RESEARCH ARTICLE

A New High Reliability Low EMI Boost Converter for Satellite Application

Jafarboland[1]* and Hadi Rismani [2]

[1,2]Department of Electrical Engineering, MalekAshtar University of Technology, Isfahan, Iran.

*Address for correspondence

M. Jafarboland
Department of Electrical Engineering,
MalekAshtar University of Technology,
Isfahan, Iran.
E-mail: j_mehrdad405@hotmail.com

ABSTRACT

The power supplies include DC-DC Converters that as the most important Electromagnetic Interference (EMI) sources are known. Different types of converters in power and operating frequency are used in Electrical Power Subsystem (EPS) of Satellite. EMI due to DC-DC Converters, interact on their performance and other satellite subsystems. The interference may be challenging condition for satellite missions such as imaging, hears communications with the ground station. A satellite can cease due to different failures or because it has reached to the end of its lifetime. EPS has must able to provide sufficient power to the satellite subsystems under all possible satellite attitudes. Therefore, DC-DC converters used in satellites must have high reliability.

In this paper, a new topology boost converter is suggested that has low EMI level. Furthermore the proposed converter due to two switches employing, improve reliability. The main feature of the new converter is a high reliability because there are two power switches.

Key words: AtDC-DC Converters, EMI, Satellite, reliability

INTRODUCTION

This EMI studies will focus on three main parts: the noise source, coupling path and purpose (electrical system affected by electromagnetic interference that its function is impaired). Most of the reduction of magnetic coupling
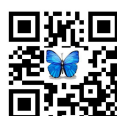
direction or ability on goal has high complexity and implementation costs. Therefore, one of the most effective noise reduction methods is attention to the noise source [1]. Noise sources are the converters that drastic changes due to switching function in the electrical parameters (rate of change of voltage and current) causes. This sudden change of voltage and current noise, are cause of electromagnetic phenomena.

Advances in semiconductor device fabrication technologies have led to increase operating frequency range, power and power electronics devices. This progress has led to reduce switching losses but on the other side, due to increased rates of rise and fall of voltage and current at the switching time, electromagnetic noise level is high [2].

Electronic and electrical systems in Electrical Power Subsystem (EPS) of Satellite, they are close together in space are employed due to limited occupied space. Some of these systems are sensitive to noise generated by other circuits, which could cause interference to each other's performance. A block diagram of a satellite power system is shown in Fig. 1. As seen in Fig. 1, the different types of satellite systems are fed from a common DC bus. The penetration noise on the common DC bus cause to noise possibly interference with other subsystems.

Different methods to overcome EMI result from DC-DC converter are proposed. The first employed switching method is soft switching. This approach applies not only to overcome the noise but positive impact of soft switching on noise reduction as an additional advantage of soft switching is considered. Soft switching techniques [3, 4] have been proposed to 1) reduce the switching losses and 2) reduce the switching stress of switched- mode power electronics circuit in order to improve the energy efficiency and reliability of power converter. Soft switching techniques reduce power density of the noise spectral. This method consists of three types of switching: ZVS (zero voltage switching), ZCS (zero current switching) and ZVZCS (switching at zero current and voltage). The results of the measurements noise show EMI and other circuit parameters in both hard and soft switching, implies a faster transient response and less EMI for soft switching method [5]. Soft switching technique can reduce EMI level of buck converter but soft switching influence on reducing EMI in boost converter type is low [6].Additional elements such as diodes, capacitors increase cost. This problem in some application such as power system of satellite is not desirable so spread spectrum frequency modulation (SSFM) pulsating technique proposed. Peak amplitudes of EMI spectrum reduced and power of peak noise spreads in neighboring frequency bandwithout changing the duty cycle of the converter [6]. The SSFM methods can be non-periodic or periodic. Applying the switching frequency modulation methods to a boost converter cause to increase output voltage ripple and the effective reduction of noise levels does not expected. However, implement of SFM in practice is difficult.To have the advantages of soft switching and frequency modulation switching, a technique based on the combination of chaotic switching (typical of switching frequency modulation) and soft switching to reduce EMI resulted from boost converters is presented in [7].

Active and passive filters are other methods for reducing EMI.In [8], the influence of switching frequency on differential and common mode noise filter is discussed. A large proportion of the volume and weight of DC-DC converters related to passive filters. By increasing power density of converters, the mentioned proportion increase. The active filters require an additional and independent DC source usually. This is a major disadvantage for this type of filters.

DC-DC converters used in satellites must have high reliability.Reliability analysis and move toward the use of power systems with high reliability are essential in satellites [9 and 10]. Because the repair any malfunction in the satellite system, due to a lack of or hard to access, it is very problematic.In this paper, two power switches under the particular pattern, are switched until to increase reliability of the converter and EMI spectral density be appropriate.

Chaotic carrier:

The basic structure on chaotic soft switching is based on a chaotic mapping and sawtooth generation. It is difficult to obtain such a carrier in a practical circuit. In [7] an applicable and practical real-time chaotic carrier design is proposed as shown in Fig. 2The n.th saw tooth signal can be determined by following mapping:

$$T_{nc}^{/} = x_n \beta T_C + T_C , x_n \in [-1,1], \beta \in [0,1) \quad (1)$$

Where T_c is the main frequency of switch which is a constant X_n, is the n.th output of chaotic mapping and β is a modulation factor. As an example, the chaotic sequence X_n can be generated by the logic mapping, which is described in equation 2.

$$F\left(x_n\right) = 1 - \alpha x_n^2 \quad (2)$$

Hard, Soft, Chaotic-Soft Switching:

The circuit of soft switching PWM Boost converter is shown in Fig. 4. For hard switching appearance of L_1 , S_1 , D_1 , C_2 is sufficient. $L_2, L_3 << L_1$ C1$<< C_2$ in choosing inductance L_2, L_3 ,capacity of C_1 must be considered. Seven different modes based on principle of soft switching is possible for Boost converter. V_s=10V, L_1 = 0.6mH,

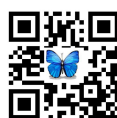$$C_2 = 10\mu F, R = 200\Omega, I_{ref} = 1A \text{ and}$$

T_c=100khz. For the soft switching control, is assumed $L_2 = L_3$=10μH,

C_1 = 10nF, while the component L_2, L_3, C_1 , D_1 and D_2 are not necessary for hard switching PWM control. I_{ref}=1A, maximum amplitude of carrier signal is 2.5.

Comparing the noise spectrum of various converters is appropriate for better study of EMI. Firstly, hard switching boost converter is simulated. Output voltage and input current by spectrum analyze of input current is shown in Figs 5, 6, 7. To obtain the spectrum of electromagnetic noise, with sampling time of simulation file consideration, Fourier analysis has been used with suitable equations.

The vertical axis in terms of dB and the horizontal axis is logarithmic in terms of kHz.According to Fig.7, the peaks appearance in the frequency spectrum in the switching frequency (one hundreds kHz) and its multiples. These peaks values are high that cause to inject noisy current into common DC bus. Soft switching is applied in order to reduce losses and EMI, but according to the concept discussed in previous section, soft switching does not have effective impact on EMI reduction. Therefore, display of results of soft switching type is avoided. A combination of soft and chaotic switching for simulation is used. Simulation results shown in Figs. 8,9,10 that show output voltage, input current of converter, frequency spectrum of input current. Although chaotic switching as an offline type is implemented.

The simulation results show the output voltage waveform is not changed and there will be not problems in load performance. Ripple of input current of converter increase slightly. In contrast, there is no other trace of peaks in the frequency spectrum of the input current and peak energy in the frequency spectrum in adjacent bands spread. If on-line chaotic switching simulate, spread of noise will occur better.

Because of ripple of input current increment, spectrum level has risen. Spectrums of input current for both of soft switching and hard switching are shown in Fig. 8 with together. The blue spectrum and red spectrum related to soft switching and hard switching respectively.

The proposed converter:

The proposed converter circuit shown in Figure 11, has two switches (S and S1) is. A Switch S1 is series with a small inductance that its value is100mh. The source voltage is ten volts, outputcapacitor value is C = 10μF and inductor value isL_1 = 0.6mH. Unlike previous switchingmodes, the value ofI_{ref}= 0.12A. The manner of pulsating waveform can be seen in Figure 12.

When this method is used in the proposed switching converters, the input current is less than the reference the converter and so the current reference will be oscillations less.

In fact, with known power of output load, average current of load is determined and so its value as a reference current is considered.

By implementing this switching method of converters, input current ripple as compared to previous switching methods, reduced but setting time of output voltage increased.

The main feature of the new converter is a high reliability because there are two power switches. In this converter, each switch with correspond to pulsating order of itself can supply the load. If each switch fails, the proposed converter can so supply the load. Due to EMI spectrum reduction, the proposed converter has suitable noisy situation in compared to previous converter. High frequency components of the input current are lower than the hard switching. The low frequency components of input current is lower than in compared to hard switching and chaotic switching type. The proposed switching pattern can be implemented as analog and digital form.

Analyze of reliability:

The reliability R is expressed by the following equation:

$$R(t) = e^{-\lambda t} \quad (3)$$

Where λ is the failure rate and has a constant value. The Mathematical mean of $R(t)$ occurs at t, as follows:

$$t = \frac{1}{\lambda} \quad (4)$$

Here t is the amount of time that should elapse until the first failure occurs. This is called the Mean Time to Failure (MTTF). The Mean Time to Repair (MTTR) of the system is negligible compared to MTTF, so the Mean Time Between Failure (MTBF) of a system is expressed by the following equation:

$$MTBF = MTTF + MTTR = \frac{1}{\lambda} \quad (5)$$

Each switch leg is divided into two subsystems: switch s, and switch s1. Only when all Switches in two phases are faulted, will the whole system fail. Since inductors' failure rates are much lower than those of semiconductors and electrolytic capacitors, their failures are not considered. The failure rate of switch can be calculated by [11].

$$\lambda_{P(S)} = \lambda_{b(S)}.\pi_Q.\pi_A.\pi_E.\pi_T \quad (6)$$

$(\bar{\lambda}_b)$ is of the switch is constant and equal to 0.012. π_T Is the temperature factor and is calculated by using (7) for the switch.

$$\pi_{T(S)} = \exp\left(-1925\left(\frac{1}{T_J + 273} - \frac{1}{298}\right)\right) \quad (7)$$

where T_J is the junction temperature and can be determined by the (8), as follows:

$$T_J = T_C + \theta_{JC} P_{loss} \quad (8)$$

Where T_C is the heat sink temperature, θ_{JC} is the thermal resistance of the switch or diode, and P_{loss} is total loss of switch or diode.

The quality factor (π_Q) and environment factor (π_E) of different elements are listed in [12] π_A and π_C are the application factor and contact construction factor, respectively. They can be determined for different elements by using Tables in [11];

$$P_{LOSS}(static) = Irms.Vce(sat) \quad (9)$$

$$P_{LOSS}(dynamic) = Vavg.Iavg. to1.Fs \quad (10)$$

$$P_{loss} = P_{LOSS}(static) + P_{LOSS}(dynamic) \quad (11)$$

Since the value of $\theta_{JC} P_{loss}$ for each switch be very smaller than T_C, T_J for each switch will be same.

$$\lambda_b = 0.012, \pi_Q = 5.5, \pi_E = 0.5$$

$$P_{OUT} = 1.28w \implies \pi_A = 1.5$$

$$\lambda_{P(Switch)} = \lambda_b .\pi_Q.\pi_A.\pi_E.\pi_T$$

$$\lambda_{P(s1)} \simeq \lambda P_S = \lambda$$

Jafarboland and Hadi Rismani

$$\lambda_{P(total)} = 2\lambda$$

$$MTBF = MTTF + MTTR = \frac{2}{\lambda}$$

The reliability that related to switch leg has doubled approximately.

CONCLUSION

In this paper, according to reliability and EMI issues of EPS of Satellite, a new strategy based on a new switching pattern. Firstly, hard switching is investigated and so soft-chaotic switching is simulated. The tendency the use of the proposed converter due to high EMI level of hard switching, difficulty in implementing chaotic switching method, and the entailment of high reliability converters produced. The proposed convert can be suitable replicable converter instead of boost converter.

REFERENCES

1. A Knitter, J Luszcz ,pjChrzan. Conducted Emi mitigation in switched mode dc-dc converters by spread spectrum techniques. Pro Compat.Power Electron IEEE 2005; 2:166 -17.
2. Chrzanpj, Haras A, Roye D. Random and programmed modulation schemes for power converter – microcontroller implementation. Motion Control PEMC 94 Warsazawa 1994; 93-98.
3. G Hua, FC Lee. An overall view of soft-switching techniques for PWM converters. Eur.Power Electron 1993; 3:39-50.
4. S Y R Hui, K W E Cheng, Prakash.Afully soft switched extended-period quasi-resonant power-factor-correction circuit. In IEEE Trans Power Electron 1997; 12: 922-930.
5. H Chung , S Y R. Hui , K KTse. Reduction of power converter EMI emission using soft-switching technique. IEEE Trans Electromagn Compat1998; 40:282-287.
6. Sudhakar, N Rajasekar, AShanmugaSundari, Suppression Of Conducted EMI in AC-DC Converters Using Chaotic PWM. ELIXIR Electrical Engineering 2011; 38: 4426-4429.
7. Danilovic M, Fang Luo, LingxioXue, Wang R, Mattavelli P, Boroyevich D. Size and weight dependence of the single stage input EMI filter on switching Frequency for low voltage bus aircraft applications. 15th International Power electronics and Motion Control Conference (EPE/PEMC) 2012; (4-6 Sept):4-7.
8. Hamzad D, Swan M, Jain PK. Suppression of common –mode input electromagnetic interference noise in DC-DC converter using the active filtering method. IEEE Journal of Power Electronics 2012; 4:776-784.
9. GH Farahani, M Taherbaneh. Extracting Best Reliable Scheme for Electrical Power Subsystem (EPS) of Satellite. IEEE Aerospace Conference 2011; (9-11 June):532-537.
10. M Zahran, S Tawfik , G Dyakov. LEO Satellite Power Subsystem Reliability Analysis. in Journal of Power Electronics 2006;6:104-113;
11. Le .Bunetel, J Gago, D Magnon, , S Bréhaut. Conducted EMI Reduction in Power Converters by Means of Periodic Switching Frequency Modulation. IEEE Trans.Power Electronic 2007; 22: 0885-8993.

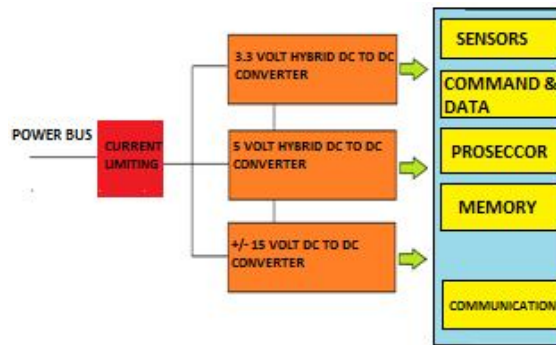**Jafarboland and Hadi Rismani**

Fig1. A NASA satellite power system
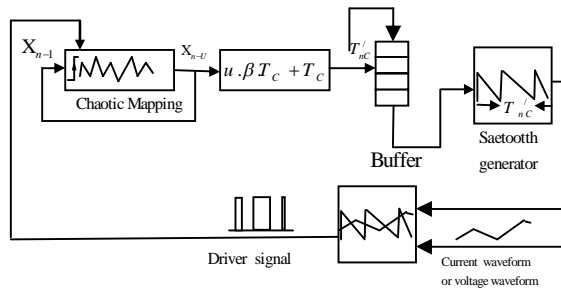
Fig2. Generation of chaotic carrier shematic
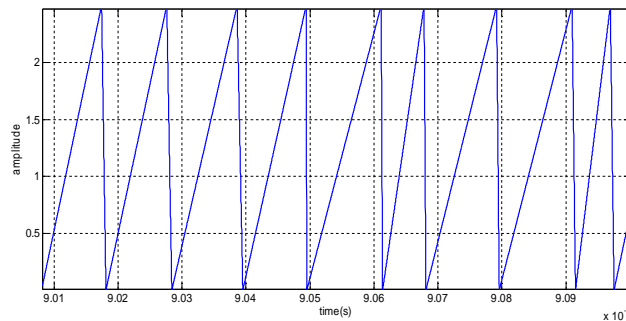
Fig3. Generation of chaotic carrier in Simulink/Matlab
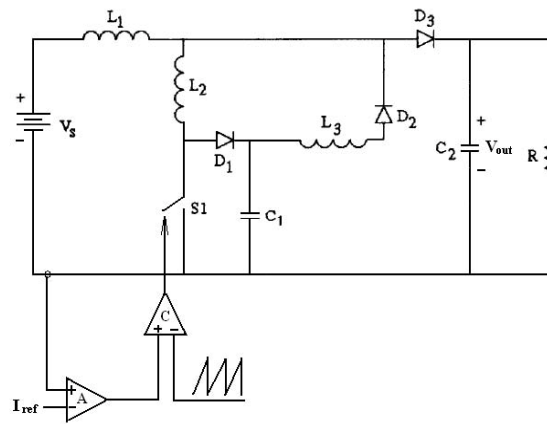
Fig4. Soft switching circuit
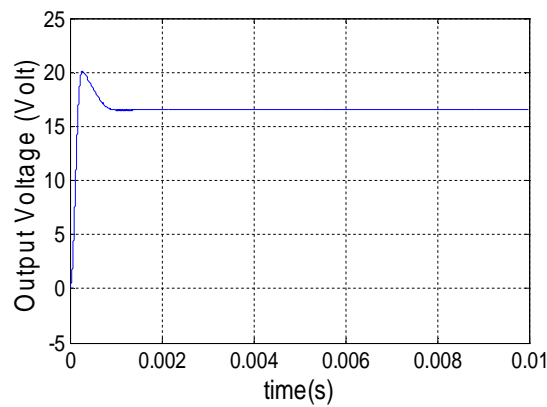
Fig5. Input voltage of hard switching converters
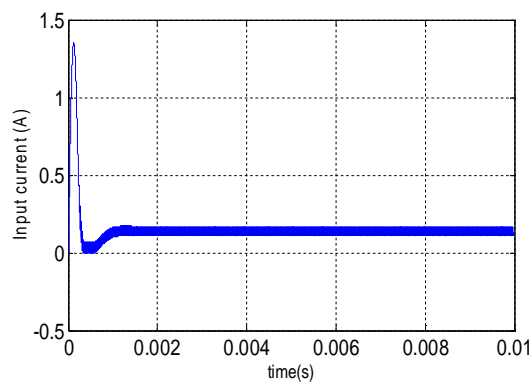
Fig6. Input current of hard switching converters

