CONTENTS

Study of the mercury removal for health care and the effect of PH in mercury removal from aqueous solutions by activated carbons

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Abstract: A serious environmental threat from heavy metal ion pollution, especially mercury, has generated a great deal of attention in recent years. Mercury is one of the priority pollutant listed by USEPA as it can easily pass the blood-brain barrier and affect the fetal brain. High concentration of Hg (II) causes impairment of pulmonary function and kidney, chest pain and dyspnoea. Consequently, removal of mercury in water and wastewater assumes importance. In this review paper, we have evaluated the efforts which have been done for controlling the mercury emissions from aqueous solutions. According to the EPA agency, the tolerance limit for Hg (II) for discharge into inland surface water is 10µg/l and for drinking water is 1µg/l. Mercury (Hg) is one of the heavy metals of concern and has been found in the waste waters coming from manufacturing industry, and natural sources. Among several types of technology for removing of Hg in water (chemical precipitation, reverse osmosis, ion-exchange, etc.), adsorption is one of most frequently used. It is a complex process involving physical, chemical, and electrical interactions at sorbent surfaces. Therefore, in this study will investigate effective parameters such as pH, initial concentration and surface characteristic.
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Key words: Mercury, Adsorption, Surface area, Activated carbon, Wastewater.

1. Introduction:

Metals are known for their toxicity towards the aquatic environment. The discharge of effluents containing metals in the environment can constitute a threat to the aquatic life and have serious repercussions on the food chain. One of these metals is mercury [1-2]. Due to its high degree of microporosity, just one gram of activated carbon has a surface area in excess of 500 m2, as determined by adsorption isotherms of carbon dioxide gas at room or 0.0 °C temperature. An activation level sufficient for useful application may be attained solely from high surface area; however, further chemical treatment often enhances adsorption properties. Activated carbon is usually derived from charcoal [1]. Activated carbons are complex products which are difficult to classify on the basis of their behaviour, surface characteristics and preparation methods. However, some broad classification is made for general purpose based on their physical characteristics. Figure 1 shows the scanning electron microscope (SEM) image of activated carbon.

The adsorption of metallic ions from liquid has been studied for years, as well as the use of some so-called available absorbents. One of the low cost adsorbents is activated carbon. Activated carbon can be produced from a variety of carbonaceous raw materials, by either a physical or chemical activation methods. The adsorptive capacity of the final product depends on internal surface area, pore structure and surface chemistry that are defined by the nature of the starting material and production process [3].Among other reported techniques for the treatment of wastewater containing organic mercury, adsorption process shows good potential and can be cost efficient [4]. A carbon sorbent selected for mercury capture should have a suitable pore size distribution and large surface area, as a result of activation process. A carbon sorbent selected for mercury capture should have a suitable pore size distribution and large surface area, as a result of activation process. Activated carbons are widely used as adsorbents for removing different pollutants from drinking water usually, micropores posses the majority of the active sites for mercury adsorption, while mesopores act as transportation routes.

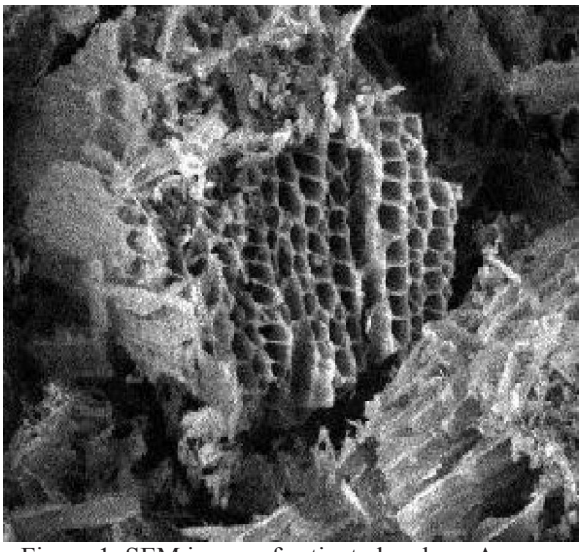

Figure 1: SEM image of activated carbon. A pours structure is observed [1].

Adsorption of Hg by activated carbons at ambient temperatures (e.g. 238C) has been suggested to be a combination of chemisorption and physisorption, whereas chemisorption is prevalent at higher temperatures; e.g. 1400C [5]. Many factors have been found to influence the efficiency of mercury removal, including carbon characteristics, flue gas composition, and the presence of active components [6].

The aim of the present work was to study the review of mercury (II) removal in aqueous solution by activated carbon. At first, the adsorption of mercury present in aqueous solutions onto fly ashes was studied in static reactor. Then a leaching test was also carried out to estimate the capacity of solids to retain durably the mercuric ions. Finally, the surface of spent ash samples after the adsorption experiments were investigated to understand mechanisms involved by mercury adsorption. In this paper activated carbon design has been studied. Therefore, some parameters such as temperature, initial concentration, and pH and isotherm models have been investigated as effective parameters.

2. Methods and materials:

The method of preparation of activated carbon involves two steps: the carbonization of the raw carbonaceous material in an inert atmosphere and the activation of the carbonized product. Various types of activated carbons with different pore size distributions can be obtained by using different raw materials and activation methods. The activation methods can be classified into physical and chemical activation. The former involves heating the carbonaceous materials at a high temperature with a reactant such as CO2 and H2O. The chemical activation involves heating the carbonaceous material at relatively low temperatures with the addition of activating agents such as H3PO4, ZnCl2, K2CO3, and KOH [7–8].

The adsorption capacity of designed activated carbon towards Hg(II) ion is investigated using an aqueous solution of the metal. The adsorbate stock solution of the test metal is prepared by dissolving the necessary amount of $HgCl_2$ in distilled water. This stocksolution is diluted to obtain standard solutions containing fixed Hg(II) concentration. Batch adsorption studies are carried out with fixed amount of adsorbent and fixed volume of Hg solution with the desired concentration at one defined by conical flasks.

Stoppered flasks containing the adsorbent and the adsorbate are agitated for predetermined time intervals at room temperature on the mechanical shaker. At the end of agitation the suspensions are filtered through microporous filter paper. The amount of the Hg(II) in the final volume is determined by atomic adsorption device.

3. Results

In the pH range of acidic condition, decreasing pH value would decrease the amount of Hg (II) concentration in result solutions. Higher Hg (II) removal will be achieved by increasing the pH value as it shown in Figure 2.

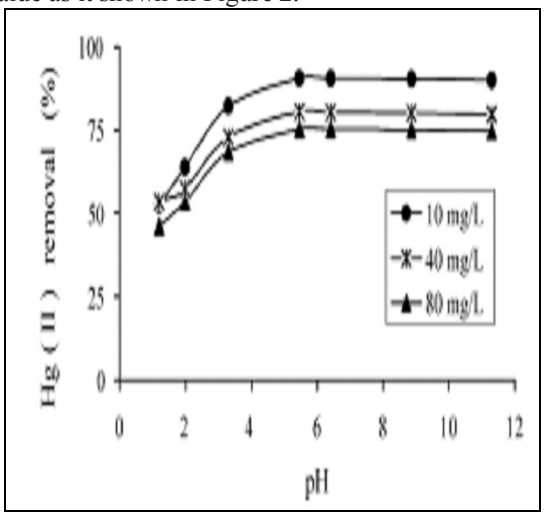

Figure 2. Effect of pH on Hg (II) removal with different initial Hg concentration by sewage sludge carbons [9].

Several studies have reported that the percentage of Hg (II) removal increased with the increase of pH value by using different adsorbents [9-11]. This effect was more significant when the mercury concentration was low. The prominent points is that with increasing in initial concentration

of mercury in liquid the removal of mercury will be increased which has been shown in Figure 3.

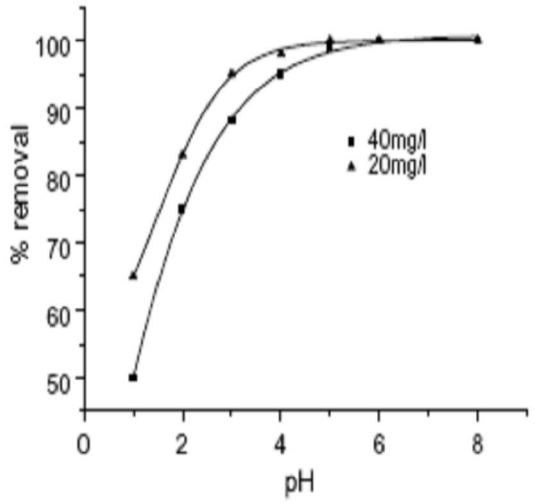

Figure 3. Effect of pH on Hg (II) removal with different mercury concentration: ▲20 mg/l, ■40 mg/l [11].

4. Conclusions:

It is well established that a serious environmental threat from heavy metal ion pollution, especially mercury, has generated a great deal of attention in recent years. The mercury is one of the priority pollutants and health threatening material listed by USEPA as it can easily pass the blood-brain barrier and affect the fetal brain. In this work we found that:

1- The results of several investigations on the adsorption of mercury ion by activated carbons from aqueous solutions reveal that the best absorbent is activated carbon with agricultural solid waste base.
2- By employing the activated carbons, adsorption will be increased by increasing initial Hg (II) concentration, pH of the solution, contact time and surface area of the absorbent.
3- With physical activation, carbonization temperature in the adsorbent preparation step, and with chemical activation, types of chemicals used in the impregnation step are the most influencing parameters on adsorption of mercury.
4- Another important factor is the structure of porosity. The best size of pore is meso size.

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Impact of solar energy application on warming, health caring and pollution prevention in Iran

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Abstract: Solar energy is cited as a clean alternative to fossil fuels. Solar panels generate energy without producing ambient pollution. Therefore, there is no argument that pure solar energy is a clean, green energy source. The result in the present paper shows that by using renewable energy special sun light energy, considerable amounts of Greenhouse polluting gasses are avoided. The use of conventional energy in factories and vehicles in has been a major source of pollution health hazards. These hazardous pollutants, such as suspended particle, heavy metal, organic matter and carbon monoxide (CO) adversely affect health. Although solar energy has significant environmental benefits in comparison to the fossil fuel, some problems has be seen in this way. The important advantage is related to the reduced CO_2 emission and air pollution prevention and it can be said this method for producing energy which has some economic benefit. The supplies of the fossil fuels used to generate much of its shrink, the cost of this energy is increasing worldwide. Solar energy allows human to generate its own energy in cheap way. To the best of our knowledge, the comparison of two categories of energy and investigation in the benefits of solar energy as a new way in Iran are investigated to prevent our environmental and natural sources.
[Hafshejani MK, Baheri A, Ojakeh M, Sedighpour A, Arad A. **Impact of solar energy application on warming, health caring and pollution prevention in Iran.** *Life Sci J* 2012;9(4):1849-1853] (ISSN:1097-8135). http://www.lifesciencesite.com. 281

Keywords: renewable energy, solar energy, air pollution, economic, Iran, Electricity, benefit.

1. Introduction

The sun is an essentially cleaning energy source which has the potential to satisfy a substantial fraction of the man's future energy needs. Solar energy from the sun is the produced power behind these life processes. Using solar energy has offered many environmental benefits that contribute to a healthy future. Sun light is the most significant resource which is converted into other energy. Using traditional energy such as natural gas, crude oil and all of fossil energy can spoil a huge amount of your energy source and money. Sun light energy is produced by using diversity technologies. This renewable source is used for industrial production, material testing, smelting, to heat up water, cook, distill and disinfect water for drinking purposes, and much more. The best thing, solar energy reduces the environmental impacts of pollutant industrials such as combustion of fossil fuel to generate heat and working which can produce green house gas and other air pollution emissions. The force to reduce CO_2 and other gaseous emissions according to the Kyoto congress is the main cause that countries try to use neat energy sources, nowadays. Global warming, greenhouse effect, climate change and ozone layer depletion are the worst effect on environment by using common energy. Solar energy applications have the wide area. One of the most important areas is the generation of electrical power [1]. Some of these applications are such as solar desalination using, solar heat, solar still method, solar water heating pipes and solar space heating and cooling [2]. In this paper, solar energy applications and their impressions on the environment are investigated and some of these applications are described in Iran as a developing country. In addition, the destructive effect of this renewable energy is represented.

2. Renewable and non-renewable sources of energy

Generally, energy sources are classified as renewable and non-renewable energy types. Renewable energy is defined by the fuel source, such as solar, wind, biomass, tidal, etc., that usually is called new resources. The capable of renewable energy is to provide cost-effective energy to remote communities without the added investment of providing fossil generation, which is shown in table 1. Another group is non-renewable energy such as coal, crude oil, gas well and fossil fuel which is called conventional resources. This category of energy has no effective economical and benefits for environment and usually causes much pollution in the ambient. [3]. Fossil fuels as a non- renewable

resources consist of deposits of once living organisms which takes centuries to form. Fossil fuels principally consist of carbon and hydrogen bonds. There are three types of fossil fuels which can all be used for energy provision; coal, crude oil and natural gas. China and India are major users of coal for energy provision [4]. Today the world daily non-renewable resources energy consumption is about 76 million barrels. Pollution depends on energy consumption. Problems associated with energy supply and use are related not only to global warming but also to other environmental impacts such as air pollution, acid precipitation, ozone depletion, forest destruction, water contaminant and emission of radioactive substances. One of the most important pollution in an ambient is the exits of NO_x and SO_x which are called acid rain. These pollutants are produced by the combustion of fossil fuels, such as industrial boilers and transportation vehicles. Another effect of these non-renewable sources of energy is Ozone layer depletion. A global environmental problem is the depletion of the ozone layer, which is caused by the emissions of organic gases from burning fossil fuels. Therefore, this problem can cause global climate change. Increasing concentrations of greenhouse gasses increase the amount of heat and temperature of the earth. Although these results of using conventional sources of energy can damage the world security but yet using of these category of energy is common. Nowadays, in some countries special in Iran the strong political will is to use the renewable energy not only for environmental effect but also the conventional resources is the prominent investment in each country that should be saved by the human. The benefits arising from the operation of renewable energy can be put into three categories: energy saving, generation of new work and decrease of ambient pollution [5].One of the best renewable energy is solar energy. By using solar energy instead of conventional fuel, large amount of pollutants are avoided. Iran is one of the biggest countries that have the wide energy resources in the world. Annually, in Iran, about 216 million tone crude oil was been producing and 98123 million cubic meters was been producing, too [6]. It is predicted that by 2030, the using of natural gas as a source of energy will be increased by the rate of 1.8%, annually. The most of these requests will be accrued in the developing countries such as India, China and special Iran. It can be said that until 2030, the consumption of natural gas and fossil fuels will be increased with rate of 21.5%. This is the main reason of ambient pollution in Iran and the other developing countries. Nowadays solar energy is used straightly for various aims. In Islamic religion, it is recommend using sun light for erasing the unclean material, which is called the neat energy resources so it is seemed that sun light energy is saint and is recommitted by some holly religions. It can be said even the first idea for utilization of renewable energy special solar energy is expressed by Muslims. Today in Iran more than 90% of power plants are using natural gas as their fuel. Annually, the amount of sun radiation is estimated 1800 to 2200 kWh that it is more than the world average. Therefore, some projects are done to produce useful energy by using of the country potential in this productivity.

Table 1. Main renewable energy sources and their usage forms

Energy source	usage options
Hydropower	Power generation
Geothermal	Urban heating, power generation, hydrothermal, hot dry rock
Solar	Solar home system, solar dryers, solar cookers
Wind	Power generation, wind generators, windmills, water pumps
Tidal	Barrage, tidal stream

3. Application of solar energy in Iran and its environmental effect

One of the solar applications is to provide the required heat energy of the generator of a single effect lithium bromide–water absorption cooling system. This experimental project has done in Ahwaz where the sun radiation is wider. The minimum required collector area was about 59.8 m^2 for the collector mass flow rate of 1800 kg/h with the initial temperature of the storage tank equal to ambient temperature during sunshine hours of the design day [7]. From this study, it can be found that one of the important conclusions is decreasing the using of fossil fuels for heating which can pollute environment. Another study in this way is about Yazd solar power plant [8]. Yazd solar power plant shows that the INTEGRATED SOLAR COMBINED CYCLE SYSTEM (ISCC-67) is the most suitable and economical project for construction of first solar power plant in Iran. The environmental effects are considered that the ISCC-67 will have the lowest Levelized Energy Costs, which is about 10 and 33% lower than combined cycle and gas turbine, respectively. It is shown overall technical and economic specifications of different cases for Yazd solar power plant in Table 2.

In Table 1, it is shown the fuel consumption in six cases. With comparison, the fuel consumption

of each power plants which has reported as m^3/MW h. The fuel consumption in traditional combined cycle is more than the others. The ISCC-67 has lower fuel consumption about 16% than combined cycle. Therefore, in this case more litter pollution emission can be released which are shown in Figure 2. In addition, it is gained by using solar system special ISCC-67 the house gases are eliminated from air which can destroy the Ozone layer.

Table 2. Overall technical and economic specifications of different cases for Yazd solar power plant [8].

Cases / Parameters and units	ISCC-33	ISCC-67	ISCC-67 AF	SEGS(Solar Electric Generating System)
Investment cost (million $)	206	251	255	110
Saving fuel (million $) in 30 years	29	59	59	59
CO_2 emission reduction (million ton) in 30 years	1.2	2.4	2.4	2.4

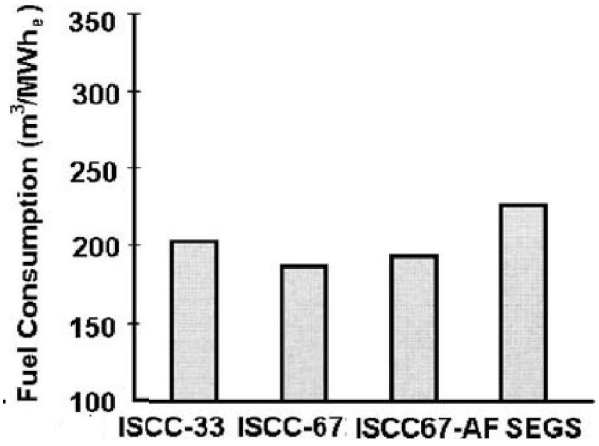

Figure 1.Natural gas consumption per unit of produced energy for different cases [8].

Since Iran is a developing country with an increasing rate of electricity of consumption, so it is better to produce by renewable sources of energy like solar energy. Many regions in Iran have a potential for using to install the solar power plant. These areas are shown in Figure 3.

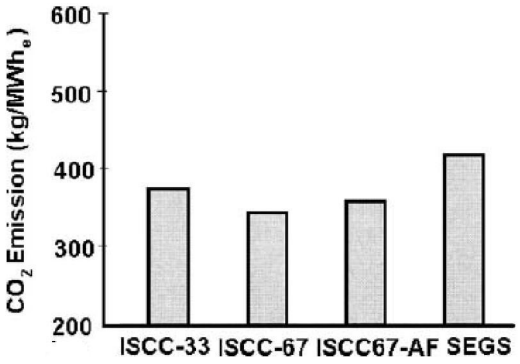

Figure 2. CO_2 emission per unit of produced energy for different cases [8].

Figure 3.The regions which have the potential to produce solar power plant [3].

By establishment of power plant for generating electricity it will be decreased the emission of pollution which is caused from fossil fuels such as crude oil and natural gas. Amount of pollutants and greenhouse gases emitted from burning fossil fuels in Iran during 2007 can be seen in Table 3. These pollutants can cause very terrible illness [9].

Another research has been investigated the application of solar energy in four climate regions in Iran. In this study, it can be seen that by using the sun light as a renewable energy, the investment and the usage of conventional energy will decrease. Figure 4.Shows divided region into four different climatic regions: cold, Temperate-humid, hot-dry and hot-humid [10]. It can be seen that all of areas in Iran have a suitable potential for using sun light and to can save much of fossil fuel and money annually. But the important result is to produce the new resources

of energy for avoiding of ambient pollution. Table 4 expresses the benefits of solar energy in four-climate condition in Iran.

Table 3. Amount of pollutants and greenhouse gases emitted from burning fossil fuels in Iran during 2007[9].

Fuels (Ton)	NO_x	SO_x	CO	CO_2	CH_4	N_2O
Kerosene	3734	17923	8525	19,446,284	811	162
Gas oil	607,460	542298	145,804	92,632,989	4481	4481 7642
Fuel oil	131,339	822796	62	58,322,366	2148	2148 429
Natural gas	283,701	745	15,521	245,452,905	6820	441

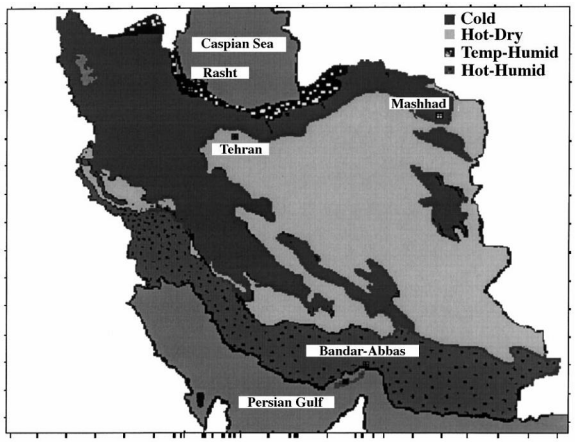

Figure 4.climate map of Iran [10].

Table 4. Annual fossil fuel savings in Iran [10].

regions	Annual fossil fuel energy saving (Gj)
Cold	109,440
Hot-dry	63,000
Temperate-humid	25,920
Hot-humid	19,440

The thermo siphon solar water heater is one of the prominent applications of sun light energy [11]. The results show that by using solar energy considerable amounts of greenhouse polluting gasses are saved. For the domestic solar heating system considered here, with electricity or diesel backup the saving, compared to a conventional system, is about 70%.

Table 5. Shows the effect of using solar energy instead of fossil fuels for heating water on environmental. In the table the eight most important greenhouse gasses are considered. The amount of emissions depends on the type of fuel used as auxiliary.

4. The negative environmental impact of renewable energy

Many types of renewable energy exist in the world that there are no emissions to the air, water, or soil, because there is no burning of fossil fuels. For example every power plant which generates from wind prevents the emission of certain amount of pollution by burning fossil fuels. This renewable energy usually is done by wind turbines which can have a bad effect on environmental such as damage of birds as a result of collisions with towers and blades. Another problem is the noise produced by wind turbines [12]. Also the negative environmental impact of solar energy system is existed which is important to select the suitable instruments. The most important of these negative impacts are land displacement, and possible air and water pollution resulting from the manufacture, normal maintenance operations and demolition of the systems. But the land displacement can be solved by using the roof of building for installing solar energy system instruments [11]. It can be mentioned to emit the air pollution and water contaminants from the manufactures where the incumbent instruments have been produced. According to the vantages of renewable energy it can be imparted they are only proper resources of energy for human and his environment because of eschewing of burning fossil fuel.

Table 5. Environmental impact of the thermo siphon solar water heater with diesel and electricity backup [11].

Emissions	Units	Conventional (electricity backup)	Conventional(diesel Backup)	Solar System(electricity backup)	Solar system(diesel Backup)
Carbon dioxide	tons/year	1.546	0.889	0.449	0.293
Carbon monoxide	g/year	374.6	1688	109.7	581.3
Nitrogen oxides	g/year	56.3	1636	16.3	544.8
Nitrous oxide	g/year	6.3	6.1	2.1	1.2
Methane	g/year	9.3	13.6	2.7	3.3
Sulfur dioxide	g/year	562.7	651.4	164.5	169.9

5. Conclusion

In the present study, the potential benefits that solar systems offer are discussed in detail, in Iran. Additionally, in the study the environmental protection offered by the most widely used renewable energy system. The results show that by using solar energy considerable amounts of greenhouse polluting gasses are saved. Ambient toxic emissions during solar system were very low, and blew detection limits. The application of such fuel system in industry of country offers a wide range of ecological and, in many cases, economical advantages like conservation of fossil fuel resources, utilization of reduction of emission of harmful species from fossil fuel burning, and minimization of waste disposal. The negative environmental impact of renewable energy is also expressed such as damage of animals like birds and land displacement by solar energy systems. However, it is clear that using of these sources of energy is more useful special for environment than conventional energy.

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Analysis of hydraulic fracturing in fractured reservoir: interaction between hydraulic fracture and natural fractures

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Abstract: Hydraulic fracturing operations in fractured reservoir, due to the complex nature of these processes require different parameters of hydraulic fracture and also studying the reaction between hydraulic and induced fractures. In this study, at first analysis of the hydraulic fracture length and its height from the point of impact on production flow rate will be evaluated. Then, in some areas of reservoir the reaction between natural and hydraulic fractures will be discussed. Interactions among three natural fractures of the angles 90, 45 degrees and one parallel with hydraulic fractures (zero degrees) will be analyzed. In this review, including tensile and shear debonding two types of reactions will be checked. Debonding phenomena at various distances before contacting the hydraulic fracture and also after reaching and being intersected by natural fracture by hydraulic fracture will studied. As we will see, depending on the natural fracture from point of their location angel relative to hydraulic fracture we have different tensile and shear debonding.

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Keywords: Fracture, Debond, Tensile, Shear, Kick point , Opening

Introduction

One way to exploit the fractured reservoir to increase production rates is connecting of natural fractures to well. The most important way to achieve this goal is the influence physics of reservoir rock that is trying to improve the physical structure of reservoir rock. Among the most important of these methods can be used to create artificial fractures in the reservoir rock. Artificial fracturing is one of the common methods in order to stimulate wells to increase the production of oil and gas. In hydraulic fracturing, there is some fractures made from well wall to oil and gas formations. With this operation, the natural fractures associated with each other via the hydraulic fracturing and finally are connected to the well.

Pre-existing natural discontinuities in the rock also affect the propagation path of a hydraulic fracture. There are several numerical techniques that are proposed to model such complicated process, some of them are based on finite element method (Zhang and Ghassemi , 2010), others are based on combining analytical and numerical methods (Weng et al. 2011). However, these methods either show problems of dealing with complicated, highly fractured reservoir models and a comprehensive analysis of how different parameters influence the fracture behavior has not been fully investigated to date. In most other cases, successful shale-gas production requires hydraulic fracturing to improve wellbore-to-natural fracture system communication, which eliminates the high near-wellbore pressure gradient. Additionally, coring has shown that hydraulic fractures have been diverted along and have propped pre-existing natural fractures (e.g. Hopkins et al., 1998 and Lancaster et al. 1992). Therefore, understanding the geometry and the growth process of hydraulic fractures and their interaction with natural fractures is important for designing, monitoring and assessing the induced fractures and their effects on the wellbore production.

There are several numerical techniques that are proposed to model such complicated process, some of them are based on finite element method (Zhang and Ghassemi , 2010), others are based on combining analytical and numerical methods (Weng et al. 2011) or multi-stranded hydraulic fractures in naturally fractured reservoirs (Fisher et al. 2005). Dynamic fracture mechanics theories (Freund 1990) indicate that crack tip branching will occur only in cases where fracture propagation speed is comparable to the seismic velocity of the material.

In this study, progress of hydraulic fracture in the fractured reservoir is reviewed. Development of hydraulic fracture in fractured reservoir with distinct element method, and the reaction between the natural and hydraulic fractures with extended finite element method are done. As we will see the hydraulic

fracturing operation in fractured reservoir, depending on the length and height can have a significant impact on production. The reaction between the natural and hydraulic fractures in reservoir depending on the contact angle and close of induction fracture is different.

Model Description

By using a distinct element method, the area around the wells that studied is simulated. The simulation by using field data such as core, Logging, and ... Has been done. Figure 1 shows the model simulation by use of distinct element code. As can be seen in figure 1 the natural fracture stated around the hole is completely specified. The block size is 20 x 20 meters that the well is located in the middle of the block.

Status of natural fractures in different areas around the well is not the same and hydraulic fracturing in each direction along the course that will produce different results because in any direction or angle, position and density of natural fractures varies. So here's the principle stress distribution around the well to form hydraulic fracture is characterized. Stress fractures parallel with maximum principle stress and perpendicular to the main stress of the minimum are extended. Based on the main stress distribution around the studied wells, hydraulic fractures at the angle of zero degrees are formed then extended (Figure 2).

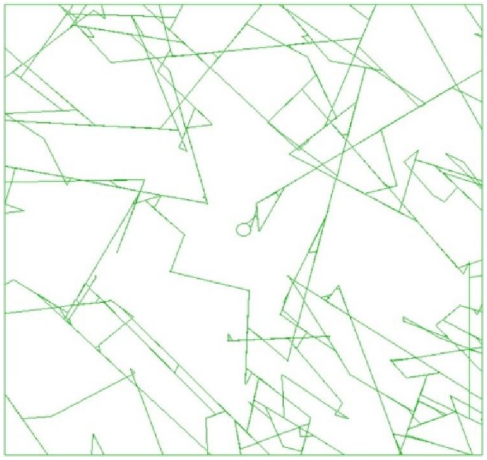


Figure1. Model of the fractures around the well

In naturally fractured reservoirs fluids generally exist in two systems (1) the rock matrix, which provides the main bulk of the reservoir volume and storage and (2) the highly permeable rock fractures which provide the main path for fluid flow. If the fracture system is assumed to provide the main path and storage for fluid, i.e. it is not connected to the matrix system, this can be considered as a single-porosity single-permeability system (SPSP) as in Figure 3-a. On the other hand, if we assume that the fluid flow in the reservoir takes place primarily through the fracture networks while the matrix-blocks are linked only through the fracture system, this could be regarded as a dual-porosity single-permeability system (DPSP) as in Figure 3-b. In addition, if there is flow between matrix-blocks, this can be considered as a dual-porosity dual-permeability system (DPDP) as in Figure 3-c. Clearly, the dual porosity dual permeability system is the most general approach to modeling fractured reservoirs and will reduce to the dual-porosity system when flow in the matrix block is assumed to be negligible (Ahmed H et. 2004). In this model consider one-phase incompressible flow in a SPSP system.

Performing hydraulic fracture design calculations under these complex conditions requires modeling of fracture intersections and tracking fluid fronts in the network of reactivated fissures. In this dissertation, the effect of the cohesiveness of the sealed natural fractures and the intact rock toughness in hydraulic fracturing are studied. Accordingly, the role of the pre-existing fracture geometry is also investigated. The results provide some explanations for significant difference in hydraulic fracturing in naturally fractured reservoirs from non-fractured reservoirs. For the purpose of this study, an extended finite element method (XFEM) code is developed to simulation fracture propagation, initiation and intersection. The motivation behind applying XFEM are desirable to avoid retesting in each step of the fracture propagation, being able to consider arbitrary varying geometry of natural fractures and the insensitivity of fracture propagation to mesh geometry. New modifications are introduced into XFEM to improve stress intensity factor calculations, including fracture intersection criteria into the model and improving accuracy of the solution in near crack tip regions (Arash dahi 2010).

Analysis of length and height of the hydraulic fracture

After determining the formation direction of hydraulic fracture by using distinct element method, hydraulic fracture with different length and height will be applied in reservoir. Production flow chart when hydraulic fracture is applied is given in Figure 4.

As can be seen when the fracture length is equal to 2, 4 and 6 meters, the production in different aperture is almost same. If looked at the area around the wells that the hydraulic fracturing with these lengths are located, it is observed that the hydraulic fracture is located in intact area and increased to 6 meters in length practically does not interrupt the natural fracture. By increasing hydraulic fracture length, more natural fractures will connected to well. If we see the chart we can conclude that the length play more important role, and production shows more sensitive then length and approximately after 200 micrometers opening, with an increase of this parameter the production is almost constant. During fracturing of the low-permeability

fractured reservoir, the fracture length is more important than the flow conductivity (Z. Zaho et al., 2005).

Obviously, because the number of natural fractures in path of hydraulic fractures are a few, so the length plays more important role and increase in aperture to formed fracture have low effect on production. In other words, if hydraulic fracture in fractured reservoir expands in area where the natural fractures with low density are existing Induction fracture with more length will have a better performance.

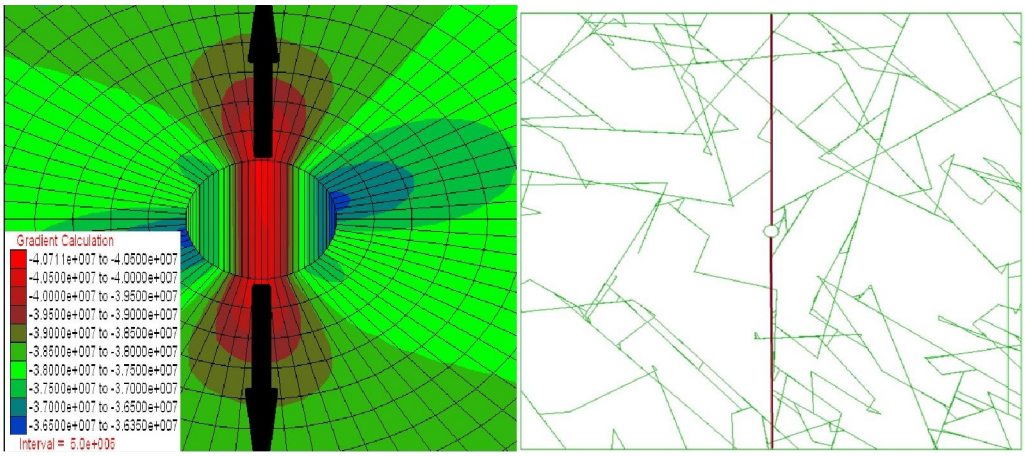


Figure2. The formation and expansion of hydraulic fractures in studied well

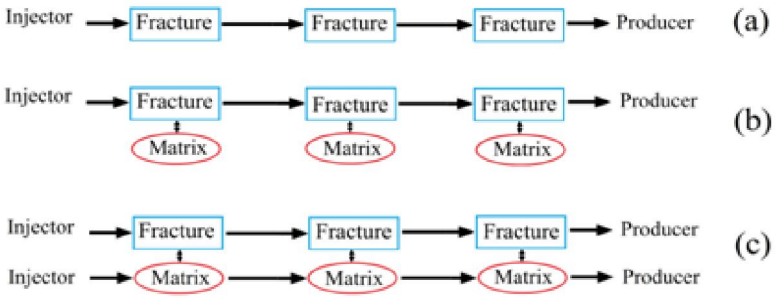


Figure3. a) Single-Porosity Single Permeability System b) Dual-Porosity Single-Permeability System c) Dual-Porosity Dual-Permeability System.

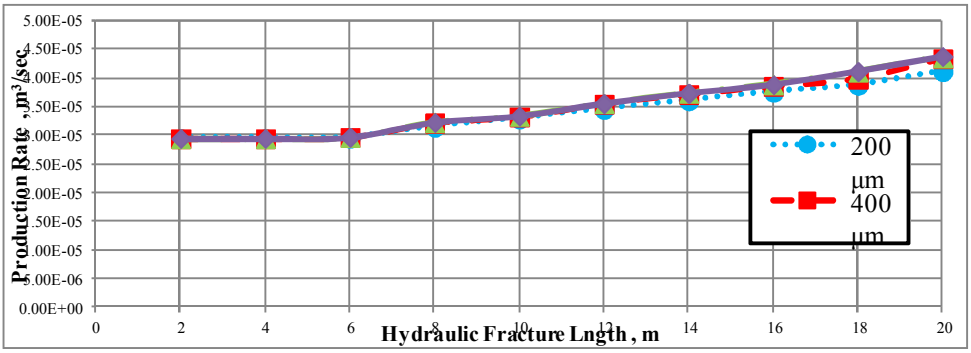


Figure4. Flow diagram of production of different length and height of the applied hydraulic fracture

Reaction analysis between Induced fracture and natural fracture

With the expansion of hydraulic fracture in fractured reservoirs, different reactions between natural fracture and hydraulic fracture will occur. This reaction is different due to various collisions that made between induction fracture and natural fracture. Based on the angle of collision, the reaction will be different. Here we study three types of collisions that occur with expansion of hydraulic fractures in reservoir. Figure 5 shows the three types of collisions. Here we only consider reaction between hydraulic fractures and

natural fractures. In other words, another natural fracture near the studied fracture may be present but we assume in any angle a natural fracture with hydraulic fracture reacts.

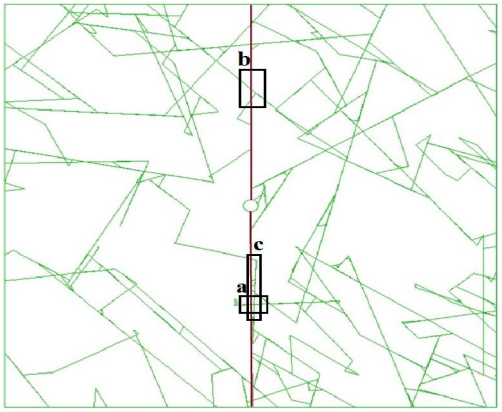


Figure5. 3 types of collisions between hydraulic fracture and natural fracture (A: angle of 90 degree, B: angle of 45 degree, C: angle of 0 degree)

The natural fractures will open if the energy of the growing hydraulic fracture is large enough to deboned (re-open) fracture cements. Debonding can also take place ahead of the primary crack before the fractures intersection. The natural fracture starts to open/shear or propagate before the hydraulic fracture arrives because of near-tip stress concentrations. If this phenomena, it may even divert the growing fractures into double-deflection in the natural fractures.

When the hydraulic fracture with 90-degree angle will close to the natural fracture, according to Figure 6, when the hydraulic fracture reach to a, b and c areas debond of natural fracture will evaluate. a and b areas are located respectively 10 and 5 cm away from natural fracture and c area is exactly located where the natural fracture and hydraulic fracture are reached together. Natural fracture length of 50 cm is considered and stress condition is assumed isotropic.

When the hydraulic fracture is close to a natural fracture two debond in natural fracture occurs: Shear failure and tensile failure. Debond review in natural fracture is from north to south of natural fracture.

The opening and sliding displacements along the debonded crack (90 degrees) is shown in figure 7. It is remarkable that the debonding length and the stress intensity factors at the tips of primary fracture or new initiated fracture are independent of the rock stiffness, because the stress field of the growing fracture is independent of rock elastic properties.

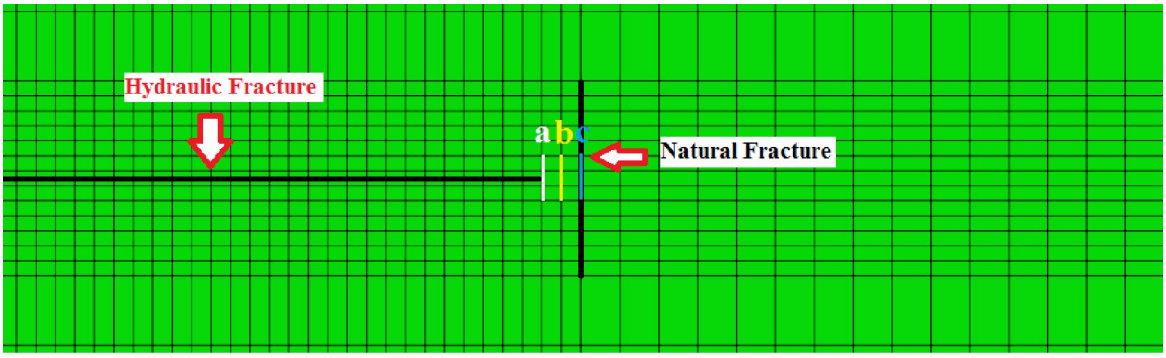
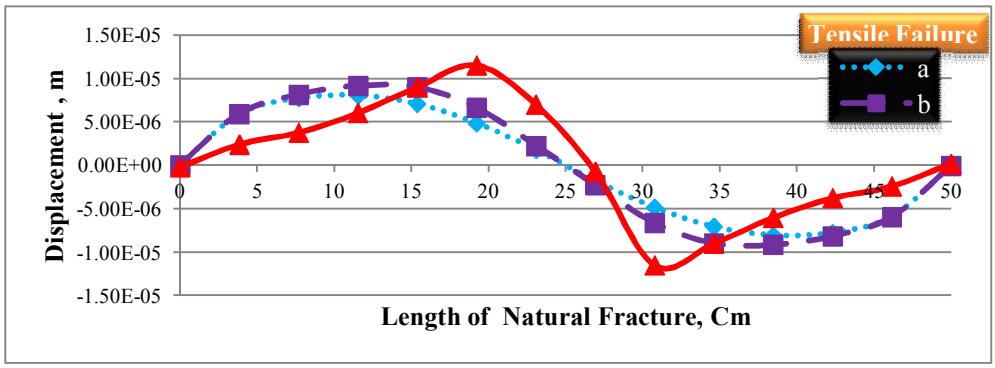


Figure6. Evaluated areas for debond of natural fracture when induction fracture with 90-degree angle



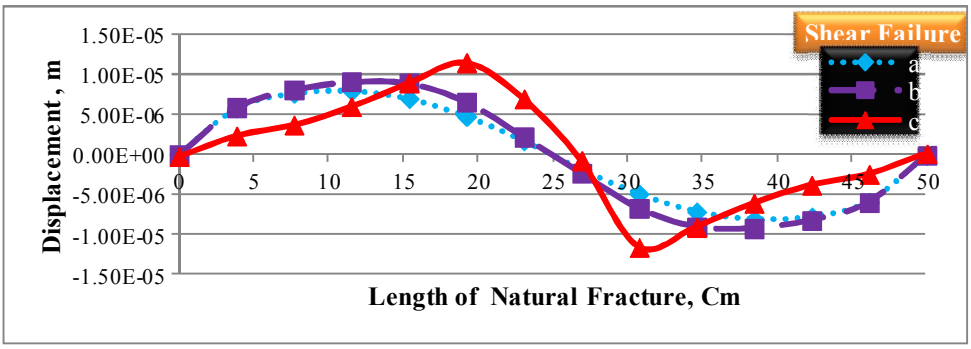


Figure7. Opening and sliding displacements along the deboned zone of Figure 6

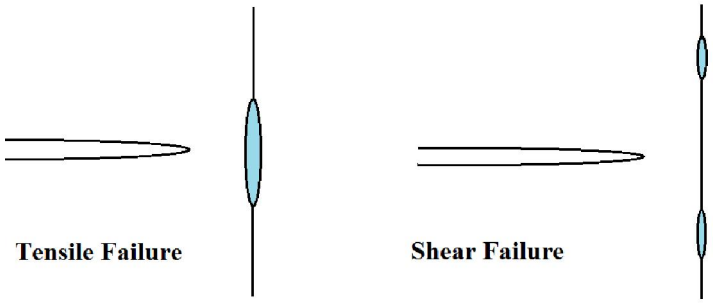


Figure8. Schematic illustration for debonding induced by the approaching crack

relative to the natural fracture spread

When the hydraulic fracture is close to the natural facture opening displacement in an area of natural fracture expands that on these area or point the natural fracture will reach and cut it (kink point) and sliding displacement in the region without the kink point above or below this point spreads (Figure 8). It is noteworthy that if the distance between induction fracture and natural fracture are less focus of debond phenomenon will be more. In other words, in the opening displacement, the central region of debonded zone by closing of induction fracture will have more expansion and sliding displacement in the region near the kink point in the debonded zone expands.

For the case of non- normal intersection, the induced debonding is asymmetric with respect to the approaching crack and may possibly become partly closed under the effect of the approaching fracture. In non-normal cases, shear failure plays a significant rule in activating the fractures and forming asymmetric debonding with respect to the approaching crack. This observation can be justified by comparing figure 9, where non-normality amplifies the shear traction exerted on the natural fracture.

Figure 9 show Normal and shear tractions ahead of the declined primary crack (45 degrees) that are experienced along the sealed crack at different distances to the middle of the seal crack: 1.0, 0.5 and 0.05 respectively (distances and tractions are normalized with respect to growing fracture length and pressure, respectively). These plots were compared with XFEM results.

To investigate the phenomenon of debond, when a natural fracture with a 45 degree angle placed in hydraulic fracture path as same as 90 degree we assume 3 regions (Figure 10). But here is difference that related to c area because here c is the exact moment that the hydraulic fracture cut the natural fracture.

The opening and sliding displacements along the debonded crack (45 degrees) is shown in figure 11. When the induction with 45-degree angle is close to the natural fracture in c area, tensile failure phenomenon is such status that the natural fracture had a 90 degree, because the middle area of natural fracture become debonding and maximum value of debonding and is at the kink point. But with less distance between natural and induced fractures the condition is slightly different. When the hydraulic fracture reach to b area, the end of natural fracture compressed (about 12 cm end of natural fracture) and other parts of natural fracture become debond. Maximum value of deboning and it is at the kink point but the symmetry of the debonding zone in natural fractures we have seen with 90-degree angle, it is not here. After being cut off the natural fracture by hydraulic fracture (c area) upper part of kink point become debonding and lower part compressed (figure 12).

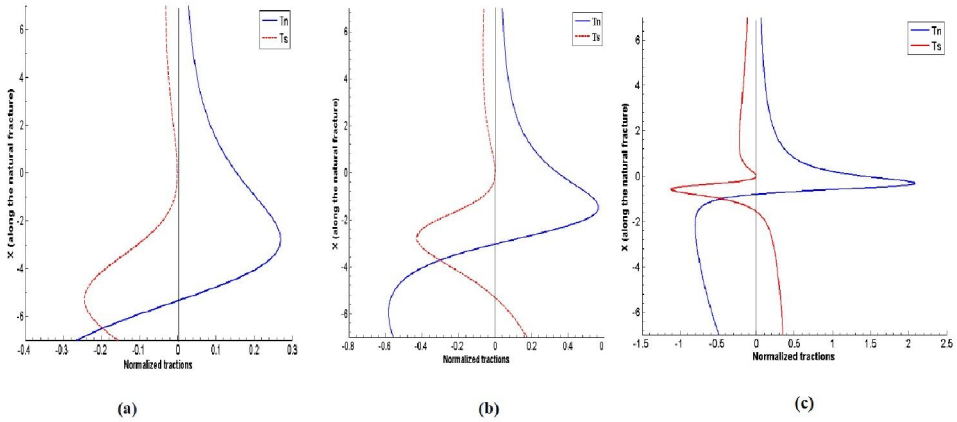


Figure9. Normal and shear tractions ahead of the declined primary crack (45 degrees)

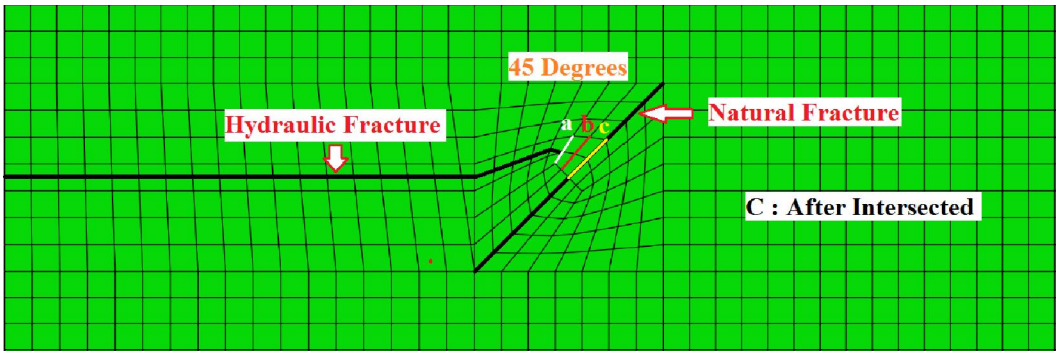


Figure10. Areas of study for Debond investigation when natural fracture with a 45 degree angle relative to the hydraulic fracture spread

According to shear failure chart of Figure 11, when the induction fracture reaches a area slide debonding in all over natural fracture in same path but its amount was quite variable and it is not symmetric So that the state has taken the form of a wave. In lower part of natural fracture the shear failure amount is up. By reaching the induction fracture to b area, the shear failure condition get more symmetric and maximum of slid debonding in near of kink point occur, and here the lower part of fracture has more slid debonding then upper part. After cutting the induced fracture by the natural fracture, the situation is quite different(c area) and the direction of shear failure in both side of kink point is not parallel and even at upper part of natural fracture the direction of slide debonding become negative then to kink point become positive and maximum statues of slide debonding in near of kink point at upper part of fracture occur. But a point that needs to be noticed is that after cutting the natural fracture in the lower kink point slide debonding direction is negative there are swinging and nearly 3 points to this slide debonding reaches its largest value in the area. The fracture deflected by non-normal intersection have an asymmetric opening which directs the fluid toward the direction going farther from the primary fracture so double-deflected fracture will tend to propagate on just one-side. The next stages of fracture propagation after debonding is complicated as the fracture propagation will be dominated by many factors such as anisotropy of tectonic stresses and the size and orientation of the debonded length with respect to tip of hydraulic fracture. Shum and Hutchinson (1990) and Hutchinson (1987) studied the crack tip shielding and anti-shielding by parallel en echelon offsetting cracks. However their analyses were limited to uniform far-field loading which is not the case for hydraulic fracture but it may represent high permeability reservoirs case, where both fractures could be pressurized. The crack debonding phenomena may also occur in parallel (and sub parallel) fractures as well. In such situations, the effect of the re-opened fractures is complicated.

At this stage, we examine condition of natural fracture debonding when placed in parallel with hydraulic fracture. As can be seen in Figure 13, we here consider the three areas. Fracture Coalescence phenomena, occur in this case with the expansion of hydraulic fracture extremely function of parameters such as stress distribution, the vertical distance between natural and induced fractures, length of natural and hydraulic fractures.

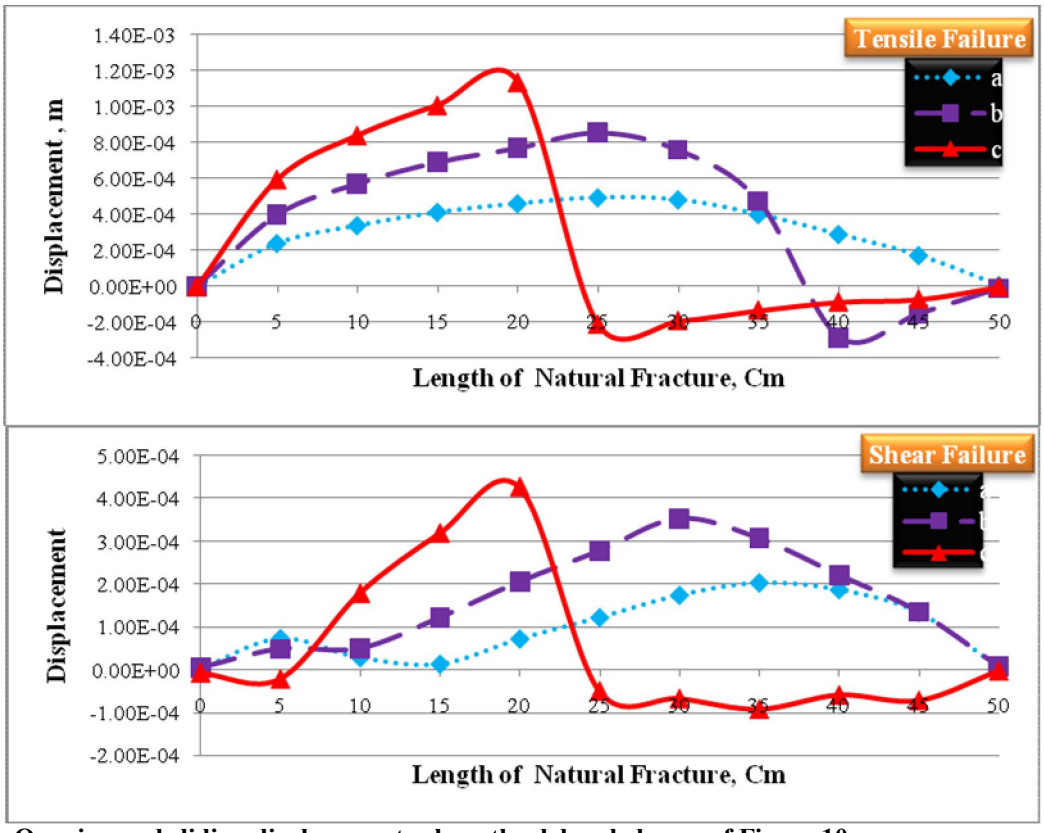


Figure11. Opening and sliding displacements along the debonded zone of Figure 10

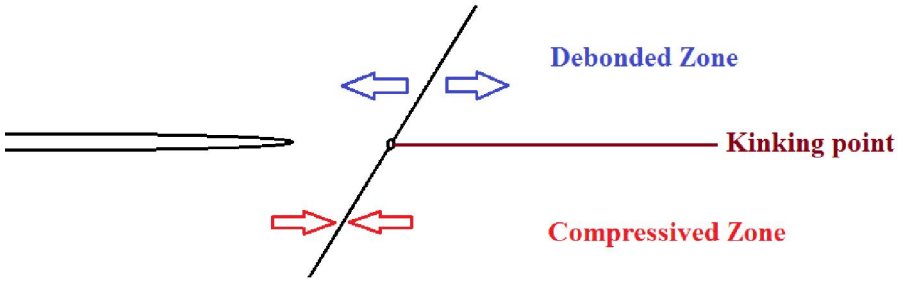


Figure12. Schematic illustration for debonding induced by the approaching crack

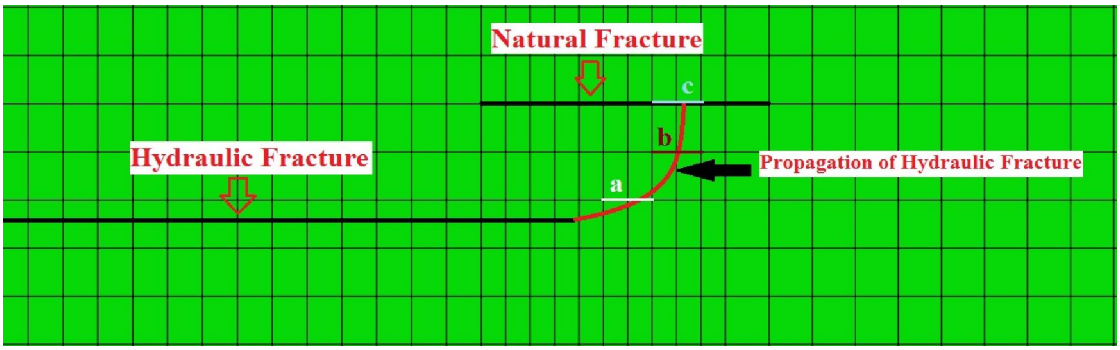


Figure13. Areas of study for natural fracture Debond when the induced fracture with zero-degree angle relative to natural fracture expands

We are here to connect the hydraulic fracture to natural fracture under the terms of isotropic tried different distances in order to induce these two together and we reached this conclusion that under these conditions when relativity of the vertical distance between natural fracture and induced fracture to natural fracture length become 0.5 the coalescence will occur. Thus the vertical distance of 25 cm fracture Coalescence occurred. However under anisotropic condition, and depending on the difference between the maximum and minimum of horizontal principal stress, the situation will quite different. Graphs of shear and tensile failure when natural and induced fractures become zero degree angles compared together are shown in figure 14.

In tensile failure subject, when induced fracture reached regions a and b, a debonding phenomenon more inclined to the right side of natural fracture. In other words when hydraulic fracture is located in region a, at the tip of a hydraulic fracture is located approximately in the middle of the natural fracture so the tensile debonding is almost symmetric mode and the maximum amount of tensile debonding in the middle of natural fracture. But by reach the region b, fracture tip is not in the middle of the natural fracture, so due to fracture coalescence phenomenon to be tends and slightly is deflected to the right so that the tensile debonding that occurs in the area b in right side is more but the remarkable thing is that the maximum amount of tensile debonding is in the center of natural fracture but by cutting the natural fracture by induced fracture (area c) the maximum amount of tensile debonding occurs in kink point. With cutting of natural fracture, as well as tensile debonding status changes, so that part of the kink point that located on the right side opens but the left side is suffering from congestion or closure just like the same phenomenon that happened in the 45 degree. It is important to note here that the concentration is not too high.

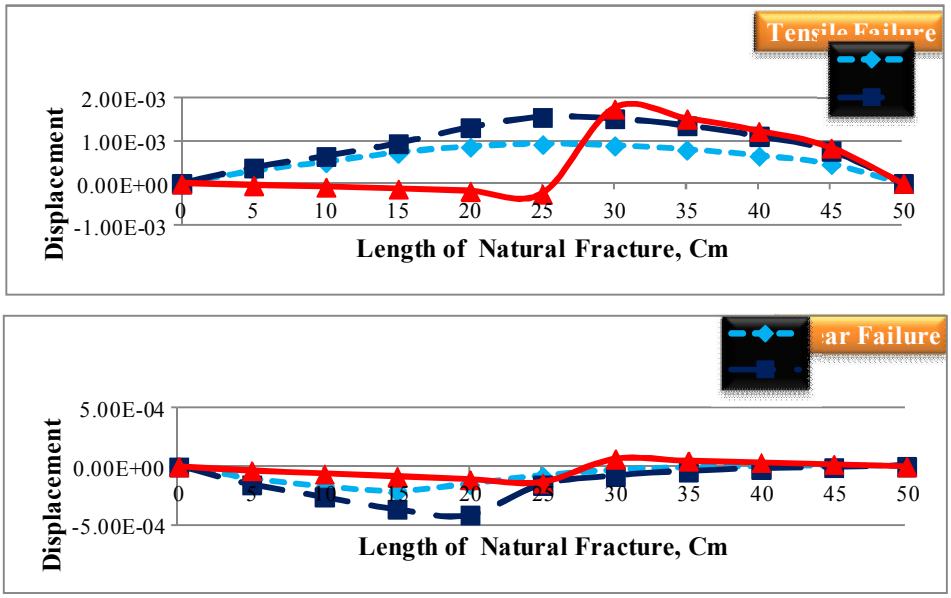


Figure 14. Opening and sliding displacements along the debonded zone of Figure 13

In the shear failure part, note that before cutting natural fracture the shear debonding in all over of fracture has the same direction. With reach the induction fracture to region a, the highest rate of shear debonding is in the left side of natural fracture on a 15 cm of natural fracture from left to right (In the b region). Here we have same situation as was in a area however, the rate of shear debonding is more and more inclined to the right side And the maximum amount of shear debonding is at 25 cm natural fracture from left to right. With cutting of natural fracture shear debonding has not same direction is all over the fracture, and it is positive in right side and negative on the other side. The main important point is that in the kink point we have directions change and the intersection point of shear debonding at both sides of fracture is located at same point.

Conclusion

Analysis of length and height of hydraulic fracture on production rate and interaction between natural and induced fracture in the fractured reservoir were studied in this study.

As seen, in reservoir with high-density natural fracture, creating a hydraulic fracture with high conductivity is suitable and in an environment with low natural fractures that dispersion of the natural fracture is high (low density of natural fractures) a hydraulic fracture

with high length will be much better. In reaction between natural and induced fractures depend on the angles that have these fractures we can reach a different condition. Here we examined three angles 90, 45 and zero degrees. As was observed in both tensile and shear debonding, which was itself based on these angles showed a different behavior.

The coalescence of the hydraulic fracture with open natural fractures causes strain relaxation at the reaching tip, which provides larger volumes mainly inside the primary hydraulic fracture and then the connected natural fracture.

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9/20/2012

An investigation of the links between the decision making strategies adopted by managers and improving productivity: A case study of the Larestan Bureau of Education

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Abstract: The most significant factor in decision making by managers is their personal ability and willingness to adopt certain styles in making decisions. It does not matter how interested managers are in making decision; rather, it is important that they possess abilities necessary for making proper decisions which contribute to success. The purpose of the present study is to investigate the relationships between the managers' decision making strategies and improving productivity in organizations. The population, which was selected using the cluster sampling method, consisted of 158 managers in three levels of executive, middle, and operational in Lar, Gerash, Evaz, and Khonj. The questionnaire adopted consisted of 21 items developed by the researcher based on the hypotheses. Validity was measured using the content validity and reliability was measured by Cronbach's alpha. Data were processed using SPSS and MINITAB and analyzed in inferential and descriptive statistics. The hypotheses were tested using the t test in MINITAB and variance analysis; and the independent t test was used to compare the respondents' opinions in terms of gender. The findings indicated that the managers of the population believe that they use their intuition in making decisions and statistical information. The findings confirmed the third hypothesis and indicated that the more moderate the managers are, the better decisions they make. Moreover, the fourth hypothesis was confirmed and the findings indicated that if managers deal with problems analytically and practically and think systematically, the make better decisions.

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Keywords: decision making, productivity, intuition, systematic thinking, moderate managers, conservative managers

Introduction

Management is sometimes defined as making decisions; and traditional managers used to make decisions based on the information about the current conditions and making inferences about the future state, which were proved proper or improper after their implementations and success or failure (Hakimi Pour, 1998, 86).

The most important factor in the managers' decision making might be their personal abilities and willingness to make decisions and their decision making strategies. It does not matter how interested the managers are in making decisions, what is important is that they possess abilities for making proper decisions which contribute to success (Manoochehr Hazer, 1998, 86).

As suggested by this study, organizations can improve the quality of their decisions by including more wisdom in the decision making process. The decision makers in government organizations should rely less on their intuition and personal experiences and more on information derived from analysis.

In the present study, the researcher's goal is to find out whether the decision making strategies adopted by managers are related to improving their decision making; and, finally, to find out:

- How the manager's effective decisions made as a result of their decision making styles improve the performance of the organization?
- Whether proper decisions made by managers result in more productivity.

The goals of the study

2- Exploring the relationship between decision making styles and the managers' moderation

3- Exploring the relationship between the managers' decision making styles and conservativeness

4- Exploring the relationship between the managers' decision making styles and systematic thinking

5- Exploring the relationship between the managers' intuition and decision making styles.

Questions of the study

1- Do the managers with stronger intuition make better decisions?

2- Do conservative mangers make better decisions?

3- Do moderate managers make better decisions?

4- Do managers who think systematically make better decisions?

