca	-	20	20	100	80	75	--	100	-	-
Mg	0	12	12	50	36	30	--	--	-	-
Cl	0	200	200	500	--	300	250	500	250	250
HCO_3	0	--	--	250	--	--	--	--	-	-
SO_4	0	--	--	100	--	--	250	500	250	250
NO_3	0	--	--	5	--	--	10	--	-	-
Cu	0.01	--	--	--	--	--	--	500	-	-
Zn	--	--	--	--	--	--	--	--		
TH	25	100	100	900	350	350	250	--	soft	-
TDS	100	--	--	1000	--	1000	500	--	-	600
pH	2.5-10.5	6- 10	6- 10	6.5-8	6.5-8.3	6-9	6.5 - 8.5	--	6-8	6.5 - 8.5
T (°F)	--	--	95	--	--	--	--	--	--	--
TSS	5	10	10	30	5	10	10	--	--	500
All units except (T) are in ppm										

Table 8. Comparing water samples with water classification for building use [16]

Ions	Permissible limit	Average concentrations (ppm)
Na^+	1160	230.89
Ca^{+2}	437	145.07
Mg^{+2}	271	74.30
Cl^-	2187	330.94
SO_4^{-2}	1460	557.44
HCO_3	350	166.59

Table 9. Todd classification [10], for tolerance crops by relative salt concentrations for agriculture

Crops Division	Low salt tolerance crops EC (µs /cm)	Medium salt tolerance crops EC (µs /cm)	High salt tolerance crops EC (µs /cm)
Fruit Crops	(0 — 3000) Limon, Apricot, Orange, Apple, Pear, Peach.	(3000 - 4000) Olive, Figs, Cantaloupe, Pomegranate	(4000- 10000) Date palm.
Vegetable Crops	(3000 — 4000) Green beans, Celery, Radish.	(4000 - 10000) Cucumber, Onion, Carrot, potatoes, Lettuce Tomato, Cauliflower.	(10000 – 12000) Spinach, beets
Field Crops	4000 — 6000 Fields beans	(6000 - 10000) Sunflower, Flax, Corn, Rice, Sorghum	(10000 - 16000) Cotton, Sugar beet, Barley (grains)

Table 10. Specification standards for irrigation waters, according to [17]

Groups		Index	Unit	Usual Range
1	**Salinity**	EC	µmoh\cm	0 - 3000
		TDS	ppm	0 - 2000
2	**Cations**	Ca^{+2}	epm	0 - 2
		Mg^{+2}	epm	0 - 5
		Na^{+}	epm	0 - 40
3	**Anions**	Cl^{-}	epm	0 - 30
		SO_4^{-2}	epm	0 - 20
		HCO_3^{-}	epm	0 - 10
		CO_3^{-2}	epm	0 - 0.1
4	**Nutrients**	NO_3 - N	ppm	0 - 10
		NO_2 - N	ppm	0 - 50
		PO_4- P	ppm	0 - 2
		K^{+}	ppm	0 - 2
5	**Miscellaneous**	pH	1-14	6.0 - 8.5
		B	ppm	0 - 2
		SAR	epm	0 - 15

Table 11. Classification of irrigation waters according to [18]

EC (µmoh\ cm)	TDS (ppm)	SAR	Na%	pH	Water Quality
250	175	3	20	6.5	Excellent
250-750	175-525	3-5	20-40	6.5-6.8	Good
750-2000	525-1400	5-10	40-60	6.8-7.0	Permissible
2000-3000	1400-2100	10-15	60-80	7-8	Doubtful
>3000	>2100	>15	>80	>8	Unsuitable

Table 12. Values of (SAR and Na%) for wells in the area of study

Well No.	SAR (epm)	Na% ratio
w23	1.32	16.5
w26	1.72	21.2
w27	1.84	23.9
w28	2.1	31
w34	2.88	39.8
w38	2.55	39.2
w39	2.68	42.3
w40	5	90.1
w41	3.98	70.2
w42	3.27	56.1
w43	2.68	43.6
w44	3.43	57.6
Average	2.78	44.3