Jafarboland and Hadi Rismani
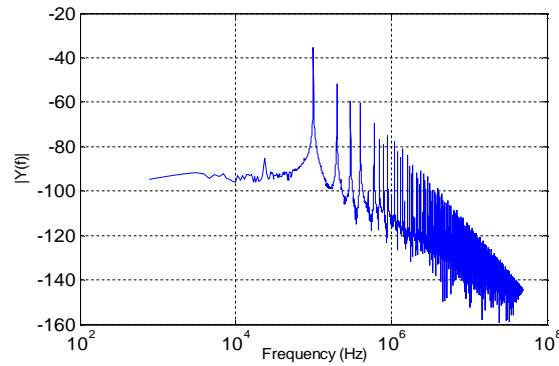
Fig7. Input current spectrum of hard
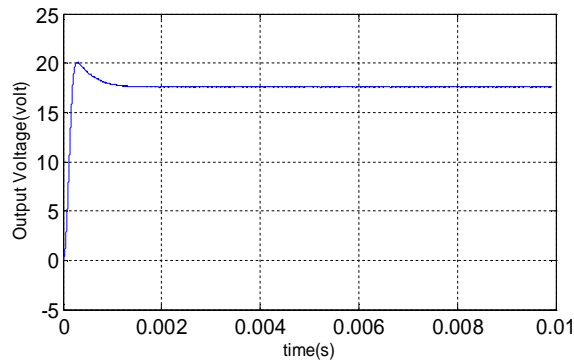
Fig8. The output voltage of chaotic- soft switching converter
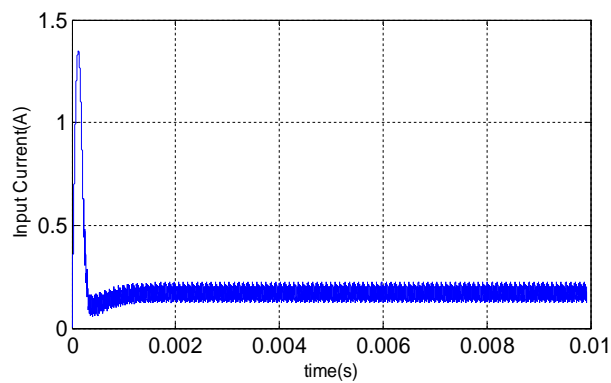
Fig9. The input current of chaotic- soft switching converter

Jafarboland and Hadi Rismani
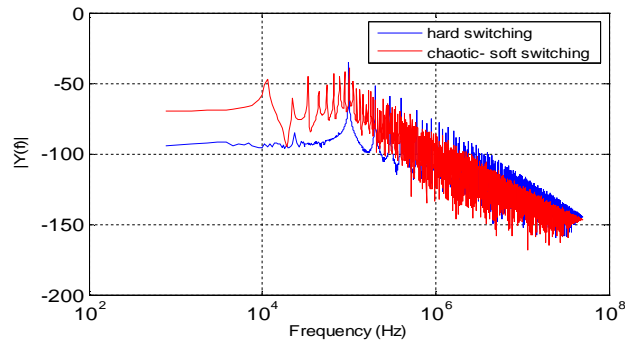
Fig10. Comparison of input current spectrum of hard and soft switching converter
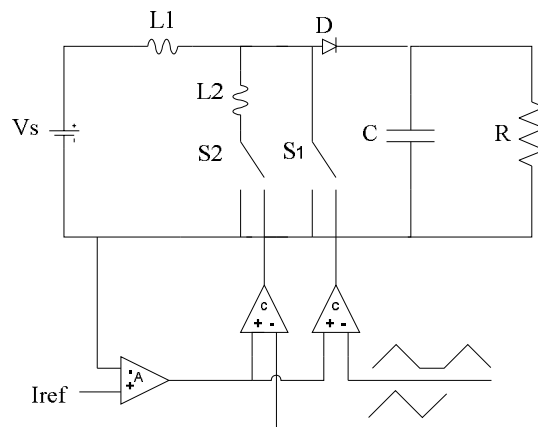
Fig11. The proposed converter
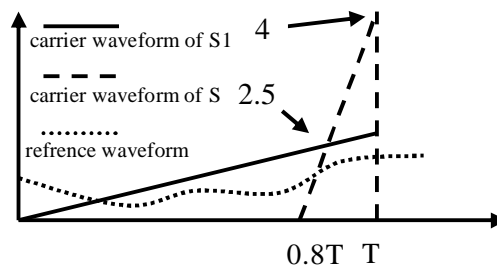
Fig12. The strategy of switching
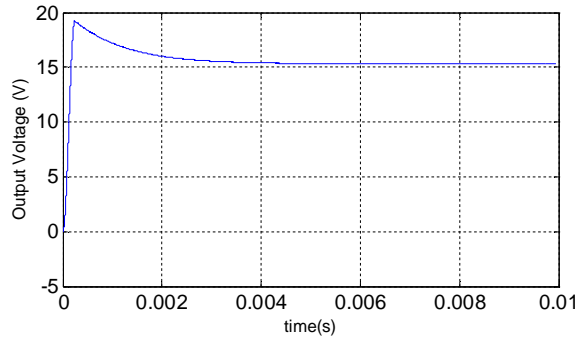
Fig13. Output voltage of the proposed converter
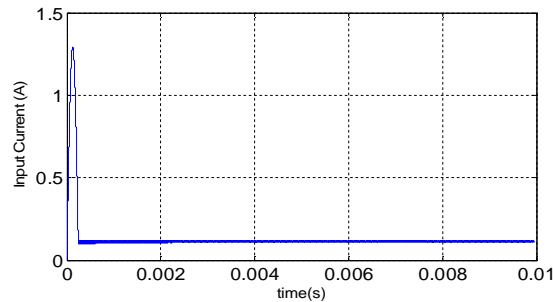
Fig14. Input current of the proposed converter
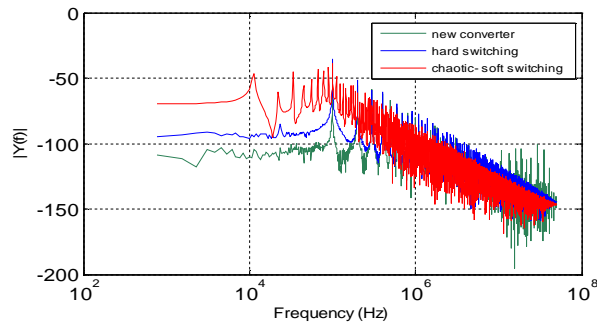
Fig15. Comparison of input current spectrum of hard and chaotic switching

Loss Analysis in Organic Laser Diodes under Electrical Pumping

Hakimeh Hemati Pour[1], Mohammad Reza Shayesteh[2]* and Seyed Mohammad Sadegh Tabatabaeifar[3]

[1,2]Department of Electrical Engineering, Yazd branch, Islamic Azad University, yazd, Iran.
[3]Department of Electrical Engineering, Mehriz branch, Islamic Azad University, Mehriz, Iran.

*Address for correspondence**
Mohammad Reza Shayesteh
Department of Electrical Engineering,
Yazd branch, Islamic Azad University,
Yazd, Iran.
E-mail: mr.shayesteh1354@gmail.com

ABSTRACT

Achieving laser threshold in organic laser diodes by using electrical pumping has been remained a great challenge. Besides all of the great features in these lasers, using optical pumping causes extra costs, so researchers attempt to find suitable material for active layer in order to minimize losses and achieve lasing by electrical pumping. In this paper, a review on two of the most important losses, bimolecular annihilation processes and field-induced exciton dissociation, in electrically pumped organic laser diodes is provided. Then a material which, provides low losses, is proposed for active layer. The losses analysis and choosing the material are done by using numerical simulations. In this study, popular models have been used to describe losses and doing numerical simulations to provide a comprehensive review on the reasons why lasing in electrical pumping has not been achieved yet. Therefore, researchers have the opportunity to study most reasons all at once.

Key words: Organic laser diode, electrical pumping, polaron, loss, photon absorption

INTRODUCTION

Organic laser diodes have been realized more than a decade [1-3]. They have many applications due to their specific properties (such as flexibility, low cost, tunability all over the visible light, etc). There are two kinds of excitation in order to achieve optical gain in these lasers, including optical pumping and electrical pumping. In optical pumping, additional pump sources, mostly inorganic, are used while in electrical pumping to achieve population inversion and consequently optical gain, charge injection will be used. Optical pumping is a high costs excitation method because of

Mohammad Reza Shayesteh *et al.*

an additional pump source is used in this method. On the other hand, electrical pumping is more popular and plenty research has been conducted in this regard recently, but its organic laser diodes have not been realized yet [4-7]. One reason is different loss processes that happen during electrical pumping and prevent achieving lasing threshold.

As previously discussed, organic semiconductors have many good properties [8]. But they have their own problems such as low charge carrier mobility which makes high current density and electric field necessary to achieve laser operation. In addition, an increase in electric field and current density causes loss processes like bimolecular annihilation and field-induced exciton dissociation. Other losses are photon absorption by polarons and triplet excitons, cathode absorption, etc. These reasons are why electrical pumping has not been realized yet.

Threshold current density in organic laser diodes is about 1 kA/cm^2. Therefore current density in orders of kA/cm^2 is needed for pumping over threshold which means high particle densities. To achieve this current density, particle densities around 10^{19} kA/cm^3 and electric fields about 10^7 V/cm are necessary. So, bimolecular annihilation (BA) and field quenching (FQ) will appear. In this article, these loss processes will be simulated (by MATLAB) and their effects on exciton densities will be shown. It is noticeable that all of the simulations are done for a laser with host-guest Alq$_3$/DCM system for active layer.

First, these losses will be studied and presented by the mathematical relations and the numerical simulation results. Finally, a material will be chosen according to the simulation results.

Theoretical analysis

As discussed earlier, achieving lasing in organic laser diodes which are using electrical pumping has not been realized due to some loss processes. In this paper, two important losses will be studied. In this section bimolecular annihilation processes and field quenching are studied by using popular modeling.

Bimolecular annihilation

Bimolecular annihilation processes are part of loss processes that occur in high excitation and make electrical pumping impossible. These processes occur between two particles; along this process the energy of one particle (charge carrier, polaron or exciton) transfers to another. Therefore the first particle will relax to ground excitonic/polaronic state and the second one will be excited to the higher energy states and then relaxes to a lower state [9,10]. Therefore each BA processes includes two particles and so the effective annihilation rate depends on multiplication of two particle densities, so these processes are important at high excitation where there are high densities. But in organic lasers high particle densities are needed (10^{19} kA/cm^3) to achieve threshold and at this range of density bimolecular annihilation processes become important. There are six kinds of bimolecular annihilations that usually matter, singlet-singlet annihilation (SSA), singlet-polaron annihilation (SPA), singlet-triplet annihilation (STA), triplet-polaron annihilation (TPA), triplet-triplet annihilation (TTA), intersystem crossing (ISC).

Most of the BA processes have negative effect on singlet exciton densities, which are responsible for optical gain. Therefore, it is expected that these processes would have significant effect on lasing threshold. The effect of BA on singlet exciton densities is demonstrated by [11],

$$\frac{\partial n_{S_1}}{\partial t}\Big|_{BA} = -(2-\xi)\,k_{SSA}\,n_{S_1}^2 - k_{STA}\,n_{S_1}\,n_{T_1} + \xi\,k_{TTA}\,n_{T_1}^2 - k_{SPA}(n_e + n_h)\,n_{S_1} \qquad (1)$$

$$- k_{ISC}\,n_{S_1}$$

Where ξ is the probability of generating singlet excitons (ξ=0.25 for singlet exciton [10]), n_{S1} is singlet exciton densities, n_{T1} is triplet exciton densities and n_e and n_h are electron and hole densities, respectively. In Eq. (1), the "k" parameters in each term show the rate coefficient of the BA process (e.g. k_{SPA} shows the rate coefficient of singlet-polaron annihilation). Standard rate coefficients and rate coefficients that are measured for some materials are shown in table 1 [9,10,12-16]. According to table 1, it is obvious that all of the rate coefficients have not been measured for a material. By considering Eq. (1), it can be understood which BA processes play roll in singlet exciton densities and if they are increasing the density or decreasing it (e.g. SSA is decreasing the density because of the negative sign). By using this equation in simulations, the effect of each annihilation process and its rate coefficient on singlet exciton densities can be recognized.

Triplet excitons create additional absorption states and decrease optical gain. Therefore the effects of BA on triplet exciton densities should be considered. The effect of BA processes on triplet exciton densities has been stated by following equation [11]

$$\frac{\partial n_{T_1}}{\partial t}\Big|_{BA} = +(1-\xi)\,k_{SSA}\,n_{S_1}^2 - (1+\xi)\,k_{TTA}\,n_{T_1}^2 - k_{TPA}(n_e + n_h)\,n_{T_1}$$
$$+ k_{ISC}\,n_{S_1} \tag{2}$$

Where, k_{SPA} is SPA rate coefficient. According to Eq. (2), TTA and TPA will decrease triplet excitons in semiconductor but during SSA and ISC, triplet excitons will be generated.

In both Eq. (1) and Eq. (2), some terms increase exciton densities and some terms decrease them. It is obvious that increase and decrease in exciton densities depends on rate coefficients, so the active material is very important.

Field quenching

Binding energy in singlet excitons is about 0.2 eV up to 1 eV and in triplet excitons is about 0.4 eV up to 1.6 eV [18-28]. So, excitons are stable at room tempreture. When an electric field (higher than 10^6 V/cm [29]) is applied, it will overcome the binding energy and excitons will dissociate to charge carriers. Besides organic semiconductors have low charge carrier mobilities. Therefore an electric field about 10^7 V/cm is necessary to achieve current density around 1 kA/cm^2 (threshold current density in organic laser diodes). Studies show photoluminescence efficiency would decrease up to 90% in presence of electric field, which is a proof that excitons will dissociate in high electric field. This process will lead to high threshold and it can be a loss channel.