5- Do managers with more working experience make better decisions?

Methodology

Methodology is referred to as a set of systematic and validated rules, tools, and methods used in investigating facts, exploring the unknown, and finding solutions to problems (Ezzati, 1998, 20).

A survey study selects small and large populations and investigates the relative level of distribution and interactions among psychological and sociological variables by studying samples selected from those populations (Kerlinger, Fred, N., 1995, 213).

A population s a set of real or hypothetical members to whom the results of the study are transferred (Delavar, 2005, 167)

A population is a set of members having one or more common features (Hooman, 1994, 147).

Based on the goals of the study, the methodology adopted here is a descriptive-survey and field study. The population consists of 158 top, middle and operational managers in Lar, Gerash, Evaz, and Khonj Bureaus of Education.

Sampling methods

The size of a sample is the total number of members in the sample. Sample size depends on the nature of the population and goals of the study (Sarookhani, 1998, 157).

In this study, the whole population is considered as the sample. 158 questionnaires were distributed and 89 ones were returned to the researcher.

Table 1: sample size

Data gathering tools

A common method for gathering data is questionnaires (Delavar, 2005, 120).

The tool adopted in this study is a researcher-made questionnaire consisting of 30 items developed on the Likert scale. The respondents must first answer general questions such as the number of working years.

Validity

Validity specifies the extent to which the tool measures the feature. Without validity it would not be possible to trust data produced by the tool (Sarmad et al, 2000, 170). In order to test the validity of the questionnaire, content validity was used. The questionnaire was developed by the researcher and other colleagues through studying the literature and theories related to the issue of the research, then it was studied by some scholars and experts and after doing some modifications, it was validated and prepared to be distributed in the population.

Reliability

Reliability is referred to as the extent to which the instrument generates the same results under the same conditions. Normally, the reliability coefficient ranges from zero (unreliable) to +1 (totally reliable) (Sarafraz, 2003, 123).

In order to calculate the reliability of the instrument, Cronbach's alpha was used. This method is used to test the internal consistency of instruments including questionnaires or tests measuring various attributes. In such instruments, the answer to each question can take on various numerical values. In order to calculate Cronbach's alpha, the variance of all scores for each subset of the test (subtest) and the total variance must be calculated. Then, alpha will be quantified through this equation:

$$r_a = \frac{J}{j-1}\left(1 - \frac{\sum S_i^{\,2}}{S^2}\right) = \frac{21}{20}\left(1 - \frac{17.48}{62.463}\right) = .756$$

Where, J= the number of subtests

S_i^2 = subtest variance

S^2 = total variance (Sarmad et al, 1999, 169).

The questions of the study

The first question: Managers with stronger intuition seem to make better decisions.

Table 2: testing questions of the first hypothesis

As the above table shows, the median of the first to sixth questions are 2.52, 3.15, 4.011, 2.56, 2.69, and 3.49, respectively. The highest accumulative percentage for agree and absolutely agree is for the first question (I always use my intuition in making organizational decisions) with 60.2, and the lowest one is for the third question (in making organizational decisions, I never rely on statistics and data and make decisions based on personal judgment) with 14.6. The average scores ranged from 2.52 to 4.011, which indicates respondents agree with the influence of intuition on making better decisions.

Table 3- a comparison of the index score of the influence of intuition on decision making with the standard score.

$$H_0 : \mu \geq 3$$

$$H_1 : \mu \prec 3$$

H_0: the more the managers use their intuition, the better they make decisions. H_1: the more the managers use their intuition, the better they make decisions

The average score of the respondents and the SD were 3.13 and 0.73, respectively. Since observed t was not significant at $p<0.01$, the zero hypothesis is not rejected. In other words, there is not a significant relationship between intuition and better decision making.

Testing the second question

Second question: more conservative managers seem to make better decisions

Table 4- testing the second question

Based on the findings represented in the above table, the average scores of questions 7 to 11 were 1.65, 2.61, 1.50, 1.98, and 1.66, respectively. The highest accumulative percentage for agree and absolutely agree were about the 7th and 11th questions (I do not make decisions until I have all the information I need) and (I never make ad hoc decisions and always decide based on accurate information and statistics) with 94.4, and the lowest one was for the 8th question (I feel if I do not gather all information required for decision making, I cannot get to sleep at nights) with 49.4.

The average scores ranged from 1.65 to 2.61, indicating the degree to which respondents agree about the influence of being conservative on the managers' decision making.

Table 5- a comparison of the mean index score of the influence of conservativeness on decision making with the standard score

$$H_0 : \mu \geq 3$$

$$H_1 : \mu \prec 3$$

H_0: the more conservative the managers, the better decisions they make

H_1: the more conservative the managers, the better decisions they make

The average score of the respondents and SD were 1.88 and 0.514, respectively. Since observed t was significant at $p<0.01$, the zero hypothesis is rejected. In other words, there is a significant relationship between the managers' conservativeness and making better decisions.

Testing questions related to the third hypothesis

Third question: more moderate managers seem to make better decisions

Table 6- testing questions related to the third hypothesis

Based on the findings represented in the above table, the average scores of questions 12 to 15 were 1.64, 1.70, 2.59, and 2.07, respectively. The highest accumulative percentage for agree and absolutely agree was about the 12th question (I try to be moderate in making decisions) with 97.8, and the lowest one was for the 14th question (I act as a mediator in group decision making) with 55.1.

The average scores ranged from 1.64 to 2.59, indicating the degree to which respondents agree about the influence of being moderate on the managers' decision making.

Table 7- a comparison of the mean index score of the influence of moderation on decision making with the standard score

$$H_0 : \mu \geq 3$$

$$H_1 : \mu \prec 3$$

H_0: more moderate managers make better decisions

H_1: more moderate managers make better decisions

The average score of the respondents and SD were 2.00 and 0.505, respectively. Since observed t was significant at $p<0.01$, the zero hypothesis is rejected. In other words, there is a significant relationship between the managers' moderation and making better decisions.

Testing questions related to the 4th hypothesis

4th hypothesis: managers with more systematic thinking tend to make better decisions

Table 8: testing questions related to the 4the hypothesis

Based on the findings represented in the above table, the average scores of questions 16 to 21 were 1.90, 1.67, 2.85, 1.60, 2.62, and 1.74, respectively. The highest accumulative percentage for agree and absolutely agree was about the 19th question (even if a problem is simple, I break it into smaller parts and then decide) with 98.9, and the lowest one was for the 20th question (I like to resolve problems quickly and move on from one problem to another) with 53.9.

The average scores ranged from 1.60 to 2.62, indicating the degree to which respondents agree about the influence of systematic thinking on the managers' decision making.

Table 9- a comparison of the mean index score of the influence of systematic thinking on decision making with the standard score

$$H_0 : \mu \geq 3$$

$$H_1 : \mu \prec 3$$

H_0: managers with systematic thinking make better decisions

H_1: managers with systematic thinking make better decisions

The average score of the respondents and SD were 1.89 and 0.383, respectively. Since observed t was significant at $p<0.01$, the zero hypothesis is rejected. In other words, there is a significant relationship between the systematic thinking and making better decisions.

The variance analysis test

Table 10- a comparison of the respondents' mean scores based on their management years

Since observed F was not significant at $p<0.05$, the respondents' opinions were not different based on their management years. In other words, managers with different management years have the same opinions about the influence of moderation, conservativeness, systematic thinking and intuition on making better decisions. Managers with 0 to 5 years of management believe that intuition, moderation, systematic thinking, and conservativeness had the largest influences on decision making, respectively.

Managers with 5 to 10 years of management believe that intuition, moderation, conservativeness, systematic thinking had the largest influences on decision making, respectively managers with 10 to 15 years of management, believe that intuition, moderation, systematic thinking, and conservativeness had the greatest influences on decision making, respectively. Managers with 15 to 20 years of management believe intuition, moderation, systematic thinking, and conservativeness had the greatest influences on decision making, respectively. Managers with over 25 years of management believe that intuition, conservativeness, moderation, and systematic thinking had the greatest influences on decision making, respectively.

The independent t test

Table 11- a comparison of male and female scores regarding research indexes

Since observed t was not significant at P<0.0.5, the male and female opinions were not different. In other words, male and female respondents have similar opinions regarding the influence of intuition, conservativeness, moderation, and systematic thinking on better decision making. Male respondents believe that intuition, moderation, systematic thinking, and conservativeness had the greatest influences on decision making, respectively. Female respondents believe that intuition, moderation, conservativeness, and systematic thinking had the greatest influences on decision making, respectively.

Conclusion and implications

Analysis of the first question

The first question: managers with stronger intuitive thinking tend to make better decisions

The analysis of the results regarding the first secondary question indicates that the mean score and SD of the influence of intuition on making better decisions were 3.13 and 0.73, respectively. Since observed t was not significant at p<01 (p=0.000), it is concluded that managers believe intuition does not influence decision making.

The greatest influence of intuition on decision making was for the first question (I always use my intuition in making decisions) with 60.2. this implies that managers should be trained how to use their intuition in making decisions.

The comparison of the responses based on the respondents' management years revealed that there is not a significant difference among the respondents' opinion regarding the influence of intuition on decision making (p=0. 101).

The comparison of the male and female responses did not show a significant difference among their opinions regarding the influence of intuition on decision making (p=0.652).

2- Analysis of the second question: more conservative managers tend to make better decisions

The analysis of the results regarding the second secondary question indicates that the mean score and SD of the influence of conservativeness on making better decisions were 1.20 and 0.514, respectively. Since observed t was significant at p<01 (p=0.000), it is concluded that managers believe conservativeness influences decision making.

The greatest influence of conservativeness on decision making was for the 7th and 11th questions (I don't make decisions until I have a complete picture of the situation) and (I never decide in and ad hoc way, and always decide based on accurate statistics and information) with 94.4. This implies that managers should have access to updated information to be able to make better decisions.

The comparison of the responses based on the respondents' management years revealed that there is not a significant difference among the respondents' opinion regarding the influence of conservativeness on decision making (p=0. 664).

The comparison of the male and female responses did not show a significant difference among their opinions regarding the influence of conservativeness on decision making (p=0.164).

3- Analysis of the third question: more moderate managers tend to make better decisions

The analysis of the results regarding the third secondary question indicates that the mean score and SD of the influence of moderation on making better decisions were 2.00 and 0.505, respectively. Since observed t was significant at p<01 (p=0.000), it is concluded that managers believe moderation influences decision making.

The greatest influence of moderation on decision making was for the 12th question (I try to be moderate in making decisions) with 97.8. This implies that managers should be trained to avoid being biased and take everything into account while making decisions.

The comparison of the responses based on the respondents' management years revealed that there is not a significant difference among the respondents' opinion regarding the influence of moderation on decision making (p=0. 283).

The comparison of the male and female responses did not show a significant difference among their opinions regarding the influence of moderation on decision making (p=0.241).

4- Analysis of the 4th question: managers with more systematic thinking tend to make better decisions

The analysis of the results regarding the 4th secondary question indicates that the mean score and SD of the influence of systematic thinking on making

better decisions were 1.89 and 0.383, respectively. Since observed t was significant at p<01 (p=0.000), it is concluded that managers believe systematic thinking influences decision making. This implies that managers who deal with problems wisely and analytically make better decisions.

The greatest influence on intuition on decision making was for the 19th question (even if a problem is too complicated, I break it into smaller parts and then I decide) with 98.9. In other words, most managers in Lar believe that if they break problems into smaller parts, they can make better decisions. This implies that managers should not make decisions based on their personal interests and based their judgments on accurate information.

The comparison of the responses based on the respondents' management years revealed that there is not a significant difference among the respondents' opinion regarding the influence of systematic thinking on decision making (p=0. 706).

The comparison of the male and female responses did not show a significant difference among their opinions regarding the influence of systematic thinking on decision making (p=0.875).

Suggestions

Since the managers in the Lar Bureau of Education do not believe in the influence of intuition on making better decisions, it is proposed that managers become aware of the problems in the organization and then be allowed to give opinions based on the goals and problems of the organization.

Since the managers believe in the influence of conservativeness on making better decisions, it is proposed that managers be given all information required for making decisions and be asked to use all instruments and methods which reduce risks in order to make the best decisions.

Since managers believe in the influence of systematic thinking on making better decisions, it is proposed that since research based on gathering useful information plays a key role in decision making, managers should gather precise information and avoid huge costs due to making improper decisions in today's turbulent conditions.

It is suggested that managers not decide based on their personal judgments, feeling and inspirations; rather, they make decisions based on accurate information. They should be provided with relevant, real, valid, and accurate information gained through logical investigations so that they get prepared to make decisions.

Future researchers are advised to clarify the meaning of the keywords to respondents so that they answer questions in the best way (Chart 1).

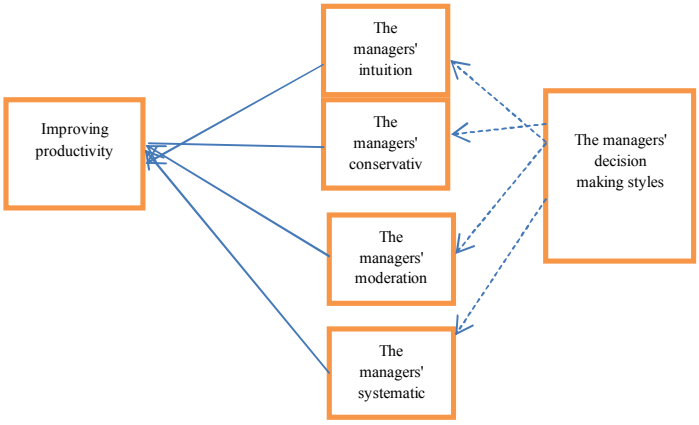

Chart 1: the conceptual model of the study

Table 1: sample size

Operational managers	Middle managers	Top executives
154	3	1

Table 2: testing questions of the first hypothesis

Question 6	Question 5	Question 4	Question 3	Question 2	Question 1	choice	
8	5	15	3	10	11	frequency	Absolutely agree
9.9	5.6	16.9	3.4	11.2	12.4	percentage	
11	31	30	10	24	42	frequency	agree
12.4	34.8	33.7	11.2	27	47.2	percentage	
11	19	20	3	7	19	frequency	neutral
12.4	21.3	22.5	3.4	7.9	21.3	percentage	
47	30	16	40	38	10	frequency	disagree
52.8	33.7	18	44.9	42.7	11.2	percentage	
12	4	7	33	10	6	frequency	Absolutely disagree
13.5	4.5	7.9	37.1	11.2	6.7	percentage	
21.3	40.4	51.1	14.6	38.2	60.2	Accumulative percentage of agree and absolutely agree	
3.49	2.69	2.65	4.011	3.15	2.52	median	
1.14	1.04	1.14	1.08	1.26	1.07	SD	

Table 3- a comparison of the index score of the influence of intuition on decision making with the standard score

P	t	SD	median	index
0.95	1.69	0.73	3.13	The influence of intuition on better decision making

Table 4- testing the second question

Question 11	Question 10	Question 9	Question 8	Question 7	choice	
37	31	48	14	40	frequency	Absolutely agree
41.6	34.8	53.9	15.7	44.9	percentage	
47	41	38	30	44	frequency	agree
52.8	46.1	42.7	33.7	49.4	percentage	
3	4	2	21	2	frequency	neutral
3.4	4.5	2.2	23.6	2.2	percentage	
2	13	1	24	2	frequency	Absolutely disagree
2.2	14.6	1.1	27	2.2	percentage	
0	0	0	0	1	frequency	disagree
0	0	0	0	1.1	percentage	
94.4	80.9	96.6	49.4	94.4	Accumulative	
1.66	1.98	1.50	2.61	1.65	median	
0.65	0.99	0.60	1.04	0.74	SD	

Table 5- a comparison of the mean index score of the influence of conservativeness on decision making with the standard score

P	t	SD	median	index
0.000	-20.45	0.514	1.88	The influence of conservativeness on better decision making

Table 6- testing questions related to the third hypothesis

Question 15	Question 14	Question 13	Question 12	choice	
21	16	32	36	frequency	Absolutely agree
23.6	18	36	40.4	percentage	
46	33	52	51	frequency	agree
51.7	37.1	58.4	57.3	percentage	
14	13	4	0	frequency	neutral
15.7	14/6	4.5	0	percentage	
7	25	1	2	frequency	Absolutely disagree
7.9	28.1	1.1	2.2	percentage	
0	2	0	0	frequency	disagree
0	2.2	0	0	percentage	
76.1	55.1	94.4	97.8	Accumulative percentage for agree and absolutely agree	
2.07	2.59	1.70	1.64	median	
0.84	1.14	0.606	0.607	SD	

Table 7- a comparison of the mean index score of the influence of moderation on decision making with the standard score

P	t	SD	median	Index
0.000	-18.55	0.505	2.00	The influence of moderation on making decisions

Table 8: testing questions related to the 4the hypothesis

Question 21	Question 20	Question 19	Question 18	Question 17	Question 16	choice	
29	16	36	25	33	27	frequency	Absolutely agree
32.6	18	40.4	28.1	37.1	30.3	percentage	
57	32	52	55	22	49	frequency	agree
64	36	58.4	61.8	58.4	55.1	percentage	
1	14	1	6	4	5	frequency	neutral
1.1	15.7	1.1	6.7	4.5	5.6	percentage	
1	23	0	3	0	7	frequency	Absolutely agree

1.1	25.8	0	3.4	0	7.9	percentage	
1	4	0	0	0	0	frequency	agree
1.1	4.5	0	0	0	0	percentage	
96.6	53.9	98.9	89.9	95.5	84.4	Accumulative percentage of agree and absolutely agree	
1.74	2.62	1.60	1.85	1.67	1.90	median	
0.64	1.18	0.51	0.68	0.55	0.82	SD	

Table 9- a comparison of the mean index score of the influence of systematic thinking on decision making with the standard score

P	t	SD	median	index
0.000	-26.92	0.383	1.89	The influence of systematic thinking on better decision making

Table 10- a comparison of the respondents' mean scores based on their management years

over 25		20-25 years		years 20-15		years 15-10		5-10 years		0-5years		index
P	F	variance	mean	variance	mean	variance	mean	variance	mean	variance	mean	
0.101	1.91	0.25	3.20	0.47	4.33	0.35	3.333	0.75	3.32	0.66	3.07	0.81	2.94	**intuition**
0.664	0.647	0.85	2.16	0.42	2.30	0.38	1.88	0.55	1.83	0.497	1.90	0.474	1.82	**conservative**
0.283	1.27	0.54	2.00	1.06	2.75	0.33	2.15	0.52	2.06	0.44	1.97	0.52	1.90	**moderate**
0.706	0.592	0.45	2.00	0.23	2.16	0.29	2.03	0.28	1.93	0.40	1.89	0.42	1.82	**Systematic thinking**

Table 11- a comparison of male and female scores regarding research indexes

		female		male		index
P	t	variance	mean	variance	mean	
0.652	0.453	0.81	3.09	0.68	3.16	intuition
0.164	-1.40	0.49	1.97	0.51	1.82	conservative
0.241	-1.18	0.49	2.07	0.51	1.94	moderate
0.875	-0.158	0.37	1.90	0.39	1.89	Systematic thinking

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Cryoglobulinemia in Hemodialysis patients

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Abstract: Background: Many of HCV infected patients on regular hemodialysis are candidates for renal transplantation and receive immunosuppressive therapy that may influence cryoglobulin formation. **Aim of the study**: is studying the cryopositive cases among H.D patients and their association with clinical symptoms and assess whether the HCV patients on maintenance HD have abnormal immune response. **Methodology**: forty CRF patients receiving regular hemodialysis sessions divided according to the presence of HCV antibodies into two groups, group I (n=20) with positive HCV antibodies and group II (n=20) with negative HCV antibodies, both groups were tested for the presence of cryoglobulinemia. **Results**: Group (I) showed a higher percent (20%) of positive Cg than that of group (II) (5%) but with no statistically significant difference (*p*-value=0.34). In the whole studied group patients with positive Cg (n=5) have significantly greater mean AST, ALT and INR values than those with negative Cg (n=35) (*p*-value=0.017, 0.02 & 0.045, respectively). AST is a significant predictor to positive Cg with OR: 1.176 (95%CI: 1.031 – 1.341). Group I showed significantly higher percent of positive RF (n=4) than those of group II (n=1) (*p*-value=0.00). **Conclusion:** no significant difference regarding the cryoglobulin concentration between HCV positive and negative patients. The symptoms of cryoglobulinemia (purpura, arthralgia & generalized weakness) appear more frequently in HCV positive patients on HD with positive cryoglobulinemia. AST was found to be significant predictor for cryopositivty in HD patients.
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Keywords: Cryoglobulin, CRF, hemodialysis, AST, HCV.

1. Introduction

Cryoglobulinemia refers to a pathologic condition caused by production of circulating immunoglobulins that precipitate on cooling and resolubilize on warming. It is associated with a variety of infections especially HCV, HBV, HGV, vascular disorders "SLE, polyarteritis nodosa, autoimmune thyroiditis, etc.", and Lymphoproliferative diseases “multiple myeloma, Waldenstrom macroglobulinemia, etc." [1]

The prevalence of hepatitis C virus infection ranges from 1% to 3% in general population, but it is higher in hemodialysis patients, ranging from 3% to 23%. This difference can be related to the fact that patients on HD have risk factors for acquisition of HCV, such as receipt of blood transfusions and use of illicit intravenous drug, and may also acquire blood born infections as a result of healthcare associated transmission in HD units. Several mechanisms have been implicated in HCV transmission among HD patients, such as dialyzer reuse, contamination of hands of staff members, or items shared among patients[2].

It has been widely demonstrated that virus C infection causes essential cryoglobulinemia[3], also Mixed cryoglobulinemia is frequently seen in chronic viral hepatitis patients[4]. The onset of ESRD in some HCV patients influences the patient's immune status[5]. The incidence of MC is expected to be high in HCV infected patients on HD[6]. Many of these patients on regular hemodialysis are candidates for renal transplantation and receive immunosuppressive therapy that may influence cryoglobulin formation and the presence of cryoglobulins may complicate patient management both pre or post transplantation[6].

We aimed at studying the cryopositive cases among HD patients and their association with clinical symptoms and assess whether the HCV patients on maintenance HD have abnormal immune response.

2. Patients and methods:

After a written informed consent was obtained, forty CRF patients receiving regular hemodialysis sessions (three sessions /week) were selected from the hemodialysis unit. They were divided according to the presence of HCV antibodies, detected using third generation ELISA (Murex Diagnostics, UK), into two groups, group I (n=20) with positive HCV antibodies and group II (n=20) with negative HCV antibodies. The patients of both groups were subjected to detailed medical examination, biochemical tests, test for cryoglobulin detection[7] and RF was measured using antibody-coated sheep erythrocytes where titer below 1:16 was considered negative.

Detection of cryoglobulins (Cg):

Cryoglobulins were detected as described as follows, fasting blood samples were collected at least 12 hours after the last meal immediately transported at 37°C and stored in a water bath at 37°C for 30 min. Then it was cleared by centrifugation at 2000 g at the same temperature for 15 min, and then stored at 4°C for 72 hours.The cryocrit was estimated by measuring the height of the column of precipitated protein relative to the total height of the serum column after incubation at 4°C for 72 hours, Or preferably (after 7 days). The level of cryocrit was expressed as a percentage. Depending on the cryocrit level, the Cg level was evaluated as follows:

- Cg negative, low level Cg: cryocrit 1–2%,
- Moderate Cg: cryocrit 2–5%,
- High Cg: cryocrit 5–10%,
- Very high Cg: cryocrit >10%, and Cg in gel form.

The result consider positive if >2%

Statistical analysis:

Patients' data were analyzed using SPSS 17.0 for windows 7. Quantitative variables were expressed by mean and SD (Standard deviation), compared using unpaired t-student test and Mann-Whitney U test. Qualitative variables were expressed by numbers (Frequency) and percent compared between groups using Chi-square test. Logistic regression analysis was performed and accuracy, sensitivity, specificity, PPV and the NPV were calculated. P value was considered to be significant if less than 0.05.

3. Results:

Data of the studied groups is represented in table (1). Clinical diagnosis showed that the causes of renal failure in the patients on hemodialysis are: obstructive uropathy in 3 (5%), pyelonephritis in 1 (2.5%), hypertension and nephrosclerosis in 20 (50%), diabetic nephropathy in 9 (22.5%), polycystic kidney disease in 1 (2.5%), cry. nephropathy in1 (2.5%), S.L.E in 1(2.5%),drug nephropathy in 2(5%), and diabetic nephropathy+ hypertension in 2(5%). In the cryoglobulin +ve patients (5 cases): Two patients had hypertension and nephrosclerosis (40%), 2 had diabetic nephropathy (40%), while one had cry. nephropathy (20%). In the cryoglobulin -ve patients (35 cases): obstructive uropathy was diagnosed in 3 patients (8.6%), pyelonephritis in 1(2.9), hypertension and nephrosclerosis in 18 (51.4%), diabetic nephropathy in 7(20%), polycystic kidney disease in 1 (2.9) & S.L,E nephropathy in another 1 (2.9%). 2 patients (5.7%) had diabetic nephropathy + hypertension and nephrosclerosis. Drug nephropathy was evident in 2 patients (5.7%).

The causes of renal failure in the HCV +ve group (20 cases) are: obstructive uropathy (2) 10%, pyelonephritis (1)5%,hypertension and nephrosclerosis (11) 55%, diabetic nephropathy (2) 10%, cry. nephropathy (1)5%, drug nephropathy (1) 5% and diabetic nephropathy + hypertension and nephrosclerosis in 2 cases (10%). In cryoglobulin +ve subgroup(4 cases) hypertension and nephrosclerosis (2)50%, diabetic nephropathy (1) 25 % and cry. nephropathy in one case (25%). In cryoglobulin -ve subgroup (16 cases), obstructive uropathy (2) 12.5%, pyelonephritis (1)6.3%, hypertension and nephrosclerosis (9)55.3%, diabetic nephropathy (1) 6.3 %,drug nephropathy (1) 6.3% and diabetic nephropathy+ hypertension and nephrosclerosis in 2 cases (12.5%).The causes of renal failure in the HCV-ve group (20 cases) are: obstructive uropathy (1) 5%, hypertension and nephrosclerosis (9)45%, diabetic nephropathy (7) 35 %, polycystic kidney disease (1) 5%, S.L.E nephropathy (1)5% and drug nephropathy in one case (5%).In Cryoglobulin +ve subgroup only one case of diabetic nephropathy. In Cryoglobulin -ve subgroup (19 cases) obstructive uropathy (1) 5.3%, hypertension and nephrosclerosis (9) 47.4%, diabetic nephropathy (6). 3 1.6 %, polycystic kidney disease (1) 5.3 %, S.L, E nephropathy (1)5.3%, and drug nephropathy in one case (5.3%). Duration of dialysis in HCV +ve group was 4.43 ± 1.8 years. while in Cryoglobulin +ve subgroup (4 cases) was 4.25 ± 1.71 years. In Cryoglobulin -ve subgroup (16 cases) the mean duration of dialysis was 4.47 ± 1.88 years. Duration of dialysis in HCV -ve group was 3.6 ± 1.11 years. Duration of dialysis in Cryoglobulin +ve subgroup (only one case) was 2 years while in Cryoglobulin -ve subgroup (19 patients) was 3.68 ± 1.07 years.

12.5% of the whole studied group of patients (n=40) proved to be positive Cg with a higher percent (20%) in group (I) than that of group (II) (5%) but this difference is not statistically significant with p-value=0.34.No statistically significant difference detected regarding mean age and duration of dialysis between positive (n=4) and negative (n=16) Cg cases in group I.Patients with positive Cg in both groups and those with negative Cg in group I showed more obvious symptoms than those with negative Cg in group, where it is was obvious that the most prominent symptoms in patients with negative Cg either in group I or II are arthralgia and generalized weakness while in patients with positive Cg arthralgia and purpura are more prevalent. In all patients (n=40) patients with positive cryoglobulin (n=5) two (40%) presented with purpura, 4 (80%) presented with arthralgia,2 (40%) presented with generalized weakness, 1 (20%) presented with Raynaud`s

phenomenon, and 2 (40%) presented with rash.But in cryoglobulin -ve subgroup(n=35) 2 (5.7%) presented with purpura,10(28.6%) presented with arthralgia,7 (20 %) presented with generalized weakness, 2 (5.7%) presented with Raynaud`s phenomenon, and 4 (11.4%) presented with rash. In HCV +ve patients (n=20). In cryoglobulin +ve subgroup(n=4) two(50%) presented with purpura, 4 (100%) presented with arthralgia,2 (50%) presented with generalized weakness, 1 (25%) presented with Raynaud`s phenomenon, 2 (50%) presented with rash. But in cryoglobulin -ve subgroup (n=16) 2 (12.5%) presented with purpura, 7 (43.8%)presented with arthralgia,4 (25%) presented with generalized weakness, 1 (6.3%) presented with Raynaud's phenomenon, and 2 (12.5%) presented with rash.

In HCV-ve patients (n=20) patients with cryoglobulin +ve only one case presented with purpura.But in cryoglobulin -ve subgroup (n=19) 3 (15.8%)presented with arthralgia,3 (15.8%) presented with generalized weakness, 1(5.3%) presented with Raynaud's phenomenon,and 2(10.5%) presented with rash.

Table (1): comparison of data of both studied groups.

	Group I (positive)	Group II (negative)	*p*-value
Age	49.45±11.12	56.55±9.25	0.034
Sex (M:F)	11:9	13:7	0.5
Cg +/-	4/16	1/19	0.3
Hb (Cg+/-)	8.3±1.61/9.59±1.69	8.2/9.99±1.99	0.3
platelets(Cg+/-)	163±34.81/211.31±83.08	235/291.58±54.53	0.00
INR (Cg+/-)	1.18±0.05/1.06±0.07	1/1.06±0.07	0.2
s.k (Cg+/-)	4.63±0.61/4.94±0.69	5/5.05±0.81	0.46
AST (Cg+/-)	35.25±4.11/23.31±8.06	13/12.21±3.88	0.00
ALT (Cg+/-)	52.5±8.19/36.75±14.64	24/22.68±6.36	0.00
S. cr(Cg+/-)	7.75±2.63/7.84±2.06	9.3/9.07±3.03	0.12
s. BUN(Cg+/-)	39.75±10.63/48.19±34.66	52/51.58±16.54	0.52
s.Alb (Cg+/-)	3.18±0.43/3.58±0.42	4/3.74±0.46	0.08
S.ca(Cg+/-)	9.4±0.36/9.89±1.15	9.2/9.29±0.63	0.07
S.Na(Cg+/-)	135.5±3.32/133.25±4.09	133/132.3±3.4	0.23
S.phos(Cg+/-)	4.85±0.79/5.58±1.72	5/5.99±1.4	0.28
Symptoms -Palpable purpura -Arthralgia -Generalized weakness - Raynaud's ph. -Rash	 -4 (20%) -11 (55%) -6 (30%) -2 (10%) -4 (20%)	 -0 -3(15%) -3(15%) -1 (5%) -2 (10%)	
Cause of renal failure -DM -Drug nephropathy -HTN -Obst. Uropathy -Polycystic kidney disease -S.L nephropathy -DM+HTN - Chronic pyelonephritis -Cry. Nephropathy	 -2 (10%) -1 (5%) -1 (5%) -11 (55%) -2 (10%) -0 -0 -2 (10%) -1 (5%)	 -7 (35%) -1 (1%) -0 -9 (45%) -1(5%) -1(5%) -1(5%) -0 -0	
Duration of Dialysis	4.43±1.8	3.6±1.1	0.089
RF +	4 (20%)	1 (5%)	0.00

Cryopositive cases	Case 1	Case 2	Case 3	Case 4	Case 1
Age	(52.5±10.47)				69
Sex	M	M	M	F	F
Symptoms -Palpable purpura -arthralgia -G. weakness -Raynaud's ph -Rash	 -Yes -Yes -Yes -Yes -Yes	 Yes Yes Yes No Yes	 No Yes No No No	 No Yes No No No	 -yes -No -No -No -No
Cause of renal failure	Diabetic nephropathy	Cry. Nephropathy	HTN & nephrosclerosis	HTN & nephrosclerosis	Diabetic nephropathy
HD duration	(4.25±1.7)		2		
RF+	Yes	Yes	No	No	No

No statistically significant difference reported between patients with positive Cg (n=5) and patients with negative Cg (n=35) in the whole studied group regarding age, sex, duration of dialysis, cause of renal failure or laboratory tests results (Hb%, BUN, Creatinine, s. Na, s. K, s.Ca, s. phosphorous, and albumin) while patients with positive Cg have significantly greater mean AST, ALT and INR values than those with negative Cg (*p*-value=0.017, 0.02 & 0.045respectively), but patients with negative Cg have greater mean platelets than those with positive Cg and this difference is statistically significant (*p*-value =0.032). By applying logistic regression analysis it was found that AST is a significant predictor to positive Cg (Figure 1) with OR: 1.176 (95%CI: 1.031 – 1.341) with an overall accuracy of 90%, sensitivity 20%, specificity 100%, PPV: 100%, NPV: 89.7% and this model is statistically significant with *p*-value=0.016 with a negative 2 log likelihood of 21.45.

Five patients in our study had positive RF where group I showed higher percent of positive RF (n=4) than those of group II (n=1) and this difference is statistically significant with p-value=0.00. Regarding the association between Cg and RF it was found that 40% of the HD cryopositive patients had RF activity positive where two patients of group I with positive Cg were positive for RF while the other three patients were negative for Cg.

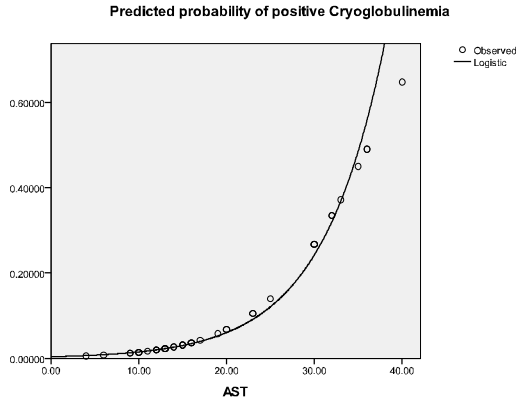

Figure (1): Predicted probability of positive cryoglobulinemia using AST.

4. Discussion:

In our pilot study the HCV infected patients on HD showed a relatively low percent of cryopostivity compared to other studies[6], with no significant association reported between Cg positivity and gender, age or dialysis duration in contrast to what was concluded in other studies[8, 9] this discrepancies may be explained by the different Cg detection methods used and the difference in demographic features of the studied groups as regional difference, Genetic factors such as HLA may also be involved in the pathogenesis of Cg[10]. Also, there is evidence that other environmental factors may play a role, MC is most prevalent in southern Europe and its frequency diminishes in more northern locations[11]. While the anti-HCV negative HD patients showed a relatively very close percent of cryopositivity to the previously reported ones[12], but relatively low compared to others[6], however, these findings adds to the increasing evidence for a role of HCV infection in cryoglobulin pathogenesis. Also, patients on HD are immunocompromised, with increased risk of acquiring other viral and non-viral infections that may induce cryoglobulinaemia[6].

Although no significant differences in the cryoglobulin concentrations between both anti-HCV positive and negative patients reported previously[6] but in our study, two anti-HCV positive patients had high cryoglobulin levels at 10% and. Both were with classical symptoms of palpable purpura and arthralgia.

RF activity positivity of HD cryopositive patients of our study was similar to that reported in some studies[12], but is greater than that reported by others[6 5]. These differences may reflect variable patient selection criteria, besides genetic and environmental factors.

No significant difference detected between both Cg positive and Cg negative patients regarding many studied parameters and this is in agreement with the results of some studies[12] but differ from others [6, 10,12, 14]. While there was significant increase in the AST, ALT and INR levels and a significant decrease in the platelets levels in the Cg positive patients compared to the Cg negative patients of our study although it is well known that serum aminotransferases activity is generally low in patients with chronic renal failure, The possible explanations for this are suppression of ALT and AST synthesis from the hepatocyte, inhibition of their release from the hepatocyte into circulation or their accelerated clearance from serum[5], So any elevation in these enzymes might be of concern.

The significant predictor to Cg positivity in our patients is the AST and not the platelets count and INR as reported by other studies[15].

Regarding clinical symptoms they were highly represented in the cryoglobulin positive patients of HCV positive cases while in the HCV negative group purpura was the only presentation confirming what was reported by previous studies. Moreover it is known that there is an established direct correlation between MC severity and the Frequency and degree of main clinical manifestations[16].

Conclusion:

The patients on regular HD showed a number of cases with positive cryoglobulinemia, where hepatitis C positive patients on regular HD showed a higher percent than that of hepatitis C negative patients but this difference was not statistically significant, also there is no significant difference in the cryoglobulin concentrations of both anti-HCV positive and negative patients, however, two anti-HCV positive patients had high cryoglobulin levels at 10% & both were represented with classical symptoms of palpable purpura and arthralgia. RF activity positivity is (40%) in HD cryopositive patients. The symptoms of cryoglobulinemia (purpura, arthralgia & generalized weakness) appear more frequently in HCV positive patients on HD with positive cryoglobulinemia. AST was found to be significant predictor for cryopositivty in HD patients.

Recommendation

Screening of cryoglobulinemia in chronic hepatitis C patients on regular hemodialysis should be taken into consideration as many of these patients are candidates for renal transplantation, as well as screening of HCV in cryoglobulin +ve patients should also be considered. Further studies are needed to clarify the effect of haemodialysis on cryoglobulinemia with larger sample size.

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A 50 Hz 0.5 mT magnetic field induces cytogenetic effects and biological alterations in Wistar rat

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Abstract: The effects of continuous whole body exposure to extremely low frequency magnetic fields (ELF-MF) (50 Hz,0.5 mT for 30 days24 hrs) on cytogenecity, bone parameters and some hematological and biochemical parameters were evaluated.Male rats were exposed continuously to ELF-MF for a period of 30 days. The exposure effects were assessed by measurements of micronucleus formation, DNA fragmentation and bone parameters. Additionally the levels of some liver and blood parameters were calculated. Moreover, osmotic fragility of erythrocytes was also considered.Exposure to ELF-MF resulted in a 6.5 fold increase in the micronucleus formation and a decrease in polychromatic erythrocytes (PCE)/normochromatic erythrocytes (NCE) ratio, in addition to a significant increase in the level ofaspartate transaminase (AST), alanine aminotransferase(ALT), alkaline phosphatase(ALP), Magnesium (Mg)and uric acid in serum was observed. However, 0.5 mT ELF-MF was unable to cause either direct DNA primary damage or changes in bone parametersand erythrocytes lyses percent.The present results provide evidence that continuous exposure to ELF-MF causes micronucleus formation and some physiological disturbance but had no effect on DNA structure and bone parameters.Furthermore, the levels of glucose, creatinine, cholesterol and the percentage of erythrocytes lyses were not affected.
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Keywords: Extremely low frequency magnetic field (ELF-MF); Micronucleus test; DNA fragmentation; Bone mineral density; haematological and biochemical parameters.

1. Introduction

In modern society, the use of electricity is so widespread that it is impossible to avoid exposure to power frequency magnetic fields (MF). Many biological effects are observed upon exposure to different types of non-ionizing radiation[1].Such effects depend on many factors such as the mode of exposure, the type of cells studied, and the intensity and duration of exposure.

An extremely low frequency magnetic field (ELF-MF) can induce a number of changes in biological systems of living species. Epidemiological studies suggest a possible link between ELF-MF exposure and clinically recognized medical disorders such as leukaemia and many types of cancers [2- 3]. Following the two pooled analyses of childhood leukemia by Ahlbom*et al.*[4] and Greenland *et al.*[5], which reported a doubling of risk above 0.3/0.4 microtesla, IARC 2002 (International Agency for Research on cancer)[6] classified magnetic fields as a class II B possible carcinogen.The 2002 California Report[7] cited childhood and adult leukaemia, brain cancer, ALS (Amyotrophic lateral Disease) and miscarriage as associated with ELF-MF. SCENIHR, [8-9] and Davanipour and Sobel[10] introduced reviews that emphasized the risk of Alzheimer's disease upon exposure to magnetic field.

On the one hand some researchers have reported harmful effects arising from alternatingand static magnetic fields[11-12]. On the other handextremely low frequencyelectromagnetic fields (ELF-EMF) and magnetic fields have been used as a therapeutic tool, for example, low frequency sinusoidal magnetic fields are used for treatment of intractable bone fractures, and extremely low frequency for treating tumors [13- 14]. Other studies didn't show any effects on biological tissues[15].

Since low energy magnetic or electromagnetic fields are not known to transmit enough energy that affects chemical bonds in the molecules it is generally accepted that such fields are unable to damage the DNA directly [15]. However, exposure to ELF-EMF may lead to the production of free radicals that induce alterations in cellular processes directly responsible for DNA damage[16]. Numerous "*In vivo*" and "*In vitro*" studies have been investigated with the effort to determine a link, if any, between such fields and mutagenesis and to establish the possible mechanism of cancer risk. It was attempted to define whether 50/60 Hz ELF-EMF as generated by high voltage power lines or electrical appliances could give rise to *in vivo* primary DNA damage and cytogenetic effects such as chromosomal aberrations, sister-chromatid exchanges, or micronuclei formation.Some studies concerning with exposing human cells to magnetic fields, revealed significant increases in micronuclei formation and chromosomal aberrations. Moreover, a pronounced

effect on cell proliferation and apoptosis took place upon such exposure to ELF-EMF [17- 19].

The aim of the present work is to study the effects of continuous whole body exposure to ELF-MF (50 Hz,0.5 mT for 30 days) on cytogenecity, bone parameters in addition to some haematological and biochemical measurements as a step forward to spot light on the action of these fields on biological systems.

2. Material and Methods

Animals

Adult male Wistar rats weighing 160- 180gm, 8 weeks old, were obtained from the Animal House of the National Research Center in Egypt. They were maintained for one week in the laboratory for adaptation. Rats (10 rats per cage) were housed in cages with free access to drinking water and standard chow diet.

All animals' procedures and care were performed using guidelines for the Care and Use of Laboratory Animals [20].

The rats were randomly divided into two groups of twentyeach: one control (sham) and one exposed. The latter group has been exposed to 0.5mT ELF-MF for 30 days24 hrs per day. The control (sham) group was treated like the exposed group with the sole difference that it was not exposed to ELF-MF. The two groups were treated equally considering light and food. The temperature and humidity were monitored continuously throughout the experimental period. This ensures that the control and the exposed animals were maintained in the same temperature. During the experimental period, all animal groups were maintained in clean first hand cages under standard condition in a separate laboratory which belongs to animal care unit. After 30 days of exposure, the two groups of rats were sacrificed by decapitation. Six rats from each group were used for micronucleus test and DNA analysis. Biochemical, hematological and osmotic fragility measurements were done by withdrawing blood samples from another six rats from each group. Lastly, other six rats from each group were dissected and their femora were isolated, cleaned from all soft tissues for bone parameters examination.

Experimental Design

The animals were housed freely in a plastic cage in the center of a magnet with a fixed magnetic field value at 0.5 ± 0.025mT. The magnetic field was generated by a solenoid carrying current of 18 A (ampere) at 50 Hz from the main supply (220-230 Volt) via a variac (made in Yugoslavia). The magnet consisted of a coil with 320 turns made of electrically insulated 0.8 mm copper wire. The coil was wounded around a copper cylinder of 2mm thickness, 40cm diameter and 40cm length. The cylinder wall was earthed to eliminate the electric field. The magnetic field was measured at different locations to find out the most homogenous zone inside the solenoid core. This was done using the Gauss/ Tesla meter model 4048 with probe T-4048 manufactured by Bell Technologies Inc. (Orlando-Florida USA). The animals were exposed by placing the whole cage (made of plastic) inside the magnet core.Animals from control and exposed groups were kept under the same environmental conditions of temperature, lightening and feeding. Cleaning and changing water and food were done to all animals two times daily. The field was switched off during cleaning the cage.

Micronucleus test

Bone marrow slides for micronucleus assay from 6 male rats of each group were prepared and stained according to the method described by Schmidt [21] using the modifications of Agarwal and Chauhan[22]. The bone marrow was flushed out from tibias using 1ml fetal calf serum and centrifuged at 2000xg for 10 min. The supernatant was discarded. Evenly spread bone marrow smears were stained using the May-Grunwald and Giemsa protocol. Slides were scored at a magnification of 1000x using a light microscopetype CX31 Olympus (Tokyo, Japan). 2000 polychromatic erythrocytes per animal were scored, and the number of micro nucleated polychromatic erythrocytes (MNPCE) was determined. In addition, the number of polychromatic erythrocytes (PCE) was counted in fields that contained 1000 cells (mature and immature) to determine the score of PCE andnormochromatic erythrocytes (NCE).

Statistical analysis was performed using the F-test with help of the software spss-version15 in order to compare the score of MNPCE, PCE and NCE for both the control and exposed samples.

Analysis of DNA Fragmentation

Analysis of DNA fragmentation was measured using agarose gel electrophoresis, according to the protocol developed by Kasibhatla*et al.*[23]. 0.5 gm homogenized liver and spleen are transferred to 1.5 ml sterile micro centrifuge tubes. Centrifuge at 200xg in an Eppendorf table, top centrifuge for 5min at 4ºC and remove supernatant. 20 µl of TES (20mM EDTA (ethylene-diaminetetra-acetic acid), 100mM Tris (hydroxymethyl-aminomethane), pH8.0, 0.8% (w/v) Sodium dodecyl sulfate) lysis bufferwere added and mixed with cell pellet. 10 µl ofRNase Cocktail were added and mixed well. Incubate for 30-120min at 37ºC. 10 µl of proteinase K, were added and incubated at 50ºC for at least 90min. 5µl of 6x DNA loading buffer were added and load DNA samples into dry wells of a 1-1.5% agarose gel in TAE (242g Tris base, 57.1 ml Acetic acid, 100 ml of 0.5 M EDTA, pH 8.0**)** buffer containing 0.5 µg/ml

ethidium bromide. The gel was run at low voltage (i.e., 35V for 4 hours or until loading dye has run two-thirds of the way down the gel). DNA ladders are finally visualized by ultra-violet (UV) light source and documented by photography. The gels were analyzed using the software: Gel-Pro Analyzer 3.1.The used chemicals were purchased from Sigma chemical co. (St. Louis MO, USA)

Bone Parameters

Femora of 6 rats each from control and exposed group were used to measure bone minerals density (BMD), bone minerals content (BMC) and cross sectional area. Bones, after cleaning all of soft tissues, were immediately weighed with an automatic balance (Sartorius research, USA), to receive wet bone weight (WW). Their lengths were measured with a digital caliper (± 0.01mm). The BMD, BMC and cross sectional area of the whole right femora and their diaphysis were measured by dual-energy X-ray absorptionmeter (DEXA, Nortand XR.46 version 3.9.6/2.3.1 made in USA). The X-ray absorption meter is routinely calibrated daily. The reproducibility of these measurements was established by repeating the scans three times, for all samples. The data were treated statistically by analysis of variance (ANOVA) test.

Biochemical and Hematological Measurements

Six blood samples were withdrawn from each rat (n=6) for control and exposed groups. Blood was collected in tubes containing (EDTA) for hematological analysis while others was maintained without anticoagulant in order to obtain serum for further biochemical analysis. The methods of measuring AST (aspartate transaminase), ALT (alanine aminotransferase), Ca (calcium), ALP (alkaline phosphatase), glucose, uric acid, creatinine, cholesterol and hemoglobin were carried out as described by Henderson and Moss, [24] Eraslan*et al.*[25]; Tietz, [26] Allston, [27] Dacie and Lewis [28]. All the chemicals used for both hematological and biochemical measurements were purchased from ELI Tech (Paris, France).

Determination of Osmotic Fragility of Erythrocytes

For the determination of osmotic fragility of erythrocytes, 6 blood samples were collected from 6 rats of each group. Blood was collected in heparinized tubes and the test was carried out within 2h of collection at room temperature according to the method described in Dacie and Lewis [28]. Fourteen test tubes each containing 5ml saline solution with a concentration range of 0.0-9.0 gm Nacl/L were prepared. Fifty µl of well mixed blood were added to each tube and they were incubated for 30 min at room temperature. After incubation time, the suspensions were centrifuged for 5 min at 1200xg. Then, the absorbance of supernatant of each tube was measured at wavelength 540 nm using a spectrophotometer [6405UV/Vis (ultra-violet/visible) spectrophotometer JENWAY England UK)]. The lyses percentage was calculated by the relation % of lyses= $A_{samples}/A_{100\%lysis}$ x 100,where $A_{samples}$ and $A_{100\%lyses}$ are the absorbance of the hemoglobin released from erythrocytes incubated with different concentration of saline and that incubated with distilled water (100% lysis) respectively.

3. Results

Table 1 shows the formation of MNPCE, PCE and NCE in the bone marrow cells in both control and exposed groups. The results show a decrease in the formation of PCE and an increase in the number of NCE formed in the exposed samples compared to the control ones. These differences were statistically significant ($p<0.05$)*.

The results from DNA fragmentation using agarose gel electrophoresis technique are shown in figure (1). Figure(1) shows that, lane(1) represents marker of standard molecular weight, lane(2) represents DNA isolated from the spleen of the control group, lanes(3,4,5) represent DNA isolated from the spleen of the exposed group, lane(6) represents DNA isolated from the liver of the control group, lanes(7,8,9) represent DNA isolated from the liver of the exposed group. The results show that the DNA from viable cells stayed on the top of the gel as a high molecular weight band. The DNA from apoptotic cells formed as a distinct DNA ladder. The results do not show any difference between the DNA isolated from the spleen and liver of the control and exposed groups.

Table 2 shows the BMD, BMC and cross sectional area of the femora for both control and exposed groups. The data revealed no significant change in bone parameters of the femora for exposed group compared to the intact one.

There was no significant difference found between bone minerals density of control group compared to the exposed one (ANOVA P=0.15), see table 2. Also there was no significant change found in the bone minerals content gm/cm of the control group with reference to the exposed one (ANOVA, P=0.26), see table 2. There was no significant difference found between cross sectional area of control group compared with the exposed one (ANOVA, P=0.27), see table 2.

Table 3 shows changes in hepatic enzymes (AST),(ALT) and (ALP). The hepatic enzymes (AST and ALT) increased after being exposed to the magnetic field and table 4 shows some hematological data for magnesium (Mg),(Ca), uric acid, Glucose, Creatinine, Cholesterol and hemoglobin.The plasma

magnesium level was significantly higher in exposed group compared with control one. In addition serum uric acid level is significantly higher in exposed group compared with the control one.

Figure(2) shows the osmotic fragility curves for both control and exposed groups. The percentage of lyses in erythrocytes is slightly increased for the exposed group compared with the control one. The error bars represent standard deviation.

Table 1: Effect of ELF- MF on NPCE, PCE and NCE formed in bone marrow cellsof six rats after 30 days of ELF-MF exposure.

Samples	NCE/1000 cells	PCE/1000 cells	MNPC/2000 cells
Control	509 ± 6	491 ± 6	3.5 ± 0.5
Exposed	558 ± 11	442 ± 11	23 ± 4
***p*-value**	0.05	0.05	0.05

Errors indicate the standard error of mean (SEM) for N = 6

Table 2: Effect of ELF-MF on bone parameters in the right femora of six rats after 30 days of ELF-MF exposure.

Samples	BMD gm/cm^2	BMC gm/cm	Area cm^2
Control	0.122 ± 0.002	0.22 ±0.05	1.93 ± 0.40
Exposed	0.121 ±0.007	0.22 ±0.05	1.93 ± 0.19
***p*-value**	0.15	0.26	0.23

Errors indicate the standard error of mean (SEM) for N = 6

Table 3: Effect of ELF- MF on the level of AST, ALT and ALP in six rats after 30 days of ELF-MF exposure.

Samples	AST U/L	ALT U/L	ALP U/L
Control	12 ±14	38 ±1.2	749 ±83
Exposed	160 ±10	55 ±1.7	496 ±33
***p*-value**	0.05	0.001	0.04

Errors indicate the standard error of mean (SEM) for N = 6

Table 4: Effect of ELF-MF on the level of Mg, Ca, Glucose, Uric acid, Creatine, cholesterol and Hb in six rats after 30 days of ELF-MF exposure.

Sample	Mg mg/dl	Ca mg/dl	Glucose mg/dl	Uric acid mg/dl	Creatinine mg/dl	Cholestrol mg/dl	Hbgm/dl
Control	1.5 ±0.06	7.6 ±0.2	116 ±7.12	0.93 ±0.09	0.5 ±0.06	73 ±4.041	10.93 ±0.03
Exposed	2.23 ±0.03	8.1 ±0.15	127 ±16	1.93 ±0.26	0.63 ±0.03	74.33 ±10.86	10.66 ±0.49
***p*-value**	0.001	0.12	0.55	0.02	0.12	0.91	0.61

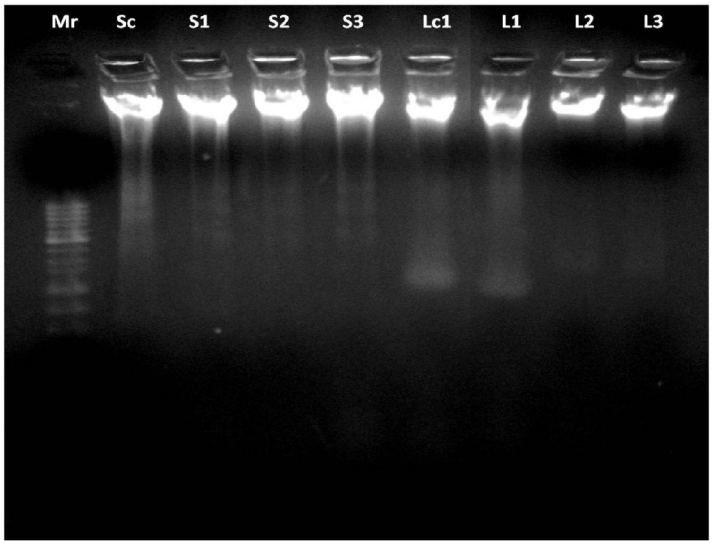

Figure (1): Gel electrophoresis of DNA. Lane(1) marker of standard molecular weight, lane(2) DNA isolated from spleen of control group, lanes(3,4,5) DNA isolated from spleen of exposed group, lane(6) DNA isolated from liver of control group, lanes(7,8,9) DNA isolated from liver of exposed group

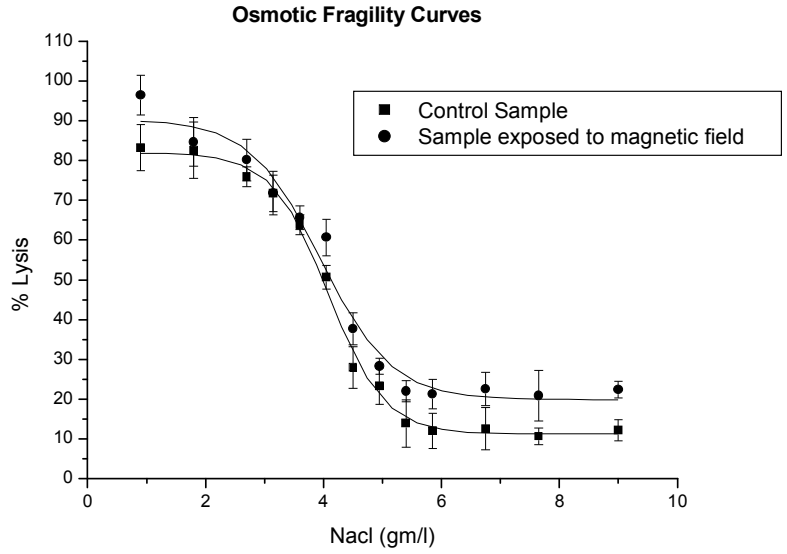

Figure (2): Effect of 0.5 mT, 50 Hz magnetic field on the erythrocytes lyses for blood samples from control ■ and exposed ● groups. Values are means ± SD from n = 6 in each group.

4. Discussion

The present study is concerned with the effects of ELF-MF on the formation ofmicronucleus, structure of DNA, density and content of bone minerals and some hematological parameters. The data indicated that continuous whole body exposure of rats to 50 Hz, ELF-MF at a flux density of 0.5 mT induced cell toxicity which was observed by a significant decrease in both PCE proportion and PCE/NCE ratio. In addition to a marked increase in the MNPC formation table 1, such effects are in agreement with previous study of Nurten *et al.* [29] who reported the occurrence of bone marrow cytotoxicity upon exposure to magnetic field. The above results are also considered as an evidence that 50 Hz ELF-MF 0.5 mT is a possible potent inhibitor of mitosis.

However, ELF-MF has no effect neither on DNA damage figure(1) nor on the bone examination made for rats femora table 2. The present data of DNA is in consistent with the studies of Milena *et al.*[30] and McNamee *et al.*[31] who reported that there was no significant effect on DNA strand breaks upon ELF-MF exposure. Moreover, the percentage lyses of erythrocytes for exposed group showed a slight increase compared to that of the control one (Fig.2). Such increments were considered within their normal range indicating that magnetic field exposure level in this study, had no marked effect on both structure and function of erythrocytes membrane **[**32**].**

Obvious changes were observed in clinical pathology measurements shown in tables 3 and 4. Exposing rats to 0.5 mT over a long period of time (30 days) produced an increase in Mg level and a non-significant increase in the glucose level. This might be due to changes in the metabolic rate [33]. In addition, there was significant increase in the hepatic enzymes of the exposed group. This finding supports the suggestion that the exposure to ELF-MF is associated with higher levels of oxidative stress and formation of free radicals [34, 35]. The lifetime of free radicals is very short and their high reactivity and the rapid rate of collisions among molecules cause them either to recombine or to interact with their surrounding within short time of their formation. Accordingly, such free radicals can affect some enzyme activities. The proportion of radicals reacting with biological molecules would increase leading to possible adverse effects on cell structure and organs function. This is supported by significant changes in ALP activity, creatinine and uric acid measurements which are considered as evidence on tissue damage in the exposed group.

Literatures on cellular effects of ELF electric and magnetic fields were reviewed bySantini*et al.*[36] who pointed out that the majority of the "*In vitro*" experimental results indicated that such fields induce numerous types of changes in cells. Such analysis concluded that this myriad of effects on biological systems should not be ignored in evaluating human health risk. Vijayalaxmi and Prihoda[37] published a meta-analysis of data from 87 publications concerning genericdamage in mammalian cells following EMF exposure. The authors main

conclusion was that differences between exposed and control cells were biologically small although statistically significant with very few exceptions.

5. Conclusion

It was concluded from the present study, that continuous exposure to ELF-MF (50Hz, 0.5mT) might cause micronucleus formation and some physiological disturbance in Wistar rats. The same exposure dose might have no effect on the DNA structure and bone parameters. It is important to carry out more investigations using various cytogenetic tests under different experimental conditions to definitively resolve the controversy concerning the possible genotoxic and cytotoxic risk associated with magnetic fields.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content andwriting of the paper.

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Patient preferences for hospital quality in Bandar Abbas using a Discrete Choice Experiment: 2010-2011

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Abstract: This study reports on the results of a discrete choice experiment undertaken in Bandar Abbas general hospitals to assess the factors influencing the demand of hospital care. In particular, the role of quality and trade-offs between attributes. It then presents a case study applying the technique to patients refferd to general hospitals in Bandar Abbas. 326 patients were questioned about the importance of five attributes with 16 hypothetical scenarios made that describe the quality of services in hospitals with 2 and 3 levels for each attribute. For each scenario, subjects chose between the hypothetical hospital; hospital A or B. A random effect probit model was used to estimate quantity of subject preferences for hospital quality and marginal rate of substitution between attributes. Marginal utility for attributes of quality of hospitals were estimated. We find that receiving services in a hospital that have discharge training paln represented by thoroughness of examination to be the most important quality attribute, followed by having high nursing care at wards and doctors giving enough information about the illness, drugs and treatment to the patient.

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Key words: Discrete Choice Experiment, Utility, Quality, hospital, Patient preferences, Tehran University of Medical Science

1. Introduction

In various ways health economists are engaged in eliciting persons' stated preferences with a view to using this information to inform resource allocation decisions in health care. One elicitation method that is increasingly being used is the discrete choice experiment (DCE).(Stirling, 2004)

Discrete choice experiments (DCEs) are an attribute-based stated preference valuation technique. DCEs are an attribute-based stated preference valuation technique. (Anthony, 2003). DCEs are an attribute based measure of benefit that is based on the assumptions that firstly, healthcare interventions, services, or policies can be described by their characteristics (or attributes) and secondly, an individual's valuation depends on the levels of these characteristics.

DCEs were introduced into health economics as a technique to go beyond the quality adjusted life year (QALY) paradigm. Users were concerned with many aspects of health care beyond health outcomes. Such factors included waiting time, location of treatment, type of care (for example, surgical or medical), and staff providing care (consultant or specialist nurse) and were referred to as process attributes. DCEs allow investigation of the trade-offs between such process and health outcomes attributes. Applications of discrete choice experiments have been extended to consider provider preferences such as strength of hospital consultants' preferences for various aspects of their work. More recently the technique has been used to value health outcomes in the provision of care (often beyond those valued within the QALY). (Mandy, 2004)

DCEs are increasingly being used to investigate preferences for healthcare products and programs and for the attributes that make up these products and programs (Ryan et al., 2001a). DCE is a stated preference method, in which respondents are requested to express preferences for sets of hypothetical choice alternatives constructed according to experimental design principles. Ryan et al. (2001b) systematically reviewed the application of DCE in health care and concluded that DCE performs well. (VAN HELVOORT-POSTULART, 2008).

The aim of this study is to understand the factors affecting the demand for hospital services in general hospitals in Bandar Abbas, Iran. The discrete choice form of stated preferences study seems most appropriate because it is relatively simple and best mimics the type of choice that individuals make in the hospital care market.