There are three models that have been using more than others to describe this process including 1 dimensional Poole-Frenkel theory, 3 dimensional Poole-Frenkel theory and Onsager theory. In this article, simulations are done based on Onsager theory, the most popular one. According to this theory, rate equation that describes exciton dissociation to charge carriers, is [28]

$$\frac{\partial n_{S_1,T_1}(x,t)}{\partial t}\Big|_{FQ,ONS} = -\frac{e(\mu_e + \mu_h)}{2\varepsilon_0\varepsilon_r}\frac{3}{4\pi a^3} \times \exp\left(\frac{E_{0,S_1,T_1}}{k_B T}\right)$$
$$\times \frac{J_1\left[2\sqrt{2}(-b)^{0.5}\right]}{\sqrt{2}(-b)0.5}n_{S_1,T_1}(x,t) \tag{3}$$
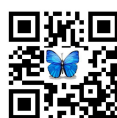
Mohammad Reza Shayesteh *et al.*

Where μ_e , μ_h are electron and hole mobilities, respectively. ε_0 and ε_r are dielectric constant of vacuum and relative dielectric constant, T is temperature and k is Boltzmann constant. $E_{0,S1}$ and $E_{0.T1}$ are the binding energies of singlet and triplet excitons, respectively and a , b are defined as follow

$$b = \frac{e^3 F}{8\pi\,\varepsilon_0\varepsilon_r k_B^2 T^2} \tag{4}$$

$$a = \frac{e^2}{4\pi\,\varepsilon_0\varepsilon_r E_{0,S_1,T_1}} \tag{5}$$

Also J is a first order Bessel function and can be calculated from below equation

$$\frac{J_1\left[2\sqrt{2}\left(-b\right)^{0.5}\right]}{\sqrt{2}(-b)0.5} = 1 + b + \frac{b^2}{3} + \frac{b^3}{18} + \frac{b^4}{180} + \frac{b^5}{2700} + \frac{b^6}{56700} + ... \tag{6}$$

This equation is written for b<3, but when F=5×10^4 V/cm, b become bigger than 3 so J will be calculated by

$$\frac{J_1\left[2\sqrt{2}\left(-b\right)^{0.5}\right]}{\sqrt{2}(-b)0.5} = \left(\frac{2}{\pi}\right)^{0.5} (8b)^{-0.75} \times \exp\left((8b)^{0.5}\right)$$
$$\times \{1 - \frac{3}{8(8b)^{0.5}} - \frac{15}{128.8b} - \frac{105}{1024\left((8b)^{0.5}\right)^3} - ...\} \tag{7}$$

According to these equations, exciton densities depend on electrical field and exciton binding energy. The effect of FQ on exciton densities and the effect of electrical field on the densities are shown by numerical simulations in next section.

SIMULATION RESULTS

According to theoretical analysis, the simulation results are discussed in this section. At first, the BA effect on singlet and triplet exitons will be studied (Fig. 1) then the effect of rate coefficients will be discussed (Fig. 2). After that, the effect of BA processes will be compared for some materials (Fig. 3). Next, the effect of FQ on exciton densities according to Onsager theory (Fig. 4) and the effect of electrical field will be demonstrated (Fig. 5). Rate coefficients in table (1) and standard amounts for other parameters have been used in simulations.

In Fig. 1, the effect of BA on singlet excitons and triplet excitons is shown. According to this figure, the reduction of singlet excitons is so much higher than triplet excitons. Also, triplet exciton density is increased at first then the effect of other processes (TTA and TPA) overcome SSA and ISC, so bimolecular annihilation processes not only decrease singlet excitons but also some of them increase triplet excitons and cause additional absorption states. It can be understand that increase or decrease in singlet and specially triplet exciton densities depends on active material rate coefficients, although rate coefficients have not been found for lots of organic materials.

Mohammad Reza Shayesteh *et al.*

Fig. 2, shows the effect of rate coefficients and compare them together. According to this figure, the amount of the diagrams for SP, SS and ST annihilations are negative, which means the slope of singlet exciton rate diagram is negative, which means singlet density is decreasing. By increasing these rate coefficients the reduction of singlet excitons will increase, because the slope of these three diagrams is negative, that means singlet rate diagrams will decrease more for higher coefficients. But TTA is positive, that means the slope of singlet rate is positive, so it's increasing. Also diagram slope is positive that means an increase in k_{TTA} leads to increase in singlet excitons. Therefore it can be understand that three SP, SS and ST annihilations result reduction in singlet exciton densities and increasing their rate coefficients leads to more reduction, but TTA results increase in singlet rate and increasing its rate coefficient leads to increase in singlet exciton densities. Also, according to simulations the effect of SPA on singlet exciton densities is more than other annihilations.

As it was expected, most of BA processes diminish singlet excitons and so they diminish optical gain. Hence, bimolecular annihilation processes are one of the loss channels that cause unrealization of electronic pumped organic laser diodes.

In Fig. 3 and Fig. 4, the effect of annihilation processes on singlet and triplet excitons for four materials is demonstrated, respectively. Rate coefficients in table (1) are used for simulations, but all the coefficients have not been measured for any material, instead standard rate coefficients are used.

According to these figures Alq_3 will be a good candidate for gain medium, the deduction of singlet excitons is minimum for this material, also triplet exciton density is less than other materials. LPPP would be second candidate for active layer and at the end PFO can be used, because of significant increase in triplet exciton density.

By using Eq. (3) for simulations Fig. 5, would be resulted. It's obvious that this process decrease both singlet and triplet exciton densities. The reduction in singlet excitons is more significant, which means deduction of laser gain.

As mentioned before, this process is due to electric field and by increasing the electric field, decrease in densities is expected. The results of increasing electric field are shown in Fig. 6 and Fig. 7.

It can be resulted that by increasing the electric field both singlet and triplet exciton densities will decrease, as it was expected. The reduction of exciton densities is more for higher fields. This process effect can be decrease if the gain medium with high binding energy is used. In this case Alq_3 can be a good choice too, because standard binding energy for singlet excitons is 0.4 /eV while this parameter for Alq_3 is 1.4 /eV, which means less singlet excitons will be dissociated during this process for lasers with Alq_3 as gain medium.

CONCLUSIONS

There are two kinds of optical and electrical pumping for organic laser diodes. Optical pumping has been realized yet and achieving lasing in electrical pumping is not realized because of high losses (like BA, FQ, etc). Besides an extra pump source in optical pumping is needed which is inorganic. Therefore system cost will increase significantly. It is noticeable that this issue will limit some applications in organic laser diodes. Therefore to achieve organic lasers with expected features and low cost, electrical pumping should be considered (in this case there would be no need to extra pump source). Using electrical pumping is challenging because of loss processes such as bimolecular annihilation, field-induced exciton dissociation, polaron absorption, triplet exciton absorption and electrode losses. Low charge carrier mobility in organic semiconductors is the reason of all the losses. As consequent, high current densities will be needed to achieve lasing, which needs high carrier densities and high electric fields. But the losses will become important at high densities and cause high threshold.

Mohammad Reza Shayesteh *et al.*

In this paper, two most important losses were studied in order to find solutions which may decrease the losses. The soltions will help to decrease system cost by using electrical pumping indirectly to help optical pumping. According to the simulations, it can be understand that bimolecular annihilation processes are the total reason of reduction in singlet exciton density and optical gain. In addition, these processes cause an increase in triplet exciton densities and as a result, absorption losses. The results revealed that Alq_3 would be a suitable medium through considering BA losses in a way electrical pumping can help optical pumping and lasing threshold will decrease even a little. Binding energy for this material is also higher than others. Therefore FQ loss processes will be lower in this case.

REFERENCES

1. Moses D(1992), High quantum efficiency luminescence from a conducting polymer in solution: a novel polymer laser-dye, Applied Physics Letters 60(26), pp. 3215–3216.
2. Kersting R., Lemmer U., Deussen M., Bakker H., Mahrt R., Kurz H., Arkhipov V. I., Bassler H. Gobel E(1994) Ultrafast field-induced dissiciation of excitons in conjugated polymers, Physical Review Letters 73(10), pp. 1440–1443.
3. Tessler N., Denton G. J., Friend R. H(1996) Lasing from conjugated-polymer microcavities, Nature 382, pp. 695–697.
4. Mazzeo M., Genco A., Gambino S., Ballarini D., Mangione F., Di Stefano O., Patane` S., Savasta S., Sanvitto D., Gigli G(2014) Ultrastrong light-matter coupling in electrically doped microcavity organic light emitting diodes, Applied Physics Letters 104, pp. 233303-233306.
5. Du G. T., Zhao W., Wu G. G., Shi Z. F., Xia X. C., Liu Y., Liang H. W., Dong X., Ma Y., Zhang B. L(2012) Electrically pumped lasing from p-ZnO/n-GaN heterojunction diodes, Applied Physics Letters 101, pp. 053503-053506.
6. Shaw-Stewart J. R. H., Mattle T., Lippert T. K., Nagel M., Nüesch F. A., Wokaun A(2013) The fabrication of small molecule organic light-emitting diode pixels by laser-induced forward transfer, Journal of applied physics 133, pp. 043104- 043110.
7. Klinkhammer S., Großmann T., Lüll K., Hauser M., Vannahme C., Mappes T., Kalt H., Lemmer U(2011) Diode-Pumped Organic Semiconductor Microcone Laser, IEEE Photonics Technology Letters 23, pp. 489-491.
8. Tsiminis G., Wang Y., Kanibolotsky A. L., Inigo A. R., Skabara P. J., Samuel I. D. W., Turnbull G. A(2013) Nanoimprinted Organic Semiconductor Laser Pumped by a Light-Emitting Diode, Advanced Materials 25, pp. 2826–2830.
9. Sokolik I., Priestley R., Walser A., Dorsinville R., Tang C(1996) Bimolecular reactions of singlet excitons in tris(8-hydroxyquinoline) aluminum, Applied Physics Letters 69, pp. 4168–4170.
10. Nakanotani H., Sasabe H., Adachia C(2005) Singlet-singlet and singlet-heat annihilations in fluorescence-based organic light-emitting diodes under steadystate high current density, Applied Physics Letters 86, p. 213506.
11. Gärtner C(2008) Organic Laser Diodes modeling and simulation, Ph.D. dissertation, Dep. Elec. Eng. Karlsruhe, pp.157-167
12. Lim S., Bjorklund T. G., Bardeen C(2003) The role of long-lived dark states in the photoluminescence dynamics of poly.phenylene vinylene. conjugated polymers. ii. excited-state quenching versus ground-state depletion, Journal of Chemical Physics 118, pp. 4297–4305.
13. Stevens M., Silva C., Russell D., Friend R(2001) Exciton dissociation mechanisms in the polymeric semiconductors poly(9,9-dioctylfluorene) and poly(9,9dioctylfluorene-co-benzothiadiazole), Physical Review B 63, pp. 165213.
14. Yu J., Lammi R., Gesquiere A. J., Barbara P. F(2005) Singlet-triplet and triplet-triplet interactions in conjugated polymer single molecules, J. Phys. Chem. B 109, pp. 10 025–10 034.
15. List E., Scherf U., Müllen K., Graupner W., Kim C., Shinar J(2002) Direct evidence for singlet-triplet exciton annihilation in p-conjugated polymers, Physical Review B 66, p. 235203.

16. Haugeneder A., Neges M., Kallinger C., Spirkl W., Lemmer U., Feldmann J., Scherf U., Harth E.,Gügel A., Müllen K(1999) Exciton diffusion and dissociation in conjugated polymer/fullerene blends and heterostructures, Physical Review B 59, pp. 15346 – 15351.

17. Haugeneder A., Neges M., Kallinger C., Spirkl W., Lemmer U., Feldmann J., Amann M.-C., Scherf U(1999) Nonlinear emission and recombination in conjugated polymer waveguides, Journal of Applied Physics 8, pp. 1124–1130.

18. Pedersen T. G., Lynge T. B., Kristensen P. K., Johansen P. M(2005) Theoretical study of conjugated porphyrin polymers, Thin Solid Films 477, pp. 182–186.

19. Knupfer M(2003) Exciton binding energies in organic semiconductors, Applied Physics a-Materials Science and Processing 77, pp. 623–626.

20. Hummer K., Puschnig P., Ambrosch-Draxl C(2004) Lowest optical excitations in molecular crystals: Bound excitons versus free electron-hole pairs in anthracene, Physical Review Letters 92, p. 147402.

21. Hill I., Kahn A., Soos Z., Pascal (Jr.) R(2000) Charge-separation energy in films of p-conjugated organic molecules, Chemical Physics Letters 327, pp. 181–188.

22. Knupfer M., Peisert H., Schwieger T(2001) Band-gap and correlation effects in the organic semiconductor Alq$_3$, Phys. Rev. B 65, p. 033204.

23. Schweitzer B., Bässler H(2000) Excitons in conjugated polymers, Synthetic Metals 109, pp. 1–6.

24. List E., Kim C., Naik A., Scherf U., Leising G., Graupner W., Shinar J(2001) Interaction of singlet excitons with polarons in wide band-gap organic semiconductors: A quantitative study, Physical Review B 64, p. 155204.

25. Weiser G(1992) Stark effect of one-dimensional wannier excitons in polydiacetylene single crystals, Physical Review B 45, pp. 14 076–14 085.

26. Scheidler M., Lemmer U., Kersting R., Karg S., Riess W., Cleve B., Mahrt R. F., Kurz H., Bässler H., E. Göbel E. O., Thomas P(1996) Monte carlo study of picoseconds exciton relaxation and dissociation in poly(phenylenevinylene), Phys. Rev. B 54, pp. 5536–5544.

27. Wu C. I., Hirose Y., Sirringhaus H., Kahn A(2010) Electron-hole interaction energy in the organic molecular semiconductor PTCDA, Chemical Physics Letters 272, pp. 43–47.

28. Onsager L(1938)Initial recombination of ions, Phys. Rev. 54, pp. 554–557.

29. Tessler N., Harrison N., Friend R(1998) High peak brightness polymer lightemitting diodes, Advanced Materials 10, pp. 64–68.

Table 1. Rate coefficients for some materials and standard rate coefficients.

Material	PFO	PPV	LPPP	Alq$_3$	F8BT	Standard material
k_{SS} /(cm^3/s)	4.9×10^{-8}	6.0×10^{-9}	4.2×10^{-9}	3.5×10^{-11}	2.6×10^{-9}	10^{-10}
k_{ST} /(cm^3/s)	5.2×10^{-10}	1.2×10^{-9}				10^{-10}
k_{TT} /(cm^3/s)						10^{-12}
k_{SP} /(cm^3/s)		1.2×10^{-8}		3.0×10^{-10}		10^{-10}
k_{TP} /(cm^3/s)				1.0×10^{-12}		10^{-12}
k_{ISC} /(1/s)					6.7×10^{6}	5×10^{7}

Mohammad Reza Shayesteh *et al*.
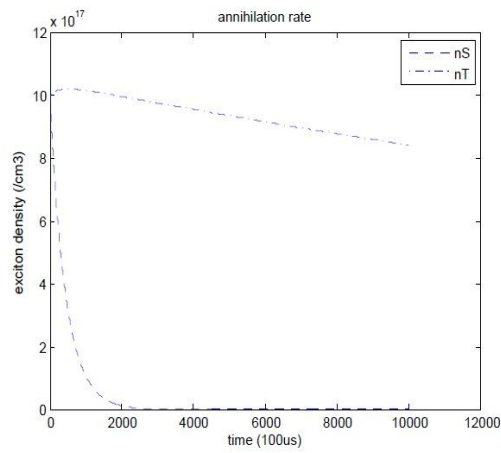
Fig. 1. Singlet and triplet rate diagrams for standard rate coefficients.
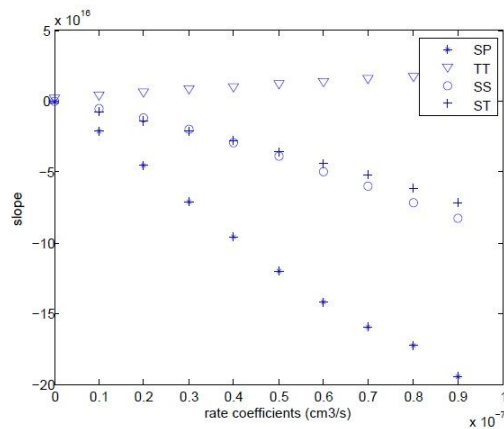
Fig. 2. Slope of singlet rate diagrams versus rate coefficients.
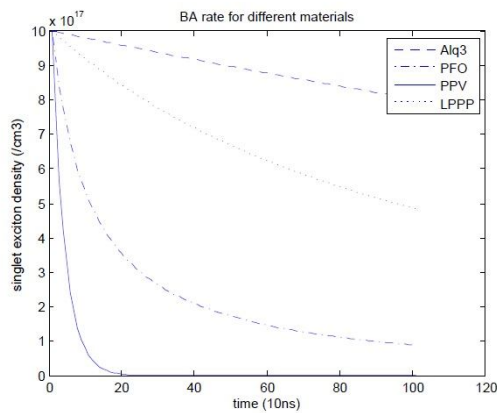
Mohammad Reza Shayesteh *et al.*

Fig. 3. Singlet exciton rate diagrams for four different materials.
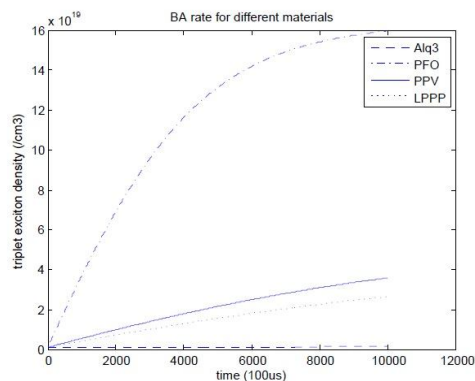
Fig. 4. Triplet exciton rate diagrams for four different materials.
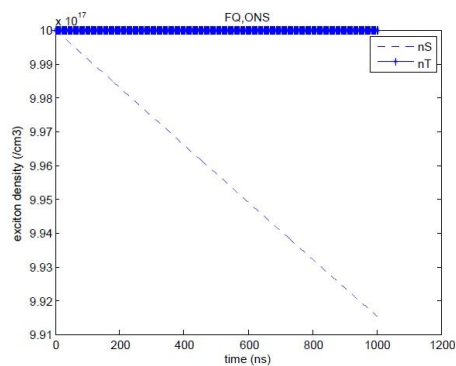
Fig. 5. Singlet and triplet rate diagrams according to Onsager theory.
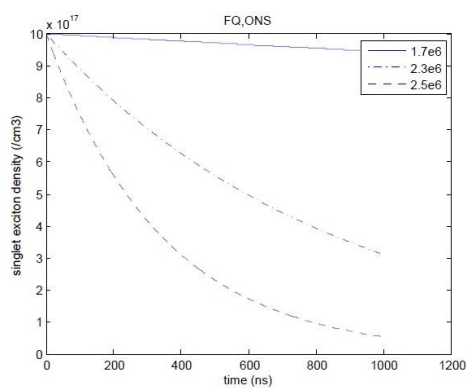
Fig. 6. Singlet exciton rate diagrams for three different electric fields.

Mohammad Reza Shayesteh *et al.*
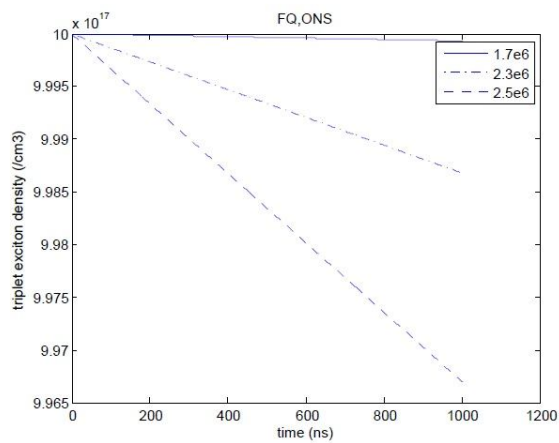
Fig. 7. Triplet exciton rate diagrams for three different electric fields.

Selecting Suitable Batteries for Storage and Maximum Power Point Tracking in Solar Power Generation Systems

Seyed Mohammad Sadegh Tabatabaeifar[1] , Javad Ebrahimi[2] and Hossein Dehghan Tezerjan[3]*

[1,2]Department of Electrical Engineering, Mehriz branch, Islamic Azad University, Mehriz, Iran
[3]Department of Electrical Engineering, Yazd branch, Islamic Azad University, yazd, Iran.

*Address for correspondence
Hossein Dehghan Tezerjan
Department of Electrical Engineering,
Yazd branch, Islamic Azad University,
yazd, Iran.
E-mail : dehghan_tz@rocketmail.com

ABSTRACT

Distributed generation sources (DGs) are generally rich, inexpensive, accessible and renewable sources that using them can significantly reduce the costs of generating electrical power.Because of advantages such as simple structure, convenient installation and low maintenance costs, solar power is one of the most important renewable sources. Because of the perfect technology, low cost and high performance, battery-based storage systems are widely used in DG systems. In the meantime, a model of the solar cell is required for the analysis of system's steady and dynamic states. Therefore we need a method to maintain the solar cell at the maximum power point so that we can attain the maximum power and the best productivity from the solar cell. At first, in this article a reviewon the battery and its variants have been conducted and the most appropriate battery have been selected to connect to the solar cells and then a control method about tracking the maximum power pointfor solar cells was studied. At the end a photovoltaic system with its converter was simulated using MATLAB / SIMULINK software.

Key words: Converter, Photovoltaic systems, Maximum power point

INTRODUCTION

Increased need to new energy sources as producers of electricity, outwearing of transmission and distribution networks, substantial investments to develop and renewal of networksand the need for electric power with high flexibility and high-quality, is leading the world towards the modern methods of electricity generation. According to

Hossein Dehghan Tezerjan *et al.*

the forecasts, about 51 percent of the electricity generation should come from the DGs. Presence of the renewable energy sources have turned the previous passive distribution networks into active networksand active networks have brought a new concept called "Micro Networks". According to the DGs, the nature of micro-networks would be different from the old networks, therefore, their technical issues and controls would be different [1].These differences could be the basis of numerous researches in this field, because as a result of their nature, micro networks have the ability to become completely independent from their upper-hand network. Of course, the outage in power networks is not the only reason of using DGs, also in recent years, development of electricity generation technologies from renewable resources,advances in intelligent management systems and the process of restructuring and development of competitive markets in the electricity industry, all together have accelerated the development of DG. By creation of the new concept (micro-networks) which includes a number of distributed generation units and load, controlling voltage and frequency of the network and DG units have become more important. This issue becomes more complicated in the island mode that lacks the reference voltage and frequency of the distribution network. Simultaneously, DG units that are based upon the power electronics devices are experiencing a fast growth. So, by controlling these electronic power converter based networks, we can increase the efficiency, reliability and flexibility of the network. Nowadays, using photovoltaic systems, generating units are one of the most widely used and applicable units of the DG systems. About the benefits of the producing energy using PV cells we can mention the independence from fuels, lower maintenance costs, lack of noise and clean nature.In this regard, the use of solar radiation and solar trackers become important. Because of the perfect technology, low costs and high performance, battery-based storage systems are widely used in DG systems. Connecting the batteries to solar cells forms a combined system that can supply constant energy with high reliability.Based upon the conditions, such as weather conditions, radiation etc, solar cells would have a maximum power point [2].Solar energy that is absorbed by the solar cells should be transferable to the local networks and loads and this task is done using power converters. Using high performance and low cost and stable converters seems necessary.

Different methods of tracking the maximum power point

1.Curve fitting method.
2. Fractional short circuit current method.
3.Fractional open circuit voltage method.
4.Look-up table based method.
5.Single-cycle control method.
6.Voltage and current feedbacks based method.
7.Deviation and observation method (P & Q).
8.Hill Climbing method.

Generally, no method can be considered as the absolutely best method. In order to select a maximum power point tracking system there are a number of criteria such as: cost, tracking speed and accuracy, easy implementation, etc that we can consider each one of them as the most efficient method in different plans. In this article, the choice of method is based on the relationship between light intensity and maximum power point voltage. Using this relationship and by measuring the light intensity at each moment, maximum power point voltage is computable and the system would regulate the output voltage at the maximum power point [3]. Controlling and tracking the maximum power point includes sensors, wave generator and maximum power point tracker system.Depending upon the MPPT method, by having the control system and measuring the required parameters for the right spot (maximum output power point), PWM would be obtained. Working spot voltage relation with the radiation intensity is as follows.

$$V_{PVmpp} = f_1\left(L, g_\sigma(L, V_{PV}, T_{Env})\right) \rightarrow$$

Hossein Dehghan Tezerjan *et al.*

$$V_{PVmpp} = f_2 \left(L , T_{Env} \right)$$

According to the fact that the temperature doesn't change a lot in short periods of time (one hour), so the temperature is considered as a constant number and we can rewrite the relation 1 as below.

$$V_{PVmpp} = f_3 \left(L \right)$$

The relation number 2 is acceptable if ambient temperature or the effect of applied ambient temperature is present in the function number (3) and it is written as below. Vmpp should be used as maximum power point voltage to the derivedvoltage and it should be considered zero. Po output, obtained voltage from this relation, is the voltage of maximum power.

$$\frac{\partial P_o}{\partial V_{pv}} = 0 \qquad \rightarrow V_{PVmpp} = f_1 \left(L , T_{cell} \right)$$

Proposed method for maximum power point tracking

Figure (1) shows the block diagram of the proposed circuit.

This method computes the voltage of working spot based upon the measurement of radiation intensity, then using the boost converter that is placed at the output array would regulate the output voltage as PWM desired voltage by changing the working cycle of the output voltage generation of the array. MPP's core processor of the information system voltage spot is a micro-controller that would keep the voltage by receiving the maximum point of radiation intensity of MPP [4]. Due to the lack of solar array voltage regulation and DC's nature, aconverter can be used in the output. Usually a boost converter is selected that its circuit has been shown in the figure (2).

Here, the influence of the relation of electric power that has been converted to heat, absorbed radiation power that is directly converted to heat and the maximum power have been reviewed and the results were simulated and now you can see them in graphs (3) and (4). The curves indicate that the intensity of radiation and electric power that make the solar panel warm have influenced the maximum output power and in 5 different radiation intensities this value is ranged from 0.2 sun to 1 sun.

The following figure shows the test sample for 5 different radiations and working spot that system has detected and figure (6) shows the power tracking.

DC/DC Convertor

In photovoltaic array, DC/DC converters have 2 important duties:

1.Tracking the maximum power point by indirect regulation of input resistance.
2.Raising the input voltage of the inverter.

As it has been shown in the figure (7), we need inverter to send the generated power of the solar system to the power network or isolated loads that are usually AC [5]. 2 duties of the converters in the photovoltaic array are:

• Converting DC power to AC.

4013

• Providing the corresponding power to maximum power point in the output of the converter and flow control.

Appropriate conditions for installation and implementation of photovoltaic systems

The efficiency of photovoltaic panels depends on orientation, location and suitable weather conditions [6]. About the important factors of an ideal matter for photovoltaic cells we can mention:

• Bandwidth from 1.1 eV to 1.8 eV.
• The market availability and being made up of non-toxic materials.
• Recycling ability and being suitable for mass production.
• Good photovoltaic conversion efficiency.
• Long-term stability.

A)Installation direction of the PV panels is very important for obtaining the maximum efficiency. For fixed panels, in comparison to the tracking panels which track the maximum solar radiation, in northern hemisphere, the south direction is the best direction to collect the solar radiations.

B)In addition to the direction, deviation angle of the panel is an important factor in solar systems design. Deviation angle is the angle that solar panels make with the horizon and varies from 0 to 90 degrees.

C)Geographical length and width (longitude and latitude) and height of the installation of solar systems are required factors for calculation of the solar radiation power. Usually, 80 to 85 percent of the sunlight (1000 W/m^2) can be absorbed during the sunny days.

D)The efficiency of all of the modules would decrease in high temperatures. As long as the temperature does not reach more than 80 ºF, this is not so important. Modules must be positioned in a way that full ventilation would be possible.Free airflow around the modules would increase the efficiency[7]. This would prevent the accumulation of the humidity and solid wastes under the solar modules so as a result it would prevent the roofdecay and deterioration of the electrical connections.

Reviewing different battery types and selecting the most compatible with solar systems

Newcomers of the battery world may think that the current available batteries of the market that have a high energy density and are very thin, like a piece of paper, should also provide a great number of charge-discharges cycles, probably more than 1000 times, but unfortunately all of these properties cannot be gathered in one battery cell. The fact is that a particular battery may have a small size and a long time of ampacity but it can't be charged-discharged many times. While, another battery may have a long life (it can be charged-discharged numerous times) but it is bulky and heavy, yet another battery may contain a high energy density but because of being expensive cannot be used in industrial sizes. First of all, batteries for solar systems should have a long lifetime as they would be used numerously and continuously. Generally, battery life is expressed as the number of charge-discharges and discharge level of the battery that it can sustain. In solar systems, batteries would be charged during the daylight and they would be discharged at nights. So each day means a charge-discharge cycle for the batteries [8]. Another important matter about the batteries of the solar systems is the ability of the batteries to be charged to the nominal capacity. In solar systems, after cloudy days, batteries may be discharged to the depth of 80 percent and batteries must have the ability to provide the load at these conditions[9].

Characteristics of various batteries

Different batteries that are available and have a large share in the market mostly include car batteries and batteries for UPS devices that are known as UPS batteries. UPS batteries have less charge-discharge cycle in comparison to solar system batteries as they only would be used at the times of outage or other emergencies[10].Batteries of a solar system should have a high capacity for charge-discharge cycles. An important point about the rechargeable batteries is that in order to reach the maximum lifetime, they should be completely discharged and then fully recharged. Size and shape of the battery must be designed compatible with voltage system performance, nightly use time, weather conditions of the area etc. In some of these systems a charge controller has been designed to ensure that charging process would be stopped after the batteries were fully charged or by disconnecting the batteries from the module would stop unusual discharges and this will affect the quality and lifetime of the batteries[11]. Unfortunately, in most of the cases the used batteries in solar systems are of UPS type and they would last between 1 to 2 years. As in solar systems the batteries have a big share of the price (between 30 to 40 percent of the costs), choosing suitable batteries is of great importance.

Suitable battery for solar systems

Among the dry Lead-Acid batteries, 2 types of batteries are suitable for solar systems.

1. AGM dry Lead-Acid batteries:

They are specially designed for solar systems. These batteries only can be distinguished by their catalog and by the writings on the body. There is no apparent difference between these batteries and UPS batteries.

2. GEL dry Lead-Acid batteries:

In comparison to AGM batteries, GEL batteries are more temperature tolerant that means they have longer lifetime in warm environments. Also GEL batteries can sustain more charge-discharge cycles in similar circumstances with AGM batteries[12].

CONCLUSION

This article is a method to track the maximum power in solar panels and to choose suitable batteries for solar systems. The proposed method is based upon the existence of a relation between radiation intensity and maximum power point voltage. By having this relation, at every moment, by measuring the radiation intensity, maximum power point voltage can be calculated. One of the characteristics of the proposed method is that it can properly track the maximum power and there is no fluctuation around the maximum power and there is no need to the solar panel model. Based upon the carried out experiments, lithium-ion efficient batteries can be economically used in the network. These batteries can store the solar/wind power in the storage stations so when the network needs them in time of shortage, they can be used. If the batteries are used properly, they can balance the overload of the network, hence they are significantly economic.Despite the price of the lithium –ion batteries, at the present time, this technology is valuable, especially in the regions with unsustainable resources.

REFERENCES

1. Kurt Johnson(2011). SunPower –Murfreesboro Solar Farm, North Carolina Sustainable Energy Conference , Business Development Manager.
2. PhD Paul Breslow(2010). The Intersection of PV Project Performance and Economics; California Solar Energy Collaborative.
3. Matt Campbell(2009). Minimizing utility-scale PV power plant levelized cost of energy using high cap acity factor configurations, SunPower Corp, San Jose, California, USA:http://www.pv-tech.org.
4. Galen Barbose, NaïmDarghouth, Ryan Wiser and Joachim Seel(2011). Tracking the Sun IV, An Historical Summary of the Installed Cost of Photovoltaics in the United States from 1998 to 2010,Berkeley Lab.
5. J. Balaguer, L. Qin, Y. Shuitao, U. Supatti and P. Fang Zheng(2011).Control for Grid-Connected and Intentional Islanding Operations of Distributed Power Generation, IndustrialElectronics. IEEE Transactions on, vol, 58, pp. 147-157.
6. F. Blaabjerg, Z. Chen, and S. B. Kjaer (2004). Power electronics as efficient interface in dispersed power generation systems. IEEE Trans, Power Electron, vol, 19, pp. 1184-1194.
7. F. Blaabjerg, R. Teodorescu, M. Liserre and A. V.Timbus (2006). Overview of control and grid synchronization for distributed power generation systems. IEEE Trans, Ind, Electron, vol, 53, pp. 1398–1409.
8. M.R.Patel(2006).Wind and solar power system, Design, Analysis and Operation, CRC Press, Taylor & Francis Group,.
9. Cai,W, Gong,X, Cao,Y (2010).Solar Energy Material s and Solar Cells, 94-114.
10. A. Kulkarni and V. John(2013).Mitigation of Lower Order Harmonics in a Grid-Connected Single-Phase PV Inverter. IEEE Trans, Power Electronics, vol, 28.
11. M. Monfared, S. Golestan and J. M. Guerrero (2014). Analysis, Design, and Experimental Verification of a Synchronous Reference Frame Voltage Control for Single-Phase Inverters. IEEE Trans, Industrial Elec, vol, 61.
12. B. Subudhi and R. Pradhan(2011).Characteristics evaluation and parameter extraction of a solar array based on experimental analysis, in Proc. 9th IEEE Power Electron, Drives Syst, Singapore.
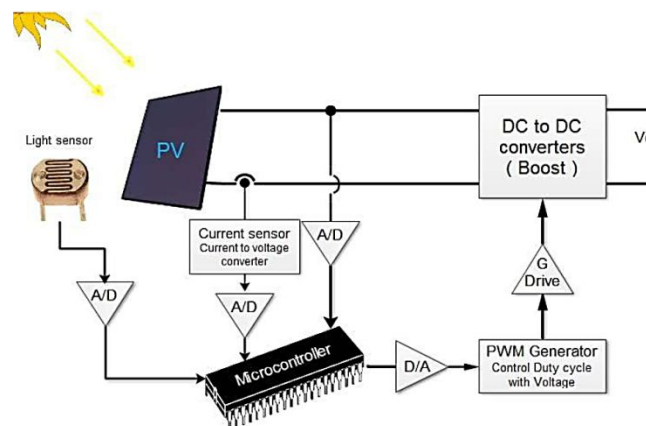
Fig1. Block diagram of the proposed circuit.