Hospitals are encouraged to augment their revenue base by generating revenue from paying patients. This implies that they are competing for patients, which should make them more responsive to patient preferences.

2. Materials & Methods

The theoretical base of discrete choice experiment are rooted in Random Utility theory. In choosing which medical center to refer, individuals face a number of options, each of which yields indirect utility, Y*. Y* is latent variable which is not directly observed. All we observe is whether an option is chosen or not. Individuals are assumed to choose the option that yields the highest indirect utility.

$Y^*_i = \text{Max}\ (Y^*_1, Y^*_2, Y^*_3, \ldots, Y^*_m)$

The indirect utility yielded by an option is assumed to be a function of choice-specific attributes. The residual ε captures unobserved variation in the characteristics of the different option and errors in measurement and optimization by the consumer.[5]

In other words:

$Y_{iq=} X_i B_i + \varepsilon_{iq}$

Where Y_{iq} is the indirect utility of individual q for option I and X_i is a vector of attributes of the ith choice.

Making the specific assumption about the distribution of the error term, the choice can be modeled using a logit or probit model. Because each individual is asked to make multiple choices the error term can not be assumed to be independent and panel data estimation techniques are required.

$\Delta Y=\beta_0+ \beta_1 (X_{1i}-X_{1j})+ \beta_2(X_{2i}-X_{2j})+ \ldots (\varepsilon_i- \varepsilon_{j(}$

The estimated parameters can be interpreted as the marginal utility from a change in the level of the attribute as one moves from option 1 to option 2. The ratio of any two parameters is the marginal rate of substitution between them.

Study was undertaken in 4 general hospitals of Bandar Abbas city, Iran.

Establishing attributes and levels:

Dimensions of hospital quality was obtained from focus group discussions and literature review. Separate discussion were held with hospital managers about the most important attributes. Discussion was conducted by a master of health economics.

Following the analysis of the focus group discussion and reviewing literatures, five hospital quality attributes were chosen to be included in questionnaire (Table1).

The level of attributes were chosen to reflect the range of situation that respondents might expect to experience.

Table 1: Attributes and levels

Attribute	Variable name	level
discharge training paln	DISCHARGE	Yes=1 No=2
nursing care at wards	NURSING	Good=2 Moderate=1 Poor=0
Likelihood that physician provide patient with information about the illness, drugs and treatment	PHYSICIAN	Good=2 Moderate=1 Poor=0
Cleanliness of wards and toilets	CLEAN	Often clean=1 Rarely clean=0
Waiting time between arrival at hospital and admission to the ward	WAIT	1hour= 2 3 hours= 1 5 hours= 0

The five attributes and levels in table 1 give rise to a total of 108 scenarios (3^2, 2^2). A fractional factorial design was used to reduce this number of scenarios to a feasible number. SPSS v. 19 software was used to generate an orthogonal main effects design which product a total of 16 scenarios. One of these 16 scenarios was randomly chosen as the constant comparator which gave a total of 15 choice pairs for each questionnaire. A sample pair of scenario is shown below:

Sample scenario:

Attributes	Hospital A	Hospital B
Information given by physician about illness	moderate	moderate
Discharge training	no	yes
Nursing care	good	moderate
Cleanliness of wards and toilets	Often clean	Often clean
Waiting time	3 hours	1 hours
Which hospital do you choose?	Hospital A □	Hospital B□

Although the use of design software to generate the scenarios was aimed at producing an orthogonal factorial design, orthogonality is no longer guaranteed once scenarios are paired.[5]

Orthogonality in attribute differences was therefore verified by using $\varkappa^2$ tests of association. Because the focus group did not directly investigate the relative importance of different attributes, it is noy possible to comment on whether the design meets the criterion of utility balance.

Data analysis:

The data were analysed using the random effect probit estimator in STATA v.6.

The codes of variables for analysis is shown in table 1. The baseline model is:

$\Delta Y = \alpha_1(\text{d-DISCHARGE}) + \alpha_2(\text{d-NURSING}) + \alpha_3(\text{d-pHYSICIAN}) + \alpha_4(\text{d-CLEAN}) + \alpha_5(\text{d-WAIT}) + \varepsilon + \mu$

Where corr $(\varepsilon,\mu) = \rho$, which take account of the correlation among an individual choice and

d-DISCHARGE = difference in having discharge training or not between options 1 and 2

d-NURSING = difference nursing care at wards between options 1 and 2

d-PHYSICIAN = difference in thoroughness of giving information about illness, drugs, … between options 1 and 2

d-CLEAN = difference in cleanliness between options 1 and 2

d-WAIT = difference in waiting time between options 1 and 2.

Theoretical validity of the valuation was assessed by determining whether the estimated quality parameters were of the anticipated sign. The sign of the different variables depends on the sign of the value taken by the constant comparator, so affecting the expected sign of the coefficient. Giving enough information about illness, good nursing care, having discharge training, less waiting time and often cleaned wards and toilets, were all expected to increase utility.

To investigate the internal consistency of responses, two choice pair was included in which one option was superior to the other in all attributes, assuming that people prefer a hospital which gives enough information about illness, have good nursing care, have discharge training, less waiting time and often cleaned wards and toilets, to exclude individuals who failed to choose the superior option or were unable to give consistent answer because of problems of misunderstanding.

3. Results:

From the target number of 330 questionnaires, 326 was achieved. In which 122 were male and 204 were female and 219 individuals stated that they have higher education equals at least to bachelor degree. This shows that understanding the questionnaires was hard to others. The interviewer also mentioned that higher educated individuals were easier to describe scenarios for them.

Table 2 presents the result from the random effects model. the statistical significance of rho confirms the appropriateness of using the panel data estimator. The estimated coefficients are all of the anticipated sign and are statistically significant. The coefficient can be interpreted as the effect of the difference between option one and option 2 on the likelihood of choosing option 1 over option 2, which the sign reflects if the level of the attributes was higher or lower in option 1.

The coefficient of waiting time is of opposite sign as anticipated reflecting a higher probability of choosing less waiting time hospital, this implies greater disutility associated with longer waiting time. The coefficient on cleanliness and waiting time were not statistically significant.

4. Discussion:

The results presented above provide new information about how consumers value the quality of hospital care. We find that discharge training is the most important quality attribute as presented by the thoroughness of examination preferences for hospital quality for studied communication are:

1- Discharge training
2- Nursing care at wards
3- Giving information about the illness by physicians
4- Cleanliness of wards and toilets
5- Waiting time

A study of patient preferences for hospital care in Zambia found the technical quality of care to be the most important quality attribute, then friendly

staff and drug availability (Maddala, 1983). Also a study of consumer preferences for hospital care in Australia found the complication rate, together with waiting times to be the most highly attributes. (Jan, 2000)

There are a number of methodological weaknesses that we would try to remedy in future studies.

First, it appears that our sampling strategy was biased toward higher educated people. This can be seen from the higher number of educated respondents.

Second, we did not include a choose neither option and consequently have effectively estimated an unconditional demand curve. (Ryan, 2005)

Third, we used a very limited form of test for dominant preferences, which may not be sufficiently powerful to detect this violation of the standard axioms. In addition to using the criterion of whether an individual always choose the superior scenarios in one attribute, it would have been useful to incorporate additional information about the relative importance of the different attributes.(Scott, 2001)

The choice of the quality attributes to include in the questionnaire and their interpretation by respondents also raises important issue for study design and interpretation of results. We choose attributes that encompasses a broad range of the quality dimensions that were identified in the focus group discussion. However this may complicate the interpretation of the coefficients which may reflect a broader construct in the mind of the respondent.

In sum, we have shown that it is feasible to undertake DCE studies and that the result can be used to inform health financing policy. Our findings suggest that policy makers will have difficulties in reconciling the demand of an equitable financing strategy with those of greater market orientation.

The characteristics of demand for hospital services may encourage hospitals to segment demand by improving quality of care.

Table 2: random effects probit model

Attribute	coefficient	Marginal effect	Z	p>|z|	95%conf.Interval
Information given by physician about illness	.4607367	0.46	4.14	0.000	.6789633 .2425102
Discharge training	1.206117	1.21	6.50	0.000	.8425976 1.569637
Cleanliness of wards and toilets	.2525942	0.25	1.28	0.201	-.1348152 .6400037
Waiting time	-.1802739	-0.18	-1.55	0.122	-.0481158 .4086636
Nursing care	.6890385	0.69	5.71	0.000	.4525837 .9254934
consistent	-.5705899	-0.57	-1.99	0.046	-1.131674 -.009506
Observations=4890 **individuals= 326** **No. of scenarios= 15** **log-likelihood= -237** **chibar2= 0.00** **wald chi2= 97.39** **prob>= chibar2= 0.00**					

Conclusions

This paper has considered the role of DCEs when eliciting preferences in the delivery of health care. While DCEs have been applied in a number of healthcare settings and potentially offer useful information to aid decision making, methodological issues should continue to be addressed. Important areas of future research relate to experimental design, alternative methods of data collection and analysis, and investigation of the underlying axioms of economic theory. Collaborative work with psychologists and qualitative researchers will prove useful when investigating these issues. (Ryan, 2001).

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Study of Sleep Disorders in Resistant Hypertensive Patients on Conventional Hemodialysis

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Abstract: Background: Every year more people suffer from end stage renal disease (ESRD). Sleep disturbances have been reported to be frequent in dialysis patients. Sleep disturbances could be sleep apnea, periodic limb movements in sleep or restless leg syndrome. **Patients and methods:** Sixty patients were chosen from Ain Shams University Hospitals dialysis units, between July 2010 and March 2012. Patients were divided into 6 groups: **Group A:** 10 patients with resistant HTN and ESRD on conventional HD having a PSQI score > 5. **Group B:** 10 patients with resistant, HTN and ESRD on conventional HD having a PSQI score < 5. **Group C:** 10 patients with ESRD only on conventional HD having a PSQI score > 5. **Group D:** 10 patients having ESRD only on conventional HD having a PSQI score < 5. **Group E:** 10 patients having resistant HTN normal renal function. They had PSQI score > 5. **Group F:** 10 patients having resistant HTN and normal renal function. They had PSQI score < 5.For all groups, creatinine, BUN, Hb, albumin, Na, K, PO_4, Ca and uric acid were done. Polysomnography was done for bad sleeper groups (group A, group C and group E). **Results:** Creatinine and BUN were significantly higher in bad sleeper groups than good sleeper groups (group A than group B and group C than group D). Nearly all polysomnographic parameters were abnormal in group A, group C and group E. In group A and group C, creatinine was positively correlated to parameters of obstructive sleep apnes OSA and periodic limb movement PLM ($P < 0.05$). In group A and group E, SBP and DBP were positively correlated to parameters of OSA and PLM. **Conclusion:** ESRD induces sleep disorders exacerbated by resistant HTN. Also resistant HTN alone can induce sleep disorders.

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1. Introduction

Sleep plays an important role in workers lives, allowing them to relax, restore, and revitalize their bodies, minds and emotions every 24 hours ***(Ohlman* and O'Sullivan ., *2009)***

Sleep is more than the absence of being awake; it is a homeostatically regulated process ***(Kotronoulas et al., 2009).***

The average sleep duration of adults is approximately 7 hours. National sleep foundation found the average sleep duration on work days in 44% of people to be shorter than this. Different studies indicate that too short a sleep duration is associated with a number of negative health outcomes, including higher risk for hypertension and cardiovascular disease ***(Portaluppi et al., 2009).***

Patients with common medical disorders often complain to their physician about sleep problems, and these patients are often referred to sleep specialists for evaluation and diagnosis. If the quality of sleep is improved, subjective symptoms related to the disease may improve ***(Parish, 2009).***

Obstructive sleep apnea (OSA), is the most common form of sleep disordered breathing ***(Hoffman et al., 2004)***

High blood pressure and obstructive sleep apnea are closely related, and the latter is considered to induce hypertension ***(Sharabi et al., 2004).***

Resistant hypertension is a common medical problem. Secondary causes of hypertension, such as obstructive sleep apnea require investigations and effective treatment if present ***(Pisoni et al., 2009).***

Hypertension is a well-known cause of renal impairment, and impaired renal function is a well known cause of hypertension; therefore the two conditions constitute a vicious circle resulting in the progressive worsening of each. This relationship is very prominent in end-stage renal disease ***(Portaluppi et al., 2009).***

Patients with end stage renal disease (ESRD) have a considerable symptom burden, among which sleep related symptoms are highly prevalent. Sleep disorders, such as restless legs, periodic limb movements and sleep apnea, and sleep complaints such as insomnia and day time sleepiness are very common in ESRD patients despite treatment with 3 times a week conventional hemodialysis ***(Hanly, 2009).***

Aim Of The Work

To assess the pattern of sleep disorders in resistant hypertensive patients on regular hemodialysis.

2. Patients and Methods:

Our study was conducted in Ain Shams University Hospital in Cairo between July 2010 and March 2012. Our study included 60 patients divided into 6 groups:

Group A: 10 patients with resistant hypertension and chronic renal failure on regular HD 3 times a week. Their pittsburg sleep quality Index (PSQI) score was > 5, known as (Bad sleepers). They were subjected to do polysomnogram study to assess their sleep pattern.

Group B: 10 patients with resistant hypertension and chronic renal failure on regular hemodialysis 3 times a week. Their PSQI score was < 5 and known as (good sleepers). They didn't do polysomnogram study as they didn't have sleep problems according to PSQI.

Group C: 10 patients with normal blood pressure and chronic renal failure on regular 3 times a week hemodialysis. Their PSQI score was > 5 and known as (Bad sleepers). They were subjected to do polysomnogram study to assess their sleep pattern.

Group D: 10 patients with normal blood pressure and chronic renal failure eon regular HD 3 times a week. Their PSQI score was < 5 and known as (good sleepers). They didn't do polysomnogram study as they didn't have sleep problems according to PSQI.

Group E: 10 patients with resistant hypertension and normal kidney function. Their PSQI score was > 5 known as (bad sleepers). They were subjected to do polysomnogram study to assess their sleep pattern.

Group F: 10 patients with resistant hypertension and normal kidney function. Their PSQI score was < 5 and known as (good sleepers). They didn't do polysomnogram study as they don't have sleep problems according to PSQI.

We excluded from the study patients with frank psychiatric problems, patients who are taking drugs that affect sleep quality like (antihistaminics or B_2 agonists), and antihypertensive drugs that are centrally acting like (α-methyldopa or lipid soluble beta-blockers).

We also excluded patients with renal failure secondary to other systemic disease like (SLE or DM), patients with multi-advanced chronic organ failure. Smokers and diabetic patients were also excluded.

All patients included in the study were subjected to complete clinical examination with calculation of body mass index (BMI), serum creatinine and BUN, Hb, Na and K according to conventional methods in Ain Shams University hospitals, Ca, Ph and serum albumin, body mass index (BMI; weight/height squared) was calculated according to the World Health Organization classification ***(Executive Summary, 1998).***

Assessment of sleep quality using the Pittsburgh sleep quality index (PSQI), which is a score derived by a self rated questionnaire, consisting of 19 questions which assess a wide variety of factors related to sleep quality in the previous month. The 19 questions are grouped into seven components scores, each weighted equally on 0-3 scale. The seven components are summed to yield a global PSQI score (range: 0-21) higher scores indicate worse sleep quality ***(Buysse et al., 1989)***. The seven components included: subjected sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction.

Patients with global PSQI score > 5 are conventionally defined as" poor sleepers", whereas those with a score < 5 are considered "good sleepers". Patients with poor sleep quality will be subjected to assessment of their sleep pattern using polysomnography in the sleep lab. Of neuropsychiatry department, for assessment of the etiology of the sleep disorder.

The polysomnography recording started at the patient's usual bedtime and was carried out using a polysmith neurotronics Inc. system, with 14 channels disturbed as follows: 3 for electroencepha-logrpay, 2 for oculogram, 1 for chin electromyography, 1 for tibial electromyography, 1 for electrocardiography, 1 for airflow, 2 for thoracic-abdominal movements, 1 for detection of body position . The system automatically analyses sleep stages using the ***Rechtshaffen and Kales (1968)*** criteria and arousals according to scoring rules of *Sleep Dis*orders *Atlas Task Force of the* ***American Sleep Disorders Association (1992)***

Polysomnography also known as a sleep study, a multiparametric test used in the study of sleep and as a diagnostic tool in sleep medicine. The test result is called a polysomnogram, also abbreviated PSG ***(Rechtschaffen and Kales, 1968).***

The patients underwent HD the day before the polysomnographic evaluation. Before the polysomnographic evaluation, clinical examination was made and weight (in kilograms), height (in meter), and the average of three systolic blood pressure (SBP, in mm Hg) measurements and three diastolic blood pressure (DBP, in mmHg) measurements were recorded, according to the recommendations of the VI report of the Joint National Committee on Prevention, Detection, Evaluation and treatment of high blood pressure ***(Joint National Committee, 1997).***

Terms of sleep study:

Apnea: was defined as the complete cessation of respiration or a > 50% reduction in airflow lasting longer than 10 seconds accompanied by persistent respiratory effort, with or without oxygen desaturation or arousal ***(Torre-Bouscoulet et al., 2007).***

Hypopnea: Defined as a reduction in airflow of < 50% for longer than 10 seconds, detected by thermistor or nasal cannula, accompanied by oxygen desaturation of > 4% or an arousal of 1.5 seconds or longer ***(Torre-Bouscoulet et al., 2007).***

Apnea-Hypopnea index (AMI)

Is an index used to assess the severity of sleep apnea based on the total number of complete cessations (apnea) and partial obstructions (hypopnea) of breathing occurring per hour of sleep. These pauses in breathing must last for 10 seconds and are associated with a decrease in oxygenation of the blood. AHI can be used to classify the severity of disease in events/ hour (mild 5-15, moderate 15-30, and severe greater than 30 ***(Peters, 2011).***

Oxygen saturation:

Normal oxygen saturation (SaO_2) is > 94% "oxygen saturation: oxygen content of blood divided by oxygen capacity and expressed in volume percent" ***(American Sleep Apnea Association, 2012).***

Desaturation Index

Another scoring criteria used is the oxygen desaturation index which is defined as the number of total oxygen desaturations of 3% or more divided by the total sleep time ***(Torre-Bouscoulet et al., 2007).***

Arousal

An abrupt change from a "deeper" stage of non-REM (NREM) sleep to a "lighter" stage, or from REM sleep towards wakefulness, with the possibility of awakening as the final outcome. Arousal may be accompanied by increased tonic electromyographic activity and heart rate, as well as by an increased number of body movements.

Spontaneous arousal index

The number of spontaneous arousals (eg arousals not related to respiratory events, limb movements, snoring, etc) multiplied by the number of hours of sleep. An arousal is a wake or "alpha" pattern for 3 to 15 seconds ***(American Sleep Apnea Association, 2012).***

Total wake episodes

It means total number of patient's wake times or episodes during the whole night sleep ***(American Sleep Apnea Association, 2012).***

Snoring episodes number

It means total number of patient's snoring times or episodes during the whole night sleep ***(American Sleep Apnea Association, 2012)***.

Periodic limb movement episodes number

Periodic limb movements defined as sets of muscle contractions occurring at intervals of < 90 seconds during the night, may cuase sleep disturbance or be associated with other sleep disorders such as apnea ***(Kataria and Vaughn, 2010).*** Here we mean how many times it occurs during whole night sleep latency.

Sleep latency :Means the duration of time from lights out or bedtime, to the onset of sleep.

Normal sleep latency is about 15 minutes, REM latency is 90 minutes, so these are OK ***(American Sleep Apnea Association, 2012).***

REM latency

After a person falls a sleep, the amount of time it takes for the first onset of REM sleep. Normal REM latency is 90 minutes ***(Gonzalez-Mayo and Shaner, 2005).***

Sleep efficiency

Sleep efficiency (or sleep efficiency index): the proportion of sleep in the episode potentially filled by sleep (i.e., the ratio of total sleep time to time in bed) or sleep efficiency = total sleep time multiplied by time in bed. Normal sleep efficiency is at least 85% (a sleep 85% of the night) ***(American Sleep Apnea Association, 2012).***

In this study, we have used the following abbreviations: BMI: body mass index, A/H index: Apnea/hypopnea index, Des. Index, desaturation index, TWE = total waking episode, PLM = periodic limb movement, TTPLM: Total time periodic limb movement. The normal values used for analyses of sleep variables were those proposed by ***Carskadon and Dement (2000)***.

The respiratory events (apnea and hypopnea) were classified according to the ***American Academy of Sleep Medicine Task Force Criteria (1999)***.

Resistant HTN is defined as blood pressure that remains alone (140/90) inspite of concurrent use of three anti-hypertensive agents of different classes, one of which being a diuretic, all agents should be prescribed at optimal doses ***(Demede et al., 2011).***

Statistical methods:

P-value

* P-value was considered significant if < 0.05 (S).
* P-value was borderline significance if < 0.1 (BS).
* P-value was highly significant if < 0.01 (HS).
* P-value was considered non significant if > 0.1 (NS).

Statistical package of social science (SPSS) version 15.0 was used for analysis of data.

Data was summarized as mean and standard deviation, t-test was used for analysis of two quantitative data and non parametric test (Mann-Whitney U) was used when data was not symmetrically distributed. Also Pearson linear correlation test was used in study of SBP, DBP and creatinine to different laboratory and polysomnogram items.

We also used chi-square test for multiple variables comparison.

3. Results

The percentage of good sleepers among our 60 patients was 50% and bad sleepers were 50%.

Among the studied 6 groups (group A, B, C, D, E and F), we didn't find a statistical significant difference as regards age and gender (P > 0.05). Group A constituted of 8 males (80% and 2 females (20%).

Group B constituted of males (100%) and no females, group C comprised 7 males (70%) and 3 females (30%). Group D comprised 10 males (100%) and no females. Group E constituted of 8 males (80%) and 2 females (20%). Group F constituted of 10 males (100%) and no females.

Table (1): Comparison between group A and B as regards different variables:

Variables	*Group A N = 10*	*Group B N = 10*	*t**	p
SBP(mmHg)	139±7	140±6	0.8	>0.05
DBP (mmHg)	103±8	98±5	1.9	>0.05
Creatinine (mg/dl)	11.1±0.6	9.7±1.2	3	<0.001
BUN (mg/dl)	91±26	88±16	0.9	>0.05
HB (gm/dl)	8.1±0.6	8±0.7	0.7	>0.05
Albumin (gm/dl)	3.8±0.9	3.9±0.8	1.2	>0.05
Na (mEq/L)	140±2.4	139±3	1.7	>0.05
K (mEq/L)	5.4±0.9	5.2±0.7	2.2	<0.05
Po4 (mg/dl)	96.5±0.2	6.9±0.3	1.2	>0.05
Ca (mg/dl)	7.5±0.9	8±0.7	0.9	>0.05
Uric acid (mg/dl)	6.5±1.2	6.1±1.2	1.1	>0.05

*unpaired t-test

Serum creatinine was significantly higher in bad sleeper patients with hypertension and ESRD (group A).

Table (2): Comparison between group A and B as regards BMI and questionnaire

Variables	Group A N = 10	Group B N = 10	t*	p
BMI	36.8±3	32±5	0.8	>0.05
PSQI	14.9±2	3.9±1.1	21	<0.001

* Unpaired t-test

There was a significant difference between group A and B as regards PSQI.

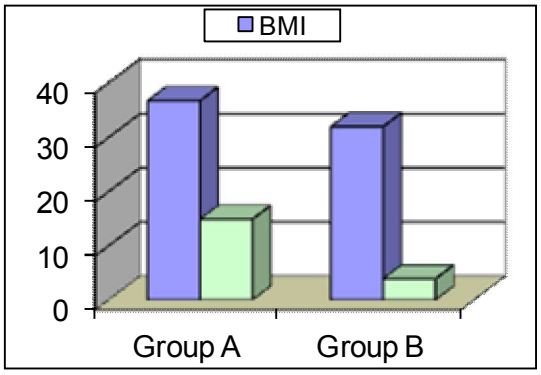

Figure (1): The diagram showing that patient within group A have BMI and PSQI score higher than group B.

Table (3): Comparison between group C and D as regards different variables:

Variables	Group C N = 10	Group D N = 10	T+	p
SBP(mmHg)	109±11	109±6	0.16	>0.05
DBP (mmHg)	69±5	97±6	1.5	>0.05
Creatinine (mg/dl)	9.9±1.3	9.9±5	0.12*	>0.05
BUN (mg/dl)	95±13	75±12	3.5	<0.001
HB (gm/dl)	8.2±0.4	8.1±5	0.2*	>0.05
Albumin (gm/dl)	3.9±0.2	3.9±0.5	0.4	>0.05
Na (mEq/L)	140±4	137±3	0.6	>0.05
K (mEq/L)	5.3±0.09	5.1±0.07	0.9	>0.05
Po4 (mg/dl)	6.5±0.6	6.1±0.5	1.1	>0.05
Ca (mg/dl)	7.5±0.3	7.5±0.2	0.03	>0.05
Uric acid (mg/dl)	4.7±0.8	6.2±1.5	1.6	>0.05

+ unpaired t-test * Mann Whitney test

Bad sleeper patients with normal blood pressure and ESRD (group C) had higher BUN than good sleeper patients with normal blood pressure and ESRD (group D).

Table (4): Comparison between group C and D as regards BMI and questionnaire

Variables	Group C N = 10	Group D N = 10	t*	p
BMI	28±3	30±3	1.2	>0.05
PSQI	13.3±1.2	2.6±0.7	23	<0.001

* Unpaired t-test

Group C had higher PSQI than group D.

Table (5): Comparison between group E and F as regards different variables:

Variables	Group E N = 10	Group F N = 10	t+	p
SBP(mmHg)	139±7	135±5	1.1	>0.05
DBP (mmHg)	98±6	95.5±5	0.5	>0.05
Creatinine (mg/dl)	0.99±0.19	0.92±0.19	0.10	>0.05
BUN (mg/dl)	11.6±1.6	13±1.1	1.3	>0.05
HB (gm/dl)	10.5±0.9	11±1.5	1.4	>0.05
Albumin (gm/dl)	4±0.5	4.2±0.18	0.9	>0.05
Na (mEq/L)	139±1.6	139.5±1.7	0.03	>0.05
K (mEq/L)	4.6±1	4.6±0.5	0.05	>0.05
Po4 (mg/dl)	3.8±0.5	3.9±0.4	0.6	>0.05
Ca (mg/dl)	8.7±0.9	9.5±0.4	1.4	>0.05
Uric acid (mg/dl)	5.9±1.3	6±0.99	1.1	>0.05

* unpaired t-test

Bad sleeper patients with normal kidney function and hypertension (group E) didn't have any significant difference as regards SBP, DBP and laboratory parameters when compared to good sleeper patients with normal kidney.

Table (6): Comparison between group E and F as regards BMI and questionnaire

Variables	Group C N = 10	Group D N = 10	t*	p
BMI	35.5±14	32.4	1.1	>0.05
PSQI	12.7±1.7	2.6±0.84	15	<0.001

* Unpaired t-test

Group E had higher PSQI than group F.

Table (7): Comparison between group A and C as regards different variables:

Variables	Group A N = 10	Group C N = 10	t+	p
SBP(mmHg)	139±7	109±11	6	<0.001
DBP (mmHg)	103±8	69±5	12	<0.001
Creatinine (mg/dl)	11.1±0.6	9.9±1.3	3	<0.001
BUN (mg/dl)	91±26	95±13	1.2	>0.05
HB (gm/dl)	8.1±0.6	8.2±0.4	1	>0.05
Albumin (gm/dl)	3.8±0.9	3.9±0.2	0.9	>0.05
Na (mEq/L)	140±2.4	140±4	0.8	>0.05
K (mEq/L)	5.4±0.9	5.3±0.09	2.2	<0.05
Po4 (mg/dl)	6.5±0.2	6.5±0.6	0.7	>0.05
Ca (mg/dl)	7.5±0.9	7.5±0.3	0.9	>0.05
Uric acid (mg/dl)	6.5±1.2	4.7±0.8	3.3	<0.05

* unpaired t-test

Patients with hypertension and chronic renal failure (group A) had higher SBP, DBP , creatinine, K and uric acid than patients with normal blood pressure and chronic renal failure (group C).

Table (8): Comparison between group A and C as regards questionnaire and different sleep parameters and BMI

Variables	Group A N = 10	Group C N = 10	t+	p
BMI	36.8±3	28±3	3	<0.05
PSQI	14.9±2	13.3±1.2	2.5	<0.05
A/H index	41.6±8	14.4±3	3	<0.001
Des. Index	35.6±8	11.5±2	2	<0.05
TWE	17.9±4	12.5±3	1.7	>0.05
Arousal index	24.8±4	20.7±4	1**	>0.05
Total number of snoring episodes	141±30	86±16	1.9*	>0.05
Mean duration of snoring episode (mns)	8.8±2.1	6.8±1.2	0.7*	>0.05
Snoring episode %	38±8	32±7	0.8*	>0.05
Duration of snoring (mns)	7.5±1.5	5.6±1	0.6*	>0.05
Total number of PLM	54.7±10	26±6	1.8	>0.05
Duration of PLM (mns)	113±23	95±20	1.7*	>0.05
Duration of PLM %	106±20	32±7	2	<0.05
TT PLM (mns)	25.4±6	8±5	1.9	>0.05
Sleep latency (mns)	28.8±6	36±8	0.7	>0.05
REM latency (mns)	165±35	105±29	1.8*	>0.05
Sleep efficiency (%)	0.67±0.10	0.75±0.09	2.1*	<0.05

+ unpaired t-test

Group A showed higher BMI, PSQI, A/H index, Des Index, duration of PLM and sleep efficiency than group C.

Table (9): Comparison between group A and E as regards different variables:

Variables	Group A N = 10	Group E N = 10	t+	p
SBP(mmHg)	139±7	139±7	0.6	>0.05
DBP (mmHg)	103±8	98±6	0.7	>0.05
Creatinine (mg/dl)	11.1±0.6	0.99±0.19	53	<0.001
BUN (mg/dl)	91±26	11.6±1.6	15	<0.001
HB (gm/dl)	8.1±0.6	10.5±0.9	6	<0.001
Albumin (gm/dl)	3.8±0.9	4±0.5	1.1	>0.05
Na (mEq/L)	140±2.4	139±1.6	0.6	>0.05
K (mEq/L)	5.4±0.9	4.6±1	3.5	<0.05
Po4 (mg/dl)	6.5±0.2	3.8±0.5	14	<0.001
Ca (mg/dl)	7.5±0.9	8.7±0.9	0.8	>0.05
Uric acid (mg/dl)	6.5±1.2	5.9±1.3	0.6	>0.05

* unpaired t-test

Bad sleeper patients with hypertension and ESRD (group A) had higher creatinine , BUN, HB, K and PO_4 as compared to bad sleeper patient with only hypertension (group E).

Table (10): Comparison between group A and E as regards questionnaire and different sleep parameters and BMI.

Variables	Group A N = 10	Group C N = 10	t+	p
BMI	36.8±3	35.5±7	0.4	>0.05
PSQI	14.9±2	12.7±1.7	2.9	<0.05
A/H index	41.6±8	29±5	1.9	>0.05
Des. Index	35.6±8	26±6	1.6	>0.05
TWE	17.9±4	16.7±3	0.7	>0.05
Arousal index	24.8±4	30.7±8	3.5	<0.05
Total number of snoring episodes	141±30	138±40	0.6	>0.05
Mean duration of snoring episode (mns)	8.8±2.1	8.3±1.5	0.09	>0.05
Snoring episode %	38±8	25.8±6	1.5	>0.05
Duration of snoring (mns)	7.5±1.5	6.4±1.5	1.1	>0.05
Total number of PLM	54.7±10	21.4±5	1.9	>0.05
Duration of PLM (mns)	113±23	174±34	1.9	>0.05
Duration of PLM %	106±20	108±20	0.3	>0.05
TT PLM (mns)	25.4±6	24.7±5	0.5	>0.05
Sleep latency (mns)	28.8±6	36.8±8	1.1	>0.05
REM latency (mns)	165±35	139±39	1.4	>0.05
Sleep efficiency (%)	0.67±0.10	0.74±0.15	0.7	>0.05

+ unpaired t-test

Group A had higher PSQI and arousal index than group E.

Table (11): Comparison between bad sleeper groups as regard diagnosis

Diagnosis	Group A N=10	Group C N=10	Group E N=10	X^{2*}	P
Mild OSA	3 (30%)	9 (90%)	4 (40%)		
Moderate OSA	2 (20%)	2 (20%)	2 (20%)		
Severe OSA	6 (60%)	0	2 (20%)		
PLM	4 (40%)	0	2 (20%)		16<0.001
Reduced sleep efficiency	0	1 (10%)	0		
Bruxism	0	1 (10%)	0		
Insomnia	0	1 (10%)	0		
Sleep induced OSA	0	0	1 (10%)		

* chi-square test

This table shows highly significant difference between the bad sleeper groups as regard diagnosis

Table (12): Correlation between SBP, versus different variables among group A

Variables	SBP r	SBP P
Creatinin	0.09	>0.05
BUN	0.11	>0.05
HB	-0.68	<0.05
Albumin	-0.65	<0.05
Na	0.60	<0.05
K	0.08	>0.05
Po_4	-0.11	>0.05
Ca	-0.17	>0.05
Uric acid	-0.15	>0.05
BMI	0.03	>0.05
PSQI	0.13	>0.05
A/H index	0.23	>0.05
Des. Index	-01.12	>0.05
TWE	0.19	>0.05
Arousal index	0.59	<0.05
Total number of snoring episodes	0.19	>0.05
Mean duration of snoring episode	0.18	>0.05
Snoring episode %	0.27	<0.05
Duration of snoring	0.37	<0.05
Total number of PLM	0.18	>0.05
Duration of PLM	0.17	>0.05
Duration PLM%	0.15	>0.05
TT PLM	0.46	<0.05
Sleep late	0.12	>0.05
REM	0.03	>0.05
Sleep eff.	0.18	>0.05

*Spearman correlation test

There was a negative correlation between SBP and each of Hb and albumin, and positive correlation between SBP and each of Na, arousal index, snoring episode%, duration of snoring, and TTPLM in bad sleeper patients with hypertension and ESRD (group A).

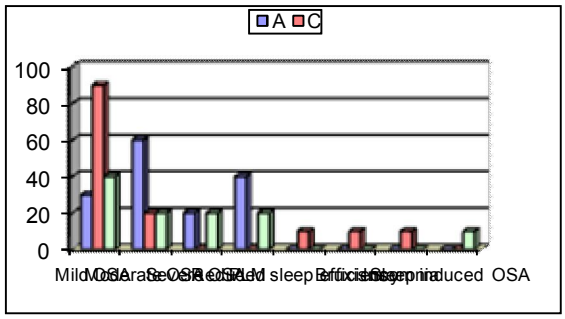

Figure (2): Comparison of bad sleeper groups as regards of different diagnosis of sleep disorders.

Table (13): Correlation between DBP, versus different variables among group A

Variables	DBP	
	r	P
Creatinin	0.17	>0.05
BUN	0.03	>0.05
HB	-0.19	>0.05
Albumin	-0.18	>0.05
Na	0.23	>0.05
K	0.26	>0.05
Po_4	0.15	>0.05
Ca	0.17	>0.05
Uric acid	-0.13	>0.05
BMI	0.20	>0.05
PSQI	0.24	<0.05
A/H index	0.04	>0.05
Des. Index	0.24	<0.05
TWE	0.15	>0.05
Arousal index	0.12	>0.05
Total number of snoring episodes	-0.13	>0.05
Mean duration of snoring episode	0.10	>0.05
Snoring episode %	0.62	<0.05
Duration of snoring	0.13	>0.05
Total number of PLM	0.17	>0.05
Duration of PLM	-0.13	>0.05
Duration PLM%	-0.19	>0.05
TT PLM	0.04	>0.05
Sleep late	0.22	<0.05
REM	0.18	>0.05
Sleep eff.	0.23	<0.05

*Spearman correlation test

There was a negative correlation between SBP and each of Hb and albumin, and positive correlation between SBP and each of Na, arousal index, snoring episode%, duration of snoring, and TTPLM in bad sleeper patients with hypertension and ESRD (group A).

Table (14): Correlation between creatinine, versus different variables among group A

Variables	Creatinine	
	r	P
SBP	0.23	>0.05
DBP	0.18	>0.05
Creatinin	-0.12	>0.05
BUN	0.04	>0.05
HB	0.22	>0.05
Albumin	0.09	>0.05
Na	0.14	>0.05
K	0.03	>0.05
Po_4	0.02	>0.05
Ca	0.18	>0.05
Uric acid	0.22	>0.05
BMI	-0.21	>0.05
PSQI	0.66	<0.05
A/H index	0.13	>0.05
Des. Index	0.32	>0.05
TWE	0.19	>0.05
Arousal index	-0.23	>0.05
Total number of snoring episodes	0.17	>0.05
Mean duration of snoring episode	0.18	>0.05
Snoring episode %	0.66	<0.05
Duration of snoring	0.16	>0.05
Total number of PLM	0.43	<0.05
Duration of PLM	0.17	>0.05
Duration PLM%	0.02	>0.05
TT PLM	0.23	>0.05
Sleep latency	0.74	<0.05
REM latency	0.65	<0.05
Sleep efficiency	0.45	<0.05

*Spearman correlation test

We found a positive correlation between serum creatinine and PSQI, snoring episode%, total number of PLM.

Table (15): Correlation between creatinine versus different variables among group C

Variables	Creatinine	
	r	P
SBP	0.20	> 0.05
DBP	0.10	> 0.05
Creatinin	-0.16	> 0.05
BUN	0.08	> 0.05
HB	0.75	<0.05
Albumin	0.03	> 0.05
Na	0.11	> 0.05
K	0.72	< 0.05
Po_4	0.07	> 0.05
Ca	0.14	> 0.05
Uric acid	0.20	> 0.05
BMI	-0.11	> 0.05
PSQI	0.44	< 0.05
A/H index	0.17	> 0.05
Des. Index	0.30	> 0.05
TWE	0.09	> 0.05
Arousal index	0.42	< 0.05
Total number of snoring episodes	-0.10	> 0.05
Mean duration of snoring episode	0.13	> 0.05
Snoring episode %	0.16	> 0.05
Duration of snoring	0.49	< 0.05
Total number of PLM	-0.20	> 0.05
Duration of PLM	-0.14	> 0.05
Duration PLM%	0.06	> 0.05
TT PLM	0.20	> 0.05
Sleep latency	0.14	> 0.05
REM latency	0.12	> 0.05
Sleep efficiency	0.45	< 0.05

*Spearman correlation test We found a positive correlation between creatinine level in the blood and each of HB, K, PSQI.

Table (16): Correlation between SBP versus different variables among group E

Variables	SBP	
	r	P
SBP	0.11	> 0.05
DBP	0.16	> 0.05
Cratinine	-0.11	> 0.05
BUN	0.06	> 0.05
HB	0.15	> 0.05
Albumin	0.07	> 0.05
Na	0.19	> 0.05
K	-0.08	> 0.05
Po_4	0.07	> 0.05
Ca	0.13	> 0.05
Uric acid	0.27	> 0.05
BMI	-0.13	> 0.05

PSQI	0.50	< 0.05
A/H index	0.45	> 0.05
Des. Index	0.35	< 0.05
TWE	0.13	> 0.05
Arousal index	0.52	< 0.05
Total number of snoring episodes	0.36	< 0.05
Mean duration of snoring episode	0.15	> 0.05
Snoring episode %	0.57	< 0.05
Duration of snoring	0.12	> 0.05
Total number of PLM	-0.10	> 0.05
Duration of PLM	-0.04	> 0.05
Duration PLM%	0.02	> 0.05
TT PLM	0.49	< 0.05
Sleep late	0.12	> 0.05
REM	0.16	> 0.05
Sleep eff.	0.27	> 0.05

*Spearman correlation test

We found a positive correlation between SBP and each of PSQI, desaturation index, arousal index, total number of snoring episodes, snoring episode % and TT PLM in bad sleeper patients with normal kidney function and hypertension (group E).

Table (17): Correlation between DBP, versus different variables among group E

Variables	DBP	
	r	P
SBP	0.17	>0.05
DBP	0.10	>0.05
Creatinine	-0.14	>0.05
BUN	-0.04	>0.05
HB	0.14	>0.05
Albumin	0.08	>0.05
Na	0.14	>0.05
K	-0.04	>0.05
Po_4	0.01	>0.05
Ca	0.13	>0.05
Uric acid	0.20	>0.05
BMI	-0.13	>0.05
PSQI	0.46	<0.05
A/H index	0.46	<0.05
Des. Index	0.33	>0.05
TWE	0.19	>0.05
Arousal index	-0.11	>0.05
Total number of snoring episodes	-0.13	>0.05
Mean duration of snoring episode	0.19	>0.05
Snoring episode %	0.37	<0.05
Duration of snoring	0.16	>0.05
Total number of PLM	-0.17	>0.05
Duration of PLM	-0.14	>0.05
Duration PLM%	0.06	>0.05
TT PLM	0.39	<0.05
Sleep late	0.15	>0.05
REM	0.12	>0.05
Sleep eff.	-0.20	>0.05

*Spearman correlation test There was a positive correlation between DBP and each of PSQI, A/H index, snoring episode % and TT PLM in group E.

4. Discussion

The relation between sleeping, waking and uremia has long been of interest, and ***Schreiner (1959)*** described the uremic patient's drowsiness by day with insomnia at night and the atypical responses to sedatives ***(Daly and Hassal, 1970)***. ***Gonzales et al. (1963)***, reported insomnia in his patients being treated with hemodialysis, thought to be of functional origin. ***Shea et al. (1965)***, however noted that Soporific effects of dialysis occurred in every patient unless the patients was particularly anxious, a view that was supported by ***Menzies and Stewart (1968)***.

An objective study of sleep and dialysis was made by ***Passouant et al. (1967)***, using EEG recordings, they found that before dialysis the total duration of sleep was diminished, with myocolonic jerks and periods of wakefulness occurring throughout the night. Paradoxical (REM) sleep was diminished and occurred at irregular intervals. After dialysis, the sleep cycles became regular. Sleep quality is a major concern as regard the quality of life in patients with resistant hypertension and chronic renal failure. Sleep disorders affect the majority of chronic kidney disease (CKD) patients. Some investigators hypothesized that end stage renal disease (ESRD) directly influences the quality of sleep. Interestingly, 80% of hemodialysis patients suffer from sleep abnormalities ***(Sabry et al., 2010; Parish, 2009; Haba-Rubio et al., 2011; Ibrahim and Omar, 2011).***

In chronic renal failure patients, an increased prevalence of sleep apnea, restless leg syndrome, and periodic limb movement during sleep has been reported. Epidemiology, pathophysiology and treatment of sleep disorders in CRF and dialysis patients are still unclear and requires further research ***(Haba-Rubio et al., 2011).***

Our patients were relatively young as compared to other studies which stated that the sleep the general population as reported by ***Makhlouf et al. (2007); Colbay et al. (2007); Mavanur et al. (2010); Glass et al. (2005); Guney et al. (2010); Elias et al. (2009); Roumeliote et al. (2011); Sabbattini et al. (2003); Sakkas et al. (2008).***

This was not observed in HD population, on the contrary younger age ranges were reported by ***Koch et al. (2008) and Musci et al. (2004)***.

We didn't find significant difference as regards age between the six groups of our study which mean that age difference didn't affect our results.

Also, we didn't find a significant difference as regards sex distribution between the six groups of our study.

Most of our study patients were males with nearly absent female gender in some groups.

Colby et al. (2007); Bilgic et al. (2007) and Perl et al. (2006) reported that female gender has been found to be a good sleeper. ***Elias et al. (2009)***; ***Unruh et al. (2003)***; ***Argekar et al. (2007) and Walker et al. (1995)*** found that male sex was associated with more sleep complaints. Other studies, however, found no association between gender and sleep disturbances ***(Merlino et al., 2006; Musci et al., 2004; Sabbattini et al., 2002; and Koch et al., 2008)*** and even more frequent insomnia symptoms were reported in female patients ***(Edinger and*** **Means** ***2005; Pai et al., 2007)***.

The average BMI of our patients was 27.11 kg/m^2 which is normal or predisposing to mild obesity and it was not considered a contributing factor to poor sleep quality in our study.

BMI was significantly higher (P < 0.05) in bad sleepers of group A with both resistant hypertension and ESRD when compared with bad sleepers of group C with ESRD only, which reflects BMI importance in ESRD patients as a contributing factor for developing poor sleep quality and resistant hypertension.

The same result was obtained when comparing bad sleepers of group A with resistant hypertension and ESRD to good sleepers of group D with ESRD only.

Abdel-Kader et al. (2012), has stated that obesity has been independently associated with higher rates of uncontrolled HTN in both the general population and among those with kidney disease.

Among risk factors for sleep disordered breathing (SDB), obesity and neck circumference are considered as reported by ***Iseki et al.(2007); Elias et al. (2009); Roumelioti et al. (2011)*** and also increased BMI as reported by ***Guney et al. (2010) Elder et al. (2008), Tada et al. (2007) and Unruh et al. (2008)***.

Moving a BMI > 30 was associated with a higher probability of sleep apnea ***(Argekar et al., 2007; Sakkas et al., 2008).***

The threshold for obstructive sleep apnea development among patients on hemodialysis is lower than in the general population (BMI in HD of 26-28) as compared to > 30 to > 42 in the general population ***(Rodrigues et al., 2005).***

Multivariate analysis showed that BMI was independently associated with occurrence of Sleep Apnea (OR 1.20, 95% CI 1.05-1.38, p = 0.008).

Mavanur et al. (2010); ***and Beecroft et al. (2007),*** stated that unlike the general population, obesity was not consistently associated with Sleep Disordered Breathing in dialysis patients.

In our study, we have used PSQI questionnaire to divide our patients into good sleepers and bad sleepers. Using PSQI questionnaire was used by different studies in assessment of sleep quality with many other disorders, by ***Huang et al. (2011); Al-Jadahli (2011); Sabbattini et al. (2003); Iliescu et al. (2003); Cengic and Resik (2012); Loewen et al. (2009); and Araujo et al. (2010).***

In our study, we have performed laboratory studies for good sleeper groups as well as for bad sleep groups.

In our study, serum creatinine was higher in bad sleepers of group A with resistant HTN and ESRD when compared to good sleepers of group B with resistant HTN and ESRD (P < 0.001).

Also creatinine was significantly higher (P < 0.001) in group A than in group C with ESRD only, both groups being bad sleeper groups.

BUN levels were significantly higher (P < 0.001) in bad sleepers of group C with ESRD only, as compared to good sleepers of group D with ESRD only.

Our results suggests that dialysis inefficiency is, at least in part, a cause of sleep abnormality and this means that uremia does affect the patients sleep pattern.

As regards other laboratory parameters, especially in bad sleepers with ESRD (group A and group C), serum potassium and uric acid were significantly higher in bad sleepers of group A with resistant HTN and ESRD as compared to good sleepers of group B" with resistant HTN and ESRD, and also in bad sleepers of group C with ESRD only as compared to good sleepers of group D with ESRD only.

Lee et al. (2009), in their study found that uric acid was correlated positively with total sleep time (TST) (r = 0.407) and negatively with apnea hypopnea index (AHI) and oxygen –desaturation index (ODI) (r = -0.377,r = -0.405).

Hsu et al. (2004), have suggested a positive effect of uric acid related to its anti-oxidant properties, predicting high mortality in HD patients with lower uric acid levels.

We have also found significantly lower Hb (P < 0.001) and higher phosphorous (P < 0.001) in bad sleepers of group A with resistant HTN and ESRD as compared to bad sleepers of group E with resistant HTN only and this confirms our opinion about inefficient dialysis as a cause of sleep disturbances.

Haba-Rubio et al. (2011); and Ibrahim and Omar (2011) reported that sleep disorders were common in patients receiving hemodialysis. Studies have suggested that the very high prevalence of sleep disorders (especially sleep apnea) in ESRD reflects suboptimal dialysis ***(Pai et al., 2007; Hanly et al., 2009; Perl et al., 2006; Unruh, 2007; Ibrahim and Omar, 2011; Bastros et al., 2007; Koch et al., 2008; Mavanur et al., 2010; Elias et al., 2009; Guney et al., 2010; Argekar et al., 2007; Al- Jadahli, 2011; and Deloach and Berns, 2009).***

On the contrary; ***Elder et al. (2008)***; ***Musci et al. (2004); Sakkas et al. (2008); Beecroft et al. (2007); and Lerma (2011)*** stated that poor sleep quality was not affected by Kt/v, serum albumin or treatment time.

Attempts in optimizing uremia control in the form of nocturnal hemodialysis (NHD) and renal transplantation have shown early clinical success in treating sleep disorders as stated by ***Unruh (2007) and Tang et al. (2006).***

Al-Jadahli (2011); ***Sabry et al. (2010); Kovacs et al. (2011); Elder et al. (2008); Sabbattini et al. (2008); Koch et al. (2008)*** in their studies reported that the risk factors for insomnia were inadequate dialysis, anemia, hypoalbuminemia and hyperphosphatemia.

Haba-Rubio et al. (2011); Ibrahim and Omar (2011); Al-Jadahli (2011); Araujo et al. (2010) and Gigli et al. (2004) stated that insomnia, restless leg syndrome (RLS) and obstructive sleep apnea were significantly associated with these mentioned risk factors in patients with ESRD on regular HD.

Koch et al. (2008), found that in patients with ESRD, the circadian sleep-wake rhythm can be disrupted by both internal factors (biochemical parameters and melatonine) and external factors (dialysis and medications).

Polysomnography is the gold standard for diagnosing sleep disorders, as reported by ***Argekar et al. (2007)***; ***Unruh et al. (2007); Ballard (2005); Lee et al. (2009); Loewen et al. (2009); Liakopoulos et la. (2008); Enomoto et al. (2008); Roumelioti et al. (2011); Elias et al. (2009); Iseki et al. (2007); Tang et al. (2010); Rodrigues et al. (2005); Koch et al. (2008); Mavanur et al. (2010); Tada et al. (2007); Miskowiec et al. (2006).***

Sleep efficiency under normal circumstances, is recorded best by means of polysomnogrpahy ***(Kushida et al., 2005)***.

Hanly et al. (2009) in their study using polysomnography found a high frequency of arousals in HD patients (up to 30/h), resulting in a sleep efficiency that ranged from 66% to 85%.

In our study, we found that nearly all polysomnogram parameters were abnormal in the three bad sleeper groups (group A, group C, and group E).

In our study, the most prevalent sleep disorder was obstructive sleep apnea , ranging from 20 to 60% in our bad sleeper groups (group A, group C, and group E), and to a much less extent periodic limb movement , ranging from 20% to 40% in the same mentioned groups.

Ibrahim and Omar (2011) in their study, found that prevalence of sleep disorders was 61.4% of their HD patients, the survey included insomnia (57.6%), RLS (56.4%) and OSA (21.2%).

Al-Jadahli (2011), reported that 46% of HD patients included in his study suffered from RLS, 67% suffered from sleep apnea, and 59% suffered from insomnia.

Loewen et al. (2009), has reported sleep apnea in up to 50-70% of patients with ESRD.

Elias et al. (2009), has reported sleep-disordered breathing ranging from 50 to 73% and the majority of respiratory events were represented by obstructive sleep apnea.

Lee et al. (2009), reported sleep apnea ranging from 50 to 70% of ESRD patients, which was more than 10 times the range in general population, 60% of patients had PLM and 50% of patients had both Sleep Apnea Syndrome and PLM.

Prevalence of sleep apnea with ***Deloach and Berns (2009)*** was 30 to 80% of HD patients, and in ***Argekar et al. (2007)*** study, ranging from 50-60%.

In ***Hanly et al. (2009) and Rodrigues et al. (2005)*** studies, OSA was the predominant type of sleep apnea in ESRD patients.

Gaetano et al. (2010), found that RLS affected 31% of his studied HD population, and in ***Araujo et al. (2010)*** study, RLS prevalence was 21.5%.

On comparing abnormal polysomnograms of bad sleeper of group A with HTN and ESRD to bad sleeper of group C with ESRD only, apnea/hypopnea index was found to be higher than normal in group A patients than group C ($P < 0.001$).

Also desaturation index was much higher in bad sleepers of group A than bad sleepers of group C ($P < 0.05$).

Duration of PLM% was much higher in bad sleeper of group A with HTN and ESRD as compared to bad sleeper of group C with ESRD only ($P < 0.05$).

Sleep efficiency was worse in bad sleepers of group A as compared to bad sleepers of group C ($P < 0.05$).

This means that ESRD does affect sleep disordered breathing and periodic limb movement and not simply inability to initiate or maintain sleep.

But coexistence of HTN, especially resistant hypertension, does exacerbate these disorders.

In bad sleepers of group A with HTN and ESRD, we found a positive correlation between creatinine and each of PSQI score ($P < 0.05$), snoring episode ($P < 0.05$), total number of PLM ($P < 0.05$), sleep latency ($P < 0.05$), REM latency ($P < 0.05$), and sleep efficiency ($P < 0.05$).

This shows the impact of high creatinine level on sleep pattern in ESRD patients.

A study made by ***Loewen et al. (2009)*** showed that patients treated with conventional hemodialysis had significantly greater odds of short sleep (OR 3.27 [1.16-9.25]) and less efficient sleep (OR 5-5 [1.5-19.6]) than a matched control group.

Anastassov and Trigger (1998); Al-Jadahli (2011); Abdel-Kader et al. (2012); Mavanur et al. (2010); and Sim et al. (2010), stated that sleep disordered breathing is highly prevalent in patients with CKD and may be due to volume overload, upper airway narrowing, older age and other co-morbidities.

Loewen et al. (2009) and Beecroft et al. (2009) found that obstructive sleep apnea was the most frequent type of sleep disordered breathing in ESRD patients.

Langevin et al. (2010), stated that during metabolic acidosis, compensatory hyperventilation leads to hypocapnia, thus more easily reaching the apneic threshold at sleep onset, generating periodic respiration and destabilization of respiratory control.

In a study of ***Beecroft et al. (2006)***, 49 ESRD patients with sleep apnea were found to have a higher apneic threshold and a higher sensitivity to hypercapnia. Their results suggested that the sensitivities of both central and peripheral chemoreceptors are increased with sleep apnea and ESRD.

Sleep apnea is characterized by abnormal respiratory patterns during sleep (apnea, hypopnea) and disturbed sleep (snoring, restlessness, resulting in daytime sleepiness and fatigue which may reduce quality of life

(QOL) and functional capacity ***(Deloach and Berns, 2009)***.

Roumelioti et al. (2011), in their study found that median AHI was higher in HD group as compared to control group.

Conventional HD group in ***Unruh (2007)*** study, had significantly less sleep time, more frequent arousals, increased number of apneas/hypopneas (> 30 respiratory events per hour and more severe nocturnal oxyhemoglobin desaturation).

Roumelioti et al. (2011),found that AHI was much higher (18.2) in HD patients that CKD patients (8.8) and controls (8.6) ($p = 0.002$). ***Loewen et al. (2009),***found that conventional HD patients were more likely to have severe sleep apnea (AHI > 30) with an odds ratio of 4.07 (95% CI 1.83 to 9.07) as compared to normal kidney function controls.

Tada et al. (2007) found that the number of obstructive apnea events per hour was significantly correlated with creatinine ($P < 0.05$, $r = 0.418$) and BUN ($r = 0.490$, $p < 0.01$). Also creatinine and BUN were correlated with OSA index ($P < 0.05$ and $P < 0.01$ respectively).

Nearly the same results were found by ***Iseki et al. (2007)***. Increasingly it is believed that "uremic factors" may play a role in the pathophysiology of sleep apnea in ESRD ***(Deloach and Berns, 2009).***

The dose of hemodialysis was significantly and inversely associated with OSA and remained significant in multivariate analysis ***(Elias et al., 2009)***. On contrary in ***Tada et al. (2007)*** study, patients with sleep apnea (SA) tended to have a larger means dialysis dose than patients without SA ($P = 0.056$).

Unruh (2007), Beecroft (2009) and Deloach and Berns (2009) reported improvement in sleep apnea following conversion to nocturnal HD.

Beecroft et al. (2008), demonstrated that improvement in sleep apnea symptoms was associated with an increase in pharyngeal cross-sectional area and that was related to nocturnal HD. ***Beecroft et al. (2007)*** found that pharyngeal area was smaller in ESRD patients.

Periodic limb movement syndrome (PLMS) is a common dysfunction of motor control during night time sleep, and it is frequently associated with signs of arousal in the electroencephalogram (EEG) plus activation of the autonomic nervous system ***(Portaluppi et al., 2009).***

Hanly (2009), ***Gigli et al. (2004), Araujo et al. (2010) and Al-Jadahli (2011),***reported that potential risk factors for RLS and PLM disorders in HD patients included peripheral and central nervous system abnormalities and hyperparathyroidism besides the previously mentioned risk factors of sleep disorders.

An association between RLS and cardiovascular disease has been observed in two epidemiologic studies on the general population ***(Ulfberg et al., 2001; Winkelman et al., 2008)a***nd one community based study of large middle age and elderly cohort of the sleep heart health study ***(Winkelman et al., 2008)***.

Portaluppi et al. (2009), reported that the prevalence of restless leg syndrome (RLS), which is high in dialysis patients would play a role in the pathogenesis of sleep-hypertension in renal patients.

The association between RLS and PLMS and the risk of hypertension, however, is controversial ***Ohayon and Roth,(2002)***; ***Ulfberg et al. (2001***);W***inkelman et al. (2008)***.

Sforza et al. (1999) and ***Siddiqui et al. (2007)***, have reported that episodes of PLM are associated with significant repetitive sleep time elevations of heart rate plus systolic blood pressure (SBP) and diastolic blood pressure (DBP).

Because of the importance of the relationship between PLM and respiratory events, as indicated by the finding of a strong linear correlation of rise in BP with the duration of respiratory related limb movements, and it seemed possible that some PLM may be in fact respiratory-related and connected to BP rise in other ways than previously postulated ***(Siddiqui et al., 2007).***

The resulting over activity of the sympathetic nervous system seemed to be responsible for non dipping BP pattern associated with PLM ***(Siddiqui et al., 2007).***

Benz et al. (2000) reported that, in renal patients with sleep disorders, the parameters used to quantify the severity of PLMs (PLM index, arousing PLM index, and arousal index), as determined by polysomnography, have been found to be associated with mortality.

In ***Enomoto et al. (2008)*** study, using polysomnography, the uremic RLS group had a higher arousal index and a higher sleep stage I percentage than controls. Uremic RLS patients were more vulnerable to the appearance of PLM, not only while asleep, but also while awake.

On comparing polysomnograms of bad sleepers of group A with HTN and ESRD to bad sleepers of group E with resistant HTN alone, arousal index was found to be higher in group E than in group A, both having an arousal index higher than normal ($P < 0.05$). This means that resistant hypertension alone can affect sleep process and causes sleep disorders. All other polysomnogram parameters were abnormal in both group A and group E.

Without significant difference between both groups. This shows how much resistant hypertension is deleterious for sleep quality, although bad sleepers of group E had normal kidney function.

In bad sleepers of group A with HTN and ESRD systolic blood pressure (SBP) had a negative correlation with each of Hb ($P < 0.05$), and albumin ($P < 0.05$). Also, SBP had a positive correlation with each of Na ($P < 0.05$), Arousal index ($P < 0.05$), Snoring episode % ($P < 0.05$), duration of snoring ($P < 0.05$), and total time PLM ($P < 0.05$).

Diastolic blood pressure (DBP) in bad sleepers of group A, had a positive correlation with each of PSQI score ($P < 0.05$), desaturation index ($P < 0.05$), snoring episode % ($P < 0.05$),

Sleep latency ($P < 0.05$) and sleep efficiency ($P < 0.05$).

In bad sleepers of group E with resistant hypertension only, SBP had a positive correlation with each of PSQI score ($P < 0.05$), arousal index ($P < 0.05$), total number of snoring episodes ($P < 0.05$), snoring episode ($P < 0.05$) and total time PLM ($P < 0.05$). DBP in bad sleepers of group E had a positive correlation with each of PSQI scores ($P < 0.05$), A/H index ($P < 0.05$), snoring episode % ($P < 0.05$) and total time PLM ($P < 0.05$).

Our results showed the relationships of resistant HTN with polysomnogram parameters in bad sleeper groups with hypertension, whether having ESRD or normal renal function.

People are sleeping less in modern societies. It is said that short sleep duration could play a role in the etiology of HTN ***(Sasanabe and Shiomi, 2009)***.

Experimentally induced sleep deprivation can raise blood pressure and worsen HTN.

Short sleep duration is associated with resistant hypertension, independently of OSA, which can itself disrupt and shorten sleep ***(Friedman et al., 2010).***

All hypertensive patients should be routinely screened for possible sleep disorders ***(Sasanabe and Shiomi, 2009).***

Huang et al. (2011) found that non dippers with poor sleep quality had an increased activity of sympathetic nervous system and a more stressful status. The decline of SBP and DBP at night was inversely related to PSQI score.

The contribution of sleep disorders to resistant HTN remains incompletely characterized. Studies examining the link between OSA and resistant HTN have explicitly excluded patients with moderate to severe chronic kidney disease or have had relatively few patients with advanced CKD ***(Abdel-Kader et al., 2012).***

Friedman et al. (2010), reported a significantly higher prevalence of obstructive sleep apnea (OSA) and reduced rapid eye movement (REM) sleep time in drug resistant hypertensives compared to controlled hypertensives. The hypoxemia, arousals and intrathoracic pressure changes associated with sleep apnea leads to sympathetic nervous system activation, endothelial dysfunction, inflammation and oxidative stress, which may be associated with arterial HTN and other adverse cardiovascular outcomes ***(Elias et al., 2009; Deloach and Berns, 2009; Hanly, 2009 and Unruh, 2007).***

Obstructive sleep apnea (OSA) is common in patients with HTN with a prevalence of up to 50% ***(Abdel-Kader et al., 2012).***

Patients with OSA needed significantly more pills than patients without OSA for optimal BP control ***(Elias et al., 2009)***

Rodrigues et al. (2005) found an impressive correlation between sleep apnea and blood pressure in dialysis patients independent of antihypertensive treatment.

In the prospective Wisconsin sleep cohort study ***(Peppard et al., 2000)***, observed that in the general population, the presence of sleep disordered breathing was associated with the development of HTN four years later, suggesting a cause effect result. Other investigators ***(Fletcher et al., 1985; Garcia-Rio et al., 2000; Lavie et al., 2000),***also have demonstrated an association between sleep disorders and hypertension in prospective or cross-sectional studies.

Abdel-Kader et al. (2012) observed that resistant HTN and severe OSA (AHI > 30) significantly more prevalent in patients with advanced kidney disease (30% resistant HTN, 25% severe OSA). ESRD patients with severe OSA were seven fold more likely to have resistant HTN than their counterparts.

Rodrigues et al. (2005), found that systolic, diastolic and mean blood pressure were higher in patients with AHI > 5 and were the only parameters significantly and positively correlated with AHI.

Demede et al. (2011) showed that patients with resistant HTN were nearly 2.5 times more likely to be at high OSA risk, relative to those with controlled HTN.

Bansil et al. (2011), in their study, found no relationship between having a sleep disorder and hypertension if short sleep or poor sleep was not also present.

Araujo et al. (2010), stated that hypertension was found associated with moderately severe RLS.

Canadian investigators have published in the journal (neurology) a study showing that patients with RLS demonstrated increase in systolic blood pressure averaging 22 mmHg and in diastolic pressure averaging 11 mmHg, and further more these blood pressure spikes occurred repeatedly every 20 to 40 seconds throughout the night ***(Forogos, 2011)*** Also ***Araujo et al. (2010)***, stated that systolic and diastolic predialysis blood pressures tended to be higher in RLS cases. Odds ratio for development of hypertension in RLS patients are well over 2 fold ***(Pennestri et al., 2007).***

4. Conclusion:

ESRD and hemodialysis, through different pathophysiology mechanisms are enough to cause sleep disorders and poor sleep quality, with their effects exacerbated by the presence of resistant hypertension. Also resistant hypertension alone is enough to disrupt normal sleep pattern away from OSA or RLS.

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Investigation of income smoothing using extraordinary items in firms accepted in Tehran's stock exchange

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Abstract:The purpose of this research is to investigate the informational content of extraordinary items and its effect on income smoothing for firms accepted in Tehran's stock exchange. Income smoothing is defined as management basic interfering in reducing the income's periodic fluctuations. The research data have analyzed using a sample including 96 firms accepted in Tehran's stock exchange for a 7 years period (2003-2009). Ordinary least square regression (OLS), scattering coefficient and determine coefficient models were used for hypothesizes testing. The obtained results suggested that the income smoothing using extraordinary items exists in the under study firms. Also the results revealed that the extraordinary items don't increase the income's informational content.
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Keywords: income smoothing, income management, extraordinary items, income before extraordinary items

1. Introduction and literature

Information play a critical role in economical decision makings and therefore investors cant detect the investing opportunities and risks sufficiently without enough information. The firms' reported incomes are always considered as one the basic criteria for financial decision makings, and the financial analyzers consider income as a basic factor for their investigations and evaluations. Therefore, managers are high motivated to represent a suitable view of their firms and reducing the investment risks and consequently smooth their incomes (Noorvash, et.al 2004) the income smoothing can effects the investors decisions and results in important outcomes specially in inefficient capital markets (Samaee et al.. 2007). The research is organized as follows: first the subject, purposes, and theoretical issues as well as previous related literatures are presented and then the research methodology. hypothesizes. statistical methods and data analyzing. and finally conclusions and recommendation are presented.

1.1. Description and research goal

The accounting international standards regulating board have tried to prevent the presentation of income and expenditure items as extraordinary items in explanatory notes and profit and loss lists. This subject is presented clearly in the articles 14-18 of accounting international standards concluding fundamentals (2008). The board believes that the items considered as extraordinary ones are originated for the business ordinary risks and doesn't need to consider separately in profit and loss lists. The board also believe that all events are originated from the ordinary activities of enterprises and so classify it as continuous operations. Therefore, the ordinary- unmoral classification is not suitable. Moreover, making distinction between the extraordinary and ordinary items need suitable judgment (Barnea, Ronen, and Sadan, 2001).

Although it seems that the new procedure of international board is better due to the low importance of extraordinary items value, but the Britain and American boards have different ideas regarding this issue. Maybe one of the reasons for separately disclosure of extraordinary items is that the presented incomes have more predicting power. Also the extraordinary items can aware investors for the potential risks of their enterprises (Khodadadi, 1996).

In accordance with the Iranian standard, the separation of extraordinary items from ordinary ones is due to its reasonable base for investors' decisions and judges. The importance issue is their schedule for income smoothing. Management misuses the extraordinary items due to different reasons such as reducing the agents costs, following the legal requirements like the loans Receiving or other contracts requirements, and marinating the firms profitability process during challengeable periods (Modares 2006, Arabi 2010).

Considering the above motioned notes, it is valuable to investigate the possibility of income smoothing in Iranian firms.. Another important note is their accurate position in profit and loss lists, informational content, and importance in analyzing and predicting the future incomes which are all studied in this research.

The main purpose of this research is to investigate the informational content of extraordinary

items and its effect on income smoothing for firms accepted in Tehran's stock exchange. The other purposes are to present the applicable results for income smoothing to the real and potential investors and credit makers for assisting them in financial decision makings.

1.2. Background

Researchers have studied the role of extraordinary items in income smoothing and informational content in several researches. Some obtained results are as follows:

In a research, (Barnea, Ronen, and Sadan, 2001) have studied the items suitable for being classified into non continuous (extraordinary) and unordinary groups in USA and evaluated that whether these items can be applied for initial income smoothing before the extraordinary items. The research has performed in a 20 years period for different American industries. The obtained results revealed that managers use extraordinary items classification changes for income smoothing.

Lynn and Guinness (2002) have studied the informational content ability for predicting the income and difference of items number in small and large firms in Hong Kong during a five year period. The obtained results suggested that there is no relation between smoothing and informational content of extraordinary items and the items is more for large firms than small ones. But there wasn't a significant relation between the items numbers and firms size.

Bettie et al (2006) have performed a research on items classification motivation and extraordinary items for income smoothing in 163 Britain firms and concluded that there is a direct relation between the smoothing motivations and importance of classification choice for expected income.

Samadi (2008) has performed a research on effects of smoothing on informational content and concluded that income smoothing increase the abilities of current and past incomes for predicting the operational cash currencies and incomes, while there is no increase for predicting the future promised items through income smoothing.

Khodadadi (1996) have studied the existence, nature, and effects of extraordinary. unordinary. and non-continuous items on income. This research was performed on firms accepted in Tehran's stock exchange during 1991-94. In accordance with his hypothesizes, the following results were obtained: these items have not informational content for predicting firms' future income. These items don't results in income smoothing. There is no direct relationship between these items and firm size. These are more important in small firms than big ones. There is weak relation between the number of these items and firm size.

1.3. Theoretical fundamentals

Since the industrial revolution and decreasing the final price of goods and services. the investors and owners who were distanced from managers have paid a part of their salary as award(often depends on a percent of shares interest) to motivate them to work better and more responsible. Therefore, managers were working more optimized to gain better awards. After some years, mangers understood that they can use the weak points of different methods and principals of accounting to manipulate different years' income in order to obtain their desired income to present in financial reports. this was the origin of income management or smoothing (Kashipour and Yaghoubi 2006).

This manipulation is possible if the accounting income contains informational content. In other words, investors consider income as an effective factor for decision making.. Ball and Brown (1968) were the establishers of research related to informational content of accounting income, they develop the proving theory. Their research showed that the accounting income changes have a relation with the share price.

The smoothing philosophy is to utilizing form the standards methods flexibility and accounting accepted principals. Of course. different explanations of accounting execution standards is another reason for smoothing. Research showed that managers manipulate the reported incomes deliberately using specific accounting policies. making changes in accounting estimations and promised items to reach their goals (Noorvash, Sepasi, and Nikbakht.2005). Ranen and Saden. ImHAV, ackel and many other researchers reveal that Hepworth was the first one to introduce smoothing (Defond T and Jiambalvo, 2006). Income smoothing is the goal oriented interference of extra organizational management in financial reporting (Schipper,1989).

1.4. Research hypothesizes

Considering the theoretical fundamentals and background sections presented earlier, two hypothesizes were considered:

hypothesizes 1: extraordinary items is used for income smoothing hypothesize 2: extraordinary items increase income informational content

2. Methodology

Considering that this research is aimed at investigating the informational content of extraordinary items and how to apply them for income smoothing in firms accepted in Tehran's stock exchange, so this is an applicable-descriptive research. The research has performed as semi empirical using previous information.

2.1. Data gathering tools

Library.stock exchange website, and Tadbir Pardaz software were used for data gathering and processing. Therefore, the data have gathered using field study method.

2.2. Statistical population and sampling

The statistical population includes all firms accepted in Tehran's stock exchange during 2003-9, sampling was performed as goal oriented. In every stage, firms which haven't conditioned with the following criteria have been eliminated and finally the remained ones selected as samples:

1. Firms have to be active continuously during the financial year.
2. Firms shouldn't be as agency, investing, lazing, or insurance.
3. The firms' financial year should be terminated by February for ease of comparison
4. The firms accounting should be completed
5. The required data of firms should be available.

Considering these limitations, 96 firms have been qualified for the statistical population. All the qualified firms were considered as the statistical population.

2.3. Data analyzing techniques and research variables

Different tests such as scattering coefficient, regression test, and determination factor R2 were used for performing the research. Software such as Excel and Eviews were used for data processing. Scattering coefficient is one of the statistical indexes which is used for determining the scattering rate from average. It is also called relative criteria or relative scattering. The index is computed as follows:

$$cv = \left(\frac{S}{M}\right) \qquad (1)$$

Where, Cv is scattering coefficient, S is standard deviation, and M is mean.

For testing the first hypothesizes and studying the income smoothing by extraordinary items, the scattering coefficient before and after extraordinary items deduction is computed and compared with above equation (Layn and Guinness,2001). For this purpose, first the mean and standard deviation of income before extraordinary items and then the scattering coefficient of income before extraordinary items are computed. Then the mean and standard deviation and scattering coefficient after extraordinary items will be computed. In case of smoothing, it should be expected that the income scattering coefficient become lower after extraordinary items.

For testing the second hypothesizes and studying the informational content of net income before and after extraordinary items. regression models were used as follows:

$$P_{it} = \alpha_0 + \alpha_1 EarnBX_{it} + \alpha_2 FSize_t + \alpha_3 CFO_t + \alpha_4 MBValue + e_{it} \qquad (2)$$

$$P_{it} = \beta_0 + \beta_1 EarnAX_{it} + \beta_2 FSize_t + \beta_3 CFO_t + \beta_4 MBValue + e_{it} \qquad (3)$$

The left term P in equations 2 and 3 represents the share price(dependent variable).EarnAX and EarnBX are net income before and after extraordinary items(independent variable), respectively. P_{ir} represents the share price at the end of first quarter after the termination of financial year, because this date is the last opportunity of firms to present their financial lists and accounting reports and the information of per share, book value of per share, and operational cash flow in this date can be appeared in shares price (Habib. 2004).

The firms' share price is presented daily in stock exchange. Also the FSize, CFO, and MBValue presents firm size, operational cash flow, and firms' total value or market value ratio to share book value (control variables), respectively.

In the second hypothesizes, first the income informational content before and after extraordinary items is computed for testing the informational content of extraordinary items. For this purpose, the amount of relation and effectiveness of mentioned incomes is compared with the daily price of under study firms. The more the relation between the income and share price, the more the informational content. Then. the informational content before and after extraordinary items will be compared.

Three control variables also were used for achieving reliable results from the reasonable relation between the net income before and after extraordinary items and share price. The control variables include firm size, cash flow of operation. and sales growth. these control variable also were used in research of Ronen and Sadan (1981) and Habib (2004). The used variable and their abbreviations are presented in table 1.

Table 1: used variable and their abbreviations

Row	Symbol	Variable and its type
1	EarnAX	Income before extraordinary items deduction
2	EarnBX	Income after extraordinary items deduction
3	P	Share price
4	FSize	Firm size
5	CFO	Cash flow of operation
6	MBValue	Ratio of market value to share book value (firm's value)

3. Findings

3.1. Descriptive statistics

Data are described before analyzing to make better sense for under study population and research variables. Data statistical description is a step toward determining the governing pattern of data and relation

between the research variables (Hafeznia. 2010). The statistical description of research is presented in table 2.

Table 2: results of statistical description during 2004-10

Variable	mean	Median	Standard deviation	max	Min	Observations number
EarnAX	182/34	216/55	88/01	354/29	12/22	672
EarnBX	180/63	218/39	72/12	329/33	11/41	672
P	8232	10345	6572	28615	1207	672
FSize	5/5678	5/89845	0/4125	6/9044	4/4116	672
CFO	0/183	0/171	0/161	0/649	-0/271	672
MBValue	15/52	8/06	3/14	32/21	0/89	672

3.2. Results of hypothesizes tests

The data of 96 understudy firms during 2004-10 were combined and tests have performed on 672 year-firm for hypothesizes testing. the results of hypothesizes tests for each hypothesizes are presented as follows:

3.2.1. First hypothesizes test

The first hypothesis tries to determine whether the under study firms use extraordinary items for income smoothing. Scattering coefficient index was used for testing this hypothesizes. The related computations are presented for 2004-10 period in table 3.

As it can be seen from table 3, the scattering coefficient (standard deviation to mean ratio) before and after extraordinary items deduction are 0.482 and 0.399, respectively. Considering that the scattering coefficient is much lower after extraordinary items deduction, therefore it can be concluded that these items results in scattering reduction around mean value. In other words, the under study firms have used extraordinary items for income smoothing. Therefore, the first hypothesizes is accepted.

3.2.2. Second hypothesizes test

The second hypothesizes tries to determine whether the extraordinary items increase the income informational content and can predict future incomes. Regression method was used for testing this hypothesizes. The results of regression models estimation 2 and 3 for studying the informational content before and after extraordinary items during 2004-10 are presented in table 4.

Considering the results of models 2 and 3 inserted in table 4. t-statistic of model 2 was significant in error level 0.05 and this means that income had informational content even after extraordinary items deduction. The determination factor R^2 was 0.582 and 0.393 for testing models 2 and 3, respectively. The more the amount of this factor. the more the relation between the model's dependent and independent variables and consequently the informational content. Comparing the results of two models reveals that the incomes before extraordinary deduction have more informational content than after it. In other words, extraordinary items doesn't increase the income informational content and therefore the second hypothesizes is rejected.

Table 3: computations and results of first hypothesizes test

Description	Results
Period	1382 -1388
Observations	672
μ_{EarnBX}	182/34
μ_{EarnAX}	180/63
σ_{EarnBX}	88/01
σ_{EarnAX}	72/12
CV_{EarnBX}	0/482
CV_{EarnAX}	0/399
Test's result	Accepted

Table 4: computations and results of second hypothesizes test

Description	Model 2 test	Model 3 test
Period	1382 -1388	1382 -1388
t-statistics (p-value)	10/43 (0/028)	9/21 (0/041)
Coefficient	0/44	0/38
Observations number	672	672
Modified R^2	0/582	0/393
Relation type	Direct	Direct

4. Conclusions and recommendations

The role of extraordinary items on income smoothing and increasing the informational content of net income has studied in this research. This research includes two hypothesizes for answering the mentioned questions.

As it was mentioned in first hypothesizes test, the income scattering coefficient before and after extraordinary items deduction were 0.482 and 0.399, respectively. Considering that the income scattering coefficient was much lower after extraordinary items deduction. so it can be concluded that the under study managers have used these items to reduce scattering around mean value. So the first hypothesizes is accepted. The obtained results for the first hypothesizes are consistent with Barnea et al 2001) and Bettie et al. 2006, while it is different from Lynn and Guinness (2002) and Khodadadi (1997).

Considering the results of second hypothesizes, the modified determination factor R^2 for models 2 and 3 were 0.582 and 0.393. Comparing the results obtained from these two tests suggest that income before extraordinary items have more informational content. In other words, extraordinary

items don't increase the informational content. Therefore, the second hypothesizes is rejected. The obtained results for the second hypothesizes are consistent with Barnea et al (2001) and Bettie et al. 2006, while it is different from Lynn and Guinness (2002) and Khodadadi (1997).

There were some limitations for this research. One of these limitations is that some factors effective on research results such as economical factors, political conditions, global economy mode, and regulations were out of the control of the author. The Other limitation is that non modification of financial lists can affect the research results through inflation.

Considering the research theoretical fundamentals and results, it is recommended that stock exchange and accounting organization make some regulations and standards for optimized control of managers' behaviors for selection among several accounting methods.

4.3. Recommendations

After studying the test results of research hypothesizes, the following subjects can be considered in future research:

a) studying the informational content of other accounting data except extraordinary items such as income per share, cash flow of operation. unspecific income and ….

b) Studying income smoothing in firms accepted in Teheran stock exchange using other common methods such as estimations. accounting methods change, transactions scheduling and etc.

c) Studying the effect of other items of loss and profit list such as exceptional items, stooped operational income,… on informational content of net income.

d) making comparison between informational content of net income and comprehensive income and their prediction power.

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A 50 Hz 0.5 mT magnetic field induces cytogenetic effects and biological alterations in Wistar rat

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Abstract: The effects of continuous whole body exposure to extremely low frequency magnetic fields (ELF-MF) (50 Hz, 0.5 mT for 30 days 24 hrs) on cytogenecity, bone parameters and some hematological and biochemical parameters were evaluated.Male rats were exposed continuously to ELF-MF for a period of 30 days. The exposure effects were assessed by measurements of micronucleus formation, DNA fragmentation and bone parameters. Additionally the levels of some liver and blood parameters were calculated. Moreover, osmotic fragility of erythrocytes was also considered. Exposure to ELF-MF resulted in a 6.5 fold increase in the micronucleus formation and a decrease in polychromatic erythrocytes (PCE)/normochromatic erythrocytes (NCE) ratio, in addition to a significant increase in the level ofaspartate transaminase (AST) alanine aminotransferase (ALT), alkaline phosphatise (ALP), Magnesium (Mg) and uric acid in serum was observed. However, 0.5 mT ELF-MF was unable to cause either direct DNA primary damage or changes in bone parametersand erythrocytes lyses percent.The present results provide evidence that continuous exposure to ELF-MF causes micronucleus formation and some physiological disturbance but had no effect on DNA structure and bone parameters. Furthermore, the levels of glucose, creatinine, cholesterol and the percentage of erythrocytes lyses were not affected.
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Keywords: Extremely low frequency magnetic field (ELF-MF); Micronucleus test; DNA fragmentation; Bone mineral density; haematological and biochemical parameters.

1. Introduction

In modern society, the use of electricity is so widespread that it is impossible to avoid exposure to power frequency magnetic fields (MF). Many biological effects are observed upon exposure to different types of non-ionizing radiation[1]. Such effects depend on many factors such as the mode of exposure, the type of cells studied, and the intensity and duration of exposure.

An extremely low frequency magnetic field (ELF-MF) can induce a number of changes in biological systems of living species. Epidemiological studies suggest a possible link between ELF-MF exposure and clinically recognized medical disorders such as leukaemia and many types of cancers [2- 3]. Following the two pooled analyses of childhood leukemia by Ahlbom*et al.*[4] and Greenland *et al.*[5], which reported a doubling of risk above 0.3/0.4 microtesla, IARC 2002 (International Agency for Research on cancer)[6] classified magnetic fields as a class II B possible carcinogen.The 2002 California Report[7] cited childhood and adult leukaemia, brain cancer, ALS (Amyotrophic lateral Disease) and miscarriage as associated with ELF-MF. SCENIHR,[8-9] and Davanipour and Sobel[10] introduced reviews that emphasized the risk of Alzheimer's disease upon exposure to magnetic field.

On the one hand some researchers have reported harmful effects arising from alternatingand static magnetic fields[11-12]. On the other handextremely low frequencyelectromagnetic fields (ELF-EMF) and magnetic fields have been used as a therapeutic tool, for example, low frequency sinusoidal magnetic fields are used for treatment of intractable bone fractures, and extremely low frequency for treating tumors [13- 14]. Other studies didn't show any effects on biological tissues[15].

Since low energy magnetic or electromagnetic fields are not known to transmit enough energy that affects chemical bonds in the molecules it is generally accepted that such fields are unable to damage the DNA directly [15]. However, exposure to ELF-EMF may lead to the production of free radicals that induce alterations in cellular processes directly responsible for DNA damage[16]. Numerous "*In vivo*" and "*In vitro*" studies have been investigated with the effort to determine a link, if any, between such fields and mutagenesis and to establish the possible mechanism of cancer risk. It was attempted to define whether 50/60 Hz ELF-EMF as generated by high voltage power lines or electrical appliances could give rise to *in vivo* primary DNA damage and cytogenetic effects such as chromosomal aberrations, sister-chromatid exchanges, or micronuclei formation .Some studies concerning with exposing human cells to magnetic fields, revealed significant increases in micronuclei formation and chromosomal aberrations. Moreover, a pronounced

effect on cell proliferation and apoptosis took place upon such exposure to ELF-EMF [17-19].

The aim of the present work is to study the effects of continuous whole body exposure to ELF-MF (50 Hz,0.5 mT for 30 days) on cytogenecity, bone parameters in addition to some haematological and biochemical measurements as a step forward to spot light on the action of these fields on biological systems.

2. Material and Methods

Animals

Adult maleWistar rats weighing 160- 180gm, 8 weeks old, were obtained from the Animal House of the National Research Center in Egypt. They were maintained for one week in the laboratory for adaptation. Rats (10 rats per cage) were housed in cages with free access to drinking water and standard chow diet.

All animals' procedures and care were performed using guidelines for the Care and Use of Laboratory Animals [20].

The rats were randomly divided into two groups of twenty each: one control (sham) and one exposed. The latter group has been exposed to 0.5mT ELF-MF for 30 days24 hrs per day. The control (sham) group was treated like the exposed group with the sole difference that it was not exposed to ELF-MF. The two groups were treated equally considering light and food. The temperature and humidity were monitored continuously throughout the experimental period. This ensures that the control and the exposed animals were maintained in the same temperature. During the experimental period, all animal groups were maintained in clean first hand cages under standard condition in a separate laboratory which belongs to animal care unit. After 30 days of exposure,the two groups of rats were sacrificed by decapitation. Six rats from each group were used for micronucleus test and DNA analysis. Biochemical, hematological and osmotic fragility measurements were done by with drawing blood samples from another six rats from each group. Lastly, other six rats from each group were dissected and their femora were isolated, cleaned from all soft tissues for bone parameters examination.

Experimental Design

The animals were housed freely in a plastic cage in the center of a magnet with a fixed magnetic field value at 0.5 ± 0.025mT. The magnetic field was generated by a solenoid carrying current of 18 A (ampere) at 50 Hz from the main supply (220-230 Volt) via a variac (made in Yugoslavia). The magnet consisted of a coil with 320 turns made of electrically insulated 0.8 mm copper wire. The coil was wounded around a copper cylinder of 2mm thickness, 40cm diameter and 40cm length. The cylinder wall was earthed to eliminate the electric field. The magnetic field was measured at different locations to find out the most homogenous zone inside the solenoid core. This was done using the Gauss/ Tesla meter model 4048 with probe T-4048 manufactured by Bell Technologies Inc. (Orlando-Florida USA). The animals were exposed by placing the whole cage (made of plastic) inside the magnet core.Animals from control and exposed groups were kept under the same environmental conditions of temperature, lightening and feeding. Cleaning and changing water and food were done to all animals two times daily. The field was switched off during cleaning the cage.

Micronucleus test

Bone marrow slides for micronucleus assay from 6 male rats of each group were prepared and stained according to the method described by Schmidt [21] using the modifications of Agarwal and Chauhan[22]. The bone marrow was flushed out from tibias using 1ml fetal calf serum and centrifuged at 2000xg for 10 min. The supernatant was discarded. Evenly spread bone marrow smears were stained using the May-Grunwald and Giemsa protocol. Slides were scored at a magnification of 1000x using a light microscopetype CX31 Olympus (Tokyo, Japan). 2000 polychromatic erythrocytes per animal were scored, and the number of micro nucleated polychromatic erythrocytes (MNPCE) was determined. In addition, the number of polychromatic erythrocytes (PCE) was counted in fields that contained 1000 cells (mature and immature) to determine the score of PCE and normochromatic erythrocytes (NCE).

Statistical analysis was performed using the F-test with help of the software spss-version15 in order to compare the score of MNPCE, PCE and NCEfor both the control and exposed samples.

Analysis of DNA Fragmentation

Analysis of DNA fragmentation was measured using agarose gel electrophoresis, according to the protocol developed by Kasibhatla *et al.*[23]. 0.5 gm homogenized liver and spleen are transferred to 1.5 ml sterile micro centrifuge tubes. Centrifuge at 200xg in an Eppendorf table, top centrifuge for 5min at 4ºC and remove supernatant. 20 µl of TES (20mM EDTA (ethylene-diaminetetra-acetic acid), 100mM Tris (hydroxymethyl-aminomethane), pH8.0, 0.8% (w/v) Sodium dodecyl sulfate) lysis bufferwere added and mixed with cell pellet. 10 µl ofRNase Cocktail were added and mixed well. Incubate for 30-120min at 37 ºC. 10 µl of proteinase K, were added and incubated at 50 ºC for at least 90min. 5µl of 6x DNA loading buffer were added and load DNA samples into dry

wells of a 1-1.5% agarose gel in TAE (242g Tris base, 57.1 ml Acetic acid,100 ml of 0.5 M EDTA, pH 8.0**)** buffer containing 0.5 µg/ml ethidium bromide. The gel was run at low voltage (i.e., 35V for 4 hours or until loading dye has run two-thirds of the way down the gel). DNA ladders are finally visualized by ultra-violet (UV) light source and documented by photography. The gels were analyzed using the software: Gel-Pro Analyzer 3.1.The used chemicals were purchased from Sigma chemical co. (St. Louis MO, USA)

Bone Parameters

Femora of 6 rats each from control and exposed group were used to measure bone minerals density(BMD), bone minerals content(BMC) and cross sectional area. Bones, after cleaning all of soft tissues, were immediately weighed with an automatic balance (Sartorius research, USA), to receive wet bone weight (WW). Their lengths were measured with a digital caliper (± 0.01mm). The BMD, BMC and cross sectional area of the whole right femora and their diaphysis were measured by dual-energy X-ray absorptionmeter (DEXA, Nortand XR.46 version 3.9.6/2.3.1 made in USA).The X-ray absorption meter is routinely calibrated daily. The reproducibility of these measurements was established by repeating the scans three times, for all samples. The data were treated statistically by analysis of variance (ANOVA) test.

Biochemical and Hematological Measurements

Six blood samples were withdrawn from each rat (n=6) for control and exposed groups. Blood was collected in tubes containing (EDTA) for hematological analysis while others was maintained without anticoagulant in order to obtain serum for further biochemical analysis.The methods of measuring AST (aspartate transaminase), ALT(alanine aminotransferase), Ca (calcium), ALP (alkaline phosphatase), glucose, uric acid, creatinine, cholesterol and hemoglobin were carried out as described by Henderson and Moss,[24] Eraslan *et al.*[25]; Tietz,[26] Allston, [27] Dacie and Lewis [28]. All the chemicals used for both hematological and biochemical measurements were purchased from ELI Tech (Paris, France).

Determination of Osmotic Fragility of Erythrocytes

For the determination of osmotic fragility of erythrocytes, 6 blood samples were collected from 6 rats of each group. Blood was collected in heparinized tubes and the test was carried out within 2h of collection at room temperature according to the method described in Dacie and Lewis [28]. Fourteen test tubes each containing 5ml saline solution with a concentration range of 0.0-9.0 gm Nacl/L were prepared. Fifty µl of well mixed blood were added to each tube and they were incubated for 30 min at room temperature. After incubation time, the suspensions were centrifuged for 5 min at 1200xg. Then, the absorbance of supernatant of each tube was measured at wavelength 540 nm using a spectrophotometer [6405UV/Vis (ultra-violet/visible) spectrophotometer JENWAY England UK)]. The lyses percentage was calculated by the relation % of lyses= $A_{samples}/A_{100\%lysis}$ x 100,where $A_{samples}$ and $A_{100\%lyses}$ are the absorbance of the hemoglobin released from erythrocytes incubated with different concentration of saline and that incubated with distilled water (100% lysis) respectively.

3. Results

Table 1 shows the formation of MNPCE, PCE and NCE in the bone marrow cells in both control and exposed groups. The results show a decrease in the formation of PCE and an increase in the number of NCE formed in the exposed samples compared to the control ones. These differences were statistically significant ($p<0.05$)*

The results from DNA fragmentation using agarose gel electrophoresis technique are shown in figure (1). Figure(1) shows that, lane(1) represents marker of standard molecular weight, lane(2) represents DNA isolated from the spleen of the control group, lanes(3,4,5) represent DNA isolated from the spleen of the exposed group, lane(6) represents DNA isolated from the liver of the control group, lanes(7,8,9) represent DNA isolated from the liver of the exposed group. The results show that the DNA from viable cells stayed on the top of the gel as a high molecular weight band. The DNA from apoptotic cells formed as a distinct DNA ladder. The results do not show any difference between the DNA isolated from the spleen and liver of the control and exposed groups.

Table 2 shows the BMD, BMC and cross sectional area of the femora for both control and exposed groups. The data revealed no significant change in bone parameters of the femora for exposed group compared to the intact one.

There was no significant difference found between bone minerals density of control group compared to the exposed one (ANOVA P=0.15), see table 2.Also there was no significant change found in the bone minerals content gm/cm of the control group with reference to the exposed one (ANOVA, P=0.26), see table 2. There was no significant difference found between cross sectional area of control group compared with the exposed one (ANOVA, P=0.27), see table 2.

Table 3 shows changes in hepatic enzymes (AST),(ALT) and (ALP). The hepatic enzymes (AST and ALT) increased after being exposed to the magnetic field and table 4 shows some hematological data for magnesium (Mg),(Ca), uric acid, Glucose, Creatinine, Cholesterol and hemoglobin .The plasma magnesium level was significantly higher in exposed group compared with control one. In addition serum uric acid level is significantly higher in exposed group compared with the control one.

Figure(2) shows the osmotic fragility curves for both control and exposed groups. The percentage of lyses in erythrocytes is slightly increased for the exposed group compared with the control one. The error bars represent standard deviation.

Table 1: Effect of ELF- MF on NPCE, PCE and NCE formed in bone marrow cellsof six rats after 30 days of ELF-MF exposure.

Samples	NCE/1000 cells	PCE/1000 cells	MNPC/2000 cells
Control	509 ± 6	491 ± 6	3.5 ± 0.5
Exposed	558 ± 11	442 ± 11	23 ± 4
***p*-value**	0.05	0.05	0.05

Errors indicate the standard error of mean (SEM) for N = 6

Table 2: Effect of ELF-MF on bone parameters in the right femora of six rats after 30 days of ELF-MF exposure.

Samples	BMD gm/cm^2	BMC gm/cm	Area cm^2
Control	0.122 ± 0.002	0.22 ±0.05	1.93 ± 0.40
Exposed	0.121 ±0.007	0.22 ±0.05	1.93 ± 0.19
***p*-value**	0.15	0.26	0.23

Errors indicate the standard error of mean (SEM) for N = 6

Table 3: Effect of ELF- MF on the level of AST, ALT and ALP in six rats after 30 days of ELF-MF exposure.

Samples	AST U/L	ALT U/L	ALP U/L
Control	12 ±14	38 ±1.2	749 ±83
Exposed	160 ±10	55 ±1.7	496 ±33
***p*-value**	0.05	0.001	0.04

Errors indicate the standard error of mean (SEM) for N = 6

Table 4: Effect of ELF-MF on the level of Mg, Ca, Glucose, Uric acid, Creatine, cholesterol and Hb in six rats after 30 days of ELF-MF exposure.

Sample	Mg mg/dl	Ca mg/dl	Glucose mg/dl	Uric acid mg/dl	Creatinine mg/dl	Cholestrol mg/dl	Hbgm/dl
Control	1.5 ±0.06	7.6 ±0.2	116 ±7.12	0.93 ±0.09	0.5 ±0.06	73 ±4.041	10.93 ±0.03
Exposed	2.23 ±0.03	8.1 ±0.15	127 ±16	1.93 ±0.26	0.63 ±0.03	74.33 ±10.86	10.66 ±0.49
***p*-value**	0.001	0.12	0.55	0.02	0.12	0.91	0.61

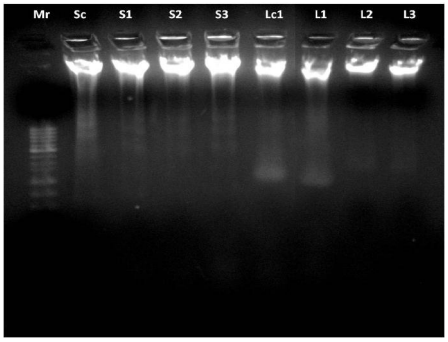

Figure (1): Gel electrophoresis of DNA. Lane(1) marker of standard molecular weight, lane(2) DNA isolated from spleen of control group, lanes(3,4,5) DNA isolated from spleen of exposed group, lane(6) DNA isolated from liver of control group, lanes(7,8,9) DNA isolated from liver of exposed group

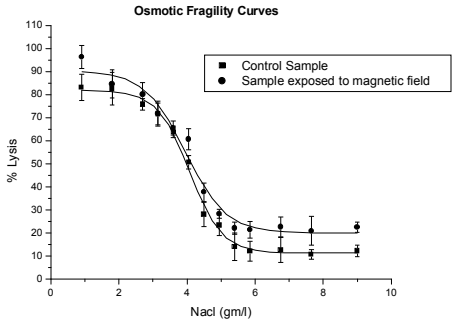

Figure (2): Effect of 0.5 mT, 50 Hz magnetic field on the erythrocytes lyses for blood samples from control ■ and exposed ● groups. Values are means ± SD from n = 6 in each group.

4. Discussion

The present study is concerned with the effects of ELF-MF on the formation ofmicronucleus, structure of DNA, density and content of bone mineralsand some hematological parameters. The data indicated that continuous whole body exposure of rats to 50 Hz, ELF-MF at a flux density of 0.5 mT induced cell toxicity which was observed by a significant decrease in both PCE proportion and PCE/NCE ratio. In addition to a marked increase in the MNPC formation table 1, such effects are in agreement with previous study of Nurten*et al.* [29] who reported the occurrence of bone marrow cytotoxicity upon exposure to magnetic field. The above results are also considered as an evidence that 50 Hz ELF-MF 0.5 mT is a possible potent inhibitor of mitosis.

However, ELF-MF has no effect neither on DNA damage figure(1) nor on the bone examination

made for rats femora table 2. The present data of DNA is in consistent with the studies of Milena *et al.*[30] and McNamee *et al.*[31] who reported that there was no significant effect on DNA strand breaks upon ELF-MF exposure. Moreover, the percentage lyses of erythrocytes for exposed group showed a slight increase compared to that of the control one (Fig.2). Such increments were considered within their normal range indicating that magnetic field exposure level in this study, had no marked effect on both structure and function of erythrocytes membrane **[**32**].**

Obvious changes were observed in clinical pathology measurements shown in tables 3 and 4. Exposing rats to 0.5 mT over a long period of time (30 days) produced an increase in Mg level and a non-significant increase in the glucose level. This might be due to changes in the metabolic rate [33]. In addition, there was significant increase in the hepatic enzymes of the exposed group. This finding supports the suggestion that the exposure to ELF-MF is associated with higher levels of oxidative stress and formation of free radicals [34, 35]. The lifetime of free radicals is very short and their high reactivity and the rapid rate of collisions among molecules cause them either to recombine or to interact with their surrounding within short time of their formation. Accordingly, such free radicals can affect some enzyme activities. The proportion of radicals reacting with biological molecules would increase leading to possible adverse effects on cell structure and organs function. This is supported by significant changes in ALP activity, creatinine and uric acid measurements which are considered as evidence on tissue damage in the exposed group.

Literatures on cellular effects of ELF electric and magnetic fields were reviewed bySantini*et al.*[36] who pointed out that the majority of the "*In vitro*" experimental results indicated that such fields induce numerous types of changes in cells. Such analysis concluded that this myriad of effects on biological systems should not be ignored in evaluating human health risk. Vijayalaxmi and Prihoda[37] published a meta-analysis of data from 87 publications concerning genericdamage in mammalian cells following EMF exposure. The authors main conclusion was that differences between exposed and control cells were biologically small although statistically significant with very few exceptions.

5. Conclusion

It was concluded from the present study, that continuous exposure to ELF-MF (50Hz, 0.5mT) might cause micronucleus formation and some physiological disturbance in Wistar rats. The same exposure dose might have no effect on the DNA structure and bone parameters. It is important to carry out more investigations using various cytogenetic tests under different experimental conditions to definitively resolve the controversy concerning the possible genotoxic and cytotoxic risk associated with magnetic fields.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content andwriting of the paper.

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Fractal method for determining the density of the stone tablet in Charak region (southern Iran)

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ABSTRACT: A prevalent method for determining the Bouguer density value as random and independent variable from topographic alternations has been introduced by Nettleton algorithm of which casually corrections for example in folded Zagros region may be accompanied with unexpected errors as a result of crustal thickening processes in southern regions of Iran. Sedimentary sequences in Charak-Namakin anticlines are known as important geological units which have been selected for prospecting oil related reservoirs by National Iranian Oil Company (NIOC) in 2002. Gravimetric datasets have been acquired by NIOC systematic land surveys in a total of 776 stations. The main target areas along Charak - Namakin salt domes are located between 54.00 - 54.30 and 27.00 - 28.45 geographic longitude and latitudes. Both Asmari (Oligocene) and Pabdeh - Gurpi formations (early Cenozoic) contain limestones with gray marls intercalations as potentially valuable facies for hosting of hydrocarbore reservoirs under ascending movements of the Paleozoic formations in diapiric systems. Hormoz series (Cambrian) including gypsum and other related evaporates play the main roles for oil trapping processes after emigrant volatiles arrive to permeable layers nearby brecciated structures. Determining of optimum Bouguer density that is only related to Charak geological impressions is an important procedure which associates number of gravimetric anomalies with probable oil trap locations. It means that, Bouguer anomalies are comfortable geophysical quantities for density estimations according to statistical techniques. Although a linear method such as Nettleton correction can be used to density estimations, some abnormal thickening of the crust may increases in topographic disturbances and subsequently causes to stochastic behaviors of the gravity values which cannot be interpreted by Euclidean geometry. Therefore, nonlinear analyses such as power law functions can be used to calculate the fractal dimensions as non-Euclid variables related to self similar peculiarities of the gravimetric values which theoretically assumed to have spatial independencies from crustal interactions with heavy masses of the lithosphere. According to Mark and Aronson (1982), a fractal based interpretation corresponding to gravimetric anomalous regions has been carried out by applying variance – distance logarithmic equation in Free Air and Bouguer georeferred datasets respectively. This research is an attempt to study of Brownian surfaces as unique area indicates to cumulative appearances of the gravimetric similarities above Charak sedimentary formations. Considering to iteration processes on the log-log plots, some Bouguer anomalies have been recognized to be independent from topographic alternations in ranges of 6.44-10.24 Km distances from backgrounds. As a result, an averaged density value equal with 2.4 g/cm^3 has been calculated for Charak lithological occurrences by stepwise fractal analysis of total density assumptions (1.8-2.4 g/cm^3). The fractal result subsequently compared with statistical conclusion that is considered ranges of 2.3-2.4 g/cm^3 as optimum density values for Hormozgan region after obtaining a new ratio of Bouguer regression versus Bouguer Poisson coefficient (R^2P) among estimation processes.

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Key words: Bouguer Density, Charak, Fractal, Gravimetry, Oil Field

1. Introduction

The selected area as a part of Zagros oil province, south of Iran in Hormozgan province is located in 54.00 to 54.30 east longitude and 27 to 28.45 north latitude, which is shown in figure1. This region is apt for development of hydro–carbon reservoirs in the carbonate country rocks due to suitable interior earth structure such as numerous dome-shaped facial occurrences resulting from the uprising of the Paleozoic evaporative sediments (Farmani, 2003). The apt areas in the prospecting oil field of Charak-Namakin consists of lime facies pertained to Aligoson (Asmari constituent) and the grey marns of early Cenozoic (Pabdeh - Gurpi constituents) and they are often situated in the lower part of the anticlinal summit of Namakin village (north-West of the map) and the Charak salt dome (in the center and east of the map). The host rock of oil reservoirs, in many cases, has been surrounded by evaporative covering rocks of Hormoz series (cambrian) and siltic – marly units pertained Aghajari constituent (Farmani, 2003). Based on the seisogram evidences (wide band and seismic trap), the depth average of Moho in the folded Zagros region is 45 kilometers (Kaviani, 2003 ; YaminiFard, 2008) and the adjustment of altitude difference resulting from structural ups and

downs(sequenced anticline and syncline in Taphrogeny Cenozoic regime) is necessary for gravity corrections. Since the measurement of the gravity variations in the host and the evaporative covering rocks accompanying it is considered as a criterion for investigating the building traps and determining the spatial situation of prospecting oil reservoirs, the error increase in determining the situation of underneath facies makes the probable reservoirs un accessible. Therefore, the correction of the pattern of anomalies and estimating the density resulting from the variation of Bouguer slab for the preliminary up of the oil fields (using gravity measuring method) seems to be necessary.

In table1, the spatial position of obtained samples of gravity section or profiles accompanied with density variations related sediment facies of Charak has been included. Based on evidence available, regional surface and systematic surveys, paralled with discovered profiles L18 – L27, have been conducted recording the gravity variations in 776 stations (Farmani, 2003). After correcting gravity data, the maximum and minimum of Bouguer's anomaly have been calculated to be -24.311mgal and -50.367mgal respectively, which enjoys marly- carmnate (the maximum amount) and conglomerate formations (minimum amount) as far as relative spatial correspondence in concerned. In the majority of broken regions, cataclastic deformity is observed before bouguer's anomaly reduction. The relative density, in different sections of Asmari formation(as the host of hydrocarbon reservoirs) has increased compared with other sedimentary units and fluctuates remarkably neighboring salt domes and broken buildings surrounding the anticline. In the previous studies(Telford et al,1990) Nettleton method has been used to adjust the effect of Bouguer slab and the density of each section has been used in the equation of determining Bouguer anomaly at the same time as free air and latitude corrections have been recorded. Table1 shows that the averaged density value, regardless the coefficient of Bouguer slab in anticlinal ups of the region, is $2.21 g/cm^3$ that is not considered of as an exact index for investigating the gravity variations in the host stone of oil reservoirs although it relatively corresponds with obtained density from the lime-marly facies of Asmari formation(2.32 – 2.36). Similarly, regarding the building ups and downs in the underneath units of Charak region, applying Nettleton pattern to correct the effects of Bouguer slab is not useful(Mark & Aronson, 1984) and the remarkable thickness of the crust of this region of folded Zagros probably increases the error resulting from topographic considerations. Therefore, the operations of determining density and measuring the anomalies in the oil prospecting field of Charak require methods other than that of the variation of the crust thickness for the realization of which suggested method by Thorarinsson et al (1990) has been used to achieve fractal functions with the exponential distribution in the self-affinity quantities(gravity self-similarities).

2. Applicable methodology of fractal functions in gravimetric studies

2.1. Chaos theory and its application in fractal measurements

Theoretically, chaos theory based methods are applicable for evaluation of gravity variations in prone regions for hydrocarbon reservoirs. In this theory, by means of the recursive function concept, the distributive index of the quantities will compute, and then compare with the edge of chaotic environments. Then it will express in the form of fractal equations (Turcotte, 1997). In other words, variations of geophysical quantities that causes different anomalies which be formed in surface resulting from field measurements. The differences in the surface formations are self-similar components and this process is synchronous with quality variation of abnormal population from a similar linear process to a complex and chaotic one. Prediction of populations behavior via traditional (Euclidian) methods, in such a component, is very difficult and in some cases, impossible. Therefore, on base of Turcotte's suggestion (1997), it is possible to apply fractal relations to achieve Brownian Surface as a geometric index corresponding to chaotic environments and the pattern of nonlinear distribution of anomalies. Geophysical components such as gravity variations, magnetism, seismography and electromagnetic it is possible to use fractal relations. It will explain after calculating the coefficient of logarithmic functions as fractal dimension. The scale independencies of the anomaly, not differentiable density function and initial component or pattern of similar quantities are three properties of anomalies measurement such as gravity variations through many fractal methods.

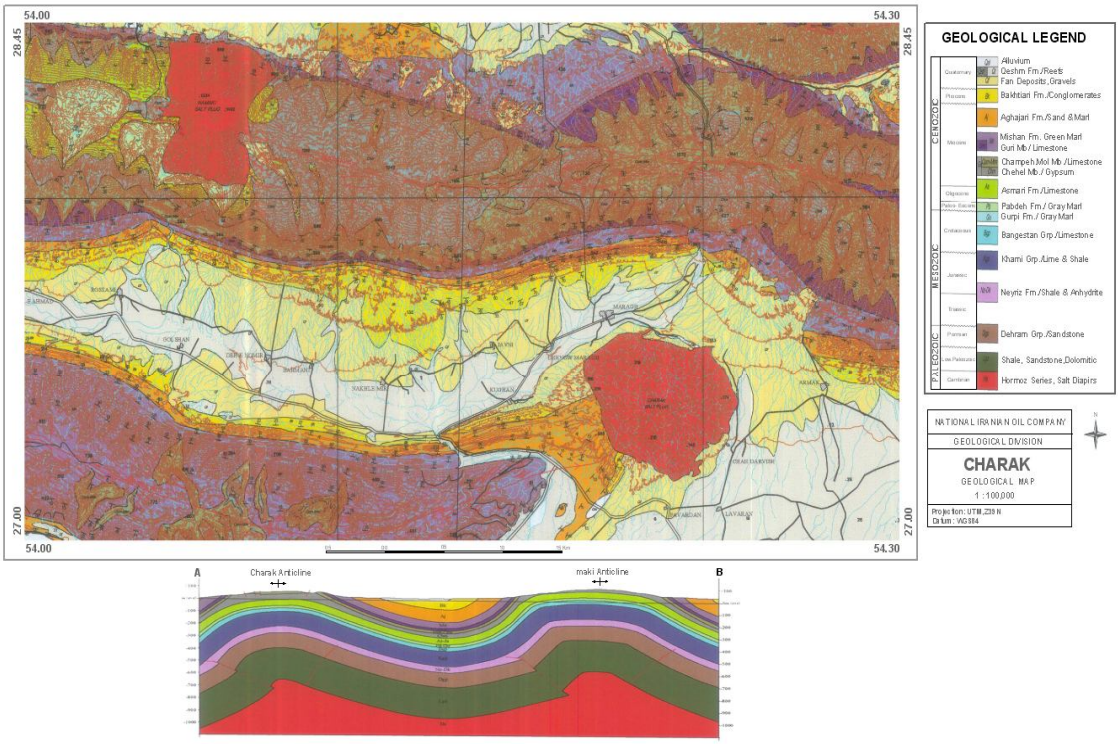

Figure1. Geological map of Charak-Namaki region located in Hormozgan province (Farmani, NIOC, 1982). Asmari limestone (Olig.) and Gurpi gray marls (Upper Cer.) are the main rock of oil reserves of folded Zagros oil province.

Table (1). Determined density by sampling and physical measurements in Charak region (reported by Farmani, NIOC, 2003)

Profiling No.	Coordinate (degree)		Stratum	Lithology	Density (g/cm3)
	Long.	Lat.			
L18	54°36′48.2″	26°31′48.6″	Bakhtiari Fm.	Conglomerates & Sandstone	1.87
L18					1.90
L18					1.90
L19					1.89
L19					1.86
L20	54°17′13.1″	26°47′46.0″	Mishan Fm.	Green Marl	2.14
L20					2.12
L21					2.13
L22					2.07
L22					2.14
L23	54°16′57.4″	26°48′05.9″	Aghajari Fm.	Sandstone & Marl	2.03
L24					2.02
L25					2.04
L26	53°38′17.8″	27°05′02.0″	Bangestan Grp.	Limestone	2.45
L26					2.39
L27					2.41
L28					2.45
L29					2.39
L30	53°38′18.6″	27°04′57.3″			2.44
L31					2.43
L32					2.43
L33					2.45
L34					2.44
L35	53°37′43.3″	27°04′18.3″	Asmari - Gurpi Fm.	Limestone - Gray Marl	2.36
L36					2.32
L37					2.32

For different spatial extension and undifferentiated function caused the similar formation populations, it is possible to make a scale-independent quantities to take pattern from geophysical variations. According to Feiffer & Obert (1889), changing in variables of linear process occurs by entering the chaotic status and simpler ones (lacking initial component) are replaced by iterative components. Practically, due to the complexity and ambiguity of the differential of chaotic functions, application of statistical parameters such as mean and standard deviation is not appropriate for self-similar population. In this state, the best way is to calculate the fractal dimension of self-affinity points to separate similar populations.

From Euclidian point of view, the appropriate dimensional equation for the surface variations of anomaly is constant. Based on fractal geometry, the appropriate coefficient angle of each surface for geometrical dimension is a number between 2 and 3. In other word, the variety and mechanism of data distribution, makes Brownian normal surface with possible maximum iterative quantities. Theoretically,

the fractal functions, which have been, adopted from specific exponential law relationships. The logarithmic characteristic of independent quantities is used to determine to range of variables depending on distribution. By consideration of two given quantities A and C indicates the sets of domain and area of the intended function with the exponential coefficient FD, it is possible to write the equation1 as:

$A = C^{FD}$ (1)

The necessary component for converting FD to the angle coefficient of fractal line is the application of logarithmic coordinates in the equation2 as below:

$\text{Log } A = FD \text{ Log } C$ (2)

The density function plot of Log A Vs. Log C and the coefficient angle, resulting from linear observation of self-affinity points is shown in figure2. It is obvious that the variation of FD coefficient is the reason of different population separations from each other and the variety of coefficient (FD1, FD2) imply the behavioral change of the phenomenon during the chaotic occurrences.

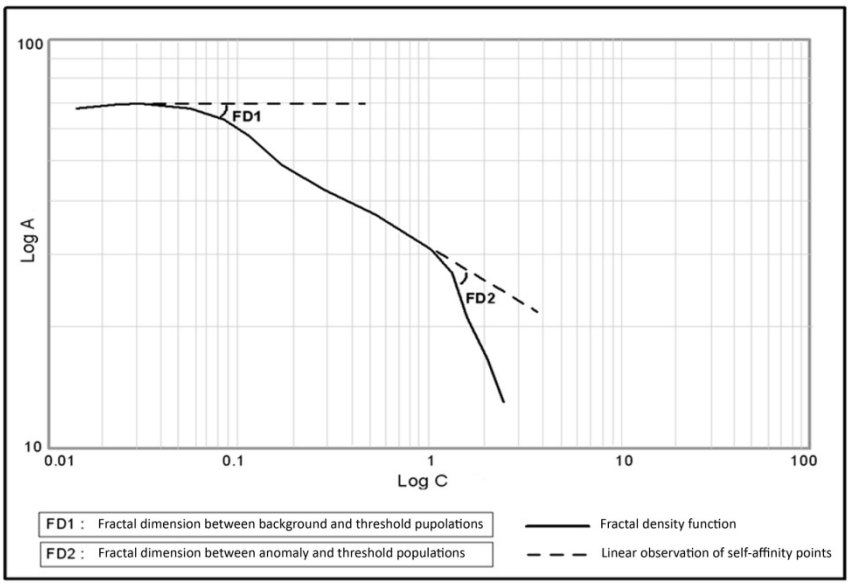

Figure2. Application of density function and variation of fractal line coefficient in population separations around the turbulent environment with respect to trend variation of fractal curve with FD1 and FD2 coefficient lines

2-2. The fractal measurement of surfaces anomalies via exponential function of distance-diffraction

To investigate the variations of surface anomalies in nonlinear methods relying on the variography principle of gravity data Mark and Aronson (1984) have introduced the following relation:

$$E\left[(Z_p - Z_q)^2 \right] = (d_{pq})^{2H} \quad (3)$$

Z_p and Z_q are the gravity variations (mgal) in the points P and Q on the surface anomalies and d_{pq} is the horizontal distance (m) between the mentioned points. The mathematic expectation, E, suits distance dimension d_{pq} with an exponential function; so:

$$2H = 3 - FD \quad (4)$$

By refer to classical statistics and random variables resulting from gravity variance corresponding to diffraction concepts in Z_p and Z_q, the mathematic expectation of $E\left[(Z_p - Z_q)^2\right]$, can be shown as:

$$E\left[(Z_p - Z_q)^2\right] = \Sigma (Z_i - \bar{Z})^2 / N \quad (5)$$

Where Z_i is the measurement of gravity component (mgal) and $\bar{Z}$ is the mean of gravity intensity (mgal) for N surveys different from surface anomalies. The obtained result of relations 3, 4 and 5 verify the relative-exponential relationship between diffraction resulting from gravity variations and the gravity distance of effect anomalies affection and 2H variable corresponds with FD fractal dimension. Application of geo statistical interpolations to establish continuity in exploration survey grid is essential component to achieve the values of relation 5. By use of logarithmic coordinates, the coefficient angle of FD line, which is known as diffraction distance fractal equation can, expressed as below:

$$\text{Log } V_z = FD \text{ Log } D_z \quad (6)$$

$\text{Log } V_z$ and $\text{Log } D_z$ are the logarithms of diffraction and gravity distance from the center of anomaly. After drawing the function of Log V – Log D, the variations of fractal dimension (FD) indicate the population tendency to form self-affinity points and consequently the appearance of similar component in the unit of anomalous surface (Mark & Aronson, 1984). Therefore, for FD≤1, the surface similar components are less likely and indicate the linear

process dominancy in the evolution process of the population (Turcotte, 1997). In case of 2>FD>1, we encounter to transitional status that some values could satisfy similar component, but due to shortage of spatial distribution of the initial component the maximum variations have been observed in the ground section and near to threshold of chaotic environment, they weaken (Turcotte, 1997). In such populations, the emergence of quasi fractal characteristics is common. That, in its turn, increases the probable achievement to self-similar patterns (Mandelbrot, 2002).

Thus, similar surface variations (Brownian surface) are necessary for ideal populations. Formation of this level is often accompanied by the dimension variations 3>FD>2 (Thorarinson & Magnusson, 1990). In other words, diffraction-distance equation is true for the set anomalies points whose fractal dimension is between 2 and 3. In such a continuous and definite domain of random variables such as FD= {2.01, 2.02,… 2.99}, the surface anomalous is desirable status and enjoys the maximum similar component.

Hence, the mentioned equation makes the evaluation of surface possible anomalous aiming at the recognition and separation of iteration patterns types of quasi fractal and chaotic distribution. Figure3 shows the locus of the Z_p and Z_q quantities in the distance d_{pq} on the supposed isograde curves. Based on the proposed methods by Mark and Aronson (1984), Thorarinson, and Magnusson (1990), the gravity variations between points p and q can be calculated by drawing concentric circles and their confluence at isograde surfaces. In this study, concerning the fractal measurement of gravity data, spatial analyst equipped with Arc View-GIS software has been used. To produce isograded maps an interpolation operations by use of geostatistic methods have been performed. The order of intended achieve quantities and their substitution in diffraction-distance logarithmic function (relation 6) are as follows:

1. The geostatistical interpolations through Kiriging method aiming at producing gridded maps.
2. Statistical reclassification to normalize the variables and extracting the required statistical parameters.
3. Producing random variable including quantitative values of surfaceanomalous (Km^2) and gravity intensity suiting each surface (mgal) as geometric and geophysical components related to the Z_p , Z_q , and d_{pq} values (relation3).
4. Processing and previous stage data completion to achieve included quantities in diffraction-distance equation.
5. Soloutin of diffraction-distance equation and drawing the diagram of logarithmic variations, Log V_z versus Log D_z .
6. Determination the self-affinity points to recognize fractal populations from types of quasi fractal and linear.
7. Calculation of self-affinity points of fractal dimension to recognize the anomaly process and its comparison to similar quantities distribution in fractal population, quasi fractal, and linear.
8. Appropriate Brownian surface recognition for gravity distribution in terms of the variations of fractal dimension (3>FD>2).

Mark and Aronson (1984) showed that the self-affinity points, projected from free air anomaly, possess independent gravidity component from the effects of isostasy. The gravity distribution at the surface of similar quantities (Brownian surface) makes it possible to estimate Bouguer density in desirable component in lacking topographic effects. Therefore, diffraction-distance equation examines the locus of anomalies accurately regardless the altitude ups and downs and reduces the error of Bouguer slab corrections.

Similarly, achieving self-affinity points projected from Bouguer anomaly and solving the diffraction-distance equation for different densities, the diagram of the variations of fractal dimension versus density can be plotted and it is the turning point of the function indicating Bouguer density value with the minimum fractal dimension in the Brownian surface. To determine Bouguer anomaly corresponding with density variations, the following relation is used:

$$B_{new} = B_{old} + (\rho_{new} - \rho_{old}) (0.32562-0.0419h) \qquad (7)$$

B_{new} and B_{old} : known and unknown Bouguer anomaly (mgal), ρ_{old} and ρ_{new} : old and new densities (g/cm^3) based on the station altitude variations from the base surface of h (m).

3. Determination of Bouguer density in Charak area

According to Farmani (2003), after essential required corrections on 776 available systematic land surveys in Charak Geophysical Information System (CGIS) with a given average density (ρ = 2.3), the Bouguer anomaly values have been interpolated. The following relations have shown the calculation procedures of density concerning some gravimetric stations in Charak region:

S_{46} , S_{129} and S_{591}:

$$ps_{46} = (\text{Free Air } S_{46} - \text{Bouguer Anomaly } S_{46})/0.0419h = (-42.868 + 48.099)/2.274 = 2.3$$

$$ps_{129} = (\text{Free Air } S_{129} - \text{Bouguer Anomaly } S_{129})/0.0419h = (-41.367 + 44.942)/1.554 = 2.3$$

$$ps_{591} = (\text{Free Air } S_{591} - \text{Bouguer Anomaly } S_{591})/0.0419h = (-39.889 + 40.738)/0.369 = 2.3$$

Where $ps_{46}, ps_{129}, and\ ps_{591}$ are the calculated density (gr/cm^3) in the gravimetric stations numbered 46, 129, and 591 respectively as it is observed, using tree quantities of free air, Bouguer anomaly (before topographic correction), and the altitude of gravimetric station, the averaged density obtained for the region under study is ρ =2.3 gr/cm^3 that is the very ρ_{old} in the relation (7). Replacing ρ_{old} by ρ_{new} , we can achieve a different pattern from the variation of Bouguer anomaly (B_{new}) in Charak-Namakin area. So, if we consider the interval of density variations originating from the variety of the formations to be from 1.80 to ρ =2.50, numerous quantitative concepts from the index of gravity variations can be inferred that, in turn, cause a lot of ambiguities in the interpretation of spatial situations of apt formations (containing oil reservoirs). Therefore, determination of the optimum density value by nonlinear methods and fractal equations to achieve independent gravity variations from the structure of ups and downs wills something unavoidable.

By attention to this point that the gravity variations of Charak region are related to various sedimentary units and the structure phenomena in the oil prospecting territory of Zagros, the error increase in calculating Bouguer density causes an inaccurate approximation of the anomalous status and consequently an unusual interpretation of the spatial situation of oil traps. In other words, the component of oil and probably gas reservoirs exploration in subsurface units of Charak anticline is the known Bouguer slab variation patterns. By separating it from the residual gravity remains known as apt formations (focusing on Asmari lime). On base of the fractal dimension variations, the mentioned method has been used to gain this important Bouguer correction.

3-1. The effect of Isostasy on the variations of free air gravity

Free air anomaly under the diffraction-distance equation is the first step of gravity data processing. It should be executed in a certain distance from similar distribution surface of gravity field, to recognize independent quantities from the mantle isostasy (Brownian surface). Based on figure4, gravity strain resulting from the projection of Cenozoic sediments distant from the Charak-Namakin domes behaves dually. A part of it has accompanied the emergence of the surface of similar variations (fractal population with the dimension of FD=2.08) and the other part has been influenced by the ups and downs of the region (chaotic population with dimension of FD≠2.08). In other words, the self-affinity points, resulting from free air variations, indicate the gravity distributions of similar characteristics and the iteration in gravity initial component will be independent from anomaly scale. That is, the points situated in 2.86 – 15.32 kilometer distance from background limits and the appearance similar quantities in Brownian surface simultaneously divide the variations of gravity field in Charak-Namakin area into two populations with nonlinear distribution patterns. Among these populations, only the self-affinity points with the line coefficient of 2.08 are pertained to Bouguer slab and are proposed to calculate Bouguer anomaly. The obtained results from testing the free air variations through diffraction-distance equation verify that:

1. Due to crust thickness and gravity essence variation, particularly when the distance is more than 15 and less than 2 kilometers, Nettleton's pattern is not allowable. It means that topographic corrections in Charak-Namakin area are necessary, because it causes diagonal increase in spatial situation of the anomalies estimation.
2. Exponential distribution of gravity and its relation to the appearance of similar components that enjoy field measuring scale independency of the quantities add to the priority of nonlinear methods such as fractal functions.
3. Density function resulting from diffraction-distance equation includes two populations, fractal (self-affinity points in the threshold of chaotic environment with the dimension of FD=2.08) and non fractal (scattered points with angle coefficient of FD≠2.08). regarding the number of similar quantities and the range of their effect in the surface of gravity distribution it is possible to use the self-similar characteristics of gravity field to achieve the pattern of Bouguer slab variations and decrease topographic effects.