Hossein Dehghan Tezerjan *et al.*
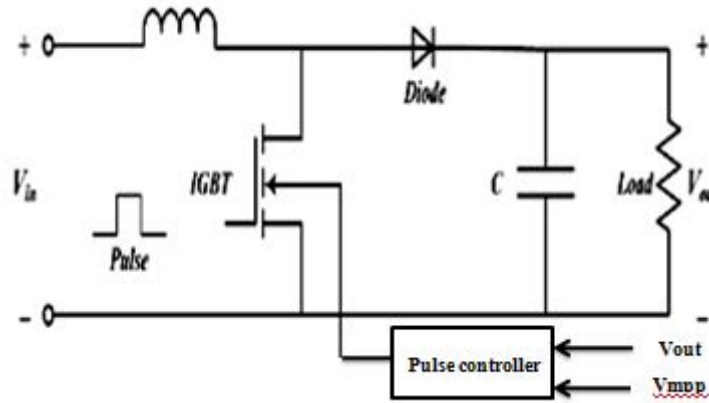
Fig2.Boost Converter
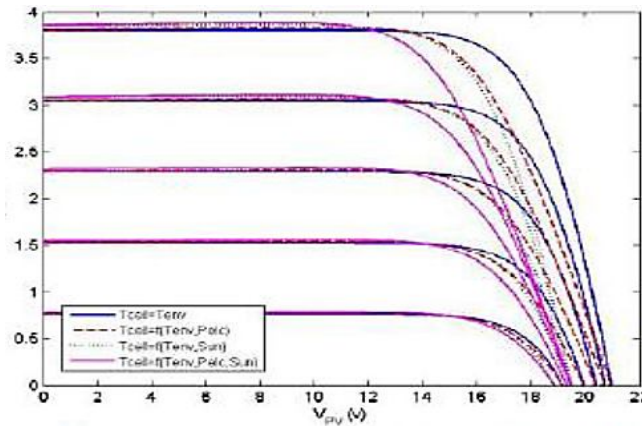
Fig3.The effect of the temperature of the variables on diagramVoltage-Current
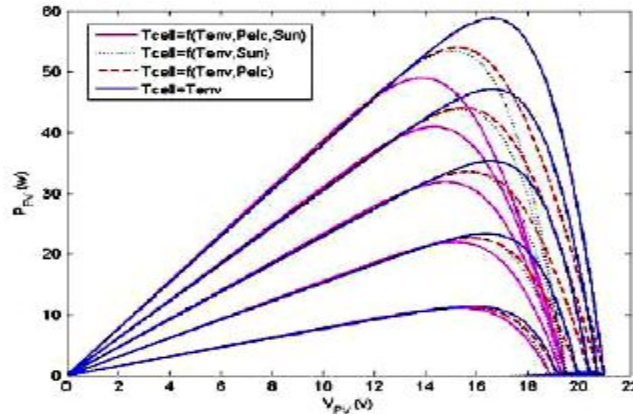
Fig4. The effect of the temperature of the variables on diagram Voltage-Power
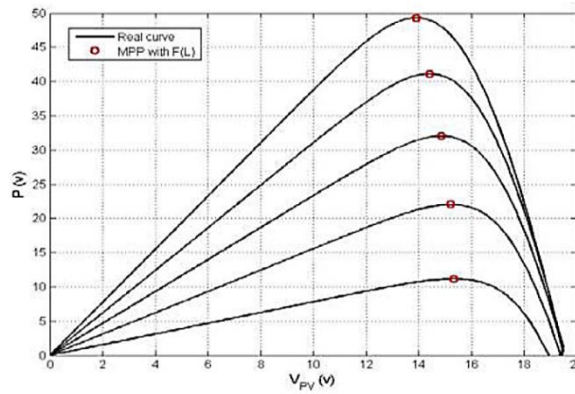
Fig5.Maximum power point of irradiation shows.
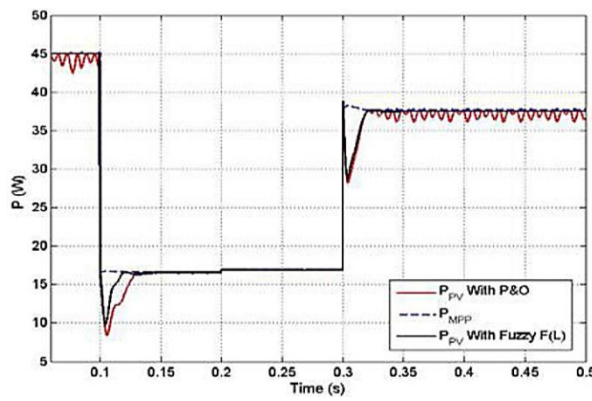
Fig6.Tracking the proposed method shows.
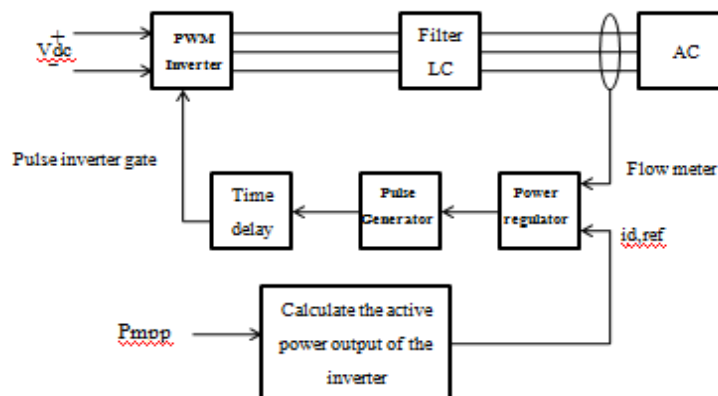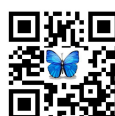
Fig7.Inverter for photovoltaic array performance

RESEARCH ARTICLE

Effects of Mindfulness-Based Stress Reduction (MBSR) Program on Female Adolescents' Psychological Symptoms

Sirvan Asmaee Majd[1]*, Abdolmajid Bahrainian[2], Morad Rasouli-Azad[3] and Shirkooh bahmani[4]

[1]Department of psychiatry, kurdistan university of medical sciences, sanandaj, iran
[2]Dept of Clinical Psychology, Shahid Beheshti Medical University, Tehran, Iran.
[3]Behavior Sciences and Research Centre, Shahid Beheshti Medical University, Tehran Iran
[4]Kurdistan welfare organization.

*Address for correspondence
Sirvan Asmaee Majd
Department of psychiatry,
kurdistan university of medical sciences,
sanandaj, iran
E- mail: sirwanasmaee@gmail.com

ABSTRACT

Background: The present study investigates the effects of a mindfulness-Based Stress Reduction (MBSR) program on psychological symptoms in a female high school sample in city of Baneh, Kurdistan, West of Iran.

Methods: A clinical trial or semi-experimental study (pre-test post-test with control group) was used to assess the efficacy of an 8 session MBSR program (Kabat-zinn, 1990).

By random sampling, eighty adolescent girls were recruited from two urban high schools of Baneh. Ten participants were excluded from the analysis because they did not complete the study, resulting in 35 participants in each group for the final analysis (35 participants for control group and 35 participants for experimental group). Psychological symptoms were measured at pre-intervention and post-intervention by SCL-90-R questionnaire. Multi-variate analysis of covariance (MANCOVA) was used to analysis of data.

Results: Results show that MBSR program can reduce depression, anxiety, somatic, interpersonal sensitivity, obsessions, phobia, psychosis, and aggression scores but it has no effect on paranoia.

Sirvan Asmaee Majd *et al*.

Conclusion: MBSR may be an effective intervention for clinical and non-clinical population. But despite its effectiveness in varieties of mental disorders, it seems that it can influence the psychological symptoms at high school girls.

Key words: Mindfulness-Based Stress Reduction (MBSR), psychological symptoms, adolescent, female.

INTRODUCTION

In concordance with studies related to the role of gender differences in coping with stress and emotional distress, findings indicate that girls have more vulnerability to depression and anxiety than boys; this vulnerability is prominent in adolescence and continues to adulthood (1). Investigators have attempted to target this vulnerabilities and designed methods to prevent and improve mental health of vulnerable population. One of therapeutic modalities in recent decades is mindfulness based interventions which used to enhance psychological well-being. The commonly used definition of Mindfulness is intentionally paying attention on propose, in present moment and non-judgmentally to unfolding of experience by moment. The Mindfulness teaches the person to pay attention in a particular way and stay in contact with present moment. The concept of mindfulness originates from eastern spiritual traditions and refers to a form of attention control developed through meditative practices (2). Mindfulness has been described by kabat-zinn (3) as non-judgmentally paying attention to purpose, in the present moment. Mindfulness has three fundamental components include attitude, attention and intention (4). Mindfulness is based on particular attitude which include non-judgment, acceptance, trust, patience, curiosity and kindliness. (4,5). another element includes focused, Broad and sustained attention, and skills in switching attention from one stimulus to another. The third component includes conscious intention and Intentional attention which can be considered as the self-regulation of attention (5). Mindfulness-based interventions have begun to show promise for treating a variety of psychological problems (6), Including preventing relapse for depression (7) and substance abuse (8,9) reducing negative physical and psychological responses to stress (10) and reducing symptoms of attention deficit hyperactivity disorder (11). These mindfulness Interventions focus on intrapersonal processes and helping individuals change the relationship they have with internal states, primarily their thoughts and feelings. Studies show that mindfulness-based techniques are related to interpersonal processes such as empathic responding, relatedness and interpersonal closeness, and emotion identification, emotion communication, and anger management (12).

A pilot study of Interpersonal Mindfulness Training, an adaptation of MBSR that emphasizes relational awareness (13) suggests that mindfulness training with healthy adults is associated with increased emotional intelligence and social connectedness. Adolescence is a critical period especially for girls. The prevalence of depression is ranging from 1 to 6 percent in general population. With regard to greater prevalence of depression in girls (14), the purpose of this study investigating the effectiveness of mindfulness based stress reduction on psychological symptoms of adolescent girls.

MATERIALS AND METHODS

Subjects:

This study used semi-experimental design with control group. Participants consisted of 80 adolescent girls from two local high schools between 2011 to 2012, drawn from small town (Baneh) in the west of Iran. Five of the 80 participants in our sample did not complete assessments prior to the beginning of the intervention, and 5 participants did not complete assessments after the end of the intervention. The final sample was made up 70 students. The participants ranged in age from 15 to 19 years. The participants were randomly assigned to experimental and control groups. All of participants was Kurdish and had no history of participation in meditation program and yoga.

Procedure:

The intervention was based on the 8-session mindfulness-based stress reduction (MBSR) Described by kabat-zinn (15). The intervention consisted of eight 1.5 hours sessions, delivered by experience psychologist in mindfulness-based interventions. Sessions were typically delivered one session per week. Participants received session handouts describing the session them and instructions for practice. Participants received a CD in each session with mindfulness exercises (body scan, mindfulness of the breath, mindfulness of sounds and thoughts), and homework completion forms so that they could still do the homework. Mindfulness techniques such as body monitoring, breathing and Yoga Postures were taught to participants. In the last session, following the end of treatment, post test was administered. Every session were structured and based on mindfulness techniques. The first session includes a review of guidelines for participants, introducing the concept of mindfulness, 45 minutes body scan techniques, mindfully sittings, introducing group members, discussion about principles of group and explanation of homework assignment. Cognitive exercises such as observing the association between worried thoughts, mood and behavior were introduced by the leader and subjects had the opportunity to practice the techniques in the form of homework assignments. Subjects were asked to practice the formal meditation practices at least 30 min every day and to record their practice. Second session includes mindful attention of breath instruction, the body scan exercise, discussion about past week practice, discussion of attitudes of mindfulness practice, review of concepts related to perception and creative responding and awareness of thoughts; Explanation of homework. Third session includes discussion of the experience and last's week homework, introduction to sitting meditation, discussion of being grounded in the present moment and explanation of homework. Fourth session includes mindful stretching; sitting meditation; discussion of homework; discussion of anatomy of stress and how to respond mindfully to events as opposed to reacting automatically. Fifth session included sitting mediation; mindful stretching; further discussion of problem versus emotion focused coping. Sixth session included guided sitting meditation; discussion of upcoming all-day session; discussion of styles of communication and explanation of homework assignment. Seventh session consisted of further discussion regarding being present and calm no matter where one finds oneself; sitting meditation; mindful stretching; discussion about diet and how it affects one's health and well-being, how mindfulness plays a critical role in recognizing and altering eating patterns. And eighth session consisted of body scan exercise, sitting meditation, discussion of how the eighth week is actually the rest of your life, general discussion about the participant's experience of the program, review of the salient features from the entire program and closing ceremony. Multi-variate analysis of covariance (MANCOVA) was used to analysis of data.

Measures:

SCL-90- R: Overall psychological distress, anxiety, depression, and somatization were assessed by using the SCL-90-R, a 90-item inventory that assesses the presence and severity of somatic and psychological symptoms on a scale of 0 to 4. This measure has three global scales include the general severity index, positive syndrome distress index and positive syndrome total and its subscales includes somatization (SOM), obsession compulsion(O-C), interpersonal sensitivity (I-S), depression (DEP), anxiety(ANX), hostility (HOS), phobia (PHOB), paranoia (PAR) and psychosis (PSY).

Internal consistency of the nine subscales ranged from 0.79 for paranoia to 0.90 for depression. Retest validity ranged from 0.78 for hostility to 0.90 for phobia. Studies showed that SCL-90-R scales have convergent relationship with MMPI-II and GHQ scales (16). Persian translation of this scale has an acceptable reliability and validity (17).

RESULTS

Of 80 subjects who were screened for the study, 70 participated in the study. Subjects' ages in two groups ranged from 15 to 19 years (Mean=17.3, SD=1.2 for experimental group; Mean=17.1, SD=1.1 for control group). Results of

Sirvan Asmaee Majd *et al.*

Box's test indicates equality of covariance (Box's M=23.11; F=1.06; P=0.05) and Leven's test indicates equality of variance of six subscales in two groups. Only somatization, psychosis and phobia violated from assumption of equality of variances. Results of these tests and Bartlett's Test (chi square=424.856; df =44; P<0.001) indicate that using MANCOVA is appropriate. To investigate the effect of program on psychological symptoms, MANCOVA were used.

Results of MANCOVA showed that Baseline scores were comparable for two conditions (Table 1). In the completer analyses, mean differences at post-treatment were statistically significant for hostility (F=12.6, p<.001, $\eta2$=.20), Obsession (F=16.8, p<.001, $\eta2$=.25), somatic symptoms (F=11.4, p<.001, $\eta2$=.19), anxiety (F=21.3, p<.001, $\eta2$=.30), and phobia (F=12.3, p<.001, $\eta2$=.20) in experimental group (Table 2). These changes on the SCL-90-R represent clinically significant effect Sizes. MANCOVA analysis indicates that the effect of mindfulness training on paranoia subscale was not statistically significant.

DISCUSSION

The results of MANCOVA demonstrate that MBSR program decreased hostility, aggression and interpersonal sensitivity symptoms that consist with B¨ogels (18), Derezotes (19), and Anderson et al (20) studies that showed that fundamental core of aggression and hostility is attention deficits. In other word, mindfulness training result in improvement in dysfunctional automatic thoughts, unhealthy habits and behaviors, and finally plays an important role in emotion regulation (21).

Also, mindfulness is associated with enhanced interpersonal skills in both traditional Buddhism (22) and West mindfulness-based treatments (23, 24). It is supposed that mindfully person demonstrates greater ability in making and maintenance of close relationship with others (25, 26). In the other hand, varied forms of interpersonal relationship can protect or inhibit mindfulness awareness (27). Mindfulness based Self awareness and nonjudgmental acceptance is associated with enhanced ability for feeling description and physical welfare, decreased social anxiety and interpersonal problems (2).

Also, MANCOVA showed that MBSR program decrease somatic symptoms. Initially, Mindfulness based intervention designed for patients with chronic pain (28), but in two last decades, Results of initial research on the effectiveness of MBSR in various patient populations have been very promising (29). Investigations showed that MBSR reduced mood disturbances in patients with chronic pain, but has no effect on pain in this group (30). this study is consistent with Plews-Ogan et al (30) that these differences can be due to different sample in both study, non-patient sample of this study have low somatic symptoms. Also, MBSR is effective in reducing somatic symptoms in non clinical population, but it needs more researches. Witek-Janusek et al (31) have shown that MBSR significantly enhanced health-related quality of life and immune function in patients diagnosed with breast cancer. Also, significant improvements following the MBSR intervention was observed in somatic diseases such as diabetes and cardiovascular conditions, and comparable changes in stress and mood symptoms were attained (32). MBSR have effectiveness in artheroid romathoeid signs (33), diabetes (34), cardiovascular diseases (35), and patients with head tumors (36). Williams et al (37) demonstrated that MBSR has a significant effect on psychological symptoms of college students.