3-2. Nonlinear distributive pattern originating from Bouguer anomaly

After conduction test of free air anomaly and recognizing independent gravity variations from station altitude effects, diffraction-distance equation has been used for Bouguer anomaly with the averaged density of ρ =2.3 which is shown in figure5. According to this figure, Bouguer threshold limit is accompanied by low self-affinity points (low correlation) in quasi fractal population with the line coefficient of FD<2, and similar quantities, by settling in the Brownian surface and keeping self-similar component (fractal dimension of FD=2.45) appear. The distance effect of self-affinity points has been estimated to be 6.44 – 10.24 kilometers from the anomaly threshold. In this distance the non diagonal approximation concerning density quantity, regardless the altitude effects and the variations due to the folding of Cenozoic sediments (the host of oil reservoirs in south Zagros) is possible. The iteration index of initial components is weakened and chaotic behavior (unpredictable) and will be observed in the variation pattern of Charak-Namakin Bouguer slab. It means a light correlation in the extreme points of the population (FD ≠ 2.45). Therefore, density determination through measuring of Bouguer slab variation is possible only in the limited distance of the gravity cointensity surfaces. So, to achieve reliable results, the calculation of Bouguer statistical

parameters in terms of gravity variations of the region is necessary (ρ =1.80–2.50).

3-3. Density determination by classical statistics

To determine Bouguer slab density in the Charak area, common statistical methods (Manley, 2004) has been used to calculate measures of central tendency, diffraction and comparing statistical tests via relative variables, which is shown in table (2), which is obtained by combination of relation (7) with excel for 776 gravity data. The maximum and minimum of density are 2.5 and 1.8 g/cm^3 respectively. The given information in table (1), showed the obtained density 2.32 from Asmari's formation and 1.78 from those of Bakhtiari. The applied statistical procedures in this study include calculation of Pearson coefficient and determination of obtained skewness from Bouguer anomaly distribution against the altitude variation of gravity points and its true limits are -1<p<1. In the case that Pearson coefficient is zero, the distribution of variables is quite normal, but in the cases that Pearson Coefficient is not zero, its sign determines the skewness direction with positive for skewing to the right and negative for skewing to the left. Regarding the obtained variations for Pearson coefficient, the maximum skewness relates to the anomaly resulting from the density of 1.8 g/cm^3 and the minimum one does to the anomaly from the density of 2.5 g/cm^3. Also, by computing the correlation between the variations of Bouguer anomaly and the altitude of surveyed gravity points, the necessary values for the statistical measurement of geophysical component (gravity and density) have been obtained and compared with the geometric variables of the region (altitude and topographic variation). Hence, a new defined relative variable, R^2P in table (2), has been used to measure linear regression of data in terms of their Pearson coefficient variation.

R^2P is a relative variable with the continuous domain between 0-1 where $R^2P = 0$, $R^2P=0.5$ and $R^2P=1$ have different concepts in terms of the relationship between the quantities R^2 (data squared correlation) and P (Pearson coefficient). The proposed relation for calculating this quantity to examine Bouguer anomaly variation is as follows:

R^2P = [Reg. (B vs.Δ h)] / [Pearson (B vs.Δ h)] (8)

Where R^2P represent the indented statistic (without unit) and the expressions Reg. (B vs ,Δh) and Pearson Coef. (B vs.Δh) have been included for the calculation of the correlation coefficient of regression and Pearson of Bouguer anomaly (B in terms of mgal) respectively versus the altitude variation (Δh in terms of meter) of the region under study. It is important to note that in the present study, the inferred concepts from R^2P variation have been interpreted merely to study gravity variation and its relationship with the Bouguer slab density of Charak area and the author does not assume any responsibility concerning the similar surveys of geophysical quantities.

As mentioned before, R^2P is determining the type and value of the correlation between R^2 and P that can be calculated in the forms of linear regression coefficient R^2 (R^2P). As shown in table (2), the anamoly correlation of Pearson coefficient and linear regression is 0.96 which indicates significant relationship between R^2 and P. It means that a direct relation between the anomaly skewness and Bouguer slab variation is available in studied area. In other word, increasing the anomaly skewness causes the increases on the same direction of the altitudes of gravity stations and the residual gravity field is affected by the structure ups and downs. Similarly, as the skewness of anomalies decreases, the direction of altitude variation towards the phenomena resulting from Bouguer slab variation weakens and the residual gravity will relatively be independent from topographic effects. Accordingly, R^2P estimates no diagonally due to the density variation of the studied region and R^2P =0.5 provides the best choice for determination of statistical procedure.

Considering R^2P =0.912 in table (2), the correlation between Bouguer slab variation and the altitude of investigated points is more than what has been expected and despite the acceptable skewness of gravity data, selecting density of 1.8 as an independent quantity from altitude effects of the region is not right. This is true for the densities 1.9 to 2.2, but R^2P =0.602 and R^2P =0.416 considering the approximation of the proportion 1.2, the suitable component for the separation of Bouguer slab variation from topographic variation is provided and following from this, the densities 2.3 and 2.4g/cm^3 are proposed as the desirable choices. The final quantity of table (2) is R^2P =0.159 that, despite the very low correlation between anomaly and altitude variation of the stations, lacks the necessary criteria for choosing the optimal density due to lowness of Pearson coefficient.

Although, statistically, the comparison of the density 2.3 with 2.4 is a suitable estimator to measure Bouguer slab variation in Charak area. Based on the proposed nonlinear method in this study the optimal density is selected and focusing on fractal functions. It is necessary to point that there are some considerations, regarding the measurement of initial components and knowing iteration patterns, which theoretically relate to scale independent quantities and enjoy enough accuracy in evaluating geophysical variables (Mandelbrot, 2006).

3-4. Density determination by fractal method

The assumption of using fractal method is the nonlinear distribution evaluation of gravity data within exponential functions (Torcutte, 1997) that previously has been referred as diffraction-distance equation (relation6). Due to sedimentary facies and density variation in apt formations of the region, Bouguer anomaly has been calculated (relation7) for different densities (1.8 to 2.5) and interpolated using kriging method. In this way the steps of achieving the Z_p ,Z_q , and d_{pq} variables (relation 5) have been

iterated for each variation in the average density of the region and the results have been used to draw fractal functions. Figure6 shows the resulting diagrams from diffraction-distance fractal functions in different densities (1.8 – 2.5). Similar to figure5, the coexistence of similar quantities (self-affinity points) has caused different population to appear and fractal dimensions with the variation of Brownian surface (2<FD<3) have made it possible to recognize Bouguer anomaly while being independent from altitude variation of the region. As it is observed, the maximum fractal dimension pertained to Bouguer slab variation has been in the density of 1.9 g/cm^3 and its minimum belongs to the anomaly resulting from density of 2.4 g/cm^3. Based on proposed method by Mark and Aronson (1984), if we contrast fractal dimension variation with density variation, a second grade quasi function will be obtained over which the locus of optimum density will coincide yield the point of the function. Therefore, in the anticline of Charak region the density of 2.4 g/cm^3, because of FD min=2.11, has been selected as an independent quantity from the structure ups and downs Bouguer slab which is pointed in figure 7.

The comparison results of classical statistics with fractal method (table2) confirms the idea that the selection of 2.4 g/cm^3 density goes along with the simultaneous reduction of R^2 and P correlation coefficient and it creates a suitable situation for the independency of Bouguer slab density from the topographic variation of the region. So, assuming $0.4\leq R^2P \leq 0.5$ as a criterion for measuring the statistics that fit the optimized Bouguer anomaly, the relationship between statistical data and the results of fractal investigation is verified. Thus, using statistical methods, Bouguer slab density in the Charak area is approximately estimated to be between 2.3 and 2.4 g/cm^3 and achieving nonlinear distribution in the gravity field (fractal method), ρ_{final}=2.40 g/cm^3 is proposed as the optimized averaged density.

Conclusion

By Introducing statistical methods and application of diffraction-distance equation to determine Bouguer slab density in the Charak area, the present study investigated the results of each section and just the most important ones are reported as follows:

- Investigating fractal distribution of the gravity data aiming at evaluating Bouguer slab variation in the Charak-Namakin area, due to using similar quantities and focusing on self-similar features resulting from field measurement, makes it possible to estimate density, independent from structures ups and downs, enjoying accurate results based on the statistical parameters if compared Nettleton's correction pattern.
- In this study, Bouguer slab variation of Charak has been evaluated using classical statistics and fractal method separately and the results have been compared with the R^2P values, which $0.4\leq R^2P\leq 0.5$, as a suitable choice has been proposed to select the average density of the region.
- In the statistical measurement of the data, R^2P has been used as a criterion to evaluate Bouguer slab variation of Charak and after examining the assumed quantities of 1.8 to 2.5 g/cm^3, the regional average density of 2.3 g/cm^3 has been estimated by 0.1 approximations.
- In fractal method, using diffraction-distance equation, a new method was introduced to investigate gravity field variation. In this equation achieving the dimension of FD≥2 indicates the presence of similar components in the Brownian surface that, in their turn, are related to the appearance of the iteration patterns in the anomaly surface and indicate the gravity field variation in the threshold of chaotic environment.
- This study has made Mark and Aronson's proposed method (1984) possible to investigate Bouguer variation in terms of various densities and has used the results to obtain the Bouguer slab effects of the Charak region. Therefore, an optimized component to use the spatial analyst of Arc view GIS has been developed and increasing of the accuracy in the approximation of geostatic data consequently was experienced. The result of such a process is achieving the value of 2.4 g/cm^3 as Bouguer slab density in the Charak-Namakin area. It is also expected that Bouguer anomaly originates from the density of 2.4 independent from structure of ups and downs of Zagros and geometrically enjoys enough surface for self-similar gravity to appear.
- The exponential function resulting from free air variation (figure 4) verifies that the resultant of the gravity force in Charak-Namakin area has been in the distance of similar components (from 2.88 to 15.32 kilometers) independent from mantle isostasy and out of this distance it influenced by the structure of ups and downs of Zagros. Therefore, allocating the density of 2.3 or 2.4 g/cm^3 is of spatial limitation and unlike the common methods (Farmani, 2003), it requires fractal considerations to interpret the behavior of the gravity field.
- The exponential function resulting from the behavior of Bouguer anomaly (figure5), verifies that variation independent from structure of ups and downs in the Charak area has been observed only from 6.44 to 10.24 kilometers from the anomaly threshold and in other areas it has been affected by topographic factors. Similarly, using various densities (1.8 to 2.5 g/cm^{-3}) have caused numerous distances and consequently the appearance of some variations in process of anomaly distribution. This method, unlike the common ones (Farmani, 2003), requires using nonlinear pattern to determine Bouguer slab density by fractal method.

- Drawing the Bouguer vs variation of fractal dimension (figure7), implies that the proposed pattern by Mark and Aronson corresponds with the gravity findings in the Charak region. Accordingly, the quantity FD_{min}=2.11 lies at the yield point of the function and it will be the estimator of no diagonality from the average density of the region (ρ_{final} =2.4). Also, determining density by fractal method corresponds with the variation of $0.4 \leq R^2P \leq 0.5$ and the probability of achieving intended results, after the interpolation of gravity variation (via geostatistic methods), increases. Thus, if maximum and minimum of points of the anomaly are calculated using kriging method and taking into account that geometric index included in the survey grid of gravity data, the limits of anomalies correspond with the effect distance of free air variation and the residual gravity, in some sedimentary formations, will be independent from topographic effects. Such regions are recommended for further discovering activities aiming at achieving extended oil reservoirs in Charak-Namakin.

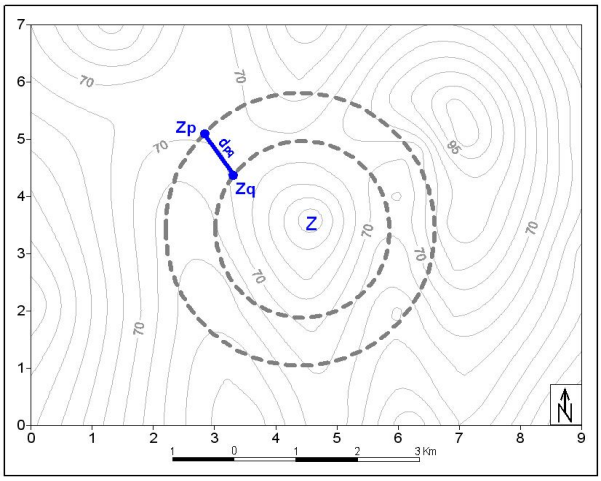

Figure3. Applied geometrical values of diffraction- distance fractal equation with 5 mgal Contour line difference (Thorarinsson & Magnusson, 1990)

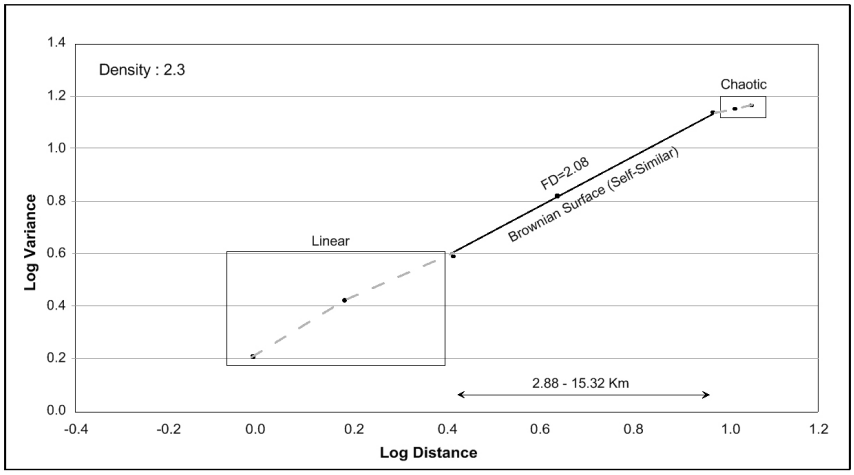

Figure4. Variation of diffraction- distance fractal equation for free air anomaly in Charak region

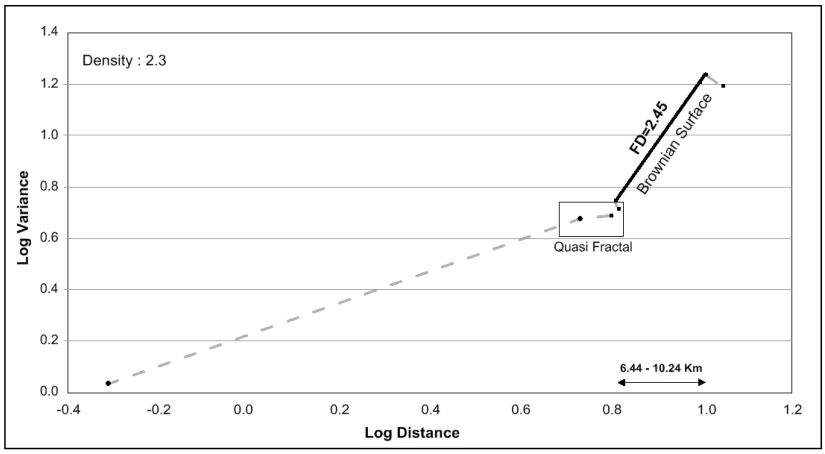

Figure5. Diffraction-distance fractal function for variation of anomaly in Charak-Namakin region (assumed density 2.3)

Table (2). Required statistical indices for comparison of Bouguer anomaly with different densities in Charak area

No	density (g/cm^3)	Bouguer Anomaly (mgal)				Bouguer Vs. Elevation		R2P Ratio
		Average	Min	Max	Stdev	Pearson Coef.	Regression (R2)	
1	1.8	-37.107	-50.441	-7.634	7.979	0.912	0.832	0.912280702
2	1.9	-37.998	-50.426	-11.104	7.111	0.888	0.789	0.888513514
3	2	-38.889	-50.411	-14.405	6.271	0.853	0.729	0.854630715
4	2.1	-39.779	-50.396	-17.707	5.472	0.802	0.644	0.802992519
5	2.2	-40.670	-50.381	-21.009	4.734	0.724	0.524	0.723756906
6	2.3	-41.561	-50.367	-24.311	4.090	0.602	0.363	0.602990033
7	2.4	-43.452	-50.352	-27.612	3.593	0.418	0.174	0.416267943
8	2.5	-43.342	-50.354	-30.914	3.308	0.163	0.026	0.159509202

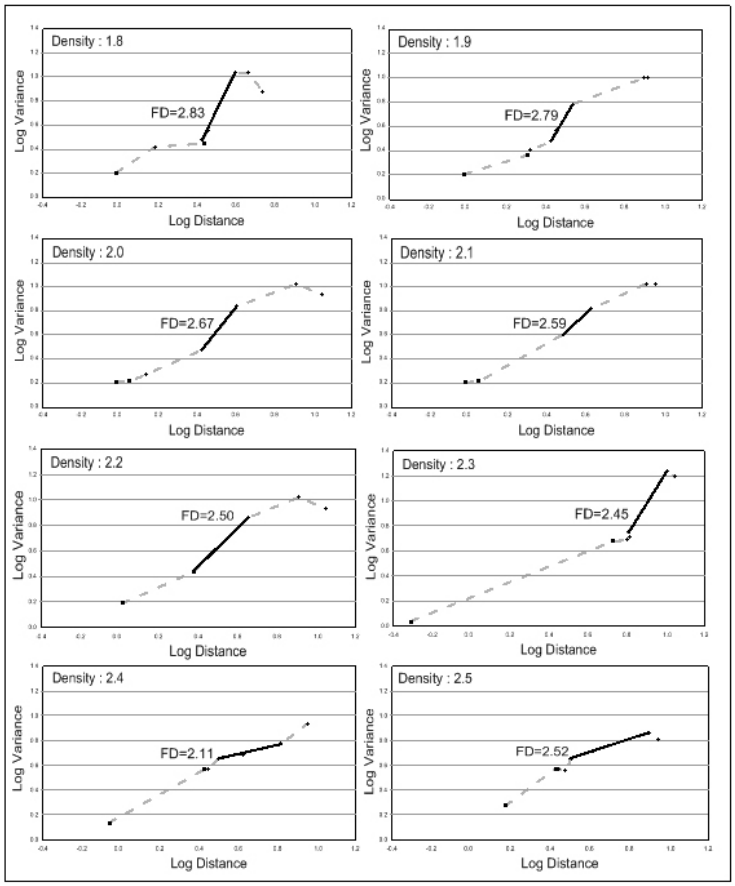

Figure6. Diffraction-distance fractal function for densities between 1.8 to 2.50 in Charak-Namakin region

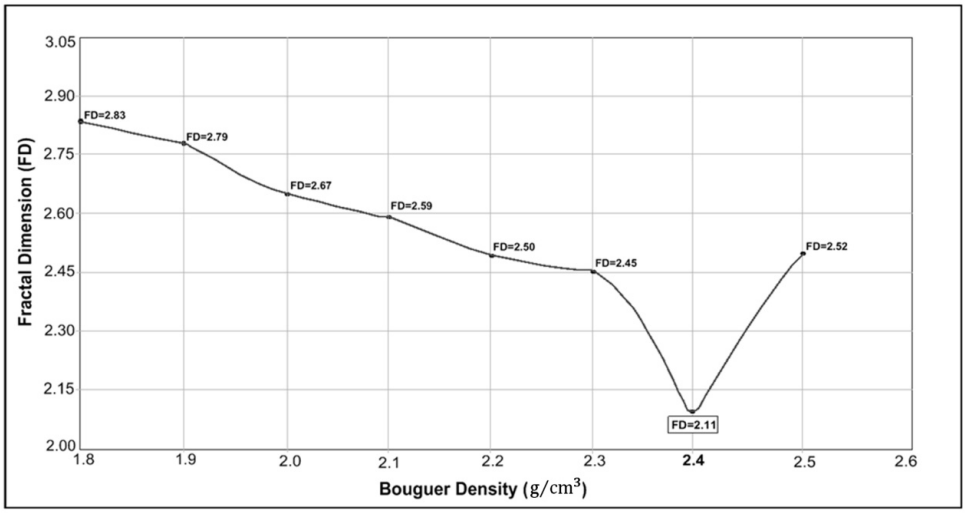

Figure7. Bouger anomaly vs. resulted fractally dimension from sedimentary formation densities in Charak-Namakin area

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A Novel Dual Mode Reconfigurable Delta Sigma Modulator for B-mode and CW Doppler Mode Operation in Ultra Sonic Applications

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Abstract: A dual mode re-configurable Delta Sigma Modulator (DSM) for ultrasonic applications is presented in this article. The proposed modulator handles two operating modes: B-mode and Continuous Wave (CW) Doppler mode. For B-mode operation a low pass modulator was designed which was modified by Noise Shaping Enhancement (NSE) technique. It achieves 71.7 dB (Signal + Distortion) to Noise Ratio (SNDR) and 80 dB Dynamic Range (DR) over 5 MHz signal bandwidth. For CW Doppler mode a band pass DSM was implemented which was modified by NSE technique. The simulated SNDR of the band pass DSM is 117 dB and DR of 100 dB with a signal bandwidth of 200 KHz. The most attractive feature of the proposed modulator is sharing most of the many building blocks between the low pass and band pass modulator and reducing the active blocks using the NSE technique.

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Keywords: Delta Sigma Modulator, low pass, band reject, Noise coupled

1. Introduction

Nowadays, most ultrasonic imaging systems are still limited for us therapeutic bureaus thanks to their massiveness, power consumption and high cost. The tendency of the conventional digital beam formers employing phased rotation and interpolations to the complexity causes them could not be integrated inside the ultrasonic probe. Also, using the high performance and expensive cable for transmitting the analog signal between ultrasonic transducer and beam formers is inevitable. Analog to digital converters (ADCs) are critical building blocks of front-end ultrasonic receivers. Phased-array ultrasonic imaging is a favorable application for delta sigma converters where overall analog hardware can be simplified in place of increased digital signal processing complexity [1].

The main reasons cause DSM is known as a best candidate are: first, since design for phased array ultrasonic imaging, 128 channel are sampled to 10 bit resolution, therefore linear operation on 128 channel with single bit stream are easier than on 128 channel with 10 bit. Second, time delaying each channel for beam steering is almost trivial for highly over sampled signals [1].

Surprisingly few multi modes DSM for ultrasonic applications have been reported in the literature to date. Norman reported a DT band pass DSM. The modulator shows 84dB SNDR over 2.5 MHz bandwidth at the center frequency of 5 MHz [1]. Another programmable band pass DSM with 200 kHz bandwidth by Qin et al. is designed in 0.18 µm CMOS process. It shows 74 SNDR [2]. Most recently Song et al. presented a dual mode DSM. It achieves 56.74 SNDR over 5 MHz bandwidth for low pass DSM and 115 dB over 200 kHz for band pass modulator [3]. As stated in the previous findings, decreasing the power consumption without losing the performance of the modulator is the main challenge. In this article, we will describe a dual mode re-configurable DSM that can be used in ultrasonic applications. The aim of this research is concentrated on several important points: reducing the active blocks without losing the performance and integrating two DSM on a single chip.

Design and simulation of a dual mode DSM for ultrasonic applications is considered in this article that is organized as follow: section 2 describes system architecture design of re-configurable dual mode DSM for ultrasonic applications. Numerous none-idealities are investigated in section 3. Simulation results are discussed in section 4 and eventually section 5 gives conclusion.

2. System Architecture

Step by step design of dual mode re-configurable DSM is considered in this section to achieve a best topology for our aim. The reasons for using low pas modulator for B-mode and band pass modulator for CW mode will be explained and the advantages of low distortion swing suppression topology will be described afterwards. A NSE technique will be investigated in both low pass and band pass modulators and eventually proposed dual

mode reconfigurable DSM for ultrasonic application will be designed.

2.1. Low Pass vs. Band Pass

There are some important considerations in the designing of DSM as a part of the ultrasonic beam formers for B-mode and CW Doppler mode. B-mode scanning is used to detect back scatter from surfaces and CW-mode detects Doppler shift due to blood flow. The ultrasound signal is centered at 3.5 MHz. For B-mode operation, 8 bit resolution is a minimum requirement for digitizing the ultrasound signals. Therefore, if a low pass DSM is employed 5 MHz signal bandwidth is sufficient for our purpose. In CW Doppler mode, the resolution of signal per channel with 200 KHz bandwidth is about 18 bit. As a result the relatively low resolution DSM for B-mode cannot be reused in CW Doppler mode. In the case of CW Doppler mode operation, ultrasound instrument should use a separate analog beam former followed by a high resolution ADC. On the other hand, numerous converters are needed for multiple channels in the beam formers, resulting in increased circuit complexity, power consumption. Re-configurability is a solution to achieve a flexible circuit that can be integrated in the single chip. With the mentioned considerations, a band pass DSM will design for satisfying the CW Doppler mode. As a result, noise shaping can be programmed between a band reject function for B-mode scanning and a notch function for CW mode scanning.

2.2. Topology Selection

Low distortion swing suppression topology is selected because of several important reasons. First of all, the NTF is not affected in this topology and the integrators do not process the quantization noise. As a result the analog building blocks can be implemented with relaxed requirement. Another advantage is that one Digital to Analog Converter (DAC) is required in the feedback loop so that the complexity can be reduced significantly [4].

2.3. Noise Shaping Enhancement Technique

Reducing the power consumption for every application is one of the most challenges in analog design. To achieve the better power efficiency, reducing the number of integrators and resonators can be a solution. A Noise Shaping Enhancement (NSE) technique has been reported that yields a higher order noise shaping with less number of integrators and resonators [5] [6]. We briefly explain this method for both low pass case and band pass case. In the low pass case, the DSM increases the noise shaping performance from L^{th} order to $L+1^{th}$ order by extraction the quantization noise and injection of quantization noise into the loop filter with one delay cycle. The NSE technique does not change the Signal Transfer Function (STF) of the modulator and the stability of the modulator preserves. Figure 1 shows the block diagram of the NSE-DSM. According to Figure 1, if the noise shaping transfer function (NTF) of conventional modulator and G (z) define by the following formulas:

$$NTF(z) = (1 - z^{-1})^{L}$$

$$G_{ij}(z) = z^{-1} \sum_{k=0}^{N-1} (1 - z^{-1})^{k}$$

The Noise Transfer Function of NSE-DSM can be written as following:

$$NTF_{NSE}(z) = NTF(z)[1 - G_{ij}(z)]$$

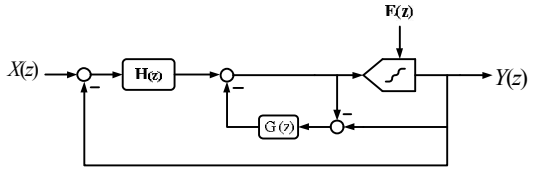


Figure 1. Block diagram of Noise Shaping Enhancement DSM

Therefore the order of modulator will be effectively increased just by adding some passive capacitors and switches. Band pass DSMs operate in much the same manner as low pass DSM. Most of the designs for band-pass modulators can be derived in a similar way as the designs for low-pass modulators. For instance, applying the transformation $Z^{-1} \rightarrow -Z^{-2}$ to a low-pass modulator, the zeros of H (z) would be mapped from DC to $\pm\pi/2$. NSE technique can be applied to increase the noise shaping performance for band pass DSM. It can be easily proven that the order of band pass DSM will be effectively increased by two [7].

2.4. Proposed Re-configurable DSM

With the previous considerations, the proposed dual mode re-configurable DSM structure is depicted in Figure 2. It is observed that this topology is based on a 2^{nd} order feed forward low pass DSM and 4^{th} order feed forward band pass DSM. The gray box illustrates the tunable characteristic of the proposed modulator. Switching between modes can be done through a controller is designed to generate bits S [2:0] on basis of two input bits in [1:0]. The trust table of the mode controller is shown in Table 1.

Table 1: Trust table of mode controller

In_0	In_1	S_0	S_1	S_2	Order of DSM	Topology
0	0	0	0	0	2	Conventional low pass DSM
0	1	1	0	0	4	Conventional band pass DSM
1	0	0	1	0	3	Proposed NSE low pass DSM
1	1	1	0	1	6	Proposed NSE band pass DSM

0: closed, 1= open

As stated before, NSE can be done by G (z) = Z^{-1} for low pass modulator and G (z) = Z^{-2} for band pass modulator. Furthermore, in order to realize an adjustable NTF, a transfer function with tunable coefficients λ_i and mode controlling switch S_j is utilized to implement the programmable polynomial Z function. The output transfer function of the proposed modulator can be written as following:

$$Y_{proposed}(z) = X(z) + NTF_{adj}(z)E(z)$$

In which X (z) is the input signal, NTF_{adj} is the adjustable NTF and E (z) is the quantization noise. It is obvious, because of the feed forward path from the modulator input to the input of the quantizer, Signal Transfer Function (STF) shows a smooth response. But the most important part of the above formula is the NTF_{adj} that will be investigated more. According to Figure 2 the NTF_{adj} is given by:

$$NTF_{adj}(z) = [\overline{S}_0 . NTF_{LP}(z) + S_0 NTF_{BP}(z)] \cdot [1 - (S_1\lambda_1 N(z) + S_2\lambda_1\lambda_2 N^2(z))]$$

Where NTF_{LP} is the conventional 2nd order low pass NTF defined by $(1-Z^{-1})^2$, NTF_{BP} is the conventional 4th order band pass NTF defined by $(1+Z^{-2})^2$, λ_i (i=1, 2) are the tunable coefficients, S_j (j=0, 1, 2) are the mode controlling switches and eventually N (z) is a transfer function in the form of Z^{-1}. The trust table shown in Table 1 and the values for tunable coefficients allow the structure to support dual mode application such as low pass modulator for B-mode and band pass modulator for CW Doppler mode. Considering the B-mode mode as an example, then if in_0 in_1=01 the switches S_0, S_2 are open and S_1 is closed. With this setting parameters the overall NTF is given as $(1-Z^{-1})^3$ which demonstrates that the NTF of the reconfigurable modulator is a 3rd order function. Based on a theoretical SNR estimation a 3rd order function is sufficient in providing the performance required for B-mode operation assuming that an OSR of 20 is used. Depending on the states of the switches S_j (j = 0, 1, 2), the CW Doppler mode is also be programmable.

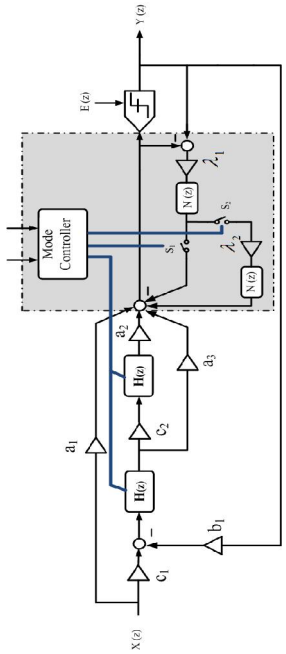


Figure 2: Proposed Dual Mode Reconfigurable DSM

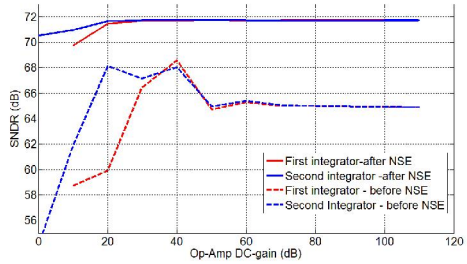
In the proposed dual mode DSM, the integrators (in B mode operation) and resonators (in CW Doppler mode) just process quantization noise therefore their performance requirement can be significantly relaxed, as well.

3. Circuit Non-Idealises Investigation and Analysis

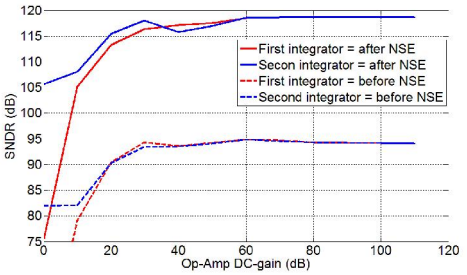
To avoid the SNDR degradation in the design of DSM, the structure is needed to be optimized a numerous set of parameters including the analog building blocks requirement. Hence, behavioral simulations were done using a set of Simulink™ models in MATLAB Simulink™ environment. Based on SIMULINK models, it was possible to include several non-idealities, such as finite DC gain, finite gain bandwidth, slew rate, thermal noise and output swing [8].

In contrast with the system level, the DC-gain of the integrators/resonators is not infinite because of the circuit constraints. In fact, the finite DC-gain of the integrators/resonator leads to a shift of the integrators/resonators poles so the overall transfer function will change. To investigate how the finite DC-gain can effect on the performance of the modulator, the degradation of SNDR as a function of finite DC-gain is plotted in Figure 3 for both B-mode and CW Doppler mode. Based on these results the minimum DC-gain of OTA's to avoid the SNDR degradation is 20 dB. Also, as shown in Figure 3 the

proposed modulator is less sensitive to finite DC-gain than the conventional one.



(a)



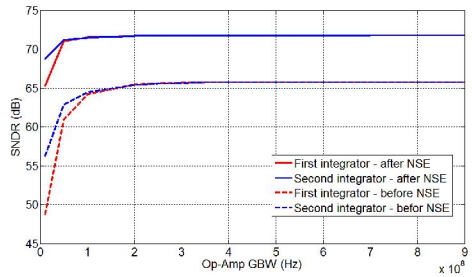
(b)

Figure 3. SNDR vs. Op-Amp DC-gain for B-mode (a), CW-mode (b)

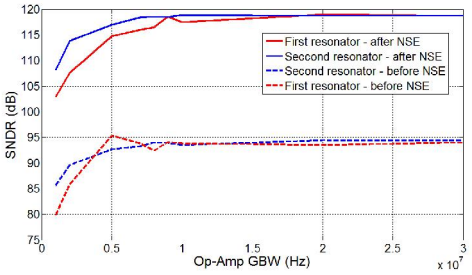
Gain Bandwidth (GBW) limitation causes the non-ideal transient response within each clock cycle. Thus producing an incomplete charge transfer to the output at the end of the integration period. The finite GBW produces harmonic distortion reducing the overall SNDR of the DSMs. On the other hand Slew Rate (SR) has the same effects on the performance of the DSM. In this design, finite GBW and SR are modeled through a user defined function as shown in equation below. Figure 4 and 5 show the SNDR versus finite GBW and SR [8]. According to these curves an OTA with 50 MHz GBW and at least 380 V/µs SR should be selected in order to preserve the SNDR requirement.

$$|\varepsilon| = \begin{cases} |V_{in}| - SR * \frac{T_s}{2} & t_{SL} \geq \frac{T_s}{2} \quad \left|\frac{\partial V_{in}}{\partial t}\right| t = 0 > SR \\ (|V_{in}| - SR * t_{SL}) * e^{\frac{-t}{\tau}} & t_{SL} < \frac{T_s}{2} \\ |V_{in}| * e^{\frac{-t}{\tau}} & \left|\frac{\partial V_{in}}{\partial t}\right| t = 0 < SR \end{cases}$$

Low-voltage and low power design in mind key OTA parameters have been set with strict limitations. As an example the saturation voltage of the OTA is set to 0.8 V. With reference to typical low-voltage implementations the remaining parameters are specified with similar restrictions.

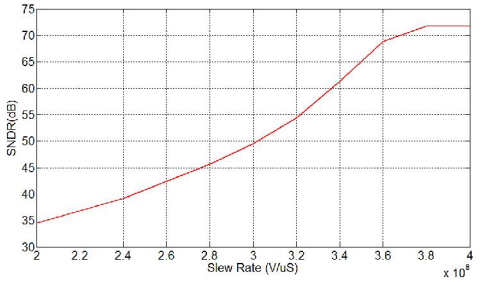


(a)

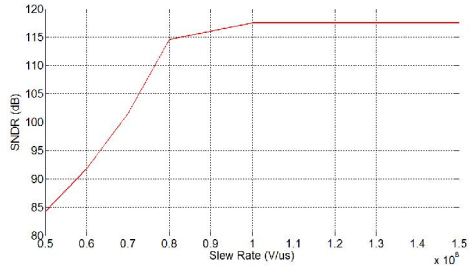


(b)

Figure 4. SNDR vs. Op-Amp GBW for B-mode (a), CW-mode (b)



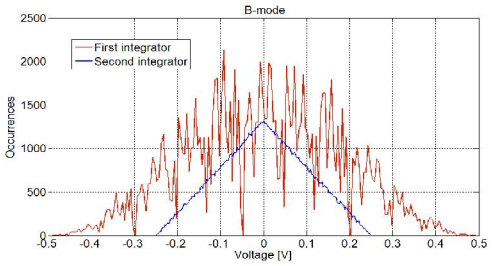
(a)



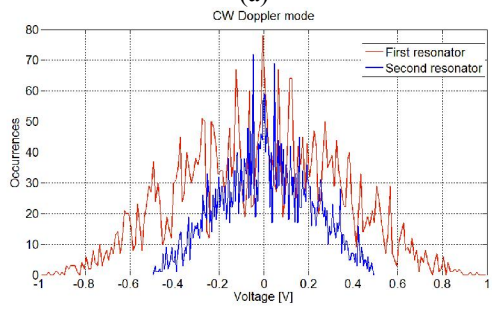
(b)

Figure 5. SNDR vs. Op-Amp Slew Rate of first integrator/resonator for B-mode (a), CW-mode (b)

Output swings of the integrators/resonators are also investigated, and as shown in Figure 6, the proposed dual mode re-configurable DSM has a low output swing which makes the structure suitable for low supply voltage circuit integration.



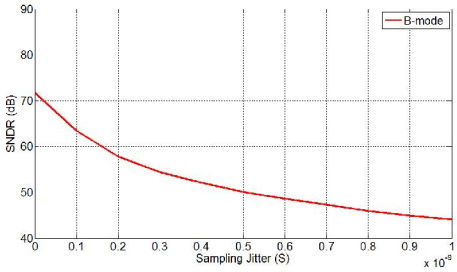
(a)



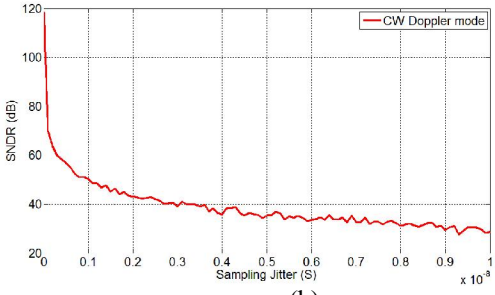
(b)

Figure 6. Output histogram of integrators/resonators for B-mode (a), CW-mode (b)

Even though in the system-level simulations it was designed that an ideal external clock signal is used to control the switched capacitor circuits, in circuit level clock jitter effect lead to the decrease of SNDR[7]. The sampling jitter effect on the modulator SNDR is plotted in Figure 7.



(a)



(b)

Figure 7. SNDR vs. Sampling Jitter for B-mode (a), CW-mode (b)

The root locus analysis method has been used to find the optimal coefficients for the maximum SNDR while maintaining stability. The selected coefficients are a1 = 1, a2 = 1, a3 = 2, b1 =1, c1 = 1and c2 = 2 for the modulator which is illustrated in Figure 2. When the simulation results for the conventional band pass DSM is compared with the results for the proposed DSM a vivid performance improvement is seen.

4. Simulation Results

System level simulations for the designed dual mode reconfigurable DSM were performed using MATLAB Simulink^{TM}. The output power spectral density in B-mode is shown in Figure 8. In B- mode the sampling frequency is 200 MHz and the input signal is 3.5 MHz/0.9 V. A sampling frequency of 200 MHz and an input signal of 3.5 MHz/0.9 V have been used in CW Doppler mode as shown in Figure 9. The MATLAB simulations show that a SNDR of 71.7/115 dB can be achieved in B and CW modes respectively. Figure 10 presents the simulated SNDR versus input signal amplitude, for B-mode and CW Doppler modes. Simulation results show a peak SNDR of 71.7 dB@-3dBFS in B-mode and a peak SNDR of 117 dB@ -3dBFS in CW Doppler mode. The overall performance of the proposed dual mode reconfigurable DSM is summarized in Table 2.

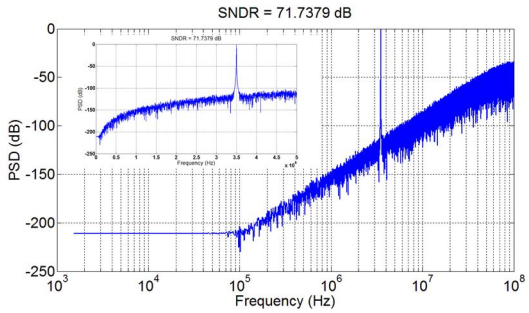


Figure 8: Power Spectral Density for B-mode operation @ -3dBFS and 3.5 MHz input signal

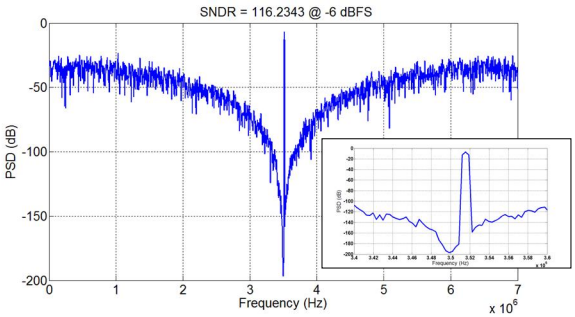


Figure 9. Power Spectral Density for CW Doppler mode operation @ -6 dBFS and 3.5 MHz input signal

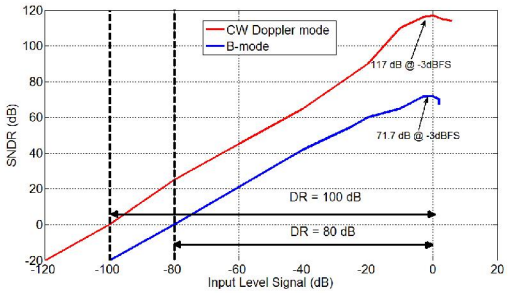


Figure 10. SNDR vs. input level signal and dynamic range curve

Table 2: State of the art multi mode DSM performance summary

Ref	Structure	OSR	Signal bandwidth (kHz)	Sampling frequency (MHz)	SNDR (dB)	DR (dB)
[2]	4th order band pass	128	200	51.2	78	-
[3]	3rd order LPM	LPDSM : 20 BPDSM : 500	LPDSM: 5 MHz BPDSM : 200 KHz	LPDSM : 200 MHz BPDSM : 200 MHz	LPDSM : 56.7 BPDSM : 115	LPDSM : 62.5 BPDSM : 115
This work	LPDSM and modified 4th BPDSM with	LPDSM : 20 BPDSM : 500	LPDSM: 5 MHz BPDSM : 200 KHz	LPDSM : 200 MHz BPDSM : 200 MHz	LPDSM :71.7 BPDSM :117	LPDSM : 80 BPDSM : 100

5. Conclusion

A novel dual mode reconfigurable DSM with a tunable NTF is presented and explored for multi-mode ultrasonic systems. The most important feature of the proposed modulator is the flexibility and re-configurability. This characteristic is achieved without the use of cascade loops and multi-bit ADC. On the other hand NSE technique is used. This approach is a best way to increase the SNDR without using the active blocks. The same approach is used for CW Doppler mode, As well. In this case increasing the performance can be done by Z^{-2}. Since the core of integrator/resonator is an OTA, it is simple to use the same OTA for all the modes. Since the proposed architecture is simple, it is potentially for low power and small chip area implementations, as well as development of ultrasonic receivers.

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10/5/2012

Effects of Plant Extracts on Salivary Gland Chromosomes of House fly (*Musca domestica* L.)

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Abstract: Plant extracts are the best alternatives of chemical insecticides and can save the plant species as well as the world's environments. For releasing the plant materials as a botanical insecticide proper plant species and plant parts screening and identifying the mode of action on insect is essential. For this purpose, different plant parts of *Calotropis procera, Derris indica, Ipomoea quamoclit, Piper longum* and *Polygonum hydropiper* and salivary gland chromosomes of *Musca domestica* L. (Diptera: Muscidae) had selected for investigation. Dose mortality test result showed the intensity of activity in a descending order as *I. quamoclit* (911.83 ppm) > *P. hydropiper* (1205.47 ppm) > *C. procera* (5410.82 ppm) > *D. indica* (5519.30 ppm) > *P. longum* (10737.43 ppm) and in all the cases significant differences were found for dose differences. The test results demonstrated potential effects on salivary gland chromosomes where highly effective plant extracts showed more compact chromosomes than lower effective extracts *i.e.* the compactness of chromosomes depended upon the activities of the plant extracts.
[Zakaria HP, Marchalina B, Motiur R, Nurul I, Faruq G. **Effects of Plant Extracts on Salivary Gland Chromosomes of House fly (*Musca domestica* L.).** *Life Sci J* 2012;9(4):1930-1935] (ISSN:1097-8135). http://www.lifesciencesite.com. 292

Keywords: Chromosomes; Diptera; *Musca domestica*; Plant extracts; Salivary gland

1. Introduction

Botanical insecticides are an interesting alternative for insect pest control but only a few from more than 2,50,000 plant species on our planet have been properly evaluated for this purpose. Moreover, insecticides from plant extracts were considered as the suitable alternatives of chemical insecticides for its pest specific and biodegradable nature (Periera and wohlgemuth, 1982). They are only alternatives that may be used in integrated pest management programs together with other available control measures. There are a lot of publications with lists of plants which have insecticidal properties. More than 500 plants grows or available in Bangladesh and have been reported to possess medicinal properties and enumerated in the literature of indigenous drugs (Ghani, 1998). In this proposition *Calotropis procera, Derris indica, Ipomoea quamoclit, Piper longum* and *Polygonum hydropiper* have been selected for investigation. The housefly *Musca domestica* was chosen for cyto-genetical studies because it is easy to rear, it has a short development time (about 12 days at 26^0c) and it has economic and medical significance. It was reported that housefly could transmit more than 20 humans and animal diseases (Hicking, 1974). Moreover, the strategy taken for housefly as a model system to investigate genetic materials might also be applied to other species (Wagoner et al., 1973). In addition, salivary gland chromosomes were investigated because it is a special type of chromosomes present in many larval tissue as well as some adult tissues of insects which belong to the family Diptera. These chromosomes are characterized by nuclei with gait chromosomes which are distinct and easily be observed. As a result, the effects of plant extracts were clearly identified. The increasing interest to observe the effects of plant extracts at chromosome level which may lead to identify exact plants part for use as insecticides for other insects were the main objective of this investigation.

2. Material and methods

In order to find useful compounds in the shortest possible time, careful selection of plant materials is obviously very important. By way of illustration, plants used in traditional medicine are more likely to provide pharmacologically active compounds (Huxtable, 1992), similarly folk use of toxic plants would be taken with desirable output. In this investigation, root bark of *C. procera*, seeds of *D. indica*, the whole plants of *I. quamoclit*, *P. longum*, and *P. hydropiper* were collected and only chloroform was selected to extract all the selected and collected plant materials separately. In addition, to carry on insecticidal test we have able to produce a consistent quality insect at an economical cost by rearing the housefly according to the methods described by Morgan (1980, 1981) and Morgan and Patterson (1975). For testing the insecticidal properties of the extracts 3rd instar larvae of the housefly *M. domstica* were selected. To test the efficacy of chloroform extracts of the five selected plants against cultured

larvae of *M. domestica* same aged population were used and provided the foods as a unit of volume by volume measurement. The food was prepared with 6.25gm of wheat bran and 0.5gm of milk powder (Red cow) and 12.75 ml of water as a total of 19.5 gm. For *C. procera* seed extract 500 mg was dissolved in 1 ml solvent (Chloroform) and mixed with the prepared food. To have a dose-effect to calculate toxicity by Probit analysis, 4 others successive doses were prepared and applied with 0.5 serial dilutions. The bioassay experiments were always done in 3 replications and a control treatment was also set simultaneously. So, the doses for *C. procera* were 26,641-, 12,820.5-, 6,410.25-, 3205.12 and 1,602.56 ppm in v/v state. In the same way for *D. Indica* the doses were 120820.5-, 6,410.25-, 3,205.12-, 1,602.56 and 801.28 ppm in v/v state. For *I. quamoclit* the doses in the same manner were 26,64-, 12,820.5-, 6,410.25-, 3,205.12 and 1,602.56 ppm in v/v state. For *P. longum* 300 mg of extract was added to 19.5g of food medium and thus the doses were 15,384.62-, 7,692.31-, 3,846.15-, 1,923.08 and 961.54 ppm in v/v state. For *P. hydropiper* the doses level were 12,820.5-, 6,410.25-, 3,205.12- and 1,602.56 ppm in v/v state. The recorded mortality of the larvae was corrected by using the Abbott's formula (Abbott, 1925):

$$pr = \frac{Po - pc}{100 - Pc} \times 100$$

Where,
Pr = Corrected mortality (%)
Po = Observed mortality (%)
Pc = Control mortality (%)
Then this percentage mortality was subjected to statistical analysis according to Finney (1947) and Busvine (1971).

A detailed protocol for making spread preparations of xenopus GV contents for the study of lampbrush chromosomes and other nuclear organelles is now well known to all. The technique which was used to study salivary gland chromosomes were the modified procedure from a laboratory procedure by Jannet et al., (2000) formerly of queen's university. Kingston, Ontario.

3. Results and discussion

These studies have pointed numerous plant species possessing potentiality for pest controlling properties under laboratory conditions, but the steps from the laboratory to the field elements have many contenders. Unfortunately, efficacy against pests is only one of a number of important criteria that need to be met for a plant extract or derivative to move successfully toward commercialization and use (Isman, 1995). In the present investigation the extracts of *C. procara, D. Indica, I. quamoclit, P. longum* and *p. hydropiper* were collected and biological activity of them were assessed to find out their potentiality for using in the future health and agriculture sectors. Dose mortality tests and tests for effect on chromosome have been done with the crude extracts. The data of all the five cases were analyzed and the results were illustrated in Table 1. and Table 2. as below:

Table 1. LD_{50} values and 95% confidence limits of dose mortality experiments of *1. quamocit, P. hydropiper, C. procera, D. indica* and *P. longum* crude extracts against *M. domestica* larvae with 24 h. of exposure

Plant organ	Time	LD_{50} value (ppm)	95% confidence limits	
			Upper	Lower
I. quamoclit	24h	911.83	54.02	15389.33
p. hydropiper	24h	1205.47	431.16	3370.36
C. Procera	24h	5410.82	2922.64	10017.29
D. indica	24h	5519.30	2586.41	11778.01
P. longam	24h	10737.43	5362.74	21498.79

Table 2. Regression equation and χ^2 value of dose mortality experiments of *1. quamocit, P. hydropiper, C. procera, D. indica* and *P. longum* crude extracts against *M. domestica* larvae with 24 h. of exposure

Plant organ	Regression equations	χ^2 value (df)
I. quamoclit	Y = 3.91+0.36X	4.33 (3df)
p. hydropiper	Y = 1.85+1.02X	0.82(2df)
C. Procera	Y= 2.09+0.77X	5.23 (3df)
D. indica	Y =2.37+0.70X	0.78(3df)
P. longam	Y = 1.07+0.97X	1.00 (3df)

3.1 Dose-mortality assessment

The dose mortality results of crude extracts against larvae of *M. domestica* were found promising. All the chloroform extracts of selected five plant materials had been found strongly effective against the 3rd instar larvae of *M. domestica*.

The LD_{50} value for *C. procera* extract was 5410.82 ppm for 24h experiments, while the regression equations were as Y= 2.09 + 0.77 X; the χ^2 value was 5.23 for 3 degrees of freedom and the 95% confidence limits were 2922.64 to 10017.29 for 24h. The LD_{50} value for *D. indica* extract was 5519.30 ppm for 24h of exposures and the regression equations were Y= 2.37 + 0.70 X; the χ^2 value was 0.78 for 3 degrees of freedom and the 95% confidence limits were 2586.41 to 11778.01 for 24h. The LD_{50} value for *I. quamoclit* extract was 911.83 ppm for 24h treatments where the regression equations were Y= 3.91 + 0.36 X; the χ^2 value was 4.33 for 3 degrees of freedom and the 95% confidence limits were 54.02 to 15389.33 for 24h. The LD_{50} value for *P. longum* extract was 10737.43 for 24h of exposures and the regression equation were Y= 1.07 + 0.97 X; the χ^2 value was 1.00 for 3 degree of freedom and the 95% confidence limits were 5362.74 to 21498.79 ppm for 24h. The LD_{50} value for *P. hydropiper* extract was

1205.47 ppm for 24h treatments while the regression equation were Y= 1.85 + 1.02 X; the χ^2 value was 0.82 for 2 degrees of freedom and the 95% confidence limits were 431.16 to 3370.36 ppm for 24h. According to the intensity of activity of the plant extracts against 3rd instar larvae the plant could be arranged in a descending order as *I. quamoclit* (911.83 ppm) > *P. hydropiper* (1205.47 ppm)> *C. procera* (5410.82 ppm) > *D. indica* (5519.30 ppm) > *P. longum* (10737.43 ppm) and in all the observations significant differences were found in case of dose differences. A number of investigators isolated, identified and screened chemical compounds from leaves and seeds of many botanical families for insect feeding deterrence and growth inhibition as toxicant (Jacobson et al., 1975; Bernays and Chapman, 1977; Doskotch et al., 1977; Carpenter et al., 1979; Warthen, 1979; Jurd and Manners, 1980; Menn, 1980; Ho et al., 1995). From the academic point of view, plants were represented as a vast storehouse of potential and useful natural products and many laboratories worldwide have screened thousands of species of higher plants for pharmaceuticals and pest control products (Van Beek and Breteler, 1993; Gonzales-Coloma et al., 1994a, b; Addor, 1995; Cornelius et al., 1995; Assabgui et al., 1997; Blaske and Hertel, 2001). However, potentials of the test plants were being contributed here mainly based on dose mortality and efficacy on insect chromosomes.

3.2 Salivary gland chromosome observation

In this investigation we observed the effects of plant extracts on salivary gland chromosomes of 3rd instar larva of *M. domestica* and tried to identify the changes at chromosome level demonstrated by death and live larva after the treatment. The effects induced by botanicals on the polytene chromosomes of salivary gland of death 3rd instar larva were both physiological and structural in nature. Among the physiological effects, the most common was chromosome stickiness; often the chromosomes completely lost their individuality and appeared clumped. The structural effects were of various kinds. For example, some chromosomes showed with unequal lengths and weak points, some chromosome showed breakage of chromosomal arms. The effects of the test material were also observed in the breakage and fusion of the chromosomes. Occasionally, due to the absence of fusion, the broken pieces of chromosome were stayed independent. The structure of chromosomes treated with different concentrations of effective extracts were dignified the potentials towards their further use for the control of crop pests, since the chromosomes were being destroyed by the biodegradable properties of plant and caused death of the insects.

The 3rd instar larva of *M. domestica* which lived after the treatment with test material showed compact chromosomes then the dead larva. Moreover, the compactness of chromosomes of live 3rd instar larvae depended on the efficacy of plant extracts *i.e.* highly effective plant extracts showed more compact chromosomes than lower effective extract. On the other hand, in case of dead 3rd instar larva opposite scenario were observed *i.e.* highly effective extracts showed less compact chromosomes than the lower effective extracts. The results were illustrated in Figure 2a., 2b., 3a. and Figure 3b. where the chromosomes represented the compactness depending upon the activity of plant extracts on death and lived 3rd intar larva compare to the normal structure presented on Figure 1.

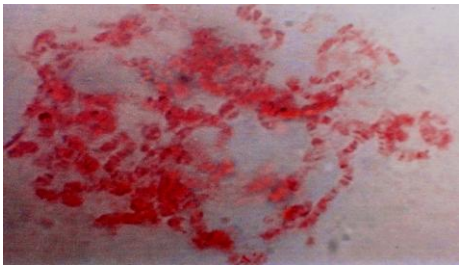
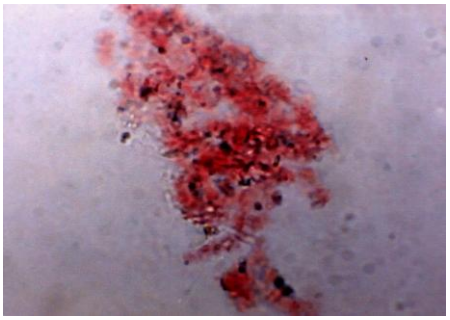
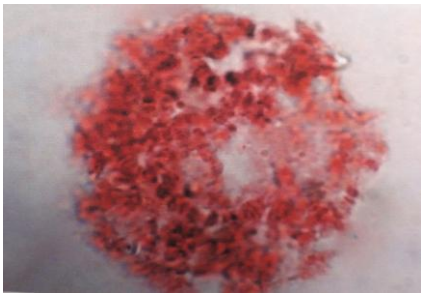


Figure 1. Polytene chromosomes of *Musca domestica* L.

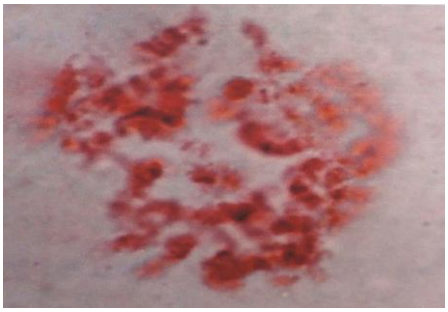
The genus *Musca* possess domestica complex, along with several species. This complex contains several integrating forms which differ according to their bio-geographical distribution, morphological characteristics, chromosomal data and hybridization tests (Milani, 1975). Previously, Milani (1967) reported that several traits such as front width and abdominal color pattern were used for taxonomical purposes but they were modified by developmental conditions and by their genetic back grounds and thus they could not be used as unconditional criteria for species identification. So, he suggested that domestica complex might be an important criterion for species identification. In addition, previous reports on the cytology of *M. domestica* had represented the basic mitotic karyotype (Ramade, 1961; Boyes, 1967; Milani, 1967) and mapping of polytene chromosomes both in the salivary gland of larvae (Sharma et al., 1979) and in the bristle-forming cells of thoracic epidermis of the pupae (Kaur and Kaur, 1982). Unfortunately, none of the reports had indicated the full potentiality of cytogenetic analysis for these chromosomes.



a) Effect of *I. quamoclit*, Dose-1602.56 ppm on 3rd instar larvae, alive.

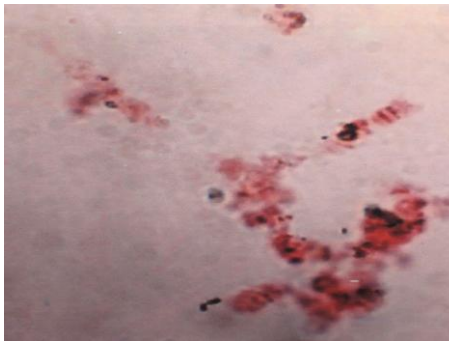


b) Effect of *P. hydropiper*, Dose-1602.56 ppm on 3rd instar larvae, alive.

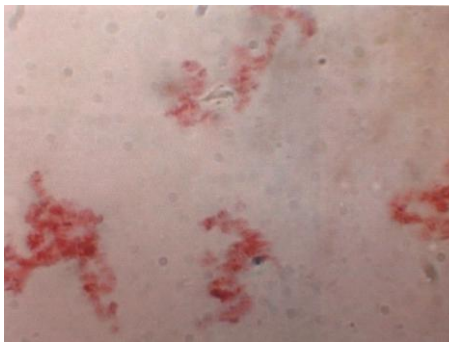


c) Effect of *C. procera*, Dose-1602.56 ppm on 3rd instar larvae, alive.

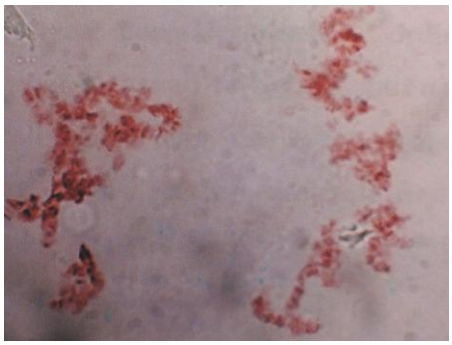
Figure 2a. Effect of plant extracts (*I. quamoclit, P. hydropiper, C. procera)* on salivary gland chromosomes on alive 3rd instar lavae of *Musca domestica* L.



d) Effect of *I. quamoclit*, Dose-1602.56 ppm on 3rd instar larvae, dead.



e) Effect of *P. hydropiper*, Dose-1602.56 ppm on 3rd instar larvae, dead.



f) Effect of *C. procera*, Dose-1602.56 ppm on 3rd instar larvae, dead.

Figure 2b. Effect of plant extracts (*I. quamoclit, P. hydropiper, C. procera)* on salivary gland chromosomes on dead 3rd instar lavae of *Musca domestica* L.

Later on, the main features of polytene chromosome were found in a standard European house fly culture, *M. domestica* by Sacca, 1967.

After this investigation, the polytene chromosomes of *M. domestica* were characterized by a clear banding pattern with high levels of ectopic pairing, break points and fragmentation (Vecchi and Rubini, 1973; Sharma et al., 1979). In the salivary gland chromosomes of *M. domestica* there were no evidence of the presence of a chromocentre binding together with non-homologous chromosomes at their centric hetro-chromatin region like *Drosophila*

melanogaster (Leffevre, 1976) and some species of chironomus (Sorsa, 1988); however, some ectopic pairing may exist. These important findings lead us for studying chromosomal changes due to the effects of botanicals. Moreover, the plant extracts were used because they have some phytochemical properties which effected directly to the chromosomes. The present study confirmed the results of the earlier studies (Puttaraju, 1988) which showed that thio-TEPA is one of the best chemicals to induce chromosomal mutation in the mosquito *Culex P. fatigans.* The different types of chromosomal abnormalities noted in this study were almost similar to those of *Aedes aegypti* and *Aedes asbopictus* (Puttaraju, 1988). However, the other aberrations such as the chromosome stickiness, clumping of chromosomes, the occurrence of centric and terminal breaks recorded in the present study had also been reported by Grover et al., (1973) in *Culex P. fatigans* due to effect of Apholate, Metapa and Hempa independently. The occurrence of laggards, stickiness, acentric and dicentric bridges and the formation of ring chromosomes in the present study had also been recorded by Rai (1963), Tadano and Kitzmiller (1969) and Grover et al., (1973) using other chemicals.