Kabat-Zinn et al (28) found that patients trained in a 10-week MBSR program showed significant reductions in anxiety, depression, and self reported medical symptoms. This finding is consistent with studies of Beauchemin et al (38), Biegel et al (39), Zylowska et al (11), Kang et al (40), Chiesa & Serretti (41), Vellestad et al (42), and sedaghat et al (43).
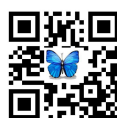
Sirvan Asmaee Majd *et al.*

Continuous stress through mental rumination causes disturbances in individual attention and intensification of experiences related with stress (44). Learning mindfulness brings about that individuals respond to situations, non-judgment thoughts and impulsivity. And also with proper mobilizing of individual attention capacity and increasing feeling control, causes escalation of internal and external knowledge and, therefore it will be a useful instrument for stress (45).

Finally, result of analysis of covariance showed that MBSR can be effective in reducing depression symptoms and causes the reduction of these symptoms in female adolescences. This finding is consistent with Shapiro et al (46) and Anderson et al (20). Even Deyo et al (47) reported that MBSR can be effective in reducing mental rumination which is common sign of depression. Mental rumination can be one of the powerful predictor in initiation and relapse of depression (48). One of the mechanisms through which mindfulness can cause the reduction of vulnerability to depression and reduction of intensity of symptoms, is the reduction of inefficient self-guidance. One of the factors which play a role in vulnerability to relapsing is the high self-discrepancy differences in real self and ideal self in patients which scrambling for filling that gap is accompanying with depression. For example, depressed patient has the ideal that he /she must be happy but is not happy in that moment and this can be an initiation of a depressive period and can cause increasing information availability that confirms the self-discrepancy difference and changed the direction of patient to depression in deflexed cycle which is strengthened by mental ruminations. The effect that mindfulness can have is that, at first, helping patient to observe his/her own consciousness process and content with non-judgment and non-criticizing state accompanying with adoption and openness of these mental contents, allow her/him to enter conscious area without focusing on them or trying to change them. Similarly, through reduction of extreme involvement in information related with self-discrepancy, learning mindfulness, allow patient to have less affection from provoking self-discrepancy differences in response to swing moods and environmental events and therefore protects patient from emerging hidden self-discrepancy differences. Another aspect of mindfulness is due to emphasis on self-acceptance, self-kindness and non-scrambling which these attitudes help individuals to reappraisal emotional regulation goals and through this causes the individual mental health improvement (49).

Ethical considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/ or falsification, double publication and/ or submission, redundancy , etc) have been completely observed by the authors.

REFERENCES

1. Rudolph KD. Gender Differences in Emotional Responses to Interpersonal Stress during Adolescence. J Adolesc Health 2002; 30(4): 3–13.
2. Baer R. Mindfulness training as a clinical intervention: A conceptual and empirical review. J Clinical Psychology: Science and Practice 2003; 10(2): 125–43.
3. Kabat-Zinn J. Mindfulness-based interventions in context: Past, present, and future. J Clinical Psychology: Science and Practice 2003; 10(2): 144–56.
4. Shapiro SL, Carlson LE, Astin JA, Freedman B. Mechanisms of mindfulness. J Clinical Psychology 2006; 62(3): 373–90.
5. Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J. Mindfulness: A proposed operational definition. J Clinical Psychology: Science and Practice 2004; 11(3): 230–41.
6. Baer RA. Mindfulness, assessment, and transdiagnostic processes. Psychological Inquiry 2007; 18(4): 238–42.
7. Segal ZV, Williams JM, Teasdale JD. Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse. New York NY: Guilford Press 2002.

Sirvan Asmaee Majd *et al.*

8.   Marlatt GA, Witkiewitz K, Dillworth T, Bowen SW, Parks G, Macpherson LM. Vipassana meditation as a treatment for alcohol and drug use disorders. In Hayes SC, Follette VM, Linehan MM (Eds.), Mindfulness and acceptance: Expanding the cognitive-behavioral tradition. New York: Guilford Press 2003.

9.   Bootzin RR, Stevens SJ. Adolescents, substance abuse, and the treatment of insomnia and daytime sleepiness. J Clinical Psychology Review 2005; 25(5): 629–44.

10. Kabat-Zinn J, Massion AO, Kristeller J, Peterson LG, Fletcher K, Pber, L. Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. American J Psychiatry 1992; 149: 936–43.

11. Zylowska L, Ackerman DL, Yang MH, Futrell JL, Horton NL, Hale ST. Mindfulness meditation training with adults and adolescents with ADHD. J Attention Disorders 2008; 11(8): 737–46.

12. Duncan LG, Coatsworth JD, Greenberg MT. A Model of Mindful Parenting: Implications for Parent–Child Relationships and Prevention Research. Clin Child Fam Psychol Rev 2009; 12(3): 255–70.

13. Sawyer Cohen JA, Semple RJ. Mindful Parenting: A Call for Research. J Child Fam Stud 2010; 19(2): 145–51.

14. Shaffer D. Depressive disorders and suicide in children and adolescents. In: Sadock BJ, Sadock VA, eds. Kaplan & Sadock's Comprehensive Textbook of Psychiatry. 8th ed. Vol. 2. Baltimore: Lippincott Williams & Wilkins, 2005.

15. Kabat-Zinn J. Full Catastrophe Living. Dell Publishing, New York, 1990.

16. Grath-Marnat G. Handbook of Psychological Assessment, 4th ed. New York, John Wiley & Sons, 2003.

17. Dabson KS, Mohammad-khani P. Effectiveness of prevention-based depression relapse intervention with goal of decreased depression relapse model presentation. Tehran, university of social welfare and Rehabilitation, 2007.

18. B˙ogels S. Mindfulness Training for Adolescents with Externalizing Disorders and their Parents. J Behavioral and Cognitive Psychotherapy 2008; 36: 193–209.

19. Derezotes D. Evaluation of yoga and meditation training with adolescent sex offenders. J Child and Adolescent Social Work 2000; 17(2): 97–113.

20. Anderson ND, Lau MA, Segal ZV, Bishop SR. Mindfulness-based stress reduction and attentional control. J Clinical Psychology &Psychotherapy 2007; 14(6):449-63

21. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. J American Psychologist 2000; 55(1): 68–78.

22. Wallace BA. Inter-subjectivity in Indo-Tibetan Buddhism. J Consciousness Studies 2001; 8(5): 209–30.

23. Hayes SC, Strosahl KD, Wilson KG. Acceptance and commitment therapy: An experimental approach to behavior change. New York: Guilford, 1999.

24. Linehan MM. Cognitive-behavioral treatment of borderline personality disorder. New York: Guilford Press, 1993.

25. Follette VM, Pistorello J. Finding life beyond trauma: Using acceptance and commitment therapy to heal from post-traumatic stress and trauma- related problem. Oakland, CA: New Harbinger, 2007.

26. Germer CK, Siegel RD, Fulton PR. Mindfulness and psychotherapy. New York: Guilford Press, 2005.

27. Burgoon JK, Bonito JA, Bengtsson B, Ramirez JR, Dunbar NE, Miczo N. Testing the interactivity model: Communication processes, partner assessments, and the quality of collaborative work, J Management Information Systems 1999; 16(3): 33-56.

28. Kabat-Zinn J. An outpatients program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Preliminary considerations and preliminary results. J Gen Hosp Psych 1982; 4(1): 33–47.

29. Praissman S. Mindfulness-based stress reduction: A literature review and clinician's guide. J the American Academy of Nurse Practitioners 2008; 20(4): 212–16.

30. Plews-Ogan M, Owens JE, Goodman M, Wolfe P, Schorling J. A Pilot Study Evaluating Mindfulness-Based Stress Reduction and Massage for the Management of Chronic Pain. J Gen Intern Med 2005; 20(12): 1136–38.

31. Witek-Janusek L, Albuquerque K, Chroniak KR, Chroniak C, Durazo-Arvizu R, Mathews HL. Effect of mindfulness based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. J Brain, Behavior and Immunity 2008; 22(6): 969–81.

32. Carlson LE, Speca M, Faris P, Patel KD. One year pre–post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatients. J Brain, Behavior, and Immunity 2007; 21(8): 1038–49.

33. Pradhan EK, Baumgarten M, Langenberg P, Handwerger B, Kaplan AG, Magyari T, Hocheberg MC, Berman BM. Effect of Mindfulness-Based Stress Reduction in Rheumatoid Arthritis Patients Arthritis & Rheumatism. J Arthritis Care & Research 2007; 57(7): 1134–42.

34. Whitebird RR, Kreitzer MJ, O'Connor PJ. Mindfulness-Based Stress Reduction and Diabetes. J Diabetes Spectr 2009; 22(4): 226–30.

35. Tacon AM, McComb J, Caldera Y, Randolph P. Mindfulness meditation, anxiety reduction and heart disease. J Fam Community Health 2003; 26: 25–33.

36. Kieviet-Stijnen A, Visser A, Garssen B, Hudig W. Mindfulness-based stress reduction training for oncology patients: Patients' appraisal and changes in well-being. Patient Education and Counseling 2008; 72(3): 436–42.

37. Williams KA, Kolar MM, Reger BE, Pearson JC. Evaluation of a wellness-based mindfulness stress reduction intervention: A controlled trial. American Journal of Health Promotion 2001; 15(6): 422–32.

38. Beauchemin J, Hutchins TL, Patterson F. Mindfulness meditation may lessen anxiety, promote social skills, and improve academic performance among adolescents with learning difficulties. J Complementary Health Practice Review 2008; 13(1): 34–45.

39. Biegel GM, Brown KW, Shapiro SL, Schubert CM. Mindfulness-based stress reduction for the treatment of adolescent psychiatric outpatients: A randomized clinical trial. J Consulting and Clinical Psychology 2009; 77(5): 855-66.

40. Kang Y, Gruber J, Gray JR. Mindfulness and De-Automatization. MA Dissertation. Yale University, 2009.

41. Chiesa A, Serretti A. Mindfulness-Based Stress Reduction for Stress Management in Healthy People: A Review and Meta-Analysis. J Alternative and Complementary Medicine 2009; 15(5): 593–600.

42. Vøllestad J, Sivertsen B, Nielsen GH. Mindfulness-based stress reduction for patients with anxiety disorders: Evaluation in a randomized controlled trial. J Behavior Research and Therapy 2011; 49(4): 281-88.

43. Sedaghat M, Mohammadi R, Alizadeh K, Imani AH. The Effect of Mindfulness-Based Stress Reduction on Mindfulness, Stress Level, Psychological and Emotional Well-Being in Iranian Sample. 2nd World Conference on Psychology, Counseling & Guidance , Antalya 2011; 25-9.

44. Trapnell PD, Campbell JD. Private self-consciousness and the five-factor model of personality: Distinguishing rumination from reflection. J Personality and Social Psychology 1999; 76(2): 284–304.

45. Kabat-Zinn J. Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life. New York: Hyperion, 1994.

46. Shapiro SL, Schwartz G, Bonner G. Effects of mindfulness-based stress reduction on medical and premedical students. J Behavioral Medicine 1998; 21(6): 581–99.

47. Deyo M, Wilson KA, Ong J, Koopman C. Mindfulness and Rumination: Does Mindfulness Training Lead to Reductions in The Ruminative Thinking Associated With Depression? J Science and Healing 2009; 5(5): 265-71.

48. Spasojevic J, Alloy LB. Rumination as a common mechanism relating depressive risk factors to depression. J Emotion 2001; 1(1): 25-37.

49. Crane C, Barnhofer T, Duggan D, Hepburn S, Fenneu M, Williams JM. Mindfulness-based cognitive therapy and self-discrepancy in recovered depressed patients with a history of depression and sociality. J Cognitive Therapy and Research 2008; 32: 775-87.

Sirvan Asmaee Majd *et al.*

Table1. Descriptive statistics of dependent variables

Measure		Control Group		Experimental Group	
		M	SD	M	SD
Hos	Pretest	6.8	3.7	8.3	5.2
	posttest	8.9	4.4	4.7	4.09
Anx	Pretest	12.8	7.9	10.5	7.3
	posttest	15.2	7.6	6	6.2
O –C	Pretest	14.3	6.6	12	6.8
	posttest	14.7	7.2	6.2	5.7
I-S	Pretest	11.8	6.1	10.8	7.3
	Posttest	12.2	6.4	7.3	6.8
Som	Pretest	15.2	5.9	12.6	9.2
	posttest	17.8	9.2	7.7	7.3
Psy	Pretest	12.5	8.6	8.7	7.1
	Posttest	13.3	7.4	4.9	4.4
Par	Pretest	11.4	4.4	9.5	4.6
	Posttest	11	4.6	6.6	4.7
Dep	Pretest	19.4	12.2	14.3	9.5
	Posttest	19.2	9.11	8.1	7.9
Phob	Pretest	19.4	12.2	5.4	4.1
	Posttest	9.8	5.9	3.7	4.7

Table2. MANCOVA summary table for effect of treatment on Dependent variables

Source	Variables	Sum of Squares	df	Mean of Squares	F	Sig	Eta squared	Power
Group	Hos	192.27	1	192.7	12.6	0.001	0.20	0.93
	Anx	788.6	1	788.6	21.3	0.000	0.30	0.99
	O-C	576.5	1	576.5	16.8	0.000	0.25	0.98
	I-C	131.9	1	131.9	3.7	0.049	0.07	0.48
	Som	739.8	1	739.8	11.4	0.001	0.19	0.91
	Psy	728.1	1	728.1	19.5	0.000	0.28	0.99
	Par	45.8	1	45.8	2.8	0.09	0.05	0.37
	Dep	956.2	1	956.2	16.05	0.000	0.24	0.97
	Pho	299.3		299.3	12.3	0.001	0.20	0.93
Error	Hos	749.2	9	15.2				
	Anx	1807.05	9	36.8				
	O-C	1679.7	9	34.2				
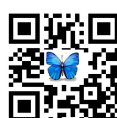
Sirvan Asmaee Majd *et al.*

	I-S	1706.1	49	34.8			
	Som	3162.7	49	64.5			
	Psy	1826.1	49	37.2			
	Par	795.7	49	16.2			
	Dep	2919.2	49	59.5			
	Phob	1189.3	49	24.2			

RESEARCH ARTICLE

Biochemical Composition of Blood Plasma and Follicular Fluid in Relation to Follicular Size in Sheep

M. Asgharimoghadam[1]*, K. Hasanpoor[2], A. Karamzadeh[3] and I. Yoosefian[3]

[1]Department of Animal Science, College of Agriculture and Natural Resources, University of Zabol, Zabol, Iran.
[2]Department of Animal Science, College of Animal and Food Science, Agricultural and Natural Resources Ramin (Khuzestan) University, Ahwaz, Iran.
[3]Department of Animal Sciences, College of Agriculture and Natural Resources, University of Tehran, Karaj, Iran.

*Address for correspondence
M. Asgharimoghadam
Department of Animal Science,
College of Agriculture and Natural Resources,
University of Zabol,
Zabol, Iran.

ABSTRACT

The aim of the present study was to examine thebiochemical composition of follicular fluid from different sizedfollicles and its relationship with blood plasma in sheep. The follicular fluid and blood plasma samples were analyzed for metabolites (glucose, total protein, cholesterol, triglycerides and urea) and ion (sodium, potassium, calcium and phosphorus). Concentrations the blood samples and ovaries of adult and healthy 40 slaughtered sheep were collected. In laboratory, the follicular fluid was aspirated from small (<2 mm), medium (2-4 mm) and large (>4 mm) follicles. The concentrations of glucose, total protein, cholesterol, triglyceride, urea and ions sodium, potassium, calcium and phosphorus in follicular fluids and blood plasma were determined and analyzed. Data were analyzed by the linear regression model. The result showed that the concentration of potassium, urea, triglyceride and total protein in the follicular fluid were decreased as follicle size increased. Contrariwise, Sodium concentration in the follicular fluid was increased as follicle size increased. The plasma concentration of glucose and cholesterol were higher than in small, medium and large follicles. The value of triglyceride in blood plasma was higher than medium and large follicles. In conclusion, our results showed that what change in the biochemical composition of follicular fluid happened during developmental follicles. This changes is correlated with

blood plasma levels of the ions and metabolites studied here and the physiological status and metabolic activity of the follicular cells.

Key words: Sheep, Biochemical Composition, Follicular fluid, Blood plasma

INTRODUCTION

The follicular fluid plays an important role in physiological, biochemical and metabolic aspects of nuclear and cytoplasmic maturation of the oocyte and release of egg from the ruptured follicle and fertilization.Chemicalcomposition of follicular fluid, particularly in sheep are limited. Among the different constituents, glucose is an energy producing substance, which might be involved in supplying energy to follicular cells and oocytes(Bordoloi et al., 2001).