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Heat Tolerance in Tomato

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Abstract: High temperature is the prevalent characteristic of subtropical and tropical regions and higher temperature has become an important limiting element for tomato production and yield. Although, tomato crops exhibit anatomical, morphological, physiological, phonological, and molecular responses to tackle with heat stress, but their reproductive stage and yields are extremely influenced by the high temperature. Various QTL's, heat shock proteins, and genes were detected in terms of heat resistance in tomato however a few stress-resistant tomato varieties are developed through traditional breeding ways. This is because the complicatedness of heat resistant characteristics that may be handled by the activity of different genes whose expression patterns are induced by several environmental elements. Furthermore, resistance to heat stress is developmentally regulated, stage-special event and resistance at one step of crop improvement is sometimes not related to resistance at other growth steps. Therefore, to produce of tomato under heat stress successfully, resistance may be required at whole imperative steps of crop growth such as germination of seed, reproductive and vegetative steps. Recently, various molecular and classical markers for heat resistance were screened and MAS (Marker-Assisted Selection) may be applied to improve tolerance of tomato to heat stress via biotechnological and molecular methods. To study heat tolerance in tomato appropriately, this paper will be an appropriate material and will assist for future studies.
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Key Words: Tomato; Temperature; Heat tolerant

1. Introduction

Tomato (*Lycopersicon esculentum* Mill.) is usually a fruit but it is sometimes called as a vegetable and vastly grown in the world and forms an imperative industry for agriculture. Throughout the world, after potato, it is mostly used as a second vegetable (FAOSTAT, 2005) and is definitely the most prominent garden plant. Tomatoes are consumed straightly as a raw vegetable or combined with other various food items such as tomatoes that are completely peeled, paste, diced products and diverse sorts of juice, soups and sauces (Foolad, 2007). In various parts of the world, tomatoes are an imperative section of a variant and balanced diet (Willcox et al., 2003). Tomato does not have a higher rate in nutrition value; one average tomato that is fresh (135gm) prepares vitamin C (47 percent RDA), vitamin A (22 percent RDA), and 25 calories energy. In the USA diet, for instance, tomato is the first among all vegetables and fruits as a rich origin of minerals and vitamins (Rick, 1980) and antioxidants that are phenolic (Vinson et al., 1998). Moreover, tomatoes which are fresh are the wealthy origins of the antioxidant lycopene (Nguyen and Schwartz, 1999) that preserves cells of plants from oxidants which have been related to cancer (Giovannucci, 1999).

Tomato crops are developed in vast sorts of environments with diverse climatic in the universe from the tropical areas to some degrees of the Arctic Circle. The biggest tomato producing nations involve China, USA, India, Turkey, Egypt, Italy, Spain, Brazil, Iran, Mexico, Canada, Greece and Russia (FAOSTAT, 2005). Although tomato has a good potential to be cultivated every location in the universe but it confronts lots of abiotic stress and high temperature is a crucial problem nowadays. According to the Intergovernmental Panel on Climatic Change (IPCC), in each decade, worldwide average temperature will be enhanced by 0.3°C (Jones et al., 1999) and reached to around 1°C and 3°C higher than the current temperature by the years of 2025 and 2100, respectively and led to warming of the globe. AVDRC proposed that "in environments that are tropical, high temperature situations are sometimes common during the growing season and with climatic alteration, tomato plants in this region will be issued to enhanced temperature stress". Climatic analysis in areas in which tomato is grown proposes that temperatures are enhancing and the intensity and quantity of above-normal temperature will rise in the next decades (Bell et al., 2000). In this condition, tomato production that is resistant to heat is extremely required.

Heat stress is identified as the enhancement in temperature below a threshold level for some time is enough to prompt irreversible harm to crop growth and improvement. As a whole, a temporary increase in temperature 10°–15°C above normal, can lead to heat stress or shock (Wahid et al., 2007). Heat resistance refers to the capability of the crop to develop and create economic production in high temperatures.

However, heat stress because of high temperatures is an important problem to plant yield throughout the world (Hall, 2001). Heat stress has been considered as one of the most imperative prompt of alteration in biochemical, morphology, and physiology facets of crops that decreases normal growth in diverse plants, involving tomato (Thomas and Prasad, 2003; Wahid et al., 2007). When temperature is up, injury of cellules and death may happen within minutes that could be related to a disturbance of cellular structure (Schoffl et al., 1999). When temperature is optimum, damages or death may happen after long term exposure. Direct damages can be happened in high temperatures such as denaturation and aggregation of protein, and enhanced membrane lipids liquidity. Indirect or slower heat damages can be occurred in terms of enzymes inactivation in chloroplast and mitochondria, limitation in of protein production, degradation of protein and loss of integrity of membrane (Howarth, 2005). Furthermore, in tomato, high temperatures can lead to remarkable losses in its yield because of the diminished fruit set, small size, and fruits low quality (Stevens and Rudich, 1978). Heat stress before anthesis period is linked with developmental alterations in the anthers, especially disorders in epidermis and endothecium, shortage in stromium opening and poor formation of pollen (Sato et al., 2002). Hazra et al. (2007) clarified that, in tomato, the signals which cause fruit set failure at high temperatures involves bud drop, abnormal flower growth, poor pollen creation, poor inflorescence and viability, abortion of ovule and reduced carbohydrate existence. Moreover, marked prohibition of photosynthesis happens at temperatures above average, causing remarkable decrease in yield. Intense heat stress (45°C, 20 min) in tomato that is mature-green leads to programmed cell death (PCD) in terms of fragmentation of DNA, cytochrome c release, and activity of special enzymes which are caspase-like (Qu et al., 2009). It is properly detected that reproductive organs of crops have higher susceptibility to heat stress in comparison with vegetative organs (Ruan et al., 2010; Zinn et al., 2010).

Crop species have different susceptibility in reaction to abiotic stress. Medium temperature for growth and reproduction is markedly different between crop species and their lines (Bohnert et al., 1995). However, in some occasions, tomato crops demonstrate special HSPs for presenting resistance to heat stress. The resistance is dedicated by HSPs which causes to promoted physiological parameters including photosynthesis, better use of water and nutrient, and integrity of membrane (Camejo et al., 2005; Ahn and Zimmerman, 2006; Momcilovic and Ristic, 2007). Such developments cause tomato growth to be feasible in heat stress situation. However, all of the lines within species have different abilities in tolerance to the heat stress but there are severe differences between and within species that provide chances to promote tomato tolerance to heat stress via genetic instruments. Vegetative and reproductive developments in tomatoes are intensively manipulated by temperature or various environmental elements (Abdalla and Verkerk, 1968).

Various endeavors to promote tomato heat-resistant lines through traditional plant breeding methods have become prosperous (Ehlers and Hall, 1998; Camejo et al., 2005). But conventional breeding ways prepare low information on the locations of chromosomes that control complicated characteristics, the contemporary impacts of every chromosomal location on other characteristics (Epistasis, Pleiotropy or Linkage), or the genetic origin of such yield related characteristics due to dominance or over-dominance nature (Semel et al., 2006). If there is merely phenotype analysis, selection by conventional breeding instruments is hard when there are huge interactions between genotype and environment. There is no trustworthy field screening method that can be applied year by year or race by race (Kamel et al., 2010). Nevertheless, progressive methods of genetic engineering and molecular breeding have prepared further instruments that could be used to promote tomato with developed tolerance to heat. Molecular markers are used for both evaluating diversity of genes in germplasm collections and detecting varieties within population. Kantety et al. (1995) exhibited that ISSR method was capable to distinguish variations among inbred lines that are closely related and also individual population. Thin ISSR is very helpful to study genotypes of tomato. One technique to simplify polygenic characteristics' selection and breeding is to detect traits of interest through genetic markers. DNA markers have eased QTL (quantitative trait locus) mapping researches in populations which are segregated and exhibited certain genomic locations resulted from wild germplasm which have good potential to promote characteristics that are related to fruit (Gur and Zamir, 2004). Discovering of RAPD markers on tomato's genome map is advantageous to develop programs for breeding plants. It provides the easiest and most rapid technique for distinguishing a huge number of genome markers (Edwards et al., 1992). Michelmore et al. (1991) promoted the bulked segregant analysis of F_2 crops as an easier alternative method to analysis of isogenic line where the greatest and lowest extremes of the F_2 population are bulked for the improvement of RAPD and SSR molecular markers required for QTL-assisted selection. ISSR markers have already found to be highly variable, require less time, money and labor than other ways and have the capability to be inherited (Wolfe and Liston, 1998). However, to make sure that this strategy is

successful, endeavors of crop physiologists, breeders and biologists are crucial (Wahid et al., 2007).

This review paper concentrates on responses of tomato to high temperature stress at the whole organs of crop, cellular and sub-cellular levels, mechanisms and methods of resistance for genetic development of tomato with resistance to heat stress that will be a substantial material for more studies.

2. Threshold levels of heat-stress in tomato

A threshold temperature can be defined as value of daily average temperature in which a decrease in crop growth starts. Upper and lowermost developmental threshold temperatures have been detected for various crop genotypes in laboratory and field via controlled experiments. A less developmental threshold or an origin temperature is one below which growth of plant stops. At the same time, an overhead developmental threshold is the temperature above which growth ceases. Identifying a steady overhead threshold temperature is hard as the crop behavior may be different depending on other environmental situations (Miller et al., 2001). In tomato, for instance, when the environment temperature is higher than 35°C, its germination, seedling and vegetative stage, flowering and fruit set and ripening phase of fruit are inappropriately impacted (Miller et al., 2001). In general, basis and overhead threshold temperatures are varied in various crops which belong to diverse environments. However, Camejo et al. (2005) clarified that 30°C as overhead threshold temperature in emergence phase is harmful for tomato. Therefore, it is extremely favorable to estimate threshold temperatures for various steps of tomato crops to hinder harms by adverse temperatures in the crop ontogeny.

3. Reactions of tomato to heat stress

3.1. Anatomical and morphological reactions of tomato

In tropic climates, extra radiation and great temperatures are sometimes the most prohibiting elements that affect plant development and final yield. Greater temperatures can lead to remarkable pre- and post-harvest harms, involving burning of twigs and leaves, leaves sunburns, stems and branches, senility of leaf and abscission, prohibition in the development of shoot and root, discoloration of fruit, and diminished production (Guilioni et al., 1997; Ismail and Hall, 1999; Vollenweider and Gunthardt-Goerg, 2005). Abdelmageed and Gruda (2009) perceived that morphological traits including fruits and flowers number per crop, percentage of fruit fresh weight and set were diverse in heat resistant and heat susceptible tomato lines and the outcomes were differed in field and glasshouse environments in 11 lines of tomato. There were vast levels of differentiations between the diverse varieties in their flowers number in glasshouse. 'CLN-1-0-3' created the greatest flowers number in each plant, but 'Omdurman' and 'UC-82-B' generated the lowermost numbers. Such impressiveness of high temperature is basically because of the reduction in bud or flower production and drop of flower. This outcome was similar to that of El-Ahmadi and Stevens (1979) where heat susceptible cultivar created only dropped flowers at high temperature. Fruits number in each plant was high in 'CLN-16-B'and 'CLN-1-0-3' but 'CLN-26-D', 'Summerset' and 'UC-82-B' had an average fruits number per crop, but the other lines had a few fruits in glasshouse. In contrast, under open field environments, the fruits number was 'zero' in the heat susceptible line 'UC-82-B' and the heat resistant line 'Summerset' yielded the biggest fruits number. Concerning percentage of fruit set; there were marked variations between the various lines. 'Summerset' presented the greatest percentage of fruit set, but 'UC-82-B' the heat susceptible variety had no fruits. Other lines generated low and 'CLN-1-0-3' was average. Percentage of fruit set exhibited a similar result as in the fruits number per crop. Satti and Abdalla (1984) and Dane et al. (1991) perceived the same outcomes in their own trials. In fruit fresh weight estimation, 'Summerset' demonstrated the greatest fruit weight and this is followed by 'Drd-85-F_1', 'Omdurman', 'Kervic-F_1' and 'Maverick-F_1', while the other lines were either medium or low. This finding proves previous discoveries of El-Ahmadi and Stevens (1979), Sato et al. (2000) and Abdelmageed and Gruda (2009).

Under high temperatures, alterations in tomato anatomy were not explored in detail and a little information was accessible. In general, it is obvious that high temperature influences markedly plants anatomy at the tissue, cellular, and sub-cellular levels. The additional impacts of all these alterations in high temperature stress can lead to crop low growth and yield (Wahid et al., 2007). In all plant organs, there is a common trend of closure of stomata and loss of curtailed water, diminished size of cell, enhanced densities of stomata, and higher root and shoot's xylem vessels (Anon et al., 2004). The tomato flower happens in the three patterns that are organizational and flowers that are simple appear as well as branched and simple cymes. Flowers number that appears in inflorescence is based on environmental elements including temperature (David et al., 1996).

3.2. Reactions of tomato in reproductive stage

Camejo et al. (2005) claimed that the medium temperatures for tomato plantation during the photoperiod are between 25°C and 30°C and during the dark period is 20°C. However, only 2-4°C rise in optimal temperature improperly influenced gamete development and prohibited the capability of pollinated flowers into seeded fruits and therefore diminished crops yields (Peet et al., 1997; Sato et al., 2001; Firon et al., 2006). Recently, Miller et al. (2001)

clarified that heat stress higher than 35°C became a major blockade element for germination of seed, vegetative growth and seedling, flowering stage, fruit set and ripening in tomato. Peet et al. (1997) claimed that heat stress inappropriately impacts meiosis and germination in pollen, development of ovule and improvement and viability of embryo. Foolad (2005) also mentioned that meiosis in male and female organs, germination of pollen and development of pollen tube, viability of ovule, style and stigmatic situations, pollen grains number that are maintained by the stigma, fertilization and post-fertilization trends, endosperm development, pre-embryo and fertilized embryo influenced improperly by high temperature in tomato. Moreover, the most outstanding impact of high temperatures on reproductive stages in tomato is the production of an exserted style (i.e., stigma is elongated beyond the anther cone), that may hinder self-pollination. Critical period of susceptibility to optimize high temperature (32°/26°C) is 7 to 15 days before anthesis (Sato et al., 2002). High temperatures also participated in development of floral bud which caused to abortion of flower. Pollen grains numbers that created by the heat resistant varieties stayed more than susceptible lines (Abdelmageed et al., 2003).

Pollen viability and production are so susceptible to small rises in temperature higher than the medium (Thomas and Prasad, 2003). A decrease in generation of pollen, release, viability, germination capability, fruit set, and production in tomato at temperatures above medium levels has mentioned by various scientists (Peet et al., 1997; Sato et al., 2000; Pressman et al., 2002). Pollen viability germination and percentage capability decreased markedly in moderate and high temperature environments. It was mentioned that pollen grains which are germinated diminished 13 times when the temperature enhanced gradually from optimum (Pressman et al., 2002). Both the pollen germination and release capability in high temperature are imperative elements to identify the capability of fruit set. This is because a fail in pollen germination or release can hinder creation of fruit set even the pollen is viable (Sato et al., 2000). Pollination, growth of pollen tube and fertilization, and pollen germination must take place prosperously for good fruit set (Kinet and Peet, 1997). The fruit set decline under optimum high temperature stress is mainly because of a decrease in release and viability of pollen but not in generation of pollen (Sato et al., 2006) formerly, Sato et al. (2000) did not detect marked linkage among produced pollen grains number and fruit set. Eventually, they finalized that both pollen release and viability are the most imperative elements that effect fruit set in high temperature condition. Pressman et al. (2002) claimed that the impact of heat stress on viability of pollen was linked with metabolism of carbohydrate during growth of anther. Under medium temperature, in pollen, concentration of soluble sugar enhanced slightly. Consistent high temperature hindered concentration of starch to be increased and caused soluble sugar content in mature pollen to be reduced. These probably lead to a reduction in livability of pollen. Poor fruit set has also been related to low amount of carbohydrates and growth regulators distributed in sink tissues of plant at high temperature (Kinet and Peet, 1997). Growth chamber and trainings of greenhouse propose that when flowers are first visible high temperature is most detrimental and susceptibility goes on for 10 to 15 days. Release of pollen and capability of germination can be a suitable standard for identifying crop reaction to high temperature and this is applied as a standard for selection in programs for breeding to choose heat resistant varieties (Comlekcioglu and Soylu, 2010).

3.3. Phenological reactions of tomato

Heat stress can induce changes in crops directly such as existing physiological trends or indirect like changes of developmental patterns. These reactions may be different in one phenological step to one other (Weaich et al., 1996). Moreover, stress resistance is adjusted extensionally, stage-special event; resistance at one step of crop growth cannot be linked to resistance at other growth steps. For instance, in tomato, although crops are susceptible to high temperatures at entire ontogeny of crop, fruit set and flowering are highly susceptible steps; fruit set is slightly influenced by temperatures above 20°/26° C day/night and is intensely impacted by above 26°/35°C (Berry and Rafique-Uddin, 1988). Perception of alterations in phenology of crop in reaction to heat stress can disclose a proper understanding of the crop and stress atmosphere interactions. Diverse phonological steps are different in their susceptibility to high temperature, but this is based on species and varieties (Wollenweber et al., 2003; Howarth, 2005). In the growth step, when crop is under stress the intensity of feasible harms is experienced by plant. It is unknown whether damaging influences of heat episodes are cumulative that occur at various developmental steps (Wollenweber et al., 2003).

Alsadon et al. (2006) perceived remarkable variations in heat resistance in twenty tomato lines at diverse steps of growth. At the vegetative step, the remarkable greatest average values for EC (electrical conductivity) were detected in Edkawi variety (63.12 µmho/cm) and this is followed by Pakmore VF, Castle Rock, Chico, Pakmore and Tnshet Star, respectively. They also identified that these lines had higher susceptibility to heat stress at vegetative step, in contrast, the marked lowermost average value for EC was distinguished in Pearson, Super Strain-B, Queen, VFN-8 and Strain-B varieties, which indicate that

these lines had the best function and were resistant to heat stress at vegetative step. The other nine genotypes exhibited average mean values for EC were detected to be mildly resistant to heat stress. In the next step, heat susceptible varieties presented the greatest average values and heat resistant varieties had the lowermost average values. The rest varieties, that demonstrated average values for EC, were noticed to be moderately resistant to heat stress. In the fruiting step, those varieties that had the greatest EC average values were detected to be rather susceptible to heat stress. In contrast, those varieties that had the lowermost EC values were noticed as the best heat resistant varieties and the rest varieties, that showed medium values, were noticed to be moderately resistant to heat stress. The same findings were perceived by Saadella et al. (1990), Kuo et al. (1993) and Ismail and Hall (1999) in cowpea and wheat.

3.4. Physiological reactions of tomato

Physiologists and geneticists express that most stress resistant characteristics are complicated and handled by rather than one gene and impacted highly by different environments (Blum, 1988). In tomato crop water relations, concentration of compatible osmolytes, cell membrane thermo integrity, photosynthesis, and alterations in hormones are important physiological reactions to heat stress.

3.4.1. Waters relations

Crop water situation is an imperative variable under changing environmental temperatures (Mazorra et al., 2002). Heat stress, in tomato, disturbed hydraulic conductivity of root and the leaf water relationships (Morales et al., 2003). During daytime, increased transpiration affects water deficit in crops, prompting a reduction in potentiality of water and causing disturbance of lots of physiological parameters (Tsukaguchi et al., 2003). High temperatures can prompt crops to face more loss of water during daytime compared to nighttime (Wahid et al., 2007).

3.4.2. Compatible osmolytes accumulation

An important adaptive system in lots of crops developed under abiotic stresses, involving salinity, lack of water and severe temperatures, is cumulating of organic compounds that have low molecular mass, commonly called compatible osmolytes (Hare et al., 1998; Sakamoto and Murata, 2002). Under stress, various crop species may cumulate different varieties of osmolytes including sugar alcohols (polyols), and sugars, quaternary and tertiary ammonium, proline, and tertiary sulphonium compounds (Sairam and Tyagi, 2004). In high temperature conditions, fruit set reduced in tomato crops because of the disturbance in metabolism of sugar and transport of proline during the narrow window of male reproductive growth (Sato et al., 2006). To summarize, due to remarkable functions of osmolytes in reaction to environmental stresses in crops, (e.g., heat) resistance may be increased by enhanced cumulating of solutes that are compatible via conventional crop breeding, MAS (marker-assisted selection) or GE (genetic engineering) techniques (Ashraf and Foolad, 2007).

3.4.3. Photosynthesis

Changes in several photosynthetic approaches in heat stress are proper indexes of thermo resistance of the crop as they are correlated with growth. When photosynthesis is limited, crop development can be prohibited at high temperatures. Photochemical responses in thylakoid lamellae and metabolism of carbon in chloroplast stroma have been proposed as the primitive areas of damage at high temperatures (Wise et al., 2004). Rising leaf temperatures and density of photosynthetic photon flux affect thermo resistance adjustments of PSII, displaying their potentials to optimize photosynthesis in different environmental situations since the overhead thermal ranges do not exceed (Salvucci and Crafts-Brandner, 2004; Marchand et al., 2005). In tomato varieties that had different capacities to thermo resistance in enhanced chlorophyll a: b proportion and diminished chlorophyll, carotenoids proportion were perceived in the resistant varieties in high temperatures, showing that these alterations were linked to tomato's thermo resistance (Camejo et al., 2005; Wahid and Ghazanfar, 2006). Moreover, in high temperatures, reduction in chlorophyll a and b was rather proved in progressed in comparison with developing leaves (Karim et al., 1997, 1999). These impacts on photosynthetic machinery or chlorophyll were proposed to be related to the creation of active oxygen species (Camejo et al., 2006; Guo et al., 2006). PSII is intensely thermo labile and its function is highly diminished or relatively halted in high temperatures (Bukhov et al., 1999; Camejo et al., 2005) that may be because of the exclusivity of thylakoid membranes wherever PSII is situated (Mcdonald and Paulsen, 1997). Heat shock decreases the number of photosynthetic pigments (Todorov et al., 2003), rubisco binding proteins (RBP), soluble proteins, and large and small subunits (SS) of rubisco in darkness but enhances them in light, exhibiting their functions as HSPs and chaperones (Kepova et al., 2005). Photosynthesis is detected as a physiological index that is highly susceptible to high temperatures, and a rise in the content of atmospheric CO_2 will make temperature to be enhanced and this may present a remarkable effect on the yield and distribution of lots of crop genotypes in the future (Wahid et al., 2007).

3.4.4. Cell membrane thermo stability

Maintained role of cellular membranes under stress is fundamental for trends like respiration and photosynthesis (Blum, 1988). Heat stress fastens the kinetic energy and motion of molecules in membranes

which lose chemical bonds in biological membranes molecules. This causes the biological membranes' lipid bilayer to be rather liquid by either proteins denaturation or a rise in fatty acids that are unsaturated (Savchenko et al., 2002). The stability and roles of biological membranes are susceptible to high temperature, as heat stress changes membrane proteins' tertiary and quaternary structures. These changes increase the penetrance of membranes, as obvious from enhanced loss of electrolytes. The enhanced solute leakage, as a symptom of diminished cell membrane thermo stability (CMT), has long been applied as an indirect estimation of heat-stress resistance in different crop species, involving potato and tomato (Chen et al., 1982), soybean (Martineau et al., 1979), cotton (Ashraf et al., 1994), cowpea (Ismail and Hall, 1999), wheat (Blum et al., 2001), sorghum (Marcum, 1998), and barley (Wahid and Shabbir, 2005).

3.4.5. Alterations in hormone

Crops have the capability to monitor and adjust to inappropriate environmental situations, although the adaptability or tolerance degree to special stresses differs between species and genotypes. Hormones have an imperative function in this issue. Under heat stress condition, hormonal homeostasis, stability, content, biosynthesis and compartmentalization are changed (Maestri et al., 2002). Stress hormones such as abscisic acid (ABA) and ethylene (C_2H_4), are included in the regulation of various physiological properties by performing as signal molecules. Diverse environmental stresses, such as high temperature, leads to enhanced ABA levels (Larkindale and Huang, 2005). Other researches also propose that various HSPs (e.g., HSP70) induction by ABA can be one system whereby it confers thermo resistance (Pareek et al., 1998). Another kind of hormone, brassinosteroids have already been presented to confer thermo resistance to oilseed rape (*Brassica napus*) and tomato, but not to cereals (Dhaubhadel et al., 1999). The potential functions of other phytohormones in tomato for thermo resistance are unclear yet.

3.5. Molecular reactions of tomato

Tomato exhibits molecular reactions to heat stress by creating heat shock proteins.

3.5.1. Heat shock proteins

Production and cumulating of special proteins are inquired when heat stress is rapid and these proteins are identified as HSPs. Enhanced production of HSPs happens when crops experience either sudden or slow rise in temperature (Nakamoto and Hiyama, 1999; Schoffl et al., 1999). HSPs induction seems to be a worldwide reaction to temperature stress, being perceived in various organisms from bacteria to human (Vierling, 1991). In semiarid and arid areas, crops can produce and cumulate remarkable levels of HSPs. Under cyclic or developmental control, certain HSPs can also be expressed in various cells (Hopf et al., 1992). In this regard, HSPs expression is limited to certain steps of growth, including germination, embryogenesis, growth of pollen, and maturation of fruit (Prasinos et al., 2005). Three sorts of proteins, as detected by molecular weight, account for most HSPs, viz., HSP90, HSP70 and less molecular weight proteins of 15–30 kDa. The ratios of these protein sorts vary between crop species (Feussner et al., 1997). In reaction to high temperatures, special HSPs have been distinguished in various crop species. For instance, HSP68, that is located in mitochondria and usually expressed incorporately, was detected to have enhanced expression under heat stress in barley, tomato, maize, potato, and soybean cells (Neumann et al., 1993). The gene for a nuclear-encoded HSP, Hsa32, that encode a 32 kDa protein, has been cloned in tomato (Liu et al., 2006). Immune-localization researches have identified that HSPs naturally link to specific cellular structures, like chloroplasts, cell wall, mitochondria, and ribosomes (Nieto-Sotelo et al., 2002; Yang et al., 2006). In tomato crops which suffer from heat stress, HSPs gather into a granular structure in the cytoplasm, probably preserving the protein bioproduction machinery (Miroshnichenko et al., 2005). Presence of HSPs can hinder other proteins denaturation that can be impacted by high temperature. The conformational dynamism and aggregate state of small HSPs may be vital for their roles in thermo-protection of crop cells from harmful influences of heat stress (Sch¨offl et al., 1999; Iba, 2002). The specific significance of small HSPs in crops is proposed by their abnormal diversity and abundance. The capability of small HSPs to gather into heat shock granules (HSGs) and their decomposition is a prerequisite for crops cells survival under constant stress environments at sub-lethal temperatures (Miroshnichenko et al., 2005). LMW-HSPs may have structural functions in stability of cell membrane. LMW-HSPs localization in chloroplast membranes proposed that these proteins preserved the PSII from improper impacts of heat stress and played a function in transport of photosynthetic electron (Barua et al., 2003). Recently, in tomato, dual function of LMW HSP21 has been expressed as conserving PSII from oxidative harm and taking part in fruit color alteration during storage at low temperatures (Neta-Sharir et al., 2005).

4. QTLs for heat tolerant in tomato

In tomato, while substantial endeavors have been appropriated to the detection and mapping of QTLs conferring resistance to environmental stresses including drought, low temperatures, and salinity less mapping study has been performed on high

temperatures (Foolad, 2005). Kadirvel (2010) showed an AVDRC report regarding two QTLs for heat resistant in tomato in chromosome 6 and 12. They exhibited that in Chromosome 6 the QTL is TES0111-SLM6-5; LOD score is 2.3; Variance10.6%; Additive influence 9.12; Donor CLN1621L and in chromosome 12 the QTL is SLM12-31-SLM12-50; LOD score is 2.6; Variance 13.0%; Additive influence 5.81; Donor CLN1621L. However, it seems that in tomato less improvement has been done in breeding and detection of QTLs for heat resistance than breeding for resistance to any other environmental stresses. This scenario proposed to a greater importance on breeding and detection of QTLs for heat resistance in tomato.

5. Molecular markers and classical genetic markers for heat tolerant tomato

To define, any characteristic which is expressed in multifold forms and inherited in a simple Mendelian fashion can be regarded and applied as a genetic marker. In tomato, there are more than 1300 morphological, physiological (e.g., male sterility, fruit abscission, fruit ripening), and disease tolerance genes (Kalloo, 1991) of them less than 400 have been mapped (Mutschler et al., 1987; Tanksley, 1993; Chetelat, 2002). The genetic markers' second generation, isozymes have been famous in 1970s and early 1980s. In tomato, 41 isozymic genes that correspond to 15 separate enzymatic responses have been detected, among them 36 have been mapped onto the 12 tomato chromosomes (Tanksley, 1993; Tanksley and Bernatzky, 1987). Despite their huge benefits, isozyme markers are so restricted in number and sometimes are not polymorphic between lines which are highly-related (Foolad et al., 1993; Tanksley and Orton, 1983).

With the arrival of DNA marker technique in 1980s (Botstein et al., 1980) and early 1990s, lots of restrictions linked to isozyme and morphological markers were conquered and genetic mapping entered to a new exciting and developed era with the promise to remarkably enhanced efficiency of crop breeding and genetics study. A DNA marker is usually branched from a small area of DNA that exhibits sequence polymorphism between individuals within or between species. DNA markers, that are phenotypically neutral and identically unrestricted in number, have permitted scanning of whole genome and assigning landmarks in high density on each chromosome in lots of crop species, involving tomato. During the past two decades, several sorts of molecular markers have been improved and progressed, like, but not restricted to, randomly amplified polymorphic DNAs (RAPDs) (Williams et al., 1990), simple sequence repeats (SSRs or microsatellites) (He et al., 2003; Tautz, 1989), amplified fragment length polymorphisms (AFLPs) (Vos et al., 1995), cleaved amplified polymorphic sequences (CAPS) (Konieczny and Ausubel, 1993), restriction fragment length polymorphisms (RFLPs) (Botstein et al., 1980), variable number of tandem repeats (VNTRs or minisatellites) (Jeffreys et al., 1985), sequence characterized amplified regions (SCARs) (Paran and Michelmore, 1993), expressed sequence tags (ESTs) (Adams et al., 1991), conserved ortholog sets (COS) (Fulton et al., 2002), single-strand conformation polymorphisms (SSCPs) (Orita et al., 1989), insertion deletions (InDels), and single nucleotide polymorphisms (SNPs) (Landegren et al., 1998). Kamel et al. (2010) secluded DNA from the two contrasting parents, LSSS1 as a heat resistant parent and Super Strain B as a heat susceptible parent, their subsequent F_1 and DNA bulks of the resistant and susceptible groups of F_2 segregating population were experimented against 10 preselected primers. All of the primers had polymorphisms with the genotypes studied. Primers A16 and Z13 presented 2 positive molecular markers that were only detected in the resistant parent (LSSS1), F_1 and the resistant F_2 bulk with 100 bp molecular sizes for primers A16 and 500 bp for primer Z13, while they were absent in the susceptible parent (Super Strain B) and the susceeptible F_2 bulk. In contrast, primers C02, C03, C05, C08, C14 and C15 demonstrated 8 molecular markers that were detected only in the susceptible F_2 bulk with 500 bp molecular size and 1500 bp for primer C02, 1750 bp and750 bp for primer C03, 2400 bp for primer C05, 550 bp for primer C08, 400 bp for primer C14 and 650 bp for primer C15. Zhang et al. (1994) and Mackay and Caligari (2000) claimed that analysis of RAPD that is mixed with BSA has been applied to screen for markers associated with genes of interest. Furthermore, Lin et al. (2006) detected 14 random amplified polymorphic DNA (RAPD) markers associated with heat resistance characteristics in tomatoes under heat stress with the use of the bulked segregant analysis. Various RAPD markers were unique to one special characteristic, and the rest were related to two characteristics while several markers demonstrate one polymorphic band and the others two polymorphic band. They also made use of 22 genetic markers as indirect selection linked to morphological traits and exhibited polymorphic bands, 13 were special to the susceptible parent i.e. C09 marker presented 1.5 kb for high number of flower and 1.0 kb for low number of fruit; D06 marker's 0.3 kb for high number of fruit and 1.0 kb for low number of flower; D11 marker's 0.3 kb for high number of flower and 0.3 kb for high fruit weight ; D12 marker's 1.0 kb for high number of flower; K06 marker's 1.1 kb for high number of flower and 1.3Kb for low number of fruit; K14 marker's 0.5 kb for high number of flower; P06 marker's 0.5 kb for high yield ; X01marker's 0.4 kb for high fruit weight and 0.7 kb for low number of

flower while 9 were specific to the resistant parent, like D08 marker's 1.0 kb for low number of flower; K02 marker's 1.6 kb for low number of flower and 0.5 kb for low number of fruit; K08 marker's 0.6 kb for low number of flower; K20 marker's 0.9 kb for low fruit weight; P08 marker's 1.2 kb for low number of flower and 0.8Kb for low yield; S13 marker's 1.2 kb for low weight of fruit and 1.3 kb for low weight of fruit. Kamel et al. (2010) also detected that 844A as a primer presented as positive molecular marker that was only distinguished in the resistant parent (LSSS1), F_1 and the resistant F_2 bulk with 650 bp molecular sizes. These findings were similar to those of Lin et al. (2010) who made use of 160 F_2 tomato crops segregating population to detect ISSR markers that were related to fruit characteristics in the tomato which exposed to high temperatures. Lin et al. (2010) screened 100 ISSR-PCR primers in the parents and 51 were identified to be polymorphic and of them 42 markers were segregated in a Mendelian fashion. The greatest (14) and lowermost (3) band numbers were created by primers 884 and 814, respectively. Lin et al. (2010) created 127 AFLP bands with fragment sizes that ranged from 50 to 500 bp with the use of 2 ECoRIMseI primer pair combinations. Of these, 50 polymorphic bands with an average number of 25 bands per primer pair were disclosed. Among detected 50 polymorphic fragments, 26 AFLP loci were identified to be associated with the genetic map. Mansour et al. (2009) detected differentiations in tomato varieties that were grown under heat stress and distinguished only 15 ISSR (814, 844A, 844B, 17898A, 17898B, 17899A, 17899B, HB8-15) and 20 RAPD (P1-20) primers that could distinguish intra-specific differentiations.

6. Marker-assisted selection (MAS) for heat tolerance in tomato

Marker-Assisted Selection is defined as a selection for a characteristic that depend on the genotype of an associated marker more than the characteristic itself. In essence, a marker that is associated can be applied as a criterion for selecting indirectly. The potential of MAS as an instrument for plant progress has been vastly investigated (Tanksley et al., 1989; Ribaut et al., 2002; Servin et al., 2004). Despite the utility of MAS for manipulating single-gene characteristics is straightforward and has been properly documented, its usefulness for complicated characteristics has also been distinguished (Stuber and Edward, 1986; Edwards and Johnson, 1994; Eathington et al., 1997; Schneider et al., 1997; Knapp, 1998; Toojinda et al., 1998; Stuber et al., 1999; Zhu et al., 1999; Hospital et al., 2000; Bouchez et al., 2002; Tar'an et al., 2003; Zhou et al., 2003; Jiang et al., 2004). However, it should be understood that MAS for polygenic characteristic progress is in its primary step and transitory process and the field is on the verge of producing convincing outcomes. Based on most simulation studies and empirical outcomes, it seems that characteristic heritability (h^2) and the number-of-QTLs are the most imperative elements impacting the impressiveness of MAS. MAS seems to be most useful for characteristics with low h^2 (0.1–0.3) and that are handled by rather small numbers of QTLs with huge impacts. In general, it is accepted that in most cases, for a trait that has a low-heritability, MAS will have better selection outcomes than selection of phenotypic (Stuber et al., 1999). Previous researches presented that heat resistance exhibits low heritability so that MAS can be applied for producing of heat resistant tomato. The stages are needed for the progress of markers to be used in MAS and various benefits of MAS are expressed in a review by Collard et al. (2005). Polymorphism level that is distinguished in molecular marker followed by the use of marker-assisted selection (MAS) has been certified to be proper alternative way of the agronomic selection, where it provides crop breeders with environmental-independent genetic markers for certain economic characteristics.

7. Development of heat-stress tolerance of tomato

Under agricultural systems, crops adaptation or their resistance to environmental stresses can be manipulated by different methods. Generally, the negative influences of abiotic stresses on agricultural yield are diminished by a composition of genetic development and cultural practices (Wahid et al., 2007). Genetic improvement involves progress of varieties that can resist to environmental stresses and generate economic yield. However, genetic progress of crops for stress resistance is an economically constant solution for generation of plants in stressful conditions (Blum, 1988). The relatives of the planted tomato have certified to be valuable origines of favorable genes for better genetic development (Rick, 1986) and prosperous inter-generic crosses have also been made among planted tomato and its nearly related Solanum species (Rick, 1960; Stoeva and zagorska, 1987; Wann and Johnson, 1963). Hybrid lines also seemed to have a proper performance consistency especially under stress than optimal growing environments (Yordanov, 1983). Both traditional and hybrid breeding ways, that benefit of additively acting genes and genetic interactions, should be useful in tomato heat resistance breeding. In favor of hybrid breeding, around 1/3 of the diallel hybrid progenies from the foregoing study had better fruit set than the better heat resistant parents (AVDRC, 1988). In another related study, crosses among heat resistant stocks were better in fruit setting capability and yield than their crosses with heat susceptible parents from the diallel test (Opena et al., 1987).

Adjustment or alterations in cultural practices, like the time of planting, crop density, and management of soil and irrigation can reduce stress impacts, for instance Hanna et al. (1997) identified development and yield reactions of heat resistant tomatoes to depth of transplant, daily irrigation time and color of polyethylene mulch. They cultivated five-week-old tomato seedlings to a depth of 15.0 cm and perceived remarkable rise in marketable yield but mean fruit mass was not affected by transplant depth, in contrast, crop dry mass was markedly enhanced by deeper transplanting. Irrigation in morning enhanced the marketable and total yields, average fruit mass in 1994, and dry mass of crop in 1995. White-surface mulch had the same impact on fruit mass and yield. They finalized that a rise in yield of heat resistant tomatoes can be performed by deeper transplanting, irrigation in morning, making use of white-surface polyethylene mulch, or a mixture of all three. Practically, to be prosperous in developing agricultural yield in stress conditions, both genetic progress and adjustment in cultural practices must be done simultaneously (Wahid et al., 2007). In below, a summary of such endeavors and improvements is discussed and demonstrated.

7.1. Traditional breeding strategies

Traditional breeding of heat resistant crops basically based on selection and a common technique of selecting crops for heat stress resistance has been to grow breeding materials in a hot target production environment and detect individuals/lines with higher yield (Ehlers and Hall, 1998). A proposed method has been detected in selection criteria during early steps of crop growth that can be linked to heat resistance during reproductive steps. In tomato, a potent positive correlation has been perceived between yield and fruit set under high temperature. Therefore, estimation of germplasm to detect sources of heat resistance has regularly been performed by screening for fruit set under high temperature (Berry and Rafique-Uddin, 1988). Among various other characteristics that are influenced by high temperature, the non-reproductive trends involve efficiency of photosynthesis, assimilate translocation, mesophyll tolerance, and cellular membranes disorganization (Chen et al., 1982). Breeding to develop such characteristics under high temperatures can lead to improvement of varieties with heat resistance approaches. Various other concerns when applying conventional breeding protocols to promote heat resistant crops are as follows:

-Detection of genetic resources with heat resistance approaches. In lots of crop species, for instance tomatoes and soybeans, restricted genetic differentiations exist within the cultivated species necessitating detection and use of wild accessions (Foolad, 2005).

-In different crop species, heat resistance is sometimes linked to various unfavorable agronomical or horticultural traits. In tomato, for instance, two unfavorable traits generally perceived in heat resistant lines are small fruit and limited foliar canopy (Scott et al., 1997).

-The small fruit production is mostly because of improper impacts of high temperature on the creation of auxins in the fruit and the poor canopy is for the sake of the highly reproductive nature of the heat resistant varieties (Scott et al., 1997).

Heat resistance breeding is yet in its primitive step and needs more attention in comparison with the past. Unfortunately, the literature has partially less information on breeding for heat resistance in various plant species. However, although all the complicatedness of heat resistance and hardships confronted during transfer of resistance, various heat resistant inbred lines and hybrid varieties with commercial acceptability have been improved and released in tomato (Scott et al., 1986; Scott et al., 1995).

7.2. Molecular and biotechnological strategies

Recent genetic researches and endeavors to convince high-temperature resistance of crops with the use of conventional protocols and transgenic attributes have vastly detected that crop heat stress resistance is a polygenic characteristic. Various ingredients of resistance, handled by various sets of genes, are vital for heat resistance at various steps of crop growth or in diverse tissues (Howarth, 2005; Bohnert et al., 2006). Therefore, the use of genetic stocks with diverse levels of heat resistance, co-segregation and correlation analyses, molecular biology methods and molecular markers to detect resistance, QTLs are promising attributes to dissect the genetic source of thermo-resistance (Maestri et al., 2002). Recently, biotechnology has assisted substantially to a proper understanding of the genetic source of heat resistance. For instance, various genes which are responsible for inducing the HSPs synthesis, have been detected and secluded in diverse crop species, involving maize and tomato (Liu et al., 2006; Sun et al., 2006; Momcilovic and Ristic, 2007). It has also been exhibited that tomato MT-sHSP has a molecular chaperone role in vitro (Liu and Shono, 1999) and recently it has been presented that MT-sHSP gene shows thermo-resistance in transformed tobacco with the tomato MT-sHSP gene (Sanmiya et al., 2004) at the crop level. Experimental data gained from transgenic, reverse-genetics and mutation attributes in non-cereal species prove causal involvement of HSPs in thermo-resistance in crops (Queitsch et al., 2000).

7.3. Induction of heat resistance of Tomato

Though genetic methods may be advantageous in the production of heat resistant crops,

it is probable that the recently produced crops are yielded low in comparison with near-isogenic heat susceptible crops. Therefore, substantial attention has been devoted to the induction of heat resistance in existing high-yielding varieties. Among the various techniques to achieve this target, foliar application of, or pre-sowing seed treatment with, low concentrations of inorganic salts, osmoprotectants, signaling molecules (e.g., growth hormones) and oxidants (e.g., H_2O_2) as well as preconditioning of crops are common attributes. Preconditioned tomato crops presented better osmotic adjustment by keeping the osmotic potential and stomatal conductance and better development than non-conditioned crops (Morales et al., 2003). Similarly, heat acclimated, in comparison with non-acclimated, turf grass leaves revealed higher thermo-stability, lower lipid peroxidation product malondialdehyde (MDA) and lower harm to chloroplast in exposure to heat stress (Xu et al., 2006). In tomato, it was exhibited that heat treatment administered to crops prior to chilling stress resulted in diminished incidence and intensity of chilling injury in fruit and other organs (Whitaker, 1994). Therefore, to promote heat resistant tomato crop, alternative methods to genetic means would involve pre-treatment of crops or seeds with heat stress or certain mineral or organic compounds. The success of such method, however, based on tomato plant and genotypes and must be studied on case basis.

8. Conclusions and future prospects

Already substantial improvement has been performed in tomato research, involving development of molecular markers, mapping of specific genes and QTLs, comparative analysis of different characters, fine-mapping and map-based cloning of genes and genome sequencing and organization. Molecular mapping can be applied as criteria for indirect selection and tomato improvement. However, little information is available for the use of markers in tomato breeding especially for the development of complex characteristics like heat resistance. However, depending on the most recent discoveries and research progresses, it is clear that the future of routine application of markers in heat resistant tomato breeding is prospective. But the most imperative problem is the improvement of appropriate markers for the breeding programs. PCR based molecular markers that can distinguish polymorphism between closely related genotypes can be used in marker-assisted breeding for heat resistant tomato. Furthermore, the complete sequencing of the tomato genome will assist to progress sequence-based high-resolving markers. This will make MAS as a routine procedure in tomato breeding programs especially for improvement of many complicated characteristics. For complex traits i.e. heat resistance obtaining a reliable phenotypic data for QTL mapping may not be proper on the other hand, partitioning of the total genetic variation for heat resistant characteristic into its physiological and developmental components would lead to detection of QTLs for individual components that may be more useful. The importance of such progresses is well distinguished by the geneticists and plant breeders and lots of research programs have commenced such activities. As heat resistant tomato is a demandable criterion in tropical and subtropical environment in future, a combination of traditional breeding protocols and marker assisted breeding will become a routine procedure for heat resistant tomato production.

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Numerical solution of linear Fredholm integral equations

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Abstract: In this paper, numerical solution of linear Fredholm integral equations of the second kind is considered by two methods. The methods are developed by means of the Sinc-collocation method and shifted Chebyshev polynomial method. Some numerical examples are presented to illustrate the method.

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1. Introduction

Many initial and boundary value problems can be transformed into integral equations and in many cases, we cannot solve this equations analytically to find an exact solution. So that by using numerical methods we try to find the approximate solution of these equations. Several authors have considered the numerical solution of the integral equations with different methods ([1 ,2,5,7,10,11]).

This paper consists of two parts. In part I, we study the numerical solution of system of linear Fredholm integral equations of the second kind by means of Sinc-collocation method, this method consists of reducing the system of Fredholm integral equations to a set of algebraic equations with unknown coefficients by using the properties of Sinc function. In part II, we study the numerical solution of linear Fredholm integral equations by shifted Chebyshev polynomial method which transforms Fredholm integral equation into a matrixequation.

Part I: Numerical solution of system of linear Fredholm integral equations by Sinc- collocation method

This part consists of three sections. Section 1, outlines some of the main properties of Sinc function which are necessary for the formulation of the problem. In section 2, we illustrate how Sinc-collocationmethod may be used to replace system of linear Fredholm integral equations into system of linear algebraic equations. Finally in section 3, we will illustrate the method by some numerical examples.

Now, we consider the system of linear Fredholm integral equations of the form:

$$\Phi(x)=F(x)+\int_{\Gamma}H(x,t)\Phi(t)dt,\quad x\in\Gamma=[a,b] \tag{1.1}$$

Where

$\Phi(x)=[\phi_1(x),\phi_2(x),\ldots,\phi_n(x)]^T$, $F(x)=[f_1(x),f_2(x),\ldots,f_n(x)]^T$ and

$$H(x,t)=[H_{ij}(x,t)]\quad ,i,j=1,2,\ldots,n,$$

is the unknown function $\Phi(x)$ F(x) and H(x, t) are known functions and to be determined.

1. Sinc function and its properties [3]

The Sinc function is defined on the whole real line by:

$$Sinc(z)=\begin{cases}\frac{\sin(\pi z)}{\pi z}, & z\neq 0,\\ 1, & z=0.\end{cases} \tag{1.2}$$

Now, for h > 0 and integer j , we define the jthSinc function with step size h by:

$$S(j,h)(z)=\frac{\sin(\pi(z-jh)/h)}{\pi(z-jh)/h},\quad j=0,\pm1,\pm2,\ldots. \tag{1.3}$$

is given by $z_k=kh$ The Sinc function form for the interpolation points

$$S(j,h)(kh)=\delta_{jh}^{(0)}=\begin{cases}1, & k=j,\\ 0, & k\neq j.\end{cases} \tag{1.4}$$

Is defined on the real line, then for h > 0 the series ϕ If

$$C(\phi,h)(z)=\sum_{j=-\infty}^{\infty}\phi(jh)\frac{\sin(\pi(z-jh)/h)}{\pi(z-jh)/h}. \tag{1.5}$$

, whenever this series ϕ is called the Whittaker cardinal expansion of

is approximated by using the finite number of terms in ϕ converges ,

(1.5). For positive integer N, we define

$$C(\phi,h)(z)=\sum_{j=-N}^{N}\phi(jh)\frac{\sin(\pi(z-jh)/h)}{\pi(z-jh)/h}. \qquad (1.6)$$

Γ. Now, to construct approximation on the interval

Let

$$\psi(z)=\omega=\ln(\frac{z-a}{b-z}), \qquad (1.7)$$

be a conformal mapping which maps the simply connected domain D onto a

where D_d strip region

$$D=\{z=x+iy:\left|\arg(\frac{z-a}{b-z})\right|<d\le\frac{\pi}{2}\}, \qquad (1.8)$$

$$D_d=\{\omega=\alpha+i\beta:|\beta|<d\le\frac{\pi}{2}\},$$

such that

$$\psi((a,b))=(-\infty,\infty),\qquad \lim_{z\to a}\psi(z)=-\infty \quad \text{and} \quad \lim_{z\to b}\psi(z)=\infty.$$

are Γ for $z\in D$ For the Sinc method, the basis functions on the interval

from the composite translated Sinc functions

$$S_j(z)=S(j,h)o\psi(z)=\frac{\sin(\pi(\psi(z)-jh)/h)}{\pi(\psi(z)-jh)/h}. \qquad (1.10)$$

The function

$$z=\psi^{-1}(\omega)=\frac{a+be^{\omega}}{1+e^{\omega}}, \qquad (1.11)$$

on the real ψ^{-1} We define the range of $\omega=\psi(z)$. is an inverse mapping of

line as:

$$\Gamma=\{\eta(u)=\psi^{-1}(u)\in D:\qquad -\infty<u<\infty\}. \qquad (1.12)$$

because they x_k will be denoted by $z_k\in\Gamma$ in D

The Sinc- collocation points

on the real line, the image $\{kh\}_{k=-\infty}^{\infty}$ are real. For the evenly spaced nodes

which corresponds to these nodes is denoted by:

$$x_k=\psi^{-1}(kh)=\frac{a+be^{kh}}{1+e^{kh}},\quad k=\pm1,\pm2,\ldots. \qquad (1.13)$$

Now, we consider the main definition and theorem.be the set of all analytic functions u in D, for which $L_\alpha(D)$ **Definition 1.** Let

there exists a constant C such that

$$|u(z)|\le C\frac{|\rho(z)|^{\alpha}}{[1+|\rho(z)|]^{2\alpha}},\qquad z\in D,\quad 0<\alpha\le1, \qquad (1.14)$$

be a positive integer and h be selected by the $\frac{u}{\psi'}\in L_\alpha(D)$, N **Theorem 1.** Let

formula

$$h=(\frac{2\pi d}{\alpha N})^{1/2}. \qquad (1.15)$$

independent on N, such that C_1 Then there exists positive constant

$$\left|\int_\Gamma u(z)\,dz-h\sum_{k=-N}^{N}\frac{u(z_k)}{\psi'(z_k)}\right|\le C_1\,e^{(-2\pi\alpha dN)^{1/2}}. \qquad (1.16)$$

2. The approximate solution of system of Fredholm integral equations

We consider the ith equation of (1.1):

$$\phi_i(x)=f_i(x)+\sum_{j=1}^{n}\int_\Gamma H_{ij}(x,t)\phi_j(t)\,dt,\qquad i=1,2,\ldots,n. \qquad (1.17)$$

For the second term on the right-hand side of (1.17), we suppose that

then by using Theorem 1, we obtain $\frac{H_{ij}(x,.)}{\psi'}\in L_\alpha(D)$,

$$\int_\Gamma H_{ij}(x,t)\phi_j(t)\,dt\approx h\sum_{\ell=-N}^{N}\frac{H_{ij}(x,t_\ell)}{\psi'(t_\ell)}\phi_{j\ell}, \qquad (1.18)$$

where

$\phi_j(x_\ell)$ denotes an approximate value of $\phi_{j\ell}$

Using (1.17) and (1.18) we obtain

$$\phi_i(x)-h\sum_{j=1}^{n}[\sum_{\ell=-N}^{N}\frac{H_{ij}(x,t_\ell)}{\psi'(t_\ell)}\phi_{j\ell}]\approx f_i(x),\qquad i=1,2,\ldots,n. \qquad (1.19)$$

$\phi_{j\ell}$, $\ell=-N,-N+1,\ldots,N;\ j=1,2,\ldots,n,$ There are n×(2N +1) unknowns

to be determined in (1.19). In order to determine these n × (2N + 1) unknowns, we apply the collocation method. Thus by setting

areSinc-collocation points: x_k in (1.19) where x_k, $k=-N,\ldots,N$

$\rho(z)=e^{\psi(z)}$. where

$$x_k = \eta(kh) = \psi^{-1}(kh) = \frac{a+be^{kh}}{1+e^{kh}}. \qquad (1.20)$$

From (1.19) and (1.20) we obtain the following system of n × (2N + 1) linear equations with n × (2N + 1) unknowns $\phi_{j\ell}$, $\ell = -N,-N+1,\ldots,N; j = 1,2,\ldots,n,$

$$\phi_{ik} - h\sum_{j=1}^{n}[\sum_{\ell=-N}^{N}\frac{H_{ij}(x_k,t_\ell)}{\psi'(t_\ell)}\phi_{j\ell}] = f_i(x_k), \quad i = 1,2,\ldots,n; k = -N,\ldots,N. \qquad (1.21)$$

and $\widetilde{H}_{ij} = [\dfrac{H_{ij}(x_k,t_\ell)}{\psi'(t_\ell)}]$ We denote

$$B_{ij} = \begin{cases} I - h\widetilde{H}_{ij}, & i=j, \\ -h\widetilde{H}_{ij}, & i\neq j, \end{cases}$$

which are the square matrices of order (2N + 1) × (2N + 1), then the system of can be expressed in a $\phi_{j\ell}$ linear equations (1.21) unknown coefficients matrix form

$$B\widetilde{\Phi} = P, \qquad (1.22)$$

where

$$B = \begin{pmatrix} B_{11} & B_{12} & \cdots & B_{1n} \\ B_{21} & B_{22} & \cdots & B_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ B_{n1} & B_{n2} & \cdots & B_{nn} \end{pmatrix},$$

$P = [f_1(x_{-N}),\ldots,f_1(x_N),\ldots,f_n(x_{-N}),\ldots,f_n(x_N))]^T$, $\widetilde{\Phi} = [\phi_{1\ell},\ldots,\phi_{n\ell}]^T$, $\ell = -N,\ldots,N$

$\phi_{j\ell}$

By solving the linear system (1.22), we obtain an approximate solution of the system of integral equations $\phi_j(x_\ell)$ corresponding to the exact solution (1.1) at the Sinc points.

3. Numerical examples

In this section we will illustrate the above results by some examples. The examples have been solved by presented method with different values of N. The errors are reported on the set of Sinc grid points

$\alpha = 1$ *and*, $d = \pi/2$, *which yields* $h = \dfrac{\pi}{\sqrt{N}}$.

In all examples we take

$$S = \{x_{-N},\ldots,x_0,\ldots,x_N\}, \quad x_k = \frac{a+be^{kh}}{1+e^{kh}}, \quad k = -N,\ldots,N.$$

The maximum error on the Sinc grid points is

$$\left\|E_\Phi^s(h)\right\|_\infty = \max_{-N\le j\le N}\left|\Phi(x_j) - \Phi_N(x_j)\right|. \qquad (1.23)$$

Example 1.

Consider the following system of Fredholm integral equations

$$\phi_1(x) = f_1(x) + \int_0^1 (x-t)^3\phi_1(t)\,dt + \int_0^1 (x-t)^2\phi_2(t)\,dt,$$

$$\phi_2(x) = f_2(x) + \int_0^1 (x-t)^4\phi_1(t)dt + \int_0^1 (x-t)^3\phi_2(t)dt, \qquad (1.24)$$

with

$$f_1(x) = \frac{1}{20} - \frac{11}{30}x + \frac{5}{3}x^2 - \frac{1}{3}x^3, \quad f_2(x) = -\frac{1}{30} - \frac{41}{60}x + \frac{3}{20}x^2 + \frac{23}{12}x^3 - \frac{1}{3}x^4$$

$\phi_1(x) = x^2$, $\phi_2(x) = -x + x^2 + x^3$. and the exact solution

We solved Example 1 for different values of N and the maximum of absolute errors on the Sinc grid Sare tabulated in Table 1. This table indicates that as N increases the errors are decreasing more rapidly where excellent results are shown.

Example 2.

Consider the following system of Fredholm integral equations

$$\phi_1(x) = \frac{11}{6}x + \frac{11}{15} - \int_0^1 (x+t)\phi_1(t)dt - \int_0^1 (x+2t^2)\phi_2(t)dt,$$

$$\phi_2(x) = \frac{5}{4}x^2 + \frac{1}{4}x - \int_0^1 xt^2\phi_1(t)dt - \int_0^1 x^2t\phi_2(t)dt, \qquad (1.25)$$

$\phi_1(x) = x$ *and* $\phi_2(x) = x^2$. with exact solution

The approximate solution is calculated for different values of N and the maximum of absolute errors on the Sinc grid S are tabulated in Table 2.

Part II: Numerical solution of linear Fredholm integral equationsby shifted Chebyshev polynomial method

This part consists of two sections. In section 1, we present shifted Chebyshev polynomial method. Section2, is devoted to introduce the numerical solution of three examples by using shifted Chebyshev polynomial method and Sinc- collocation method.

Consider the following linear Fredholm integral equation:

$$\varphi(x) = f(x) + \lambda \int_0^1 K(x,t)\varphi(t)\,dt, \quad x,t \in [0,1], \tag{2.1}$$

$\varphi(x)$ is a real parameter and λ where f(x), K(x, t) are given functions,
is unknown function.

1. Shifted Chebyshev polynomial method

In this section we will study the approximate solution of equation (2.1) by means of shifted Chebyshev polynomial method.
of equation (2.1) can be represented by truncated $\varphi(x)$ The unknown function
Chebyshev series as follows:

$$\varphi(x) = \sum_{j=0}^{N}{}' a_j T_j^*(x), \qquad 0 \le x \le 1 \tag{2.2}$$

a_j denoted the shifted Chebyshev polynomial of the first kind, $T_j^*(x)$ where
is a sum whose first term is Σ' are the unknown Chebyshev coefficients,
halved and N is any positive integer.

of equation (2.1) and K(x, t) can be expressed $\varphi(x)$
Suppose that the solution
as a truncated Chebyshev series. Then (2.2) can be written in the following form:

$$\varphi(x) = T^*(x)\,A,$$

where

$$T^*(x) = [T_0^*(x) \quad T_1^*(x) \quad \dots \quad T_N^*(x)], \quad A = [\frac{a_0}{2} \quad a_1 \quad \dots \quad a_N]^T,$$

Now, K(x, t) can be expanded by chebyshev series as follows:

$$K(x_i,t) = \sum_{r=0}^{N}{}'' k_r(x_j) T_r^*(t),$$

are the x_i denotes a sum with first and last terms halved Σ'' where
thechebyshev collocation points defined by

$$x_i = \frac{1}{2}[1 + \cos(\frac{i\pi}{N})], \qquad i = 0,1,\dots,N, \tag{2.4}$$

are determined by the following relation $k_r(x_j)$ and Chebyshev coefficients
[4,9]:

$$k_r(x_j) = \frac{2}{N} \sum_{j=0}^{N}{}'' K(x_i,t_j) T_r^*(t_j), \quad t_j = \frac{1}{2}[1 + \cos(\frac{j\pi}{N})].$$

given by $K(x_i,t)$ Then the matrix representation of

$$K(x_i,t) = K(x_i)\,T^*(t)^T, \tag{2.5}$$

where

$$K(x_i) = [\frac{k_0(x_i)}{2} \quad k_0(x_i) \quad \dots \quad k_{N-1}(x_i) \quad \frac{k_N(x_i)}{2}].$$

By substituting from Chebyshev collocation points defined by (2.4) into equation (2.1), we obtain a matrix equation of the form

$$\Phi = F + \lambda I, \tag{2.6}$$

where I(x) denotes the integral part of equation (2.1) and

$$\Phi = \begin{pmatrix} \varphi(x_0) \\ \varphi(x_1) \\ \vdots \\ \varphi(x_N) \end{pmatrix}, \quad F = \begin{pmatrix} f(x_0) \\ f(x_1) \\ \vdots \\ f(x_N) \end{pmatrix}, \quad I = \begin{pmatrix} I(x_0) \\ I(x_1) \\ \vdots \\ I(x_N) \end{pmatrix}. \tag{2.3}$$

When we substitute from Chebyshev collocation

$$\Phi = T^* A. \qquad (2.7)$$

points (2.4) into (2.3), the becomes Φ matrix

for i = 0, 1, ...,N , j = 0, 1, ...,N and $I(x_i)$ Substituting from (2.3) and (2.5) in

using the following relation [9],

$$Z = \int_0^1 T^*(t)^T \, T^*(t) \, dt = [\int_0^1 T_i^*(t) T_j^*(t) \, dt] = \frac{1}{2}[z_{ij}],$$

where

$$z_{ij} = \begin{cases} \frac{1}{1-(i+j)^2} + \frac{1}{1-(i-j)^2}, & \text{for even } i+j, \\ 0, & \text{for even } i+j, \end{cases}$$

we obtain

$$I(x_i) = K(x_i) Z A. \qquad (2.8)$$

Therefore, we obtain the matrix I in terms of Chebyshev coefficients matrix in the following form:

$$I = K Z A, \qquad (2.9)$$

where

$$K = [k(x_0) \quad k(x_0) \quad \dots \quad k(x_N)]^T.$$

Now, by using the relation (2.7) and (2.9), the integral equation (2.1) transforms into a matrix equation which is given by:

$$T^* A - \lambda KZA = F. \qquad (2.10)$$

The matrix equation (2.10) corresponds to a system of (N + 1) linear algebraic equations with (N + 1) unknown Chebyshev coefficients. Thus the unknown can be computed, hence we obtain the approximate solution. a_j coefficients

Particularly : If we apply Sinc-collocation method which is given in part I in case of linear Fredholm integral equation (2.1) we obtain the following system $\varphi_{1\ell}$, $\ell = -N, \dots, N$: of (2N +1) linear equations with (2N +1) unknowns

$$\phi_{1k} - h \sum_{\ell=-N}^{N} \frac{K_{11}(x_k, t_\ell)}{\psi'(t_\ell)} \varphi_{1\ell} = f_1(x_k), \quad k = -N, \dots, N. \qquad (2.11)$$

2. Numerical examples

In this section we present three examples to illustrate the above results.

Example 1.

Consider the following linear Fredholm integral equation of the second kind

$$\varphi(x) = x^2 - \frac{4}{3}x + \frac{1}{4} + \int_0^1 (x+t)\varphi(t)\,dt, \qquad 0 \le x \le 1, \qquad (2.12)$$

$\varphi(x) = x^2 + 1$. with the exact solution

The numerical solution of equation (2.12) in case of shifted Chebyshev polynomial method and Sinc-collocation method is given in Tables 3 and 4.

Example 2.

Consider the following linear Fredholm integral equation with exact solution

$$\varphi(x) = x(x-1)$$

$$\varphi(x) = \frac{1}{4} - x + \int_0^1 (3t - 6x^2)\varphi(t)\,dt, \qquad 0 \le x \le 1. \qquad (2.13)$$

The numerical solution of equation (2.13) in case of shifted Chebyshev polynomial method and Sinc-collocation method is given in Tables 5 and 6.

Example 3.

Consider the following linear Fredholm integral equation with exact solution

$$\varphi(x) = e^x (2x - 2/3)$$

$$\varphi(x) = 2xe^x - 2\int_0^1 e^{(x-t)} \varphi(t)\,dt, \qquad 0 \le x \le 1. \qquad (2.14)$$

The numerical solution of equation (2.14) in case of shifted Chebyshev polynomial method and Sinc – collocation method is given in Tables 7 and 8.

Table 1. Numerical results of Example 1 in part I

N	h	$\left\|E_{\phi_1}^S(h)\right\|_\infty$	$\left\|E_{\phi_2}^S(h)\right\|_\infty$
5	1.404963	3.150485 E−3	1.346648 E−3
10	0.9934589	1.827180 E−4	2.301931E−4
15	0.8111557	3.388524 E−5	7.402897 E−5
20	0.7024815	6.556511 E−6	4.351139 E−6
25	0.6283185	2.384186 E−7	7.152557 E−7
30	0.5735737	7.078052 E−8	1.192093 E−8
35	0.5310261	4.103521 E−9	7.326145 E−9
40	0.4967294	5.214782 E−10	2.019321 E−10
45	0.4683210	3.458109 E−10	8.729451 E−10
50	0.4442883	1.248273 E−11	6.402321 E−11

Table 2. Numerical results of Example 2 in part I

N	h	$\left\|E_{\phi_1}^{S}(h)\right\|_{\infty}$	$\left\|E_{\phi_2}^{S}(h)\right\|_{\infty}$
5	1.404963	5.940656 E−3	1.474380 E−3
10	0.9934589	2.918275 E−4	2.361536 E−4
15	0.8111557	4.464388 E−5	1.257658 E−5
20	0.7024815	8.225441 E−6	2.920628 E−6
25	0.6283185	8.509960 E−7	7.152557 E−7
30	0.5735737	4.807629 E−8	5.960464 E−8
35	0.5310261	1.197832 E−8	3.135621 E−8
40	0.4967294	6.601731 E−9	4.047211 E−9
45	0.4683210	7.706242 E−10	2.942132 E−10
50	0.4442883	3.416235 E−11	7.066213 E−11

Table 3. Numerical results of Example 1 in part II in case of shifted Chebyshev polynomial method for N = 5:

x	Error
0.1	3.576279 E−7
0.2	3.576279 E−7
0.3	3.576279 E−7
0.4	2.384186 E−7
0.5	3.576279 E−7
0.6	3.576279 E−7
0.7	4.768372 E−7
0.8	4.768372 E−7
0.9	7.152557 E−7
1	8.344650 E−7

Table 4. Numerical results of Example 1 in part II in case of Sinc- collocation method

N	h	$\left\|E_{\varphi_1}^{S}(h)\right\|_{\infty}$
10	0.9934589	1.914620 E−3
15	0.8111557	2.176762 E−4
20	0.7024815	3.68356 E−5
25	0.6283185	7.748604 E−6
30	0.5735737	4.649162 E−6
35	0.5310261	9.536743 E−7
40	0.4967294	5.960464 E−7
45	0.4683210	4.053116 E−7
50	0.4442883	9.536743 E−7

Table 5. Numerical results of Example 2 in part II in case of shifted Chebyshev polynomial method for N = 5:

x	Error
0.0	9.164214 E−7
0.1	7.525086 E−7
0.2	5.811453 E−7
0.3	3.874302 E−7
0.4	2.235174 E−7
0.5	8.940697 E−8
0.6	2.980232 E−8
0.7	1.192093 E−7
0.8	2.086163 E−7
0.9	3.278255 E−7
1	4.619360 E−7

Table 6. Numerical results of Example 2 in part II in case of Sinc- collocation method

N	h	$\left\|E_{\varphi_1}^{S}(h)\right\|_{\infty}$
5	1.404963	7.003546 E−7
10	0.9934589	4.059984 E−9
15	0.8111557	5.820766 E−10
20	0.7024815	2.103206 E−12
25	0.6283185	0.000000000000
30	0.5735737	0.000000000000

Table 7. Numerical results of Example 3 in part II in case of shifted Chebyshev polynomial method for N = 5:

x	Error
0.0	1.490116 E−6
0.1	3.099442 E−6
0.2	2.175570 E−5
0.3	1.013279 E−5
0.4	1.642108 E−5
0.5	2.914667 E−5
0.6	1.484156 E−5
0.7	1.299381 E−5
0.8	2.312660 E−5
0.9	7.152557 E−7
1	3.099442 E−6

Table 8. Numerical results of Example 3 in part II in case of Sinc- collocation method

N	h	$\left\|E^{S}_{\varphi_1}(h)\right\|_{\infty}$
5	1.404963	1.708865 E−4
10	0.9934589	3.409386 E−5
15	0.8111557	1.549721 E−6
20	0.7024815	7.152557 E−7
25	0.6283185	5.960464 E−8
30	0.5735737	5.960464 E−8
35	0.5310261	0.000000000000

Conclusion

In part I of this paper we study the numerical solution of example 1 and example 2 by Sinc-collocation method. But example 1 has been studied by Taylor-series expansion method in [6] and example 2 has been studied by using Block-Pulse functions in [8] by comparing the results we find that our method is better than the results of Maleknejad et al.,[6] and Maleknejad et al.[8]. In part II we study the numerical solution of three examples of linear Fredholm integral equations by using shifted Chebyshev polynomial method and Sinc- collocation method which derive a good approximation.

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Landscape Design methodology in Form's origination

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Abstract: Organizing ideas and transferring them into practical models and sketches are one of the main duties of a landscape architect. Landscape designing ideas separated from the designer's mental imaginations, are made upon context features, programs and designer's Intellectual and philosophical attitudes. These ideas turn into physical and practical sketches and plans by using principles such as axes, movements, geometrical forms, hierarchies, structural elements, Private and public spaces, perspectives and views. Although there are limitations for designers to use patterns , in areas of function and technique, but they are free to express design in shapes. Thus, it could be said that the main responsibility of a designer in establishing a style is; creating the form.Form in a field of art, doesn't just mean its physical appearance, size and volume, but includes all of components which intervene in it's structure and composition. It is assumed that most of those above -such as a line in painting sound in landscape or a pause in music- do not have a clear description of themselves and find meaning when get organized in final production. So the main components are his form and space. It should be mentioned that there are differences between design methods and the references or methods which produce forms. Each designer may use a totally specific or spectacular method to design, but the created form can be analyzed with two mechanisms which is going to be investigated in this essay.The purpose of this essay is to find a mechanism which would be able to analyze different approaches of emerging forms in landscape architecture. By analyzing factors such as Fabric, Pattern, Shape and Geometry, finally we would compile or methodology in form's creation. With this knowledge, the landscape designer's thoughts would be organized and put into various models in which the created form and the local effects could be analyzed.
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Keywords: Form, Architecture, Landscape design, Geometry and Logic architecture, intuition and sensibility.

1. Introduction

Landscape architecture and methods which are the origins of landscape architecture have a long history. From hundreds of years ago we could see landscapes which have been ordered(organized) and designed consciously such as landscape of religious places, temples, gardens (which are a symbol of heaven and paradise and also show our ancient relationship with nature) and parks which somehow show ideal forms of nature. If we would be able to identify the morphology of each landscape and afterwards consider it in our own cultural fabric and identify the processes which have shaped the landscapes, then we would be able to use this knowledge to make decisions about future application, conservation, management and development. Also, we can use patterns which have originated from certain changes and then analyze them from an aesthetical point of view. Therefore, effective processes in creating landscapes and the pressures and attitudes towards changes could be a response of our reactions and could be related to society's common values and their own culture. But the final visual goal in each design is to make a balance between variety and united elements while the spirit of place is taken into consideration. Patterns and structures, compositions or landscapes are shaped with organization of a variety of various basically elements. Thus, it is essential to know more about that how forms are attained before we find possible methods to organize elements in the design process in advance.

2. Form

Form is the utility with which designers share most of their psychological and emotional desired impressions with the users of a space. As Hadi Mirmiran explains," architecture is memorized by form and felt by space". Visual shapes, quality, scale, proportion and the form of a space is organized by its components such as floors, walls and ceilings and the person communicates with them in this surrounded space.

2-1.Terminology

In Americana encyclopedia, Form is defined and expanded as:

In Encyclopedia: form determines a number of different but related concepts, some for what is essential for our knowledge of reality… Philosophical usage of the term - metaphysics ,epistemology, aesthetic – is more than other similar usages. With a simple look, form of a material object is it's shape ,as distinct from the material which object has. Also form is the order of a set of elements, separately from their hidden nature, distinct from the material that the object is comprised, for example, the spiral arrangement of atoms in a molecules or their geometric symmetry in a crystal in their organic organization, form is not just physical structures, but also a function of several physical performance .In social relations form is a scale or pattern ... also form is the structure which includes political and economical systems and other organizations, a simple definition of form cannot cover all these usages but a major means can be extracted of their pure internal relations.

Form is used in the meaning of shape, appearance and figure. In the Persian philosophical literature, the term "appearance" is used instead of 'form'. Appearance is the aspect of an object which it is recognized by. Such as the form of a table which is shaped by the way that the lumbers have been connected and joint together and if we put them in another position they could look like a bed (couch) and different objects with different forms could be built of these lumbers.

In Webster World Dictionary "Form" implies within many categories, as noun within twenty categories, as transitive verb in seven categories and as intransitive verb in three separated categories. Most important of them are : 1)Specified shape of everything.. 2) Configuration or combination of a character o animal 3)Special state of being that something have, like water which obtains form in vapor state. 4) Arrangement, especially arrangement in an order, the method in which parts of a whole organize…and 19) Philosophy, Nature of something according to reality or inner character of it which makes the appearance special.

As can be seen from the definitions in Webster Dictionary, the philosophical definition of form seems to be more complete. Form in Webster Dictionary is defined as a general term. Although it has mentioned some synonyms, meaning of form includes all of them. These synonyms are: Figure, Outline, Shape and Configuration.

In philosophy it is expressed that "Figure (form) is separated from substance (component parts). This means that for instance the form of a cube could be made of different materials. So, form could be imagined as an abstract concept separated from substance and it could be shaped in the mind which is known as picture of mind or" image".

2-2. Meaning of form in art

Form in art is definitely related to an artistic work. As it was discussed above, form is putting an object in practice and it is the objective matter of an object. Whatever in art is put into practice and becomes manifested is an impression of art or an artistic work. It should be mentioned that this impression presences in the mind of the artists before its manifestation (at the beginning of an artistic activity/creation). Form is a complete position (expression) of an artistic work (Ocvirk et al; 1990). In popular(cultural) library of art form has been described as: form is a term which is used for describing some aspects of an artistic work such as its inner structure (regulation/order) and shape. And mostly it is to some extent differed from substance, subject, content, function and artistic styles. The most valuable aspect that we value in an artistic work results from its connections (relationships) and proportions. Form is our subjective view about art. Anyhow, form is not just connections and proportions (between objects parts) and an artistic work is not just those either (Dic of Art, Vol. 11).

Wassily Kandinsky in his book, concerning the spiritual of art (1973) defines form" Every form is the delimitation of a surface by another one". Victor Wassily in "Notes for a manifesto" states that form and color are a single entity (1970) and could not be separated. In popular(cultural) library of art these three "forms" are distinguished from each other and the entire uses in which the term "form" are used in art are defined and developed as below;

I. Form as an organized rule (which is named as order, classification, arrangement and structure).
II. Form as a shape, condition, ornament or a special arrangement of spaces of all kind and all dimensions (perceived by sight or by other senses).
III. Form as a kind or type and variety and diversity.
IV. the fourth description that should be added: Form as a basis for actions, patterns or repeatable incidents which are mostly created by the classifications of the third part.

In the two first meanings we usually talk about the form of an art work (the unique form of an art work), but the two later meanings are seen as the art work as an example of a form (pattern) (the kind of an art work). But there is also a common use which is separated from those above; form as a practical and identifiable existence in the area of art works (Dic of Art: vol.11).

A complete art work is created upon four united entities; form, content, subject and substance. Sometimes substance is being ignored because of

similarity (such as color and canvass in paintings). It should be considered that in applied arts these entities are different: form, substance and function. In applied arts, in addition to aesthetic dimensions, an art work is used as a useful object which is practical and has functions as well. The difference between subject and content is that the subject of an art work is a general narrative (story) which the artist chooses between various events and phenomena; and the content is the preferred message or it is something that will be revealed in the subject and is confirmed in the art work. In other words, subject is a figure which the artist chooses to express its meaning (content). The artist chooses an appropriate appearance between perceivable appearances to express the content. So the subject itself has a form and could be an aspect of the form of an art work.

2-3. Form and Architects point of view

Although the aim of this article is to get to different approaches in form origination in landscape architecture, but it is necessary to analyze architects and landscape architects points of view in order to get to a right perception about form. The term "FORM" has a good academic background in architecture which we will discuss in continue.

In" Architecture, Form, Space and Order" Francis Ching states shape as below;

'Shape is a surrounding line of a surface or a visible volume and it is the main element to recognize an object' but Behrooz Mansouri (Mansouri, 2004) has five descriptions about 'form' in his article named[i]:

1. Form is a composition, an arrangement and formation of components which have set together, such as the arrangement of elements which combine together in order to create a complete composition. For instance; the combination of musical notes or the shapes which combine with each other in a painting. A proper form should have dimensional proportions, scale and harmony.
2. Another description of form emphasizes on non-conceptual aspects and it is applied to objects that directly catch our senses.
3. In the third description, form is a concept which expresses the existence of an object and makes it different from other objects. This description of form emphasizes on the objective aspect of an object which could be observed its appearance or outer shapes. This is what we call it Morph (in Persian literature).
4. In the fourth description, A Form is the purest essence of an object which causes its perfection. In this description, form is a content. This is the same with the Plato's description of form;' Form is an entity; it is a true reality superior to superficial and perceivable realities of man. Which all these human ideas would exist in ideation world (EDIOS) and mankind can only follow these ideas in order to reach perfection.
5. In the fifth description, Form is a definition which our mind builds for us and with this definition; mind can establish a structure over our sensible world. Kant's criticism on theoretical wisdom, describes form as human's ability to perceive as it was initiated from the past. From this definition, it can be said that forms are human's mental issues.

In a general conclusion, Mansouri asserts that the meaning of the terms 'shape' and 'form' are close together. Both of these sometimes refer to organized and shaped elements and other times refer to how elements are organized and how they are shaped or they express the sort of connection between elements. In a systematical approach to architecture both of these terms are really important. In both of the terms we deal with substantiality and tangible aspects of architecture.

Grueter describes form as a sensible and clear manifestation of a phenomenon which faces judgment. He emphasizes that in opposition to form, shape is two dimensioned and independent of time and place. He declares:" form is a structure, development of content, shape and interpreting it, form or figure could indicate color ,shape and dimension , structure , body, location, direction ,visual balance, material , location and etc. Thus, shape is not equal to form and feature, but it is just one of form's aspects besides other aspects".

3. Form in Landscape Architecture

Form in landscape architecture is a final and visual expression of numerous powers which affects outdoor spaces design. The site (the location where the building is being constructed) itself expresses its opportunities and limitations. The landlord and the engineers have their own obligations and at the same time the potential users are looking for comfort and beauty. Form in landscape is a skilful composition of all mentioned powers.

Grant W.Read presents the imagination of this skilful composition as the key to achieve a desired form. He suggests that form and function are the two critical elements of this process. Some believe that form follows function, it means that form is a consequence of a primary analyze of functional attributions. Some other also believes that form has its own genuineness which could affect the ways which a site is used. He believes that form is a compounded part of a function and this reflect in both opinions.

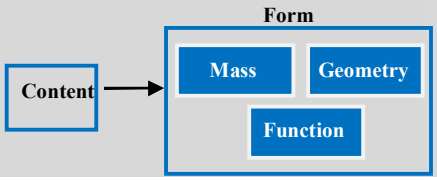
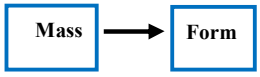
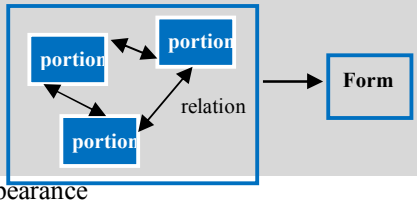
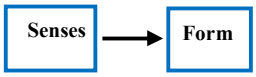
In order to design desirable and meaningful environments and landscapes, first of all we should recognize factors which have an effect on form. Meanwhile we should know the meanings which each of these factors explain. Rapoport believes that in most

cultures, there are three main factors which affect the design progress:

i. Physical features and conditions such as the site, climate and etc.
ii. Percepetion , cultural attributes, inclinations and ideologies which have built the philosophical bases of culture and shape the main inclinations about concept of man, his relationships, nature and cultural paradox, economics, time and etc.
iii. Available resources and technologies in order to reform existing conditions and also recognize cultural attitudes and perspectives.

In communities such as ours, the fourth factor should also be taken under consideration: aesthetical aspects, proportions and visual qualities such as aesthetic and artistic features in landscape are included in this category. Inspiration, conceptualism and locality in landscape are the goals of the fourth factor.

Table 1: Architects different approaches in describing form

Architects and Researchers	Approaches(Tendencies)
Louis Kahn	Form impressed by content 
Ching	Form impressed by volume 
Behrouz Mansouri	Form impressed by components ant their relationship 
Greuter	Form impressed by tangible appearance 

3-1.The necessity of applying form theory landscape design

Regarding to Turner's opinions (2001), we can categorize the difficulties of landscape design after the nineteenth century and aspect dimension of landscape design which are related to form will be brought forth for discussion (social, cultural, ecological and aesthetical):

In the classical period(1800) designing simply became to disappear at the time following nature meant designing the gardens based on experimental interpretations of natural forms (which exist in the nature).Thus, art seemed to be artificial. nature was irregular and unorganized and gardens became concretized.

While the theory of landscape restoration began at the late of nineteenth century, reformers(such as Goder) paid more attention to social functions and ecological processes this led to a separation between designing, planning and landscape from fine arts and this caused an inattention in form as a specialized subject in landscape.

After 1954, landscape designers integrated in order to work on functional aspects of modernism but this union was mortal. Efforts to reflect that form functional requirements caused a figurative revision in developing new design skills.

Plan based designs, such as the SAD (Survey-Analysis- Design) method, encouraged planners to consider landscape design as a two dimensional design with few perspectives.

During the twentieth century, social, ecological, political, literal and artistic issues in landscape designing remained separated from each other. Landscape was known as planting and the role of designers in composing 5 elements of outdoor spaces, land forms , forms of landscape elements, buildings, aqua, vegetation and pavements was ignored.

Generally owner did not have professional designers available in order to design places in a manner to seem spectacular and at the same time

supply their social needs and also to notice the desired ecological aspects. (Turner, 2001). But Post-Modernism abandoned this attitude from dependency on functionalism which was generally advantageous, and instead, post modernism considered subjects which had been ignored since the renascence era such as humanism, emphasizing on history and historical aspects, historical memories and etc, these factors makes trends to eclecticism. This idea that form can be manipulated without considering functional requirements caused a figurative revision in developing and evolution of new design skills (Antoniades, 1992). In table 2-1 professionals theoretical perspectives in landscape design has been represented.

Table 2 – The necessity of theoretical views in landscape design, source: Khakzand, 2009.

Abstract of opinions	Theoretician	The necessity of theoretical views in landscape design
Shape is not the goal in landscape design. Sources of creation are more important.	Terib, M., 1933	
There are many conceptual and theoretical levels which are neglected in landscape design.	Morphi, 2005	
Design thoughts , attention to opinions, relation between research and landscape.	Zovieh, 1986	
The necessity of relation between correlation research and design process.	Newman S., 1973	
Fear of abandonment of landscape design due to lack of legitimate scientific basis.	Zovieh, 1973 , Rapaport, 1977	
To offer newer methods for SAD analyzing method.	Sasaki, 1950	
To offer new strategies for Paklida design process.	Tetnur, 2000	

3-2.The role of Form in Landscape Architecture

If we define landscape as a system, in other words, a composition of elements which interact with each other, then it can be said that form can refer to both substantial parts (elements) and the connection between parts which keeps them together. But the systematical and detailed approach to landscape architecture has not yet been announced (except in a few cases). And most of the processes refer to the circumstances of carrying out the project or parts of the design.

Design's main questions cannot be eliminated by every vague effort scientifically but they can be explained by experimenting design results via scientific studies. Some researchers believe that designer's pre-imaginations make designing possible in fact and it is truly what makes its recognition of a design possible at the first place (Steadman, 1970).

Most of the landscape architects such as Patrick Godez have discussed about processes executive in landscape design (Hough, 1984; Lynch, 1972; Jellico, 1983; Mc Harg, 1969). In Espiren's opinion the landscape design process could be such as:

1. Collecting the listed data's.
2. Analyzing in order to assess landscape details , understand the patterns, perceptions and intristic processes in landscape.
3. Design creativity, form configuration (Espiren, 1998)

In Ingram's opinion principles such as color, line, shape, fabric and scale can be brought to landscape design and these are utilities which are used in a composition for the purpose of form emersion and these principles lead to the following stages in landscape design:

1. Preparing the plan
2. Presenting the site analyze
3. Assessing Families requirement and preferences
4. Assigning the activity zones
5. Designing the activity zones
6. Selecting plants and planting (Ingram, 2003).

Beardsley believes that when it comes to the design creativity, landscape designers must pay attention to some key principles such as the form which is they important. In his reflections landscape architecture has some principles such as;

- Style and content
- Quantity and balance

- Simplicity
- Uniqueness
- Color
- Fabric and profundity
- Profitableness(Beardsley, 2001)

4. Landscape Architecture assessment through an approach to form emersion

Mark Tribe suggests that landscape assessment could not be possible without considering three (main) factors; bio-environmental and formal (which is based on shape and space rather than style). Social harmony without considering place could lead to improper natural landscapes. capitulating climatic restrictions could also lead to undesirable (inelegant) natural landscapes with the absence of human beings.
In the opinion of Mark Tribe, as we cannot accept any changes in classifying form in landscape in to two formal and informal categories, landscape designing methods should be considered in three directions(aspects);

- Formal(including space-shape and material)
- Cultural(including historical-social aspects and behaviors)
- Environmental(including ecology, hydrology- gardening and natural processes)

In the recent years, in the widst of 1980, landscape by patterns was established and it was defined by artificial and natural materials and limitations in the shapes of trees and plants which have attracted a lot of attentions. In most parts, the designs have produced clear approaches of these outstanding images and the techniques are used in order to build and experiment form and order in the environment. These landscape designs, might be elegant or inelegant, pure or compounded, exclusive or for public and they might be designed for various countries with different ecologies and industrial components.

In this article, the first method would be taken into consideration. But before discussing the subject it is necessary to take a look at factors which put an effect on form in both architecture and landscape architecture.

1. Functional factors-function, circulation, light, sound, connections and etc.
2. Natural and climatic factors- slope, topography, water, wind and rain and etc
3. Constructional factors- techno tic, technology, material and etc.
4. Spiritual and cultural factors- culture, myths, faith, religious beliefs and etc.

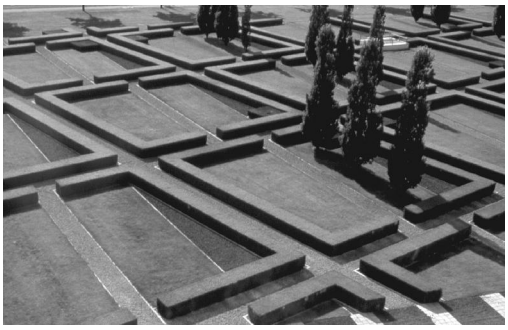


Image 1: kampinsky Hotel, Munchen, Germany, Peter Walker and partners, 1994. Source: Treib, M., 2001.

By knowing these four factors, now we can categorize the form origination approaches into two classifications.

- In the first category are those who try to complete the project by considering general and logical concepts towards a design with specified forms. This is method which is logical and organized in most parts. Geometry and function which are the bases of this structure join together and change to a method which takes form into consideration.
- The seconds are those who look for metaphors and special concepts in their method and try to come to particular and different forms (second method) which are abstractive and naturalistic. (shape 1)

The first method is based on logical and geometrical forms which are. The elements, relations and connections follow the absolute regulations of intrinsic order which in mathematics they exist as different geometrical shapes. (Image 1) But in the second method and in the opinion of the romanticisms, geometry is boring, awkward and unpleasant and they want to bring meaning to their designs. They come about their desire by an illogical and an intuitional approach, by using naturalistic forms. (shape 2)

Here, we should mention that both of the methods have a intrinsic structure and it is not necessary to separate them through structural aspects. For instance; the passion at using accidental forms is to experience some hidden aspects of an absolute order, as in a circle. But even a circle can have a shapeable diversity. Take a look at the circular forms of the bubbles which have put and stringed together accidently.

The shapes might seem mixed, meaningless and accidental but in the opinion of users who are looking for joy and excitement they seem more attractive.

Shape 1: (1-1 to 1-2) Abstract and nature oriented forms with approach of using geometric forms. Source: Reid. G. W., 2007.

2-1

1-1

Shape 2 : (2-1 to 2-3) Nature oriented forms with intuitive approach. Source: Reid. G. W., 2007.

3-2

2-2

1-2

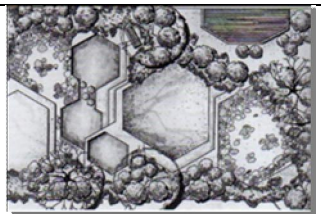
4-1.The geometrical-functional approach

By repeating the simple geometrical forms (deprived from geometry), a form with a high integration would be achieved. By changing scales and locations, even with very simple and primary forms we can lead to various interesting forms. The first point in creating geometrical forms is to use the primary shapes (square, triangle, circle) and each of these primary volumes (shapes) are derived from the secondary themes which are listed below. (Shape 3)

- The Rectangular (90 degree) theme which is an independent shape
- The 45-90 degree theme
- The 30-60 degree theme
- Various types of circular shapes(circles crossing each other, circles and radius, circles and tangent lines, parts of the circles, ellipses and spiral forms).

Shape 3: (3-1 to 3-4) Samples related to geometrical-functional approach. Source: Reid. G. W., 2007.

4-3



3-3

2-3

1-3

4-2.The abstract-naturalistic approach

There are different shapes and images in the palette of nature which can be used in the designs. The shapes may be an imitation or an abstract of the natural forms or they may resemble nature. Imitation copies the existing shapes of the nature without much change. Thus, a city built by human might resemble a mountainous stream.

On the other hand, an abstract is a natural shape which has been used for inspiration and it has been changed and adapted by the designers in order to proportionate a special condition. The final shape has a slight resemblance with the original subject (shape).

There might be a lot of reasons which make the designer to decide to choose shapes that are more natural and irregular rather than totally regular geometrical shapes. This also might be true for the site as well; landscapes which are disorganized by human interferes in the nature or landscapes which have attractive natural details might be more adapted to natural forms and materials.

The durability of the relations between the built environment and natural environments is related to the designer's method and the intrinsic conditions of the existing place. Depending on nature, this relation is discussed in three stages. The first stage is the essence of ecological design. Here, not only the basic processes of nature are identified, but human interventions must have the least effect on the ecology of the place and they must have vital and life giving or productive effects on the outcome.

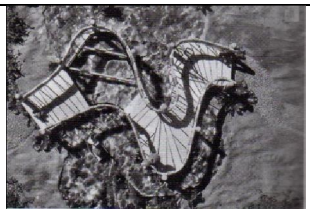
The second stage arouses the feeling of natural environment without a complete system of natural processes. Artificial controls such as pumps and ladles and watering systems keep the plants and herbs fresh.

In the third stage, there is less relationship with the nature and there is not much similarity between the designed space and natural processes. The designed space is mostly built of man-made materials such as sand, glass, brick and wood. Shapes must follow an order through this artificial structure.

Shape 4 : (1-4 to 4-4) Samples related to abstract-nature oriented approach. Source: Reid. G. W., 2007.

4-4

3-4



2-4

1-4

5. Form variation

Another important note in the methodology of form creation which is profitable is form variation. Form variation is the process of changes of forms in which the form is finalized by responding to inner and outer motivations (Antoniades 1991). Form variation has been the fundamental method of giving finishing touches to forms since classical era till now. For instant; a form could change by cutting one or some of its dimensions but still has its (formal) identity. For instant; a triangle could transfer to other prismatic forms by changing its height, length and width. Also it can transfer to a planar form by getting pressed or it can develop to a linear form.

Now, we are in conditions that we should present and discuss all possible approaches to this strategy and examine each of them. It can be said that no one as Antoniades has examined form variation so profoundly. Antoniades believes that it has three main strategies which are discussed as below.

5-1. Main strategies in form variation

There are three different methods in the variation of form:

1. The Traditional method: form's gradual evolution of form takes place through adapting each stage with limitations such as outer factors (such as site, views, directions, dominant winds, environmental problems), inner factors (such as functional standards, structural and physical planning) and artistic factors (such as the designers ability, will and approach towards changing the form along with the costs and other functional standards). This method, itself brings some restrictions in an unlimited form selection. Although this method defines and describes the figure, yet it restricts the possibility of new visual outcomes. By supposing a formal container (such as a cube) as a proper volume constantly, even if variations could occur in response to restrictions, the final outcomes are predictable. If the designer acts like a computer with the ability to calculate and identify the results and consequences of form's variations-regarding restrictions- then the results would always be the same.
2. Adaptation: the possibility to acquire formal movements in painting, sculpture, objects and other artificial products and learn from their two-three dimensional aspects, while considering their

efficiencies and capabilities. Adaption is an expression of "illustrative transfer" which can also be expressed as an "illustrative metaphor". As a painting turns to a background in which the process of formal changeability in landscape origination can take place, it is obvious that the second category makes the formal changeability possible through unrelated forms (such as a non-landscape painting). This is unacceptable in the theoretical aspects of traditional changeability when it comes to science, biology, mathematics and the theory of recognition.

3. Deconstructionism: is a process in which a supposed volume could become detached in order to find new solutions to compose (its) various parts and through this, the possibility of the origination of new forms.
4. would increase and new arrangements of compound (strategies) and various structured strategies would be available . Thus, a new composition would be created. In order to find a general infrastructure to help him understand and assess different strategies in formal variations, Antoniades turned to the ideas of the famous Biologist, Dorothy Thompson (1860-1948) in her popular book, *about Form and Growth.* In Thompson's opinion, form's variations is the phenomenon and process in which form changes in conditions which make changes. In his point of view, there are two possibilities for form description in any specified time:
5. Descriptive: through alphabetical applications
6. Analytical: through numeral applications, mathematics and Cartesian coordinates.

The direct relationship between this theory and architectural form could be understood immediately, because form in architecture could also be described by a word which is known as the "narrative method". Also, it could be described by mapping which are the extreme limits in form description in architecture. (Table 3).

Table 3 : relationship between archite cture and biology.

Biology	**Architecture**	**Description**
Descriptive	narrative	**Through alphabetical applications**
Analytical	illustrative	**Through numeral applications, mathematics and Cartesian coordinates**

Afterwards, Antoniades identified a relationship between form in architecture and form in biology. He understood that the comparison he made between Thompson's descriptive/analytical methods with the Architectural narrative/ illustrative method was not absurd. No matter what sketching might seem abortive (ineffectual) and undisciplined (irregular), it produces legibility and clearness which produce unlimited flexibility to achieve perfection. Finally he found that formal variations are a visual action which is independent to any other scientific fields. In a comparative study between biology and architecture in form's variations, Antoniades analyzes six standards of related forms, unrelated forms, narrative, illustrative, accepted experiments and new enforcement frameworks with four natural, obligatory, strong and weak indexes. In defining form in landscape and its methodology in form origination, the field of architecture assisted us, as Biology had assisted Antoniades, now we will make a comparative comparison between form variations in the fields of architecture and landscape (Table 4).

Table 4 : Adaptive analogy in variability of form in architecture and landscape. Source: Authors.

	Related forms		Unrelated forms		narrative		illustrative		Accepted experiments		New enforcement frameworks	
	Architecture	Landscape Architecture	Architecture	Landscape Architecture	Architecture	Landscape Architecture	Architecture	Landscape Architecture	Architecture	Landscape Architecture	Architecture	Landscape Architecture
	From one building to another	From nature to the built environment	From painting to a building	From painting to landscape	Describing a form in architecture	Describing a landscape					Structural limitations	
natural	●	●		●					●	●		
compulsory			●								●	●
strong						●	●	●	●	●		●
weak					●						●	

6. Conclusion

In this article, different approaches to form origination in landscape architecture were discussed. By not considering (being free of) detailed factors which could be effective in every design process, we came to the two "geometrical - functional" and "abstract - naturalistic" approaches in landscape design. The geometrical-functional' approach apart from its inspirational source could be analyzed based on Euclidean geometry and secondary themes such as the 90 degree theme, the 45-90 degree theme, the 30-60 degree theme. The 'abstract-naturalistic' approach leads to existing forms in nature and irregular shapes in order to restore (gain access to) order.

Although, sometimes it might be questioned that how can a production of a conceptual meaning appear

as a geometrical model or as a model with a natural form. To answer this, it should be mentioned that this research is based on a practice-Theory attitude and this question will be answered through a Theory-practice attitude.

The importance of form variation which would result as one of the mentioned approaches above was discussed. A variation in landscape (architecture) is a new topic in design theories of landscape studies. By recognizing the mentioned approaches, the designer's thoughts will be organized and put into different models in order to analyze the produced form and the special effects. As mentioned in this article, theorizing concepts such as form in landscape architecture is much more restricted than architecture. We hope that this article would help landscape designers to find new researchable methods in the design process.

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Assessment of different approaches in reducing co2 emissions

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Abstract: Fossil fuels will remain a key element in the development of global economy in coming decades. Therefore the accumulation of CO2 in the air caused by fossil fuel consumption must be prevented because of the environmental concerns. Therefore the global issue of CO2 production has been under concentration in recent years through declarations such as the Kyoto protocol and also by industry leaders. To solve this problem and stabilize CO2 levels, the leaders must look towards adopting CO2 management strategies across their various enterprises. The purpose of this paper is to review three different and currently used methods of reducing CO2 emissions
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Introduction

With the rapid development of modern civilization, carbon dioxide (CO2) is produced in large quantities in industry, for instance, by the combustion of coal, coke, and natural gas, in the fermentation of carbohydrate materials and sugars, in the manufacture of cement and lime, and etc. Indeed, more than 30 billion tons of CO2 are added to the atmosphere each year. However, the emission of CO2, one of the major greenhouse gases, has raised great concerns about the relationship between anthropogenic CO2 and global warming; the emission of CO2 may have contributed to urban smog, acid rain, and health problems [1,2]

Policies on sustainable development have resulted in the wide concern about clean and environmental-friendly energy production. Resolutions of Kyoto Protocol [1], for example, aim to reduce the emission of greenhouse gases (GHG) in order to mitigate the climate change. However, according to recent IEA reports [2,3], world energy demand is growing at a rate of about 1.6% per year, and is expected to reach about 700 * 10^{18} J/y by 2030, with more than 80% of worldwide primary energy production still coming from combustion of fossil fuels. Meanwhile, global carbon dioxide (CO2) emissions are expected to exceed 30 * 10^{9} t/y in the near future. This particular situation leads to inevitable conflict between satisfying increasing demand and reducing GHG emissions. In recent years, a lot of scientific effort has been put to compromise the needs and constraints. Since combustion process involves production and emission of CO2 as a GHG component, its reduction has become an important agenda for many research areas

The improvement of energy efficiency is seen as one of the most promising measures for reducing global CO2 emissions. The European Union has set an indicative objective to reduce its primary energy consumption by 20% by 2020 compared to projected 2020 energy consumption in order to reduce emissions and dependence on imported fossil fuels [3]. However, the emission reduction potential may seem different from the industrial plant and policy-makers perspectives. Therefore Co-operation with the government and industrial sector is essential for understanding the contribution of energy conservation measures towards meeting the energy efficiency target and CO2 emission reduction commitment at the national level. [4]

Some of the important technologies for carbon emissions abatement are liquid biofuels in transportation, and carbon dioxide capture and storage in power generation.
Despite the positive impact on environment, widespread use of these technologies has certain

disadvantages. In case of biofuels, their production may strain agricultural resources that are needed also for satisfying food demands and processing capacity for downstream conversion of biomass into biofuel. At the same time, CCS (carbon capture and storage) is rather expensive technology and its practical implementation in power facilities must be carefully considered and planned. One challenge with CCS is that the understanding of the techno- economics of capture and storage is rapidly evolving, so that the most economic system-wide specifications in (say) 2030 may be different from those envisaged today by individual participants.
In addition, there is the important question about whether CO2 should be treated (and regulated) as a commodity product (for example in EOR) or as a pollutant/waste [5].

Generally low carbon technologies include:

- Energy efficiency enhancements through process or product design, modification and retrofit.
- Alternative, non-combustion energy sources such as hydroelectric, wind, solar and nuclear power.
- Combustion of carbon neutral biomass-based fuels for both transportation and industrial applications.
- CO2 capture and storage (CCS) techniques in conventional fossil fired power plants and large industrial facilities. CCS is sometimes alternatively referred to as carbon dioxide sequestration.

Biofuels

Although world oil reserves have been estimated to suffice for about 40 years, its distribution is highly concentrated in small number of sites, making the oil scarce in many parts of the world. Furthermore, the transportation sector contributes up to 30% of CO2 emission. For these reasons, there has been significant interest in biofuels in both developed and developing countries [6–9]. In order to reduce both dependence on foreign oil and emission level, biofuels have entered development widely supported by governments' legislations. For instance, latest EU directive 2009/28/EC [10] requires all Member States to displace 10% of diesel and petrol used in transportation with biofuels by 2020. According to this directive, each Member's government is supposed to develop its own schedule for biofuels introduction. Biofuels are considered to be carbon–neutral in principle because of closed carbon cycle. Carbon dioxide produced in combustion process is subsequently fixed during the growth of the feedstock. Additional emissions may occur through other means, such as use of fossil fuels for farm inputs; emission of GHGs from land use change; and the production of biofuels with both biomass and fossil components (e.g. biodiesel based on methyl esters). On the other hand, there are many concerns about large-scale biofuel production. For instance, some regions suffer from limited land and water resources that may lead to the competition between biofuel and food crops. Large-scale biofuel production would result in either higher food prices or scarcity of resources (water in particular) [11–14]. Furthermore, expansion of farmland contributes to environmental degradation (e.g. deforestation, biodiversity loss). Finally, biofuels may not be completely carbon– neutral. Different life-cycle analyses (LCA) show that carbon footprint for biofuels is wide-ranged and may even exceed that of conventional fuels under unfavorable conditions [15]. Furthermore, supply of biofuels in growing markets may exhibit instability or oscillation, thus undermining the role of biofuels in enhancing energy security [16]. Summarizing the above, biofuel production is highly constrained with occurrence of multiple footprints [17]. Although fuel displacement has become mandatory in many countries due to governmental policies, it is of importance to introduce biofuels into the market without detriment to environment and economy.
Some recent works that addressed the problem of resource constrained biofuel production have been reported, with the objective being to satisfy demand with most effective utilization of available resources and minimum biofuel import [18,19]. Such an approach leads to maximizing self-sufficiency of the local market.
It has been reported also that in case of biofuel planning, combining all constraints in a single approach is essential [19]. However, instead of developing unified quality criterion for pinch analysis, as has been suggested [19], approach presented below takes full advantage of mathematical programming using the source–sink framework.

Carbon capture and storage

The application of Carbon Capture and Storage (CCS) technology to energy-intensive processes is starting to attract attention, presenting an opportunity for developing multi-user CO2 transportation networks. Recognizing that most industrial facilities have not been designed with CCS in mind,[5]

The subject of Carbon Capture and Storage (CCS) for power stations running on coal or natural gas is both important and prominent. The application of CCS to other industries which have large carbon dioxide (CO2) emissions is equally important but much less prominent. Industry accounts for 40% of global energy-related CO2 emissions. In 2007 the global figure for direct CO2 emissions from industry was 7.6 Gte of direct CO2 emissions to which could be added 3.9 Gte of indirect CO2 emissions from power stations supplying electricity to industry [20]. The much-quoted IEA ''blue map'' scenario for halving global CO2 emissions between 2005 and 2050 shows a 19% contribution from CCS which is split roughly equally between the power generation sector and the rest of industry [20].

Pre-combustion carbon capture technology is often proposed for new power plant facilities such as Integrated Gasification Combined Cycle (IGCC), and oxyfuel combustion technology is being developed as a promising energy-efficient process, but for retrofit applications the main interest tends to be in post-combustion capture technology [21,22]. In its conventional form it carries an energy penalty because additional energy is expended in regenerating the solvent used to dissolve CO2.
Several processes are available for retrofitting to power stations and process plants, capturing CO2 from flue gases. Licensors of ammonia based chemical solvent processes claim lower operating costs than for the more familiar amine-based process (described below) because less energy is required for regenerating the solvent.
Amine scrubbing is a more common and more mature process for removing CO2 from a flue gas stream although it is known to suffer from a significant energy penalty. The problems to be solved depend on the composition of the flue gas. For example, on a gasfired power station with 3–4% CO2 in the flue gas compared with a coal-fired power station with 13–14% CO2 in the flue gas, larger absorbers are required in order to capture the same quantity of CO2, leading to high levels of solvent consumption and a large energy penalty for solvent regeneration [23]. Once the range of target plants is expanded to include other industries, the range of flue gas compositions also expands.

Alternative processes based on physical solvent adsorption have also been developed. They offer lower regeneration costs but tend to require a high operating pressure and are therefore less attractive in flue gas applications. A range of more advanced CO2 separation technologies is under development, but they are not presently marketed for retrofits [22].

Turning to industrial facilities, the challenges of retrofitting CCS can in some cases be particularly demanding since CO2 emissions are often an inherent part of the basic process itself. For example, the basic process of calcining limestone (calcium carbonate) to make cement must inevitably generate CO2 as a by-product because of the fundamental chemical reaction involved.
UNIDO have analyzed five broad industrial sectors: high-purity CO2 producers, refineries, cement, iron/steel and biofuels [24]. The processing of natural gas (which in its raw form contains between 2% and 70% CO2) is an example of a high-purity CO2 process where some people are already deploying CCS. Another large part of the high-purity sector is ammonia production for fertilisers. UNIDO estimate that the cost of capturing a tonne of CO2 spans a wide range from $4 to $47 depending on the plant configuration.
For the other processes, the range is smaller (between $9 and $31), including production of ethylene oxide (a petrochemicals building block) where the CO2 stream purity can be anywhere between 30% and 100%. In the cement sector CCS has not been deployed commercially yet. A post-combustion capture facility based on established amines technology could be retrofitted with minimal change but with an energy and cost penalty. Changing to a new process based on oxygen rather than air would be attractive in energy and operating cost terms but is not really a retrofit option. In the iron/steel industry there is interest in processing the blast furnace gas stream which is rich in CO2 and carbon monoxide, and which can be reformed into a 60% pure CO2 stream.
Refineries have the option of capturing CO2 from their various hydrogen production processes such as steam methane reforming and gasification of heavy oils/residues. On complex refineries which include fluidized catalytic crackers, about 50% of the CO2 emissions derive from catalyst regeneration and can in principle be captured in a post-combustion process. With CO2 capture costs ranging from €19/te to €85/te across the various options, practical deployment has tended to be at the low-cost end (viz. steam methane reforming) where there is a nearby outlet for CO2. The easiest retrofit option for biofuels plants is on fermentation processes since they produce large volumes of high-purity CO2. For example, the Arkalan bioethanol plant in Kansas, USA, captures CO2 from a 60% pure stream for use in EOR [24].

Carbon dioxide (CO2) emissions are believed to be a major contributor to global warming. As a consequence, large anthropogenic CO2 sources

worldwide will eventually be required to implement CO2 capture and storage technologies to control CO2 emissions [25]
Unfortunately, no current technologies for removing CO2 from large sources like coal-based power plants exist which satisfy the needs of safety, efficiency, and economy; further enhancement and innovation are much needed.[25]
As a result, a variety of methods have been studied and patented for the removal and separation of CO2 from industrial waste and mine gases, from the air, and from gases produced by animal metabolism, such as human respiration.
Many technical challenges, however, are facing potential large scale implementation of CO2 capture in power plants [26]

CO2 capture is the key step economically and has two technology routes: (1) pre-combustion: capture from the reformed synthesis gas of an upstream gasification unit; and (2) post combustion: capture CO2 from the flue gas stream after combustion

Upon capture, CO2 can be stored underground, used for enhancing oil recovery, and as carbon resources to be converted into other useful compounds [27,28]

The current technologies for CO2 capture and separation mainly include solvent, sorbent, and membrane, and the mechanisms for CO2 capture depend on the chemistry of the capturing approaches or materials

In the case of industrial applications where large quantities of sorbents, solvents, and membranes are used, or in the case of extracting CO2 from an anesthesia gas system, the impact of carbon capture materials on the environment and health is more of a concern. Attempts have been made to reduce dust or vapor formation, for instance, by providing solid sorbents with a protective coating (e.g., US3259464 [29]); this process, however, may also impair the CO2 capture capacity of the sorbent. Use of filters has also been studied in applications like self-contained diving gear but the filters may increase back pressure and cause a serious reduction of air flow.

In many cases, an organic solvent is used for CO2 removal or is involved in the preparation of sorbents or membranes for CO2 removal. In sorbents or membranes, the organic solvent must be stripped before they can be used for CO2 removal. Obviously, solvent recovery systems are quite expensive and there is always a possibility that the solvent will not be completely stripped. In such cases, the sorbents or membranes may be odorous. If the solvent is toxic then the prepared sorbents or membranes may not be used in applications like an anesthesia flow system or a life-supporting gas system.[25]

It has been noted previously that the fossil fuels remain a primary resource in the worldwide energy production. This particular trend is likely to be sustained for many years since no alternative source is known at present to be applicable on such a scale. For reasons discussed above, nuclear energy contributes only about 10% to world supply (even if it is used widely in some countries e.g. France, Japan), leaving the bulk of electricity being produced in natural gas and coal-fired plants. However, coal and other fossil fuels are most carbon-intense sources of energy. Furthermore, it is difficult to financially justify the shutdown of fully functional power plants before they have served the full extent of their economic lives. Options to retrofit such plants to allow them to continue operating are thus considered attractive. Thus, CCS technologies are required to meet the requirements of CO2 emission reduction. Several techniques of CCS are considered to enter commercial application in the near future [30–33]:

- Post-combustion capture (PCC) that consists in absorption of CO2 from the flue gas using chemical agents.
- Integrated gasification combined cycle (IGCC), which uses self generated hydrogen in combustion process. This approach involves pre-combustion capture of CO2 from the fuel.
- Oxyfuel combustion (Oxyf), or combustion in pure oxygen instead of air, which eliminates the need to separate of CO2 from combustion gases.

All these capture methods offer the potential for at least 80% CO2 removal. Also, in all cases, compression of captured CO2 is required prior to storage in various sinks (e.g. impervious geological formations, unmineable coal deposits, depleted oil wells or saline aquifers, among others). Although retrofitting power plants with CCS is considered an attractive way to lower the carbon intensity of fossil fuels, its application entails additional expenses for installation and maintenance of CCS equipment (e.g. compressors, absorption units, etc.). According to estimates [34], capital and operating costs of retrofitted plants are 20–70% higher as compared with baseline plant. Furthermore, plants with CCS suffer from efficiency losses. Due to energy consumption of additional equipment for CO2 capture and compression, power output of retrofitted plant is 15–20% lower than baseline level [32]. This

may result in a drop in plant thermal efficiency of 5–10% points. If CCS is deployed on a large scale, it is also necessary to compensate for the missing power by using additional carbon-free sources or introducing efficiency enhancements [35]. Otherwise the result would be raised CO2 emissions or power shortages. All these factors must be taken into account when planning CCS placement, as they combine to raise the final cost of electricity from the retrofitted plants

However, extensive retrofit would likely result in major expenses and power output drops [35], leading to increasing fuel consumption for a given power output and higher prices. Therefore, minimization of total cost is essential.

Pre-combustion technology advantages and challenges [25,36]

CO2 capture technology	Advantages	Challenges
Physical solvent	- CO2 recovery does not require heat to reverse a chemical reaction - Common for same solvent to have high H2S solubility, allowing for combined CO2/H2S removal - System concepts in which CO2 is recovered with some steam stripping rather than flashed, and delivered at a higher pressure may optimize processes for power systems	- CO2 pressure is lost during flash recovery - Must cool down synthesis gas for CO2 capture, then heat it back up again and re-humidify for firing to turbine - Low solubilities can require circulating large volumes of solvent, resulting in large pump loads - Some H2 may be lost with the CO2
Solid Sorbent	- CO2 recovery does not require heat to reverse a reaction - Common for H2S to also have high solubility in the same sorbent, meaning CO2 and H2S capture can be combined - System concepts in which CO2 is recovered with some steam stripping rather than flashed, and delivered at a higher pressure may optimize processes for power systems	- CO2 pressure is lost during flash recovery - Must cool synthesis gas for CO2 capture, then heat it back up again and re-humidify for firing to turbine - Some H2 may be lost with the CO2
H2/CO2 membrane	H2 or CO2 permeable membrane: - No steam load or chemical attrition H2 permeable membrane only: - Can deliver CO2 at high-pressure, greatly reducing compression costs - H2 permeation can drive the CO shift reaction toward completion – potentially achieving the shift at lower cost/higher temperatures	- Membrane separation of H2 and CO2 is more challenging than the difference in molecular weights implies - Due to decreasing partial pressure differentials, some H2 will be lost with the CO2 - In H2 selective membranes, H2 compression is required and offsets the gains of delivering CO2 at pressure. In CO2 selective membranes, CO2 is generated at low pressure requiring compression
Water gas shift membrane	- Promote higher conversion of CO and H2O to CO2 and H2 than is achieved in a conventional WGS reactor - Reduce CO2 capture costs - Reduce H2 production costs - Increase net plant efficiency	- Single stage WGS with membrane integration - Improved selectivity of H2 or CO2 - Optimize membranes for WGS reactor conditions

Post-combustion technology advantages and challenges [25,36]

CO2 capture technology	Advantages	Challenges
Solvent	- Chemical solvents provide a high chemical potential (or driving force) necessary for selective capture from streams with low CO2 partial pressure - Wet-scrubbing allows good heat integration and ease of heat management (useful for exothermic absorption reactions)	- Trade off between heat of reaction and kinetics. Current solvents require a significant amount of steam to reverse chemical reactions and regenerate the solvent, which de-rates power plant - Energy required to heat, cool, and pump nonreactive carrier liquid (usually water) is often significant - Vacuum stripping can reduce regeneration steam requirements, but is expensive
Solid sorbent	- Chemical sites provide large capacities and fast kinetics, enabling capture from streams with low CO2 partial pressure - Higher capacities on a per mass or volume basis than similar wet-scrubbing chemicals - Lower heating requirements than wet-scrubbing in many cases (CO2 and heat capacity dependent) - Dry process—less sensible heating requirement than wet scrubbing process	- Heat required to reverse chemical reaction (although generally less than in wet-scrubbing cases) - Heat management in solid systems is difficult, which can limit capacity and/or create operational issues when absorption reaction is exothermic - Pressure drop can be large in flue gas applications - Sorbent attrition
Membrane	- No steam load - No chemicals - Simple and modular designs - 'Unit operation' vs. complex 'process'	- Membranes tend to be more suitable for high-pressure processes such as IGCC - Trade off between recovery rate and product purity (difficult to meet both high recovery rate and high purity) - Requires high selectivity (due to CO2 concentration and low pressure ratio) - Poor economy of scale - Multiple stages and recycle streams may be required

Energy management and planning techniques

To identify the optimum use of low-carbon technologies, detailed reliable planning methods are required. Examples of energy planning techniques that have been used previously are life cycle assessment [37, 38] and system perturbation analysis [39], which place emphasis on descriptive modeling of the linkages that exist within complex energy supply chains. Pinch analysis and process integration methods have also been extended for energy planning applications. Among many applications of carbon-constrained planning some address optimization within single facility [40], while other focus on more general, regional-level targeting [41–47]. In terms of techniques, both graphical targeting and mathematical programming have been used so far. Recently presented pinch analysis approach [41], had proven again to be an effective technique, portable between various fields of application due to well-established principles. Pinch analysis was initiated for the synthesis of heat exchanger networks (HENs) and other energy recovery system [48–50], which was then extended to a range of other problems such as industrial resource conservation [51–53], supply chain planning [54–56] and batch plant scheduling [57]. Most pinch analysis methods rely on graphical displays that provide decision- makers with an intuitive understanding of the problem structure. Such insights, in turn, facilitate proper planning. However, pinch approaches suffer from inherent simplifications and lower expandability than mathematical programming. Hence, mathematical programming should be used when detailed planning scenarios are encountered.

Tan and Foo [41] emphasized that energy planning cannot be limited only to the stationary applications

such as industrial and residential. About 30% of global final consumption is contributed by transportation sector, which is mainly powered by petroleum products and is thus considered particularly vulnerable to price and supply fluctuations [58].

Several measures associated with thermal energy management are considered as [3]:

1- Usage of low quality exhaust heat in refrigeration cycles by absorption.
2- Use of thermal residues for preheating feedstock (for example recovery systems can recover the heat produced in coking processes).
3- Design of energy and/or mass (water and hydrogen) integration basically employing the Pinch Techniques; the use of Pinch Techniques provides energy savings in refineries of 20%.
4- Improving burners through better burning control.
5- Direct feeding of intermediate products to the processes without cooling and storage, aiming at recovering part of the residual heat in these products. For example, the thermal energy of the products of the distillation column can be directly recovered in the downstream units, thereby avoiding storage and cooling.
6- Using heat pumps.
7- Increasing turbulence in the heat exchange surfaces.
8- Adoption of a steam management system. For example, the quality of steam used in stripping and vacuum generation is normally lost in the cooling water or wasted to the atmosphere. Normally steam used for stripping ensures the flashpoint temperature and improves the fractioning of products, increasing the yield of the refining units.

Besides reducing the area of heat exchangers fouling causes maintenance problems and risk of accidents. Heat exchange networks with incrustations have approach temperatures higher than 40 C [59] when typical values in refineries hover between 10 and 20 degrees centigrade. Estimates done in the early 1980s for a typical refinery of its period with a primary processing capacity of 100 thousand barrels per day suggest that fuel consumption could be 30% less in the atmospheric distillation column by controlling fouling in the heat exchangers [60]. A more recent study, however, pointed to a lower potential. Although still significant, the reduction was only 10% [61] Yet incrustation in heat exchange networks is a bottleneck impeding the application of heat recovery systems. The gains achieved from reducing fuel consumption by controlling incrustation were estimated at 2% for refineries in the United States [62]. Meanwhile, Panchal and Huangfu [63] analyzed the effects of incrustation in a 100 kbpd atmospheric distillation column and found an additional energy consumption of 13.0 MJ per barrel processed (or around 3.4% of specific energy consumption in Brazilian refineries).

Depending on the design of the power plant, heat conservation can lead to either reduced or increased electricity output from an industrial CHP (combined heat and power) plant. In the case of a back-pressure plant, reduced heat output leads to reduced electricity output, which enables fuel conservation at the site but at the same time increases the demand for grid-based electricity. On the other hand, if there is a condensing unit in the steam turbine, heat conservation enables increased electricity output from the industrial CHP plant, and therefore less grid-based electricity is needed [4]

Khrushch et al. [64] defined the CO2 emission reduction potential in the US chemicals and pulp and paper industries by applying CHP technologies. In this study, the emission reduction was evaluated based on the assumption that CHP electricity production replaces electricity purchased from the grid. So, significant emission reduction potential at negative cost was found.

Axelsson [65] found that the opportunities for energy and cost savings and emission reductions in industry are heavily dependent on the existing design of the process and the energy system, the electricity-to-fuel price ratio, and the emissions of purchased electricity production.

Laukkanen [66] studied process integration in the pulp and paper industry, including the influences of steam saving on CHP production. He found that steam saving is not always profitable if the conserved heat cannot be somehow utilized, e.g. for the production of district heat or additional electricity from a condensing unit in the steam turbine. Therefore, the energy utility system and the production plant should be optimized together. According to Axelsson and
Berntsson [67] heat conservation can, depending on energy prices, be realized as fuel savings or increased electricity production by investing in a new steam turbine

Since cost-effective production and profit maximization are usually the main goals of industrial operation, the attractiveness of CHP production has to be ensured by proper energy policy and supporting mechanisms. Therefore, many EU countries have supported CHP within their national allocation plans due to its favorability from the wider perspective. For example, double benchmarking and CHP bonuses have been applied in order to promote CHP [68].

A wider perspective can be considered by widening the system boundary. The importance of clearly defining the system boundary has been noted in some industry related energy efficiency studies, such as Larsson et al. [69] and Tanaka [70]. In addition, wider system boundaries have been used when the integration of industrial energy production into the district heating system of outside society has been studied in Sweden [71,72]. These studies have focused on evaluating the increase in energy efficiency and the reduction in CO2 emissions in integrated systems.

Conclusion

Generally, low-carbon technologies are either well-developed (as in the case of first generation biofuels) or emerging (like CCS technology for power plants or second-generation biofuels for motor vehicles). However, their potential for widespread use in the immediate future remains uncertain due to various limitations. For instance, CCS is subject to uncertainties inherent in unproven technologies, particularly with regard to the reliability of long-term carbon dioxide storage in various sinks. It is also expected to significantly increase the cost of electric power. Also first generation biofuels that are derived from agricultural crops consume valuable land and water resources and their ability to displace large proportions of global petroleum demand is now in doubt. On the other hand, associated technologies for second-generation biofuels are still not yet commercially viable due to high costs. Thus, it is of some interest to policy-makers to determine the minimal level of deployment of low-carbon technologies needed to meet desired GHG emission levels.

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The Effects of Foliar Applications of Nitrogen, Boron, and Zinc on the Fruit Setting and the Quality of Almonds

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Abstract: Fruit drop in orchards of almonds (*prunus amygdalus L.*) is one of the major problems encountered by producers of fruit in Iran. Nutritional elements, particularly nitrogen and boron, have an effective role in this issue. To study the effect of these elements, a factorial experiment was done based on randomized complete blocks with 18 applications and three repetitions – altogether, 108 8-year-old Azar trees were tested in the county of Shabestar during 2002 and 2003. The first factor was nitrogen supplied from a urea source in two levels (zero and 5000 ppm), the second factor was boron from a boric acid source in three levels (zero, 2000 ppm and 4000 ppm), and the third factor was zinc supplied by a source of zinc sulfate in three levels (zero, 2000 ppm and 4000 ppm). The highest percentage of fruit setting (24 percent) was measured at the third levels of boron and zinc. The highest final fruit setting percentage (15 percent) was obtained for second- and third-level boric acid. Also, the highest single kernel weight (2.4 grams) was measured for combined foliar application with 5000-ppm urea and 4000-ppm boric acid. The highest kernel percentage (14 percent), on the other hand, was achieved with third-level boron. The highest fruit length (4.4 centimeter) was also obtained for third-level boron. Furthermore, second- and third-levels of boric acid led to the highest fruit width (3.1 centimeter). The highest oil percentage measured (53 percent) was observed for third-level zinc without applying nitrogen. The highest hard shell percentage (22 percent) was obtained when combined foliar applications of second-level nitrogen and second- and third-level boric acid were used. On the other hand, the highest protein percentage (23 percent) was measured for the combined foliar application of urea and third-level boric acid. No significant simple or interactive year by location effects were obtained for any of the fertilization applications.
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Keywords: nitrogen, boron, zinc, initial fruit setting, final fruit setting, almonds

Introduction:

Despite ranking fourth in the world in the production of almonds, Iran lacks in performance and quality in this field. Therefore, considering the role this product can have in increasing exports and bringing in foreign currencies, ways to enhance performance should be examined and determined. One of the factors leading to decreased performance is mismanagement particularly in the case of the lack of nutrients, a problem that crucially needs to be resolved. As Vezvaee and Ghaderi (1999) have reported in Karaj, autumn foliar applications of boric acid and zinc sulfate brought about an increase in fruit setting from 18.5 percent in the control application up to 39.5 percent in the combined application of boron and zinc. As reported for Italian plums by Hanson (1985), autumn foliar applications of boron led to 15 percent increases in fruit setting as well as lowered ovary lengths in trees without boron deficiency. Mahyoub et al. (1993) brought about considerable increases in apricot yields by means of combined foliar applications of boron along with nitrogen. Ahmad and Abddel (1995) reported that foliar applications of boron, nitrogen and zinc on oranges leads to higher product yield, fruit weight and diameter, extent of dissolved solid matter and total sugar content. As reported by Salem (1996), the application of iron, zinc and nitrogen raises the number and amount of tangerine yields. This researcher reported that autumn applications of 5000-ppm zinc sulfate and urea causes noticeably higher fruit settings. Nyomora et al. (1999) concluded that foliar applications of 1 percent boric acid in the autumn following harvest – when active green surfaces for sufficient boron intake existed – led to considerably higher amounts of boron in the almond plants' internal organs as well as 22 percent increases in fruit setting and 15 percent raises in product yield.