Follicular fluid is in part exudates of serum and is also partially composed of locally produced substances, which are related to the metabolic activity of the follicular cells(Gerard et al., 2002).This metabolic activity, together with the 'barrier' properties of the follicular wall, is changing significantly during the growth phase of the follicle(Wise, 1987, Gosden et al., 1988). As a result, the components of follicular fluid change during growth and expansion of each follicle(Wise, 1987).

Follicular fluid composition has been under intensive investigation in recent times in a bid to increase knowledge of follicular development, oocyte maturation and follicular atresia(Mishra et al., 2003). Metabolic activity and blood–follicle barrier properties change during the growth phase of the follicle and hence a different biochemical composition of the follicular fluid in different size follicles could be expected. As the oocyte and granulosa cells enlargement and mature,thebiochemical environment change, small follicles turn into large (Nandi et al., 2007). The metabolite, ion and enzymatic characteristics of follicular fluid and follicle or oocyte development are highly correlated(Iwata et al., 2006). Changes in biochemical constituents of blood are important indicators of physiological state of an animal.Glucose is prerequisites for the maturation and fertilization of bovine oocytes in vitro(Orsi et al., 2005). Before focusing on the possible effects of metabolic changes of the follicular fluid on the oocyte quality, it is necessary to determine physiological concentrations of the most common metabolites, ions, hormones and enzymes in the follicular fluid from different-sized follicles (Arshadet al., 2005).

The aim of the present study was to examine the metabolite (glucose, total protein, cholesterol, triglycerides,and urea) and ion (sodium, potassium, calcium and phosphorus) concentrations of follicular fluid in relation to follicular size in sheep.

MATERIALS AND METHODS

Forty adult non-pregnant ewes (Arab sheep) in good health and with normal reproductive tracts upon macroscopically examination after slaughter were used for this study. Ovaries were collected and immediately wrapped in plastic sheets, placed in an icebox, and taken to the laboratory within 1 hour after slaughter. In the laboratory, each ovary was cleaned for the extraneous tissue. Each ovary was examined for the presence of graafian follicles. Ovaries associated with pregnant ewes and those with any pathological lesions were not included in the study. The diameter of various follicles present on each ovary was measured with the help of vernier calipers. These follicles were placed in three groups according to their diameter, small (< 2 mm), medium (2-4 mm) and large (>4 mm)(Nandi et al., 2007). Then, fluid from each follicle was aspirated with the help of a disposable sterilized insulin syringe. For each sheep and follicle class, a different needle and syringe were used.The Follicular Fluid ofdifferent sizes in similar animals from each group were collected and pooled. Follicular fluid samples were stored at -20°C for

Asgharimoghadam *et al.*

further analysis. The follicular fluids from three different sizes of follicles were subjected to biochemical analysis (metabolites: glucose, total protein, cholesterol, triglycerides and urea and ions: sodium, potassium, calcium, phosphorus).Jugular blood samples were collected from each sheep immediately before slaughter in a test tube containingEDTA as an anticoagulant. These tubes were placed in an icebox beside the ovaries and were carried to the laboratory. In the laboratory, these samples were centrifuged at 3,000 rpm for 15 minutes; the plasma was separated and stored at -20°C for further analysis. Plasma samples were subjected to biochemical analysis (metabolites: glucose, total protein, cholesterol, triglycerides and urea and ions: sodium, potassium, calcium, phosphorus).

The follicular fluid of small, medium, and large follicles and blood plasma samples were analyzed for various metabolites and ions concentrations with photometry method using Auto Analyzer (RA-1000, Technicon).Differences between the biochemical constituents among the different size follicles were analyzed by the linear regression model. A computer assisted statistical software package (Graph Pad Prism, San Diego, CA, USA) was used to analyze the data. Significance or non-significance of differences between mean values was determined at the 5% level of significance ($P < 0.05$).

RESULTS

The values of various biochemical constituents in fluid from small, medium, and large follicles and blood plasma are given in Table 1.

The results were showed that calcium, phosphorus, glucose and cholesterol contents of the follicular fluid did not differ between follicle classes ($P>0.05$).The concentration of potassium, urea, triglyceride and total protein in the follicular fluid were decreased as follicle size increased ($P < 0.05$). As well as,sodium concentration in the follicular fluid was increased as follicle size increased ($P < 0.05$). However,there were no significant differences in triglyceride, potassium, sodium and total protein levels between medium and large follicles ($P>0.05$). Also, the amount of urea was not significantly different between small and medium follicles ($P>0.05$).

The plasma concentrations of glucose and cholesterol were significantly higher ($P<0.05$) than in small, Medium and large follicles. The value triglyceride in blood plasma was significantlyhigher thanmedium and large follicles, with exception of small follicle ($P<0.05$).Our data also showed that the plasma concentration of sodium was significantly higher ($P<0.05$) than in small follicle. The concentrations of urea in in blood plasma was significantly higher than in medium follicle ($P<0.05$). Also, the plasma concentration of total protein, potassium, calcium and phosphorus did not differences in follicle classes.

DISCUSSION

In the present study, the metabolite (glucose, total protein, cholesterol, triglycerides, and urea) and ion (sodium, potassium, calcium and phosphorus) concentrations of follicular fluid in relation to follicular size were investigated in sheep.

Result of the present study showed thattotal protein contents of the follicular fluid was significantly higher in small follicle compared to other follicles.Arshadet al. (2005) and (Leroy et al., 2004)) reported that a decrease in total protein concentration in follicles fluid with an increase in follicle size. The total protein content of the follicular fluid in our study was comparable with earlier reports in sheep(Bhaskaran and Abdulla Khan, 1981) and(Singh et al., 1999) in sheep and goats. However, our results differed from those of (Sidhu et al., 1985) in goats,(Leroy et al., 2004)in cattle and sheep (Nandi et al., 2007). Thangavel and Nayeem.(2004) reported that a decrease in the total protein concentration as the follicle size increased. The result of studies are similar to that in our study in which as the

follicular fluid volume increased with an increase in follicle size, the protein concentration decreased(Singh et al., 1999, Mishra et al., 2003). Continuous protein equilibrium existed between plasma and follicular fluid and the protein concentration was reported to be similar in small and large follicles in cattle(Andersen et al., 1976). In this study, concentration of urea in various sizes of follicles was decreased with oocyte development that is agreement with results of(Leroy et al., 2004). The difference in concentration of urea in various sizes of follicles was expected as lower urea concentration favors oocyte development(Leroy et al., 2004), and oocytes retrieved from large follicles were found to have higher developmental competence(Nandi et al., 2007).

As shown in results, triglycerides concentration were significantly higher in small follicle and blood plasma compared to medium and large follicles, which was in agreement with the findings of Thangavel and Nayeem(2004) and Tabatabaei and Mamoei(2011) in buffalo. This discrepancy can be attributed to triglycerides might serve as an alternate sources of energy for the cells in follicles (Harlow et al., 1987, Leroy et al., 2004). One the other hand, very low-density lipoprotein fraction (VLDL; as transport mechanism for lipids) did not pass through the follicular membrane ((Grummer and Carroll, 1988)), and triglyceride of follicular fluid levels were mainly a consequence of local metabolic processes(Leroy et al., 2004).

Glucose, as the major energy source for the ovary, plays an important role in ovarian metabolism. Unlike the observations of(Landau et al., 2000))in buffalo, (Leroy et al., 2004) in dairy cattle, (CHANG et al., 1976) in goats, there were no significant differences in glucose concentration between follicles in this study. Also, our results showed that the glucose concentration in blood is significantly higher in compared to follicles. This may be due to the principal source of follicular fluid glucose is blood, and very little glucose, if any, is produced locally by the granulosa cells of follicles(Akhtar and Ali, 2005). A study reported that the glucose concentration of follicular fluid was less than the level found in serum(Leroy et al., 2004).

The cholesterol concentration did not differ with an increase in follicular size, which was in agreement with the findings of(Arshadet al., 2005). In this study, however, there were significant differences in cholesterol concentration between follicles and blood plasma. This is in agreement with results of (Leroy et al., 2004);Arshadet al., 2005). Tabatabaei and Mamoei(2011) reported that the cholesterol concentration of follicular fluid decreased from small to large follicles, which is not in agreement with our results.

The data obtained in the present study showed that there is increase in sodium concentration of follicular fluid between follicles which is in agreement with results of(Wise, 1987) in cattle, (Kaur et al., 1997) in buffalo and(Bordoloi et al., 2001) in goat. It seems that follicle viability lead to increase in follicular fluid sodium concentrations. As well as, increased follicular fluid sodium were linked to the active follicular synthesis of estrogen. In the large follicles, 19-hydroxyandrostenedione was found in large concentrations. This compound may lead tosodium retention (Wise, 1987). By the movement of water from blood to antrumbased onan osmotic gradient across the follicular wall, the follicle dimension was developmental during follicular growth. So, increased sodium concentration in large follicles cause an osmotic gradient across the follicular wall to facilitate osmosis(Sharma et al., 1995).

The potassium concentration of follicular fluid showthe physiological status and metabolic activity of the follicular cells. In follicular cells, anoxia and intracellular acidosis resulting from ischemia could lead to degeneration of granulose cells resulting in high potassium concentration (Knudsen et al., 1979).

(Sharma et al., 1995) reported lower concentration of potassium with advancement of follicle size, which is in agreement with our results. By increased use of glucose in developing follicle, follicular fluid potassium concentration decreased during follicular development(CHANG et al., 1976).

The data obtained from this study showed that there were no significant differences in calcium concentrations between fluid of small, medium, large follicles and blood plasma, which confirms the results of (Tabatabaei and Mamoei, 2011)) in buffalo and (Nandi et al., 2007) in sheep. Unlike the observations of our study, Wise (1987) in cattle showed that calcium concentration increased significantly with advancement of follicular size. The amount of phosphorus not differ between follicles and blood plasma, which was in accordance to an earlier report in sheep(Nandi et al., 2007).
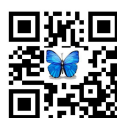
Similar to the observations of(Leroy et al., 2004), in this study urea concentration in large follicle was lower than small and medium follicles and blood plasma. This result is not in agreement with results of Tabatabaei and Mamoei(2011) and Nandi et al.((2007). The lower urea concentration is appropriate for oocyte development(Leroy et al., 2004), and oocytes retrieved from large follicles were found to have higher developmental competence (Nandi et al., 2007).

CONCLUSION

In conclusion, we observed a decrease in the concentration of potassium, urea, triglycerides and total protein and an increase in sodium concentration in the follicular fluid from small to large follicles. Also, there were no differences in calcium and phosphorous levels between follicles and blood plasma. Our results showed that what change in the biochemical composition of follicular fluid happened during developmental follicles. This changes is correlated with blood plasma levels of the ions and metabolites studied here and the physiological status and metabolic activity of the follicular cells.

REFERENCES

1. Akhtar, N. and S. Ali. 2005. Studies on some biochemical constituents of ovarian follicular fluid and peripheral blood in buffaloes.
2. Andersen, M. M., J. Krøll, A. Byskov, and M. Faber. 1976. Protein composition in the fluid of individual bovine follicles. Journal of reproduction and fertility 48(1):109-118.
3. Bhaskaran, R. and C. Abdulla Khan. 1981. Role of blood serum inorganic phosphorus in post-parturient anoestrus cows. Livestock adviser.
4. Bordoloi, P., B. Sarmah, D. Dutta, and B. Deka. 2001. Macro and micro minerals in caprine follicular fluid. Indian J. Anim. Reprod 22(6):23-25.
5. CHANG, S. C., J. D. JONES, R. D. ELLEFSON, and R. J. RYAN. 1976. The porcine ovarian follicle: I. Selected chemical analysis of follicular fluid at different developmental stages. Biology of reproduction 15(3):321-328.
6. Gerard, N., S. Loiseau, G. Duchamp, and F. Seguin. 2002. Analysis of the variations of follicular fluid composition during follicular growth and maturation in the mare using proton nuclear magnetic resonance (1H NMR). Reproduction 124(2):241-248.
7. Gosden, R., R. Hunter, E. Telfer, C. Torrance, and N. Brown. 1988. Physiological factors underlying the formation of ovarian follicular fluid. Journal of reproduction and fertility 82(2):813-825.
8. Grummer, R. and D. Carroll. 1988. A review of lipoprotein cholesterol metabolism: importance to ovarian function. Journal of Animal Science 66(12):3160-3173.
9. Harlow, C., R. Winston, R. Margara, and S. Hillier. 1987. Gonadotrophic control of human granulosa cell glycolysis. Human Reproduction 2(8):649-653.
10. Iwata, H., J. Inoue, K. Kimura, T. Kuge, T. Kuwayama, and Y. Monji. 2006. Comparison between the characteristics of follicular fluid and the developmental competence of bovine oocytes. Animal reproduction science 91(3):215-223.

11. Kaur, J., O. Takkar, K. Khera, K. Chaudhary, S. Rajvir, J. Kaur, and R. Singh. 1997. Mineral elements in follicular fluid of buffalo ovary. Indian J Anim Reprod 18:36-38.

12. Knudsen, J., L. Litkowski, T. Wilson, H. Guthrie, and S. Batta. 1979. Follicular fluid electrolytes and osmolality in cyclic pigs. Journal of reproduction and fertility 57(2):419-422.

13. Landau, S., R. Braw-Tal, M. Kaim, A. Bor, and I. Bruckental. 2000. Preovulatory follicular status and diet affect the insulin and glucose content of follicles in high-yielding dairy cows. Animal reproduction science 64(3):181-197.

14. Leroy, J., T. Vanholder, J. Delanghe, G. Opsomer, A. Van Soom, P. Bols, and A. de Kruif. 2004. Metabolite and ionic composition of follicular fluid from different-sized follicles and their relationship to serum concentrations in dairy cows. Animal reproduction science 80(3):201-211.

15. Mishra, O., J. Pandey, and P. Gawande. 2003. Study on biochemical constituents of caprine ovarian follicular fluid after superovulation. ASIAN AUSTRALASIAN JOURNAL OF ANIMAL SCIENCES 16(12):1711-1715.

16. Nandi, S., V. G. Kumar, B. Manjunatha, and P. Gupta. 2007. Biochemical composition of ovine follicular fluid in relation to follicle size. Development, growth & differentiation 49(1):61-66.

17. Orsi, N. M., N. Gopichandran, H. J. Leese, H. M. Picton, and S. E. Harris. 2005. Fluctuations in bovine ovarian follicular fluid composition throughout the oestrous cycle. Reproduction 129(2):219-228.

18. Sharma, R., R. Vats, and A. Sawhney. 1995. Changes in electrolytes of antral follicles in goat. Indian J Anim Prod 16:18-21.

19. Sidhu, K., T. Ahmed, and S. Guraya. 1985. Electrophoretic characterization of follicular fluid proteins from the goat ovary. Indian J. Reprod 6:41-48.

20. Singh, D., M. Sharma, and R. Pandey. 1999. Biochemical and hormonal characterization of follicles from follicular and luteal phase ovaries of goat and sheep. Indian journal of experimental biology 37:434-438.

21. Tabatabaei, S. and M. Mamoei. 2011. Biochemical composition of blood plasma and follicular fluid in relation to follicular size in buffalo. Comparative Clinical Pathology 20(5):441-445.

22. Thangavel, A. and M. Nayeem. 2004. Studies on certain biochemical profile of the buffalo follicular fluid. Indian veterinary journal 81(1):25-27.

23. Wise, T. 1987. Biochemical analysis of bovine follicular fluid: albumin, total protein, lysosomal enzymes, ions, steroids and ascorbic acid content in relation to follicular size, rank, atresia classification and day of estrous cycle. Journal of animal science 64(4):1153-1169.

Table 1.The concentrations of various biochemical compositions in fluid from small, medium, and large follicles and blood plasma in sheep

biochemical	Size of follicles			Blood plasma
	Small (<3mm)	Medium (3 to 5 mm)	Large (<5mm)	
Calcium (mg/dl)	2/13±0/67	2/18±0/42	2/53±0/8	2/53±0/3
Phosphorus(mg/dl)	3/23±0/45	3/19±0/68	3/18±0/26	3/18±0/44
Sodium (mM)	110/02±3/2 b	115/63±4/9 a	117/3±4/2 a	118/2±3/5 a
Potassium (mM)	13/78±2/32 a	10/92±1/25 b	10/45±1/06 b	12/4±1/8 ab
Glucose (mg/dl)	1/05±0/21 b	1/18±0/28 b	1/34±0/16 b	3/32±0/2 a
Urea (mg/dl)	4/89±0/34 a	4/56±0/67 a	3/3±0/56 b	4/9±0/4 a
Cholesterol (mg/dl)	1/78±0/16 b	1/93±0/83 b	2/24±0/51 b	3/8±0/72 a
Triglyceride (mg/dl)	0/25±0/04 a	0/15±0/07 b	0/13±0/02 b	0/26±0/06 a
Total Protein (g/dl)	7/02±1/03 a	6/21±0/89 b	6/15±0/54 b	6/9±0/4 ab

Values with different superscripts in the same row differ significantly (P<0.05)

Antimicrobial Activities of Myrtus CommunisL against Salmonella Typhimurium

Morteza Asgharimoghadam

Department of Animal Science, College of Agriculture and Natural Resources, University of Zabol, Zabol, Iran.