Furthermore, Nyomora et al. (1995 and 1997) concluded that autumn foliar applications of boron upon the flower leaves and stigmas led to 20 and 25 percent increases of the concentrations of this element respectively as compared to the control application. These researchers concluded that boron deficiency brings about slower growth and thus delayed flowering in almonds. When boron deficiencies occur, the stamen loses its spore tissue, and part of the plant's reproductive organs is injured. In such circumstances, the stamens have lower capacities for producing pollen, and the size and the growth of the pollens is thus affected. Chaplin et al. (1977) presented a theory based upon which boron exists in the pollen tube along with callose compounds. With boron deficiencies, callose increases, and pollen tubes grow and evolve with difficulty. Furthermore, nitrogen and carbohydrates

accumulate in the leaves when there is insufficient boron. They concluded that autumn foliar applications of boron at concentrations of 5000 milligrams per kilograms upon Italian plum trees had no effect upon spring fruit setting, when the amount of fruit wetting was already high (12.2 percent) with suitable temperature; however, in early cold springs, when temperatures ad also fruit settings are low (3.2 percent), there was a 32 percent increase in fruit setting. The amount of boron existing in plum fruits is often insufficient for appropriate fruit setting. Autumn foliar applications of boron led to 115 percent increases in fruit settings and 40-100 percent performance enhancements in Italian plums; no signs of boron deficiencies were observed in the leaves, either. Using foliar applications of boron and zinc on oranges, Quin (1996) brought about considerable increases in pollen tubes, fruit settings, product yield and fruit sugar contents. Moreover, as indicated by the findings made by Supriya et al. (1995) on lemons, foliar application with zinc decreased the amount of potassium in the leaves. Spark (1998) also observed that foliar application with zinc lowered the amount of magnesium in the leaves. This research has endeavored to examine the effect of foliar applications of nitrogen, boron and zinc upon the fruit setting and some other characteristics of almonds.

Table 1. The results for leaf analysis made for major almond production in the province

	percentage			milligrams per kilogram			
element region	nitrogen	phosphorous	potassium	iron	manganese	zinc	boron
Azarshahr	2.2	0.32	1.4	96	46	15	25
Bonab	1.9	0.33	1.5	86	72	14	46
Shabestar	1.8	0.30	1.7	97	66	13	23
Maragheh	2.2	0.32	1.9	79	71	19	24

It should be noted that the figures for each column have been derived from the means for 10 orchards.

As seen in Table 1, most groves in the province show deficient or average amounts of nitrogen, zinc and boron. In the regions of Bonab and Shabestar, there is lack of nitrogen, and the amount of nitrogen in the region of Azarshahr is also at the minimum desirable level. In the regions of Azarshahr, Bonab and Shabestar, zinc exists at desirable levels. Boron, on the other hand, proves to be lacking in the regions of Azarshahr, Shabestar and Maragheh, whereas it is at a desirable level in the region of Bonab. Thus, the region studied is lacking in fertilizers, and greater need than before for the area to be studied (Malakouti and Gheibi, 2000). There clearly must be a correlation between the consumption of these elements and enhanced fruit settings. Nevertheless, despite the desirable amount of some elements, the foliar applications of nitrogen, boron and zinc have proved to be influential upon fruit setting percentage. This research has merely attempted to study and compare the effects of the consumption of nitrogen, zinc and boron upon the amount of fruit setting. The aim of the present study has been focused only on the effects of the elements concerned in the study rather than quantitative factors.

Methods and Materials

This project was conducted as a factorial experiment based upon randomized complete blocks with 18 applications and three repetitions – altogether, 108 8-year-old Azar trees were tested in the county of Shabestar (the Teel Production Cooperative) during 2002 and 2003. The trees included in the study were 8 years old. The orchard studied included Sahand, Nonperiel and Monagha almonds, and was a combination of pollinating and pollen-accepting. The first factor was nitrogen, supplied by an urea source in two levels (zero and 5000 ppm), the second factor was boron supplied from a source or boric acid in three levels (zero, 2000 ppm and 3000 ppm), and the third factor was zinc from a source of zinc sulfate in three levels (zero, 2000 ppm and 4000 ppm). The trees were first selected and labeled based upon the research plan and the applications. Around a month after harvesting the product, foliar applications of boric acid, zinc sulfate and urea were carried out. Applications were done in the evening to facilitate better absorption. About 0.05 percent of Citowett solution was added to nutrient solutions as foliar wash. The control application was sprayed with water and washing material. About 10 liters of solutions was consumed for each tree. Half of the nitrogen fertilizer was used in Esfand, and the other half was applied in Khordad. For each tree on the first location, 800 grams of urea, 500 grams of triple superphosphate, 600 grams of potassium sulfate, 50 grams of iron chelate and 1500 grams of manganese sulfate were used; 350 grams of urea, 250 grams of triple superphosphate, 100 grams of iron chelate and 300 grams of manganese sulfate were used for the second location. During the growth season, measures were taken to contest pests, diseases and weeds. The soil the almond trees were planted in and also the irrigation water used on location were analyzed (Tables 2 and 3). In this experiment, trees of almost the same size were selected in rows, and one branch of each was marked. Thus, even branches located on geographically equal sides of the trees in the experiment were chosen; five fertile branches with diameters of approximately 2.5 centimeter and from the same geographical side were selected from each tree. Equal numbers of pollinating and pollen-accepting trees of the orchard have been used. Counting was carried out 30 days

after initial fruit setting and 60 days after final fruit setting, thus determining the number of flowers, and subsequently, the number of fruit formed and the percentage of fruiting. The concentration of nutrients in the nitrogen fertilizer applications were measured using wet ash methods and Auto Kjeldal; for phosphorous, spectrophotometers were used, whereas flame photometry was used for potassium and dry-ash methods along with atomic absorption were used to measure trace elements. Furthermore, quantitative factors such as single fruit weight, kernel percentage, fruit length and width, oil percentage (using the Soxhlet method), single kernel weight, hard shell percentage and protein percentage were also measured.

Table 2. The results of analyses made on the soil of the study locations during 2002-3 at the Shabestar Teel Cooperative

year	soil depth (cm)	EC dS/ m^{-1}	pH	Percentage of neutralized material	organic carbon (%)	**milligrams per kilogram**						soil tissue
						phosphorous	potassium	iron	manganese	zinc	boron	
The 1st location	0-30	1.2	8.1	10	0.62	11	200	4.9	5.2	0.28	0.4	L.S
The 2nd location	0-30	1.1	8.2	12	0.41	5	120	4	3.6	0.20	0.31	L.S
The 1st location	0-30	1.7	8.2	14	0.51	10	220	4.8	4.9	0.22	0.39	S.L
The 2nd location	0-30	1.6	8.2	23	0.38	4	110	3.5	3.2	0.18	0.22	S.L

Table 3. The results for the chemical analysis of the irrigation water

EC ($dS.m^{-1}$)	milliequivalents per liter				pH
	bicarbonate	chlorine	calcium	magnesium	
0.120	2.7	0.5	2.6	0.5	8.1

Results:

The soil of the region had no salinity problems, was highly alkaline, and moderate in lime; on the other hand, organic compounds, phosphorous, potassium, iron and manganese were at moderate levels, whereas deficiencies were seen in trace elements such as zinc and boron. The water in the region had no salinity problems, and was to some extent alkaline.

Table 4. The effect of various applications upon the concentrations of various nutrients in almond tree leaves

Milligrams per kilogram of dry plant matter					**Percentage in dry plant matter**					**Factor** / **Application**
boron	copper	zinc	manganese	iron	Mg	Ca	K	P	N	
26 C	4/8 A	8/5 C	39 A	46 AB	0/42 A	3/21 AB	1/56 A	0/24 A	1/86 B	$N_0B_0Zn_0$
25 C	5/1 A	25 B	40 A	45 AB	0/39 A	3/20 AB	1/52 A	0/21 B	1/97 B	$N_0B_0Zn_1$
27 BC	5 A	25 A	42 A	46 AB	0/45 A	3/33 A	1/50 A	0/21 B	1/87 B	$N_0B_0Zn_2$
30 B	4/9 A	10 C	40 A	45 AB	0/42 A	3/28 AB	1/52 A	0/25 A	1/98 B	$N_0B_1Zn_0$
39 B	5 A	15 C	42 A	40 B	0/45 A	3/29 AB	1/48 AB	*0/22* AB	1/96 B	$N_0B_1Zn_1$
40 AB	5/1 A	27 A	40 A	42 B	0/43 A	3/30 AB	1/49 AB	0/20 AB	1/87 B	$N_0B_1Zn_2$
42 AB	5/5 A	11 C	41 A	45 AB	0/44 A	3/32 A	1/51 A	0/26 A	1/88 B	$N_0B_2Zn_0$
42 AB	5/2 A	17 C	42 A	47 A	0/45 A	3/31 AB	1/50 A	0/22 AB	1/78 B	$N_0B_2Zn_1$
43 AB	4/9 A	26 A	41 A	48 A	0/43 A	3/30 AB	1/49 A	0/20 B	1/82 B	$N_0B_2Zn_2$
29 BC	4/8 A	14 C	39 A	45 AB	0/45 A	3/66 A	1/48 AB	0/24 A	2/1 A	$N_1B_0Zn_0$
28 BC	4/7 A	21 B	40 A	47 A	0/44 A	3/52 A	1/47 AB	0/21 B	2/15 A	$N_1B_0Zn_1$
30 B	4/6 A	27 A	42 A	48 A	0/43 A	3/48 A	1/49 A	0/19 B	2/12 A	$N_1B_0Zn_2$
40 AB	4/5 A	13 C	41 A	46 AB	0/42 A	3/36 A	1/50 A	0/23 A	2/15 A	$N_1B_1Zn_0$
42 AB	4/7 A	19 B	41/5 A	45 AB	0/45 A	3/42 A	1/51 A	0/21 AB	2/17 A	$N_1B_1Zn_1$
43 AB	4/9 A	24 A	42 A	46 A	0/43 A	3/5 A	1/52 A	0/20 AB	2/19 A	$N_1B_1Zn_2$
45 A	4/6 A	14 C	41 A	47 A	0/42 A	3/52 A	1/51 A	0/24 A	2/11 A	$N_1B_2Zn_0$
48 A	4/7 A	21 B	39 A	46 A	0/45 A	3/6 A	1/51 A	0/23 A	2/12 A	$N_1B_2Zn_1$
49 A	4/8 A	29 A	40 A	45 AB	0/44 A	3/5 A	1/50 A	0/22 AB	2/18 A	$N_1B_2Zn_2$

The averages with similar letters in each column show no significant difference at a 5 percent level (Duncan's multiple range test)

As seen in Table 4, the amount of nitrogen in the leaves shows a significant increase in level N_1 compared to N_0. The amounts of phosphorous, potassium, manganese and copper in the leaves, on the other hand, show no significant difference in all applications. Enhanced levels of zinc and boron, however, leads to considerably higher concentrations of these elements in the leaves. The main effects of nitrogen, zinc and boron on product performance became significant at one percent probability levels, and the highest performances (4.6 and 4.9 tons per hectare) were obtained through the third-level foliar applications of zinc and boron, respectively. As seen in the results displayed in the variance analysis table, the main effects of nitrogen, zinc and boron levels at one percent probabilities upon initial almond fruit setting prove to be significant. The highest initial fruit setting was measured at third-level

zinc (4000 ppm) (Figure 3). Moreover, the highest initial fruit setting was measured at third-level zinc (4000 ppm) (Figure 4). The main effects of nitrogen and boron levels upon final fruit setting percentage became significant at a one-percent probability. Furthermore, the highest percentages of final fruit settings were obtained by second- and third-level boric acid (Figure 5). The main effects of nitrogen and boron upon the weight of single almond fruits became significant at the probability of one percent. The second and third levels of boric acid showed the highest weight for a single fruit in grams (Figure 6). Furthermore, the main effects of nitrogen and boron levels upon shelled almond percentages proved significant at a one-percent probability. The highest shelled percentage (15.6 percent) was obtained at third-level boron (4000 ppm) (Figure 7). The main effects of nitrogen and boron levels upon the length of almond fruits became significant at the probability of one percent. The highest fruit length (4.4 centimeter) was measured at third-level boron (Figure 8). Moreover, the main effects of nitrogen and boron levels on the width of almond fruits became significant at a one-percent probability. The highest width obtained for almond fruits was for second- and third-level boric acid (Figure 9). The main effects of nitrogen and boron levels for shelled almond percentages also proved significant at a one-percent probability. The highest percentage of shelled fruit was obtained for third-level zinc (4000 ppm zinc sulfate) as compared to control (Figure 10). The main effects of nitrogen and zinc levels upon almond oil percentage were shown as significant at the probability of one percent. The highest oil percentage was measured as compared to control at second and third levels of zinc (Figure 11). The main effects of nitrogen and boron levels at a one-percent probability and the mutual effects of nitrogen and boron at 5-percent probabilities proved to be significant upon the weight of a single shelled almond. The highest weight of single shelled almond fruits were obtained by simultaneous foliar applications of 5-per-thousand concentrations of urea and 4000-ppm concentrations of boric acid (Figure 12). The main effects of nitrogen at a one-percent probability, the main effect of boron, and the mutual effect of nitrogen and boron at a 5-percent level of probability upon hard almond shell percentage also proved to be significant. The highest percentage of hard shell was obtained for foliar application simultaneously with second-level nitrogen alongside second- and third-level boric acid (Figure 13). The main effect of nitrogen and boron levels and also the mutual effects of nitrogen and boron upon almond protein percentage became significant at a probability level of one percent. The highest percentage of protein was resulted in by simultaneous foliar applications of urea and boric acid (Figure 14). The main effects of nitrogen and zinc at one-percent probability levels and the mutual effect of nitrogen and zinc at a 5-percent probability level showed to be significant.

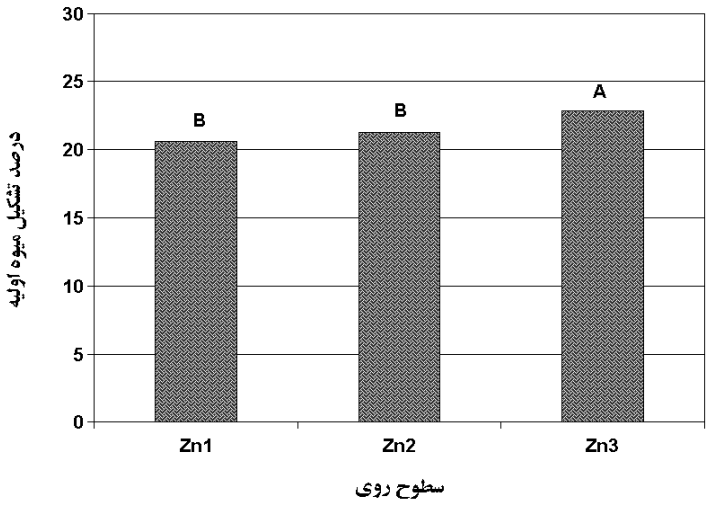

Figure 1. The effect of various levels of zinc upon initial almond fruit setting percentage

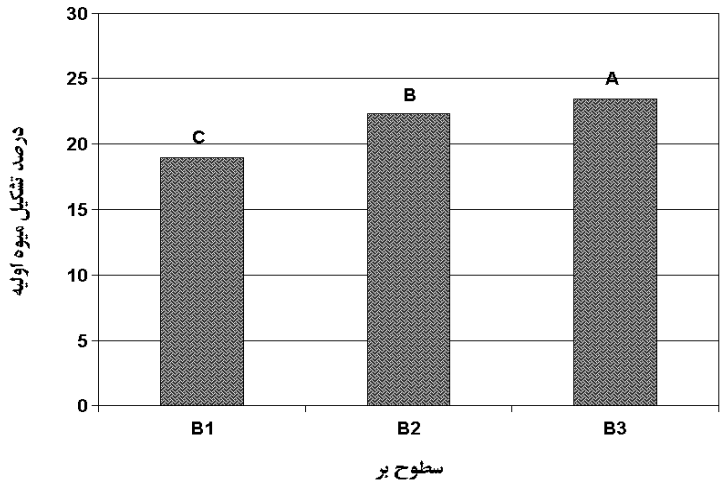

Figure 2. The effect of various levels of boron upon initial almond fruit setting percentage

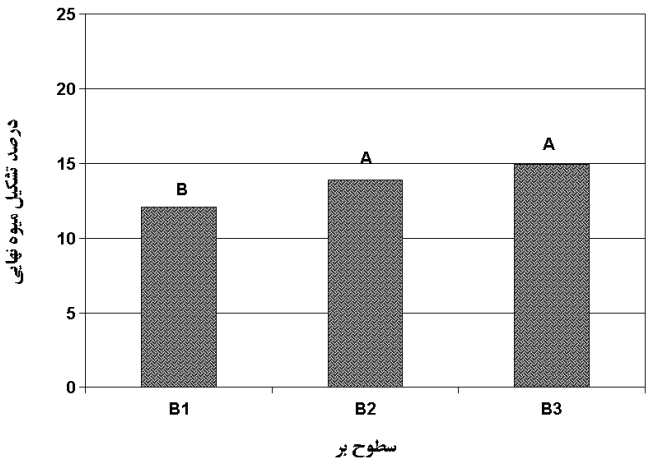

Figure 3. The effect of various levels of boron upon final almond fruit setting percentage

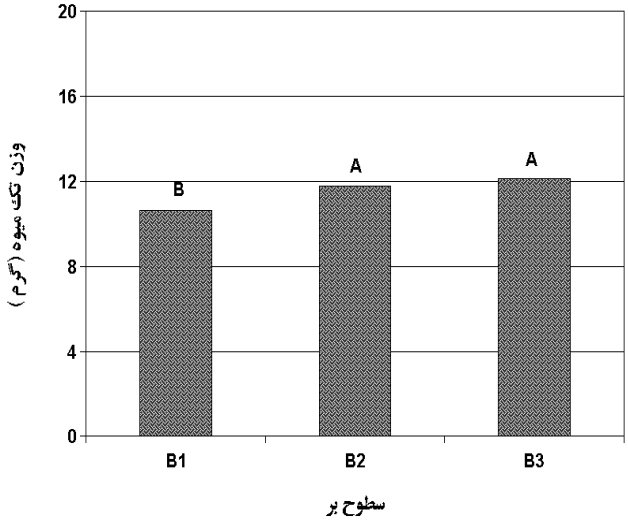

Figure 4. The effect of various levels of boron upon the weight of a single shelled almond

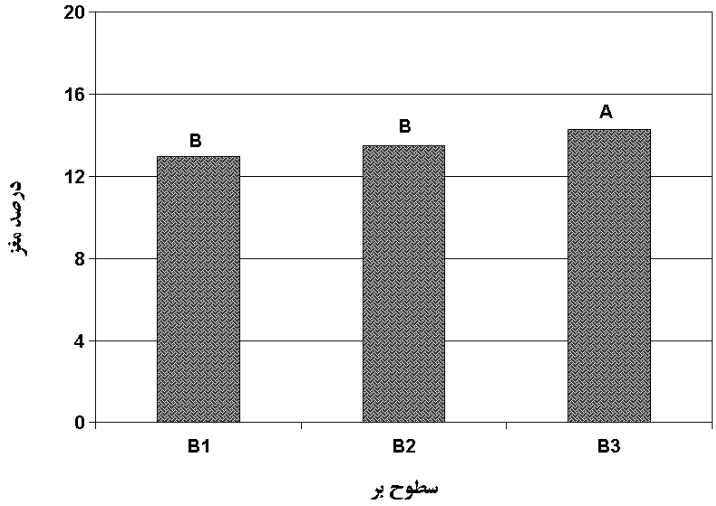

Figure 5. The effect of various levels of boron upon shelled almond percentage

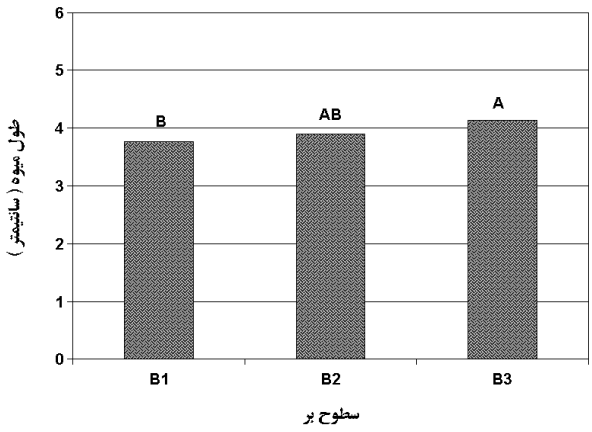

Figure 6. The effect of various levels of boron upon the length of the almond fruit

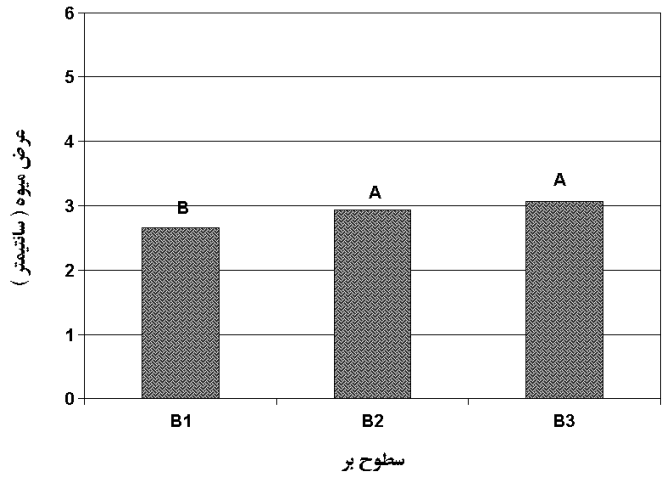

Figure 7. The effect of various levels of boron upon the width of the almond fruit

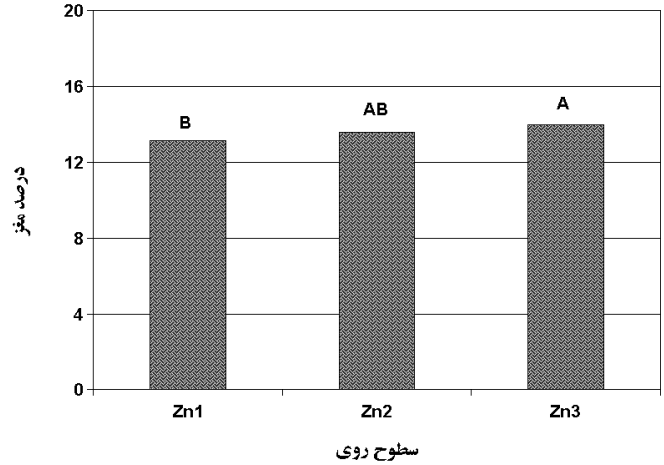

Figure 8. The effect of various levels of zinc upon shelled almond percentage

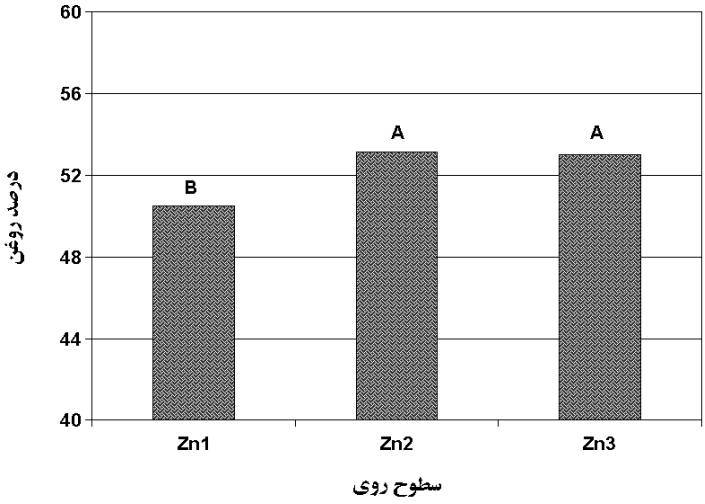

Figure 9. The effects of various levels of zinc upon shelled almond oil percentage

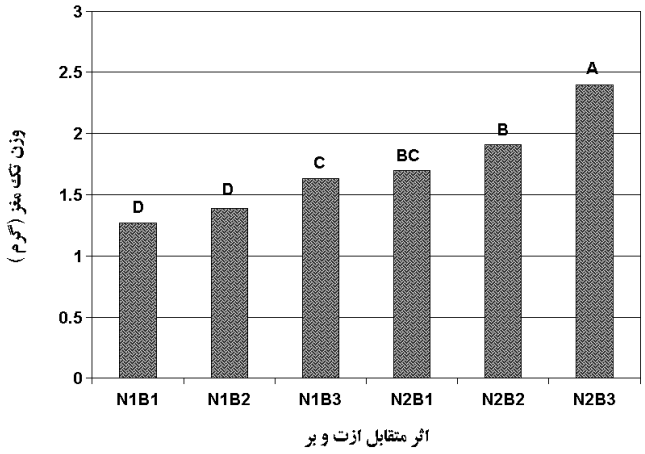

Figure 10. The effect of various levels of nitrogen and boron on the weight of a single kernel

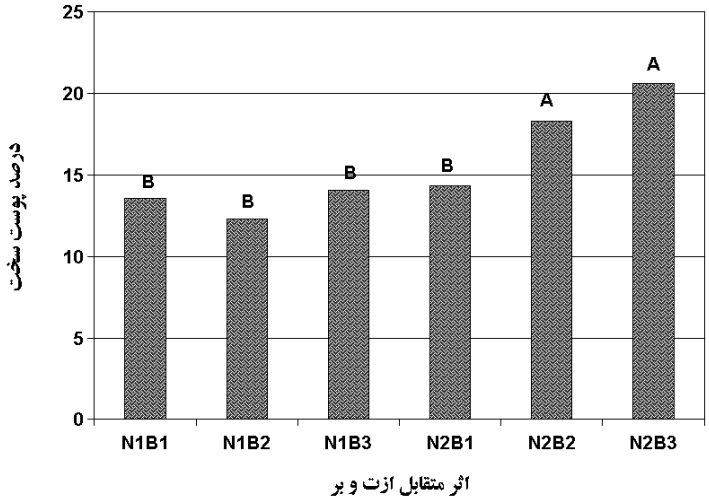

Figure 11. The effect of various levels of nitrogen and boron on the percentage of hard almond shell

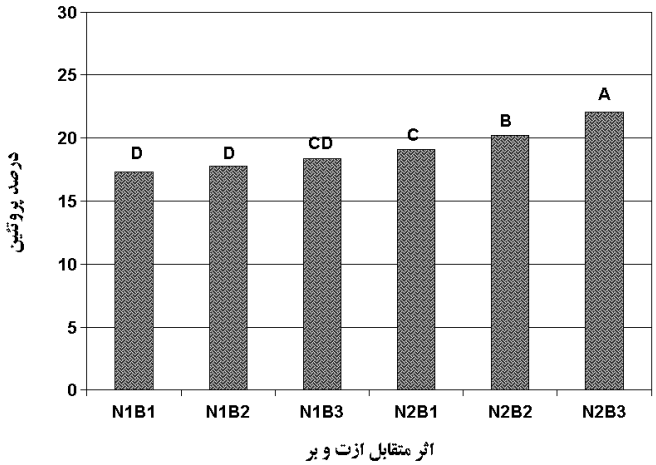

Figure 12. The effect of various levels of nitrogen and boron on almond protein percentage

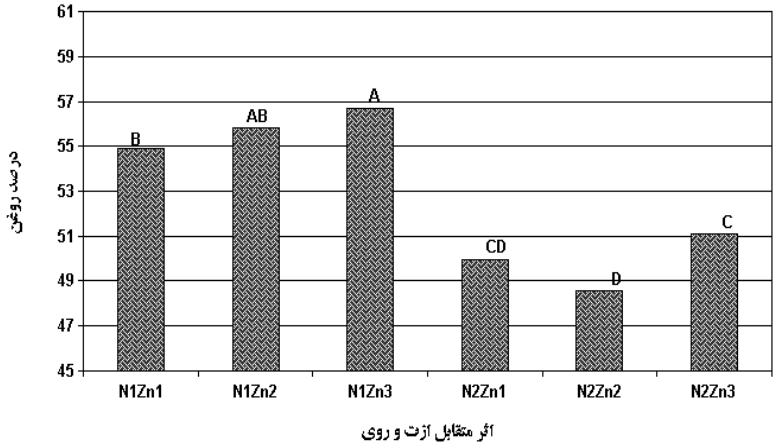

Figure 13. The effects of various levels of nitrogen and zinc upon the percentage of almond oil

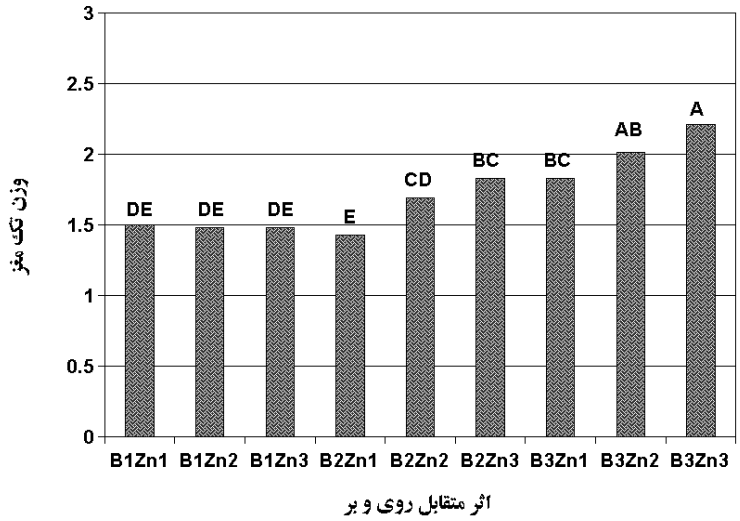

Figure 14. The effects of various levels of boron and zinc upon the weight of a single kernel

The main effects of nitrogen and boron levels at a one percent level of probability and the mutual effects of nitrogen and zinc at a 5 percent probability level proved to be significant upon the percentage of almond oil. The foliar application of third-level sulfate without nitrogen consumption provided the highest percentage of oil (Figure 13). Higher nitrogen consumptions do not seem to have decreased almond oil percentages. Furthermore, the variance analysis table shows that the main effects of nitrogen, boron and zinc amounts as well as the mutual effects of nitrogen and boron upon the weight of a single shelled almond became effective. As seen in Figure 14, the highest weight for a single shelled almond was obtained through simultaneous foliar applications of zinc sulfate (4 per thousand) and boric acid (4 per thousand). No significant simple or mutual effects of years or locations brought about by fertilization applications were observed.

Discussion and Conclusion

based on the results obtained, the foliar application of boron led to a significant increase in the amount of final fruit setting, which was not unexpected given the low amounts of this element in the soil and in the sample leaves of the location studied. It is obvious that sufficient amounts of boron are vital for fruit setting, and the existence of this element is necessary for pollen tube growth. In some cases, pollen budding depends only upon the existence of sufficient amounts of boron in the stigma. Boron also increases nectar amounts and decreases the length of the calyx tube, thus making it easier for bees to be attracted to flowers (Agarwala and Sharma, 1981). Moreover, foliar applications of sulfate showed significant effects on the amount of initial fruit setting. In their studies upon the effects of foliar applications of zinc and boron on cherry fruit setting, Usenik and Stampar (1999) concluded that simultaneous foliar applications of zinc sulfate and boric

acid led to significant increases in initial fruit settings. These researchers attributed the impact of these elements to pollen tube growth, the existence of sufficient pollen and longer fertilization time. Third-level foliar application of boron also led to enhanced quantitative factors such as single fruit weight, almond kernel percentage, almond fruit length and almond fruit width. With deficient boron, the process of cell division is disrupted in all plants, including almonds, and does not occur fully. This indicates irregular, incomplete cell division, which leads to weak leaf development, resulting in lower photosynthesis rates and hence decreased carbohydrates, certainly impacts the qualitative factors of the product. Considering the low amount of boron in the soil of the location studied and as shown in leaf analyses, the intake and supplying of this element seems to have been carried out with difficulty. Sotomayor and Castro (1999) concluded that if the amount of boron in flower stigmas is lower than 35 milligrams per kilogram, fruit setting decreases considerably. Sotomayor et al. (2000) also reported that in Nonpareil almonds, foliar applications of boric acid with 4000 ppm concentrations enhanced final fruit setting by 27.7 percent, and by 23.4 percent for zinc foliar applications. Moreover, combined foliar applications of zinc and boron brought about 38.1 percent increases in final fruit setting and 15 percent increases in almond performances. Carol (2000) stated that autumn 5000 ppm foliar applications of zinc sulfate after harvesting the product led to 17 percent enhancements of fruit setting in the following year. The role of boron and zinc in increasing the amounts of oil and protein in almond fruits probably lies in the positive effects of these elements in nucleic acid compounds, perimidine and some cellular reactions such as starch biosynthesis. It seems that foliar applications of urea have also led to slightly significant positive effects upon fruit setting percentage and other quantitative factors.

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The effect of betamethasone on fetal movement, biophysical profile and fetal circulation in preterm fetuses

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Running Title: Betamethasone and Biophysical Profile in Preterm Fetuses

Abstract: Objective: Evaluating the effect of antenatal betamethasone on the biophysical profile and Doppler indices of umbilical and middle cerebral arteries. Materials and Methods: Twenty-five preterm labor singleton pregnancies (gestational age, 26-34 weeks) were studied prospectively. These patients received two consecutive doses of betamethasone 24 hours apart to accelerate pulmonary maturation. Fetal biophysical profile (BPP) and Doppler assessment were performed twice, on admission and 48 hours after administration of the first dose. The mother recorded fetal movement before, during and after the study periods. Comparison was made between biophysical profile score, fetal movement and Doppler indices of the umbilical and middle cerebral artery before and after betamethasone administration. Continuous data were compared by paired t test and dichotomous data were compared by McNemar test between pre and post treatment evaluations. The statistical significance was set at 0.05 levels. Results: Twenty-five women–median age, 26 (19-42) years; median of gestational age, 32 (26-34) weeks–which were referred to Imam Sajjad hospital, Yasuj from August 2010 to December 2011 were enrolled into the study. There was significant different in fetal movement before and after betamethasone administration (p=0.004). The frequency of BPP scores ≤8 increased from 13 to 21 subjects (p=0.039) at post treatment evaluation which was significant statistically. There was statistically significant difference in the reduction of umbilical artery PI (0.10) (95%CI: 0.01-0.19) and RI (0.07) (95%CI: 0.08-0.06)), but these changes were not important clinically. The mean changes of MCA PI and RI were 0.01 (95% CI:-0.16-0.19) and -0.01 (95% CI:-O.08-0.06), respectively. Conclusion: After betamethasone administration, fetal movement, BPP scores and umbilical artery indices were decreased, while MCA Doppler indices were not affected.

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Keywords: Betamethasone, Biophysical profile, Doppler indices, Fetal movement

1. Introduction

Preterm birth is associated with significant prenatal morbidity and mortality rates. The overall preterm delivery (PTD) rate is 8.1% (1). The use of prophylactic maternal corticosteroids to enhance fetal lung maturity in women at risk of PTD has currently been carried out (2). Biophysical assay is a useful tool for the assessment of the fetal well being. Previous studies have shown that antenatal steroid administration may suppress fetal activity and change the biophysical score (3). Sometimes this transient changes may result to un warranted iatrogenic delivery. Doppler velocimetry of the brain circulation and umbilical for evaluation of the well being of the fetus in the uterus has been used (4, 5). We have also been want that used this technique in healthy preterm fetus, because that can differentiate between fetal distress and suppression of biophysical profile due to steroid effect. Therefore we studied onset and duration of betamethasone administration on biophysical profile and Doppler indices of healthy fetus. These information can decrease management errors due to misinterpretations of biophysical profile data.

2. Materials and Methods

Thirty one single fetus pregnancies at high risk for preterm delivery who were admitted to the obstetrics unit of Imam Sajjad hospital, Yasuj from August 2010 to December 2011 with 26-34 weeks gestation were enrolled into the study. Six of these patients were excluded from the analysis due to spontaneous delivery prior to completion of all the examinations or incomplete data. The median age was 19-42 years. The main indication for hospital admission and steroid use was third trimester vaginal bleeding, previous preterm delivery, uterine anomaly and false labor due to other risk factors of preterm labor. Usually, any patient who was admitted to the hospital with a gestational age of less than 34 weeks received steroids. Informed written consent was obtained from all patients. Before baseline examination, an ultrasonography examination was performed for the biometry and estimated fetal weight. All of the examinations were done after

breakfast at 8-12 midday to control the fetal circadian rhythm. The gestational age was calculated based on the last menstrual period (LMP) which agreed with the second trimester ultrasonography examination.

Some of the patients who had received medication such as magnesium sulfate and narcotic were excluded from the study because it might interfere with the biophysical profile and Doppler studies. One person carried out all the examinations). Sampling of both arteries was performed at the lowest practical incident angle.

The patients who were included in the study received two doses of 12 mg betamethasone, 24 hours apart). BPP scores and Doppler flow velocimetry wave forma of umbilical and middle cerebral artery were performed at 0 and 48 hours after the first dose of betamethasone administration. If the initial biophysical profile scores were equal or higher than 8, the fetuses were included.

Each component of the biophysical profile, including fetal movement, fetal tone, fetal breathing, amniotic fluid volume and fetal heart rate tracing (non stress test) was given a score of 0 or 2 points. The fetal heart rate tracing was obtained before the biophysical profile and interpreted as reassuring or nonreassuring.

Instantly after scoring of the biophysical profile, Doppler studies were carried out. Certain indices such as the peak systolic velocity, pulsatility index (PI), resistance index (RI), S/D ratios were achieved for the middle cerebral artery and the umbilical artery.

The data were analyzed using SPSS version 11.5, continuous data were compared by paired t test and dichotomous data were compared by MCNemar test between pre and post treatment evaluation. The statistical significance was set at 0.05 level.

3. Results

Twenty five women with the median (range) age of 26 (19-42) years were enrolled into the study. The median (range) of gestational weeks at delivery was 32 (26-34) weeks.

The mean reduction of umbilical artery PI was 0.10 (95% CI: 0.01-0.19) and of the umbilical artery RI was 0.07 (95% CI: 0.01-0.12). The mean changes of MCA PI and RI were 0.01 (95% CI: -0.16-0.19) and 0.01 (95% CI: -0.08-0.06), respectively (Table 1).

In nine (36%) subjects, fetal movement decreased 48 hours after steroid treatment (P = 0.004).

The frequency of a higher or equal to 6 BPP score increased from 2 to 3 subjects (P=1.0) and the frequency of a higher or equal to 8 BPP score increased from 13 to 21 subjects (P = 0.039) at post treatment evaluation.

Table 1. The mean changes of MCA PI and RI

	Pre treatment	Post treatment	PV*
	N = 25		
UA PI	1.09 (± 0.32)	0.99 (± 0.34)	0.025
UA RI	0.62 (± 0.11)	0.55 (± 0.16)	0.019
MCA PI	1.99 (± 0.61)	1.98 (± 0.72)	0.875
MCA RI	0.84 (± 0.13)	0.85 (± 0.19)	0.823

* paired t test

MCA: Median Cerebral Artery; UA: Umbilical Artery; PI: Pulsatility Index; RI: Resistance Index

4. Discussion

In this study, it was observed that administrating betamethasone for the mother may lead to a significant but temporary decrease of biophysical profile scores in healthy preterm fetuses. In a study performed by Rotmensch et al., a profound suppression was observed on the biophysical profile scores at 48 hr of steroid use (5) which was consistent with our findings Synthetic glucosteroid has a suppressive activity on the neural system which has been documented previously. Diffuse expression of glucocorticoid receptors in different parts of the brain such as the cerebral cortical part and the mid brain may explain this suppression (6); furthermore, glucocorticoid receptors are widely expressed in cerebral cortical tissues, mid brain and subcortical nuclei which may partly explain the suppression. Jackson et al. also reported the same result. They showed that theadministration of betamethasone decreases fetal movement and breathing and as a result the biophysical profile scores may be decreased. In their study, amniotic fluid was also decreased, but this result was not obtained in our study (7).

In the at risk fetus, it has been shown that bio physical monitoring using biophysical indices may decrease mortality and morbidity. Biophysical profile is the most commonly used tool in at risk fetuses and also in the high-risk pregnancy monitoring (8).).(The changes due to antenatal steroid consumption effect the biophysical parameters which may lead to misinterpretation (9).
Another modality for evaluation of the fetal status is Doppler velocimetry of the umbilical and fetal cerebral circulation (10). In a previous study carried out by Cohlen et al., corticosteroids had no effect on Doppler indices obtained from fetal, placental or uterine arteries (11). This finding has been subsequently confirmed by others (12, 13). In our study, the middle cerebral and the umbilical artery Doppler indices decreased, although not clinically significant. The above-mentioned points highlight the reliability of this method for the evaluation of

antenatal steroid-exposed fetuses. In the fetal biophysical profile, Doppler studies are capable of differentiating steroid-induced changes from alterations due to fetal compromise (14). The fact that antenatal steroid usage is rising, subsequently leading to an increase in the rate of abnormal biophysical profile highlights this matter as a notable clinical consideration (15). Until new monitoring tools or algorithms are added, the decision regarding the delivery of preterm fetuses exposed to antenatal steroids should be cautiously made.

5. Conclusion

We demonstrated that betamethasone administration can cause a remarkable, but impermanent reduction in fetal body movement. This result is particularly outstanding for the biophysical profile score obtained after 48 hr of steroid administration. Confusional results due to the effect of steroid on biophysical profile parameters as an evidence of fetal distress could lead to unapproved intervention and consequently the delivery of a preterm fetus, but Doppler studies of the MCA and UA can differentiate between the compromised and non compromised fetus groups.

Acknowledgement
None declared.

Conflict of Interest
None declared.

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Scenarios Evaluation in Water Resources Management in the Standpoint of System Sustainability and Conflict Resolution Theory

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Abstract: scenarios evaluation in water resources planning and management has done by the objective of increasing efficiency and systems sustainability and decreasing probable conflicts. Development and Simulating of the scenarios based on the results of the optimization model that optimize the reservoir rule carve by Genetic Algorithm. Sustainability indicators and conflict resolution theory, implemented the evaluation of them. Results show that the water resources planning and managing scenarios evaluation by this method lead the water resource systems to sustainability.

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1. Introduction

Operating policy for reservoir management has significant importance, since a reservoir can be used for various purposes including meeting the human demands, energy production and flood control. Some of these purposes are at odds with each other, for example, meeting the human demands and energy production usually go together, however, these may be in conflict with the flood control purpose. Therefore, design of an appropriate pattern for an optimal operation of reservoirs is important. Many researchers have emphasized on the development of an optimal reservoir operating policy. Therefore, Simulation-Optimization models have been generally used for this purpose. Tung et al. (2003) presented a specific kind of rule curve including optimal operational areas from a reservoir. They took the height of the point where the rule curve is broken as the decision variables of the problem. Using that, they submitted their rule curve which included optimal operational areas from a reservoir. Cai et al. (2004) developed a decision support system for water resources planning and evaluation by combining multi objectives analysis and multi decision making criteria. The results of model implementation in north china show the efficiency of that DSS in conflict resolution and water systems sustainability.

In this paper, to apply different approaches of operation of Karkheh reservoir system, two scenarios are extended. Scenario evaluation is one of the valid methods of analysis methods in planning and water resource management. Thus, in this study, this purpose is done by evaluation of system sustainability by sustainability indicators of water resource systems and system analysis by conflict resolution theory. Scenarios are analyzed and compared in two scales of seasonal and annual and the best scenario is selected. Development of scenarios is done based on two different approaches in integrated operation of reservoir that is elaborated as:

VD scenario: in this scenario, the operator by considering climate prediction at the beginning of water year manages the probable tension to water resource system of the watershed by applying logical change (reduction or increase) of downstream agriculture demands. In this scenario, the operator accepts the operation risk of the reservoir and social, economical tensions at the beginning of the water year and tolerates demand management costs.

CD scenario: In this scenario the operator by the rule curve extracted from reservoir operation historical period and by assuming not applying tension to beneficiaries or development of downstream consumptions during water year by applying resource-based policies, supply management is done. In this scenario, bargaining and social tensions are less in short term.

The aim of developing these two scenarios is the comparison of common approaches of water resource management and long-term evaluation of operation policies of water resource systems that is not possible without using historical data and optimization-simulation models. Integrated Water Resources Management is the map of a way for sustainable development that planning and operation management tools of water resources systems are defined and its process is determined. Localization of these processes is possible by development of local scenarios and their integrated evaluations.

2 Problem Formulation

The efficiency of the systems is evaluated in the form of three definite concepts that is correct in water resources systems:

1) How often the system is failed in a definite time interval?(Reliability)
2) What is the probability of system returning to a good state after a failure? (Resiliency and Fixing)
3) How sever are the observed failures (Vulnerability)

2.1 Reliability

According to the definition of Hashimoto et al (1982), reliability means that no failure is occurred in operation of the system in a definite period:

$$\alpha = Prob\left[X_t \in S\right] \quad (1)$$

This indicator indicates the amount of fulfilment of the purposes of the system and one of the most important indicators to investigate the efficiency of operation policies of water resources systems at normal conditions. To calculate the qualitative or quantitative reliability, quality and quantity time series of water quality of each section is plotted and the demand of that section is considered as the water quantity threshold of that section. If the attributed time series is higher than the demand value, failure is not occurred in the system and $X_t \in S$

In long-term, water resources systems are faced with the risk of intrinsic and uncertain change and the lack of information and knowledge. Risk is regarded as one of the important components of water resources management. From a comprehensive view, reliability shows the success of the system and risk indicates the frequency of system failure. Reliability definitions in water resources management are including as follows:

- Reliability of event that indicates the ratio of the number of success periods of the system to operation periods.
- Time reliability that is calculated as time ratio in which the system is in success condition to total operation (function).
- Volume reliability that is calculated sometimes as the ratio of the supplied volume to the total required volume.

2.2 Resiliency (Reversibility)

Resiliency indicates the probability of the system returns to optimal state after a failure. Resiliency of a system in a planning horizon is defined as follows:

This index is of great importance in drought and flood periods because the damage of floods and droughts is consistent with the bad performance of time period of the system.

To calculate the qualitative or quantitative resiliency qualitative and quantitative time series of water attributed to each section is plotted and the demand of that section is considered as water quantity threshold to each section. According to the definition of Cai (2004), quantity resiliency is the time period that the system requires to return to the normal state that is achieve by division of the maximum consecutive periods of failure by total period.

2.3 Vulnerability

Vulnerability shows the magnitude of the system failures. To measure the system vulnerability, the damage severity index is defined. Hashimoto et al (1982) defined system vulnerability as follows:

$$v = \sum_{j \in F} s_j e_j \quad (3)$$

Let e_j be the probability that X_j, corresponding to S_j, is the most unsatisfactory and sever outcome in F set. In some references, (the value of severity is defined as average exceeding of threshold value as follows (Loucks, 2006) :

$$v = \frac{sum\ of\ possitive\ value\ of\left(X_t - \hat{X}\right)}{number\ of\ times\ an\ unsatisfactory\ value\ occurred} \quad (4)$$

Where X_t is the attributed water or water quality; $\hat{X}$ is the qualitative and quantitative threshold of the system.

According to the definition of Cai, the minimum demand supply is raised as the magnitude of failure. It can be said that in addition to the 3 mentioned indicators, there is another parameter in the evaluation of sustainability of water resources systems including healthy environment, fair attribution and social-economical acceptance.

3. Problem Solution

The extended scenarios are compared by the evaluation of system sustainability indicators of the system as reliability, resiliency and vulnerability are calculated for parameters of downstream demand supply, the lack of excess discharge and the losses of dam reservoir spill. Evaluation scale is defined in two seasonal and annual states to analyze the management approaches of two defined scenarios from the aspect of short-term and long-term sustainability.

3.1 Evaluation in seasonal scale

In this section, the results of performing the model in seasonal scale is investigated by sustainability of resources-consumption system of Karkheh and planning period is including 164 steps equals the number of 41 seasons of simulation period.

3.2 Demand supply

By assuming the deficit or the lack of total demand supply as failure, three sustainability indicators of the system are calculated for two scenarios and the result is as follows:

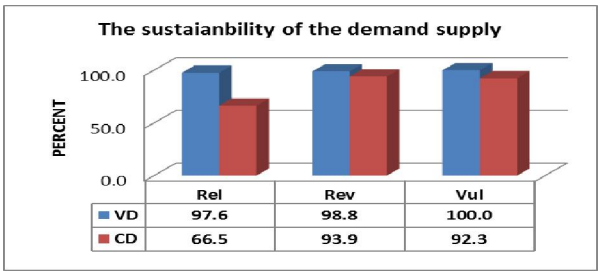

Fig.1 The sustainability of demand supply for different scenarios in seasonal scale

As it is shown in fig. 1, in planning and seasonal analysis of the operation policies of the reservoir, the system reliability of demands supply is significantly better in VD scenario and the system in this scenario immediately returns from failure state to natural sate of demand supply. It can be said that failure severity or in other words, the minimum demand supply is occurred in this scenario and when downstream consumptions are drinking, industry and environmental demands, the prediction of providing the alternative resource is essential.

3.3 The lack of excess discharge

By assuming the discharge of reservoir more than the demand of a definite season as failure, three sustainability indicators of the system are calculated for two scenarios and the results are presented in Fig. 2.

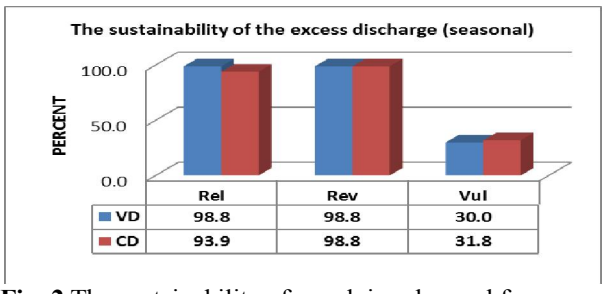

Fig. 2 The sustainability of supplying demand for different scenarios in seasonal scale

The comparison of the system behaviour indicates that in both system management approaches, the system had good vulnerability and resilience. The Reliability of VD scenario is a little higher than CD scenario. Considering the extraction of rule curve based on long-term historical statistic, in the selection of the best scenario, the parameter can't have important role in seasonal evaluation.

3.4 The lack of spill of reservoir

By assuming the spilled volume of water as losses and failure, three indicators of system sustainability are calculated for two scenarios. Fig. 3 shows the results of this calculation. It can be said that in water resources system of this watershed, there is no adverse effects and the production of hydro energy is planned, if necessary. This parameter is investigated for comparison.

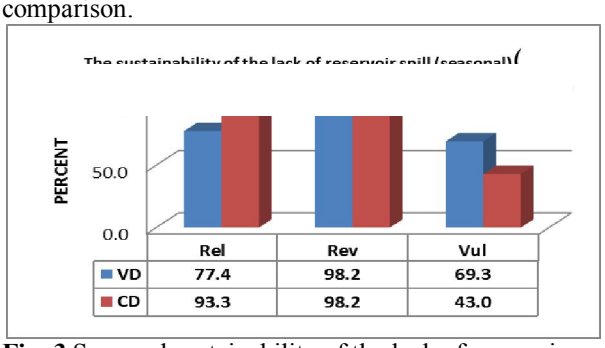

Fig. 3 Seasonal sustainability of the lack of reservoir spill in seasonal scale

As it is shown, CD scenario has better performance regarding the assurance of the lack of reservoir spill and the severity of the spills and the damage to the downstream installations and ecosystem. As the effects of this parameter are important in short-term scales, the comparison of the seasonal indicators can be helpful in decision making.

3.5 Evaluation at annual scale

In this section, the results of performing the models in the annual scale are investigated by the system sustainability of resources-consumptions system of Karkheh and planning period is including 41 steps that equal the number of years of optimization-simulation model.

3.6 Demand supply

By considering the deficit or the lack of supplying the total demand, as failure, three indicators of sustainability of the system are calculated for two scenarios and are presented in Fig.. 4.

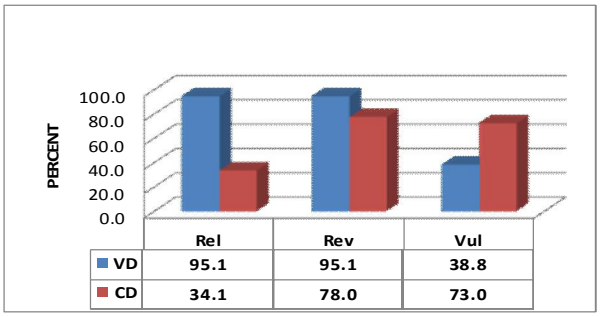

Fig. 4 The sustainability of supplying demand at annual scale

As it is shown in the results, VD scenario by being the best in three indicators (high reliability and

resiliency and low vulnerability) compared to CD scenario, confirms long-term planning approach in meeting the demands. The values indicated that in this scenario by following the extracted rule curve in 95% of the planning years, supplying the demand is done without any problem or challenge.

3.7 The lack of excess discharge

By assuming the discharge from the reservoir more than the demand of a definite year as failure, three indicators of system sustainability are compared for two scenarios and the results are as Fig. 5.

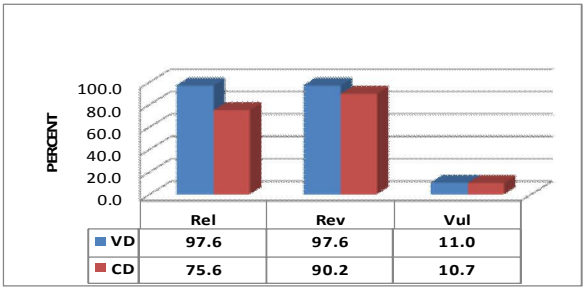

Fig. 5 The annual sustainability of the lack of excess discharge at annual scale

The superiority of VD scenario in this parameter is obvious and vulnerability index shows that in both scenarios, the excess discharge of the reservoir is reduced that controls the vulnerability of the downstream system. This issue in seasonal comparison of this parameter supports this reasoning. Indeed, the formulation of the strategy and operation curve is considerable by the logic of distributing the adverse effects during the period and reduction of extreme in the results.

3.8 The lack of spill of the reservoir

By considering the spilled water volume as losses and failure, three indicators of sustainability of the system are calculated for two scenarios and the result is presented in Fig. 6. With reference to the explanations of seasonal evaluation of this parameter, this comparison is not analyzed in annual form.

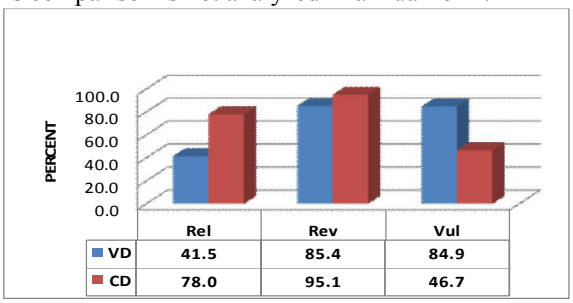

Fig. 6 The sustainability of the lack of reservoir spill at annual scale

3.9 Conflict resolution in water resources management

In a decision making process, if the number of decision makers is over one person then decision making will face to some problems, because different persons have different goals, view points and priorities and the final solution must be compatible to all different ideas. There are many ways to solve these problems which named Conflict resolution models. Priority in allocation rates to different consumptions is one of the most important decisions and must involve the stakeholders' utilities and conflict resolution among them.

In 1954, John Nash claims a solution for the negotiation problem which involves all the conditions for a legal solution in a negotiation problem. Two models were developed by Nash which involved symmetrical and unsymmetrical solutions. Symmetrical solution is as if the opponents of a symmetrical negotiation Problem, in disagreement, have equal proportion, this solution also allocate equal proportion too each of them finally. If the participants are over two in a negotiation problem the g function will be defined as equation (5)

$$g(u_{1,}u_{2,\ldots,}u_n) = (u_1 - d_1)(u_2 - d_2)\ldots(u_n - d_n) = \prod_{i=1}^{n}(u_i - d_i) \quad (5)$$

Which u is utility function and d is disagreement point component for each participant and n is a number of participants. As previously defined, the solution of a negotiation problem by Nash model is found by following optimization problem:

$$\text{Maximize } g = \prod_{i=1}^{n}(u_i - d_i)$$
$$\text{Subject to : } u_i \geq d_i \quad i = 1,\ldots,n$$
$$u = (u_1,\ldots,u_n) \in U \quad (6)$$

The modified Nash model developed after some problems such as inefficiency of symmetric model in cases of un symmetric and not make any attention to participant's importance and relative strength of them in problem. In this case the g function will be defined as equation (7).

$$g(u_{1,}u_{2,\ldots,}u_n) = (u_1 - d_1)^{w1}(u_2 - d_2)^{w2}\ldots(u_n - d_n)^{wn} \quad (7)$$

Which u is utility function of participant I and $(d_1, d_2, \ldots, d_n)$ is the disagreement of participant's vector. W_i is the relative strength of problem opponent. With due attention to relative weight, equation (8) must be true.

$$\sum_{i=1}^{n} w_i = 1 \quad (8)$$

n is the number of participants (decision makers).

By rewriting equation (6), optimizing problem can be solved by equation (9)

$$\begin{aligned} &Maximize \ \ g = \prod_{i=1}^{n} (u_i - d_i)^{wi} \\ &Subject\ to: u_i \geq d_i \quad i = 1,\ldots,n \\ &u = (u_1,\ldots,u_n) \in U \end{aligned} \quad (9)$$

In this research the multiplier symmetric Nash equation has been used as criteria for assessment of conflicting rate because of its abilities.

In a basin system the utilities can be defined as type of need securing, quality parameters or economic profit. Negotiation among stakeholders is in this category that it can take the persons who will influence (decision producers) as water responsible or administrator of each need group in the whole basin.

There is a systemic and integrated point of view to allocation problem in this research and the scenarios evaluation will be done by Nash multiplier equation.

Scenarios evaluation with the conflict resolution theory

Scenarios evaluation will be done with the base of the conflict resolution concept and with the use of symmetric multiplier equation in this part, as the disagreement point for each parameter will be derived as below:

$$d = \min(u_1, u_2, u_3) * 0.9 \quad (10)$$

Tables 1 and 2 show that in the scale of short time management, no variation in consumption values (related to scenario CD) will face the exploitation with lower stress and higher assurance. Whereas in VD scenario annual management with the point of view of conflict resolution will be collect as the best scenario with meaningful difference. If we assess the subject with the governance point of view it can be said that by control of temporary and weak stresses, beneficiary system can manage in long time scale with minimum stress.

Table 1: Seasonal reliability assessment

seasonal scale		REL	seasonal scale		REL
VD	Demand supply	97.6	CD	Demand supply	66.5
	lack of excess discharge	98.8		lack of excess discharge	93.9
	lack of reservoir spill	77.4		lack of reservoir spill	93.3
conflict resolution index		6302	conflict resolution index		7574

Table 2: Annual reliability assessment

annual scale		REL	annual scale		REL
VD	Demand supply	95.1	CD	Demand supply	34.1
	lack of excess discharge	97.6		lack of excess discharge	75.6
	lack of reservoir spill	41.5		lack of reservoir spill	78
conflict resolution index		14440	conflict resolution index		7245

In the point of system reversibility, the management in CD scenario of short or long time scale can be done with lower stress. This condition is meaningful for administrator of dam exploitation and also stakeholders. (Table 3 and 4)

Table 3: Seasonal reversibility assessment

seasonal scale		REV	seasonal scale		REV
VD	Demand supply	98.8	CD	Demand supply	93.9
	lack of excess discharge	98.8		lack of excess discharge	98.8
	lack of reservoir spill	98.2		lack of reservoir spill	98.2
conflict resolution index		1066	conflict resolution index		1837

Table 4: Annual reversibility assessment

annual scale		REV	annual scale		REV
VD	Demand supply	95.1	CD	Demand supply	78
	lack of excess discharge	97.6		lack of excess discharge	90.2
	lack of reservoir spill	85.4		lack of reservoir spill	95.1
conflict resolution index		3231	conflict resolution index		3884

It can be seen the same assessment of reliability in the case of vulnerability in a concept that with agreement of temporary stresses and VD scenario point of view, water resources and demands management will be done with more reliability and less vulnerability in long time (Table 5 and 6).

Table 5: Seasonal vulnerability assessment

seasonal scale		VUL	seasonal scale		VUL
VD	Demand supply	100	CD	Demand supply	92.3
	lack of excess discharge	30		lack of excess discharge	31.8
	lack of reservoir spill	69.3		lack of reservoir spill	43
conflict resolution index		9264	conflict resolution index		2912

Table 6: Annual vulnerability assessment

annual scale		VUL	annual scale		VUL
VD	Demand supply	38.8	CD	Demand supply	73
	lack of excess discharge	11		lack of excess discharge	10.7
	lack of reservoir spill	84.9		lack of reservoir spill	46.7
conflict resolution index		2384	conflict resolution index		2514

4. Conclusion

According to the comparison of two extended scenarios, various technical aspects of VD scenario are selected as the best management approach and the results of performing the mode are analyzed. It can be said that in this study, the development of scenarios was very wide but the aim is the analysis of the approaches and the generalized methodology and results and localization for different conditions consistent with the advantages and limitations. Results show that the water resources planning and managing scenarios evaluation by this method lead the water resource systems to sustainability and indicated the conflict resolution approaches.

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