*Address for correspondence
Morteza Asgharimoghadam
Department of Animal Science,
College of Agriculture and Natural Resources,
University of Zabol,
Zabol, Iran.

ABSTRACT

According to the reports of many researches, antibacterial resistance is a worldwide growing-problem. The present study was carried out to determine the potential antibacterial effect of ethanol extracts of Myrtus Communis L. against antibiotic resistant Salmonella typhi.

The antimicrobial parameters (Minimal inhibitory Concentration MIC and Minimal Bactericidal Concentration MBC) were determined by the micro dilutionmethod.

The result of herbal extraction showed the most MIC (the minimum inhibitory concentration) was 10mg/ml concentration that 2 strains of them were inhibited by this concentration. The lowest MIC was 2/5 ppm concentration that two strain of Salmonella were inhibited.The Myrtus Communis extract could be useful in combating emerging drug-resistance among Salmonella typhi

INTRODUCTION

Development of microbial resistance to antibiotics is a global concern. Isolation of microbial agents less susceptible to regular antibiotics and recovery of increasing resistant isolates during antibacterial therapy is rising throughout the world which highlights the need for new principles. The use of essential oils as functional ingredients in foods, drinks, toiletries and cosmetics is gaining momentum, both for the growing interest of consumers in ingredients from natural sources and also because of increasing concern about potentially harmful synthetic additives (Reische et al.,

4034

Morteza Asgharimoghadam

1998). Myrtus communis L. (Myrtaceae), commonly known as Myrtle, is an evergreen shrub widelydistributed in Europe, Asia, Africa and America(Polunin and Huxley , 1972;Baytop, 1984). The plant have been used internally asastringent, antimicrobic, for constipation, antihemorrhagic, appetizing, against diabetes andexternally for wound healing in Turkish folk medicine (Baytop, 1984).The leaves contain tannins,flavonoids such as quercetin, catechin and myricetinderivatives and volatile oils (Baytop, 1999; Romani et al.,1999).Myrtus communis seeds have no apparent dormancy, and we could thus predict that fast germination and high germinability are advantageous, in order to maximize reproductive success and seedling recruitment (Harper 1977; Jones et al. 1997).

Salmonella species are the causative agents of typhoid fever and diarrheal diseases in humans, responsible for an estimated 16 million cases of systemic typhoid fever worldwide each year(Pang, et al., 1998).Salmonella typhicauses typhoid fever in humans. Typhoid fever, a systemic febrile illness, is transmitted by the fecal-oral route, mainly via contaminated food and water in the developing world. On a global scale, at least 16–20million cases of typhoid fever occur annually, resulting in approximately 600,000 deaths (Pang et al., 1998).The present study was carried out to determine the potential antibacterial effect of ethanol extracts of Myrtus CommunisL. against antibiotic resistant Salmonella typhi.

MATERIALS AND METHODS

Plant materials:

The leaf Myrtus Communis was collected in the region of Iran (Kerman, south-eastern, Iran) dried at room temperature. Samples were crashed and transferred into glass container and preserved until extraction procedure was performed in the laboratory.

Preparation of extracts:

Plant was properly dried and pulverized into a coarse powder. Each of 20 g grinded powders was soaked in 60 ml ethanol 95 %, separately for one day (shaking occasionally with a shaker). After one day of

dissolving process, materials were filtered (Whatman No. 1 filter paper) .Then the filtrates were evaporated using rotary evaporator.

Bacterial strains:

All strains were isolated at different times during 2013- 2014 from contaminated bird. Samples were diluted and/or homogenized in TSBmedium, and isolates obtained by Salmonella selective enrichmentin Rappaport–Vassiliadis (RV) mediumafter 24 h incubation at 43°C.

Agar disk diffusion assay:

The susceptibility of all antibiotics was carried out using disc diffusion method on Muller-Hinton agar as recommended by CLSI (CLSI, 2002). The procedure followed is briefly described here. Salmonellaisolated plates were grown overnight on Nutrient agar and colony suspension was prepared using the sterile salin water equivalent to a 0.5 McFarland standard. Suspension (100 µl) was spread over the media plate and antibiotic disc was transferred aseptically on the surface of inoculated media plate. Isolated plates were tested with different antibiotics and their concentration shown in parenthesis viz. ampicillin (10 µg) and penicillin (10 µg).

Morteza Asgharimoghadam

Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of plant extracts:

The broth microdilution method was used todetermine MIC and MBC. Alltests were performed in Mueller Hinton brothsupplemented with Tween 80 at a final concentration of0.5% (v/v). Briefly, serial doubling dilutions of the extractwere prepared in a 96-well microtiter plate ranged from0.3 mg/ml to 10.00 mg/mL. To each well, 10 µl ofindicator solution and 10 µl of Mueller Hinton Brothwere added. Finally, 10 µl of bacterial suspension (10^6CFU/mL) was added to each well to achieve theconcentration of 10^4 CFU/mL. The plates were wrappedloosely with cling film to ensure that the bacteria did notget dehydrated. The plates were prepared in triplicates,and then they were placed in an incubator at 37oC for 18-24 h. The color change was then assessed visually. Thelowest concentration at which the color change occurredwas taken as the MIC value. The average of 3 values wascalculated providing the MIC and MBC values for thetested extracts. The MIC is defined as the lowestconcentration of the extract at which the microorganismdoes not demonstrate the visible growth. Themicroorganism growth was indicated by turbidity. The MBC was defined as the lowest concentration of the extract at which the incubated microorganism was completely killed.

Statistical Analysis:

All experiments and measurement were repeated at least three times. Statistical analyses were performed using SPSS and Excel 2010 software. All experimental results were analyzed using mean descriptive statistics and the correlation-coefficient. A value of $P<0.05$ was regarded as statistically significant.

RESULT

The result of herbal extraction showed the most MIC (the minimum inhibitory concentration) was 10mg/ml concentration that 2 strains of them were inhibited by this concentration. The lowest MIC was 2/5 ppm concentration that two strain of Salmonella were inhibited.The highestMBC value of extract of M.communis Lwere20 mg/ml respectively (Table1).

Today natural products derived from plants are being tested for presence of new drugs with new modes of pharmacological action.

The result of herbal extraction showed the most MIC (the minimum inhibitory concentration) was 10mg/ml concentration that 2 strains of them were inhibited by this concentration. The lowest MIC was 2/5 ppm concentration that two strain of Salmonella were inhibited. Recently, it has been reported that the essential oil of M. communis is strongly active against Salmonella typhimurium (Gündüz et al., 2009).The study of Mert, the result show that n-hexane, methanol, ethanol, ethyl acetate and waterextracts of Myrtus communis L. leaves inhibited the growth of Escherichia coli ATCC 29998, Escherichia coli ATCC 11230, Staphylococcus epidermidis ATCC 12228, Salmonella typhimurium CCM 5445 and Pseudomonas aeruginosa ATCC 27853. The growth of Escherichia coli ATCC 25922 was only inhibited by the methanol extract. None of the tested extracts showed activity against Enterobacter cloacae ATCC 13047, Enterococcus faecalis ATCC 29212 and Candida albicans(Mert et al., 2008).

The study of Alem, the Minimum Bactericidal Concentration of Myrtle for most tested microorganisms was similar to the Minimum Inhibitory Concentration. i.e. 0.5 mg/ml. for S. aureus, 2.5 mg/ml for P. mirabilis and P. vulgaris, 15 mg/ ml for Klebssiela and S. typhi, 20 mg/ml for P. aeruginosa. And the MBC of Myrtle for the two relatively least sensitive species, Shigella and E. coli was 40 mg/ml and 45 mg/ml of media, respectively(Alem et al., 2008).The study of Bonjar, the least MIC, as 0.62 mg/ml, belonged to Myrtus communis seeds against S. aureus, Bacillus cereus and B. bronchiseptica, and to Terminalia chebula ripe seeds against S. aureus(Bonjar, 2004).Akin et al also assayed

Morteza Asgharimoghadam

antimicrobial activity of M. communis against seven pathogen bacteria Staphylococcus aureus, Listeria monocytogenes, Enterococcus durans,Salmonella typhi, Escherichia. coli, Pseudomonas aeruginosa and Bacillus subtilis(Akin et al., 2010).It showed some activity on Gram positive and Gram negative bacteria. The higher efficacy of M. communis was confirmed by the agar dilution method(Akin et al., 2010).This study of N. Malik was include the investigation of the antibacterial activity of ethanolic extract for (12) type of Iraqi plant leaves (Allium porrum L, Apium graveolens Mill., Cassia angustifollia Vahl., Lawsonia inermis L., Lepidium sativum L., Malva sylvestris L., Monthapiperita L., Ocimmum bassillicum L., Pettroselinum crispum Mill., Raphanus sativus L., Sponacia oleraceal. and Trigonella foenum L.). In different concentrations (20, 40, 60, 80, 100) mg/ml against Salmonella typhimurium in vitro using agar well diffusion method. All ethanolic extract of leaves showed a high activity against this bacterium except of Cassia angustifollia Vahl. as compared with the other extracts(N. Malik et al., 2011).This study indicates that M.communis L has the potential to generate novel antimicrobials metabolites against MDR strains of salmonella. M.communis L can provide alternative solution for the treatment of salmonella infection.

Authors' Contributions

All authors had equal role in design, work, statisticalanalysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

1. N. Malik S, J. Mohammed H, Misak JA. 2011. Screening of Antibacterial Properties for Some Iraqi Plants Against Salmonella typhimurium. The Iraqi J. Vet. Med 35 (2): 28 –35
2. Bonjar GH. 2004. Antibacterial screening of plants used in Iranian folkloric medicine.Fitoterapia.75(2):231-5.
3. Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing (2002), 16th International supplement. CLSI document M100-S12 Davis, H.R (1997).
4. Alem G, Mekonnen Y, Tiruneh M, Mulu A.2008.Invitro antibacterial activity of crude preparation of myrtle (Myrtus communis) on common human pathogens.Ethiop Med J.46(1):63-9.
5. Mert T, Fafal T, Kivcak B, Ozturk HT.2008. Antimicrobial and Cytotoxic activities of Myrtus communis L. J. Fac. Pharm, Ankara 37 (3) 191 – 199.
6. Gündüz GT, Gönül ŞA, Karapınar M.2009."Efficacy of Myrtle oil against Salmonellatyphimurium on fresh produce" Int. J. Food Microbiol., **130**, 147-150.
7. Polunin O, Huxley A.1972. Flowers of the Mediterranean, Publications of Chatto and Windos Ltd., London, p. 285.
8. BaytopT.1984. Therapy with medicinal Plants in Turkey (Past and Present), Publications of theIstanbul University, No:3255, İstanbul, p. 326.
9. Baytop T .1999. Therapy with medicinal plants in Turkey (Past and Present). Nobel Tıp Kitapevleri Press, _stanbul.
10. Romani A, Pinelli P, Mulinacci N, Vincieri FF, Tattini M 1999.
11. Identification and quantitation of polyphenols in leaves of Myrtus
12. communis L. Chromatographia, 49: 17-20.
13. Reische DW, Lillard DA, Eitenmiller RR .1998. Antioxidants in food
14. lipids. In: Ahoh CC, Min DB (Eds.), Chemistry, Nutrition and
15. Biotechnology. Marcel Dekker, New York, pp. 423–448.

16. Akin M, Aktumsek A and Nostro A. 2010. Antibacterial activityand composition of the essential oils of Eucalyptuscamaldulensis Dehn. and Myrtus communis L. growing inNorthern Cyprus, Afr J Biotechnol**9** (4), 531-535.
17. PangT, Bhutta ZA, Finlay BB and Altwegg M. 1995. Typhoid fever and
18. other salmonellosis: a continuing challenge. Trends Microbiol. 3:253.
19. Harper JL. 1977. Population Biology of Plants. AcademicPress, London.
20. Jones RH, Allen BP, Sharitz RR. 1997. Why do earlyemerging
21. tree seedlings have survival advantages? A testusing Acer rubrum (Aceraceae). American Journal of Botany,**84**, 1714–1718.
22. Pang T, Levine MM, Ivanoff B, Wain J, FinlayBB. 1998. Typhoid
23. fever—important issues still remain. Trends Microbiol. 6, 131–133.

Tabel1: The minimum inhibitory concentration extract against Salmonella

Strain cod	MIC/MBC for extract plant(mg/ml)	Antibiotic resistant
1	5/10	AM- P
2	5/10	AM- P
3	2/5/ 5	AM- P
4	5/ 10	AM- P
5	5/ 10	AM- P
6	2/5/ 5	AM- P
7	5/ 10	AM- P
8	10/ 20	AM- P
9	5/ 10	AM- P
10	5/ 10	AM- P
11	10/ 20	AM- P
12	5/ 10	AM- P

AM= Ampicillin
P=Penicillin

Comparison of Different Ripening Period's Effect on Biogenic Amines Content of Lyghvan Cheese and Ultra-Filtered Cheese

Javad Mohtadinia[1], Mohammad Aria[2], Hossein Khadem Haghighian[3]*, Ehsan Ghaedi[4] and Masoud Bazrafshan[5]

[1]Associate Professor, Dept. of Food sciences and Technology, Faculty of Health and Nutrition, Tabriz University of Medical sciences. Tabriz, Iran.
[2]MSc Student, Departments of Nutritional Science,Arvand International Division of Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
[3]Ph.D. Student, Dept. of Nutrition, School of Paramedical, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.
[4]Bachelor Student, Dept. of Nutrition, School of Paramedical, Ahvaz Jundishapur University of Medical Science, Ahvaz, Iran.
[5]Department of Food Science & Technology, Sabzevar Branch, Islamic Azad University, Sabzevar, Iran.

*Address for correspondence
Hossein Khadem Haghighian,
Ph.D. Student, Dept. of Nutrition,
School of Paramedical,
Ahvaz Jundishapur University of Medical Science,
Ahvaz, Iran.
Tel: +989148375283,
Fax number: +98 6113738330.
E-mail: khademnut@yahoo.com

ABSTRACT

Biogenic amines are the low molecular organic basis formed through enzymatic decarboxylation of amino acids. No information about the amounts of amines in Lyqvan cheese is available. The aim of this study was to test the different ripening times on biogenic amine production.To study ultra-filtered and Lyqvan cheeses, samples were randomly assigned for production line. Sixty day study period and 15 day intervals work was considered (Time 0, 15, 30, 45, 60). Samples were extracted and injected to HPLC.All of the Lyqvan pasteurized samples had biogenic amines. Main amine produced in Lyqvan samples and UF samples were histamine and tyramine.All of the biogenic amine in Lyqvan samples increased in

Hossein Khadem Haghighian *et al.*

ripening time, this increase was significant in all cases (P <0.05) except:cadaverine and putrescine.Due to side effects in susceptible consumers need special attention in the control cheese production.

Key words: Biogenic amines, Lyqvan cheese, Ultra filtered cheese, ripening time

INTRODUCTION

Biologically active amines are organicbases,basic nitrogenous compounds of low molecular(Buňková et al. 2010)weight with aliphatic, alicyclic, aromatic or heterocyclic structures(Lanciotti et al. 2007), which occur as anoutcome of metabolic processes in animals, plants, and microorganisms(El-Zahar 2014). BAs are chiefly formed by the decarboxylation of certain amino acidsand small quantities are biosynthesizedin plant and animal cells and naturally exist in a variety of food products, such as fish, alcoholic beverages, cheese and meat products(Szterk and Roszko 2014).

The most important BA in foodstuffs is tyramine, histamine, cadaverine, putrescine, 2-phenylethylamine and agamatine(Gezginc et al. 2013). The presence of BA in foods is undesirable because of their possible toxicity(Lanciotti et al. 2007). An excessive oral intake of BAs can cause headache, rashes,and alterations of the blood pressure, pyrexia, respiratory distress, hot flushes, sweating,heart palpitation,oral burning, urticarial, gastric and intestinal ulcers, haemorrhage, and neuronal sequelae(Gezginc et al. 2013; Ladero et al. 2009; Önal et al. 2013; Rabie et al. 2011; Schirone et al. 2013). Actually, histamine poisoning is the most general food-borneintoxication caused by BA(Edalatian et al. 2012). Moreover, what is termed "cheese-reaction" is due to BAs and in particular close relationship was found between tyramine-rich food, such as cheese, and migraine crisis in adolescents and children(Schirone et al. 2013). Furthermore, Tyramine, 2-phenylethylamine and histamine can cause distress, mainly due to the effects on nervous and vascular systems(Lanciotti et al. 2007)

Aside from vasoactive amines such as tyramine (hypertension, headache) or histamine (hypotension, headache, flushing, abdominal cramps), rising attention has been given to the polyamines spermidine and spermine, and diamines putrescine and cadaverine, because of their ability to produce steady carcinogenic N-nitroso compounds and to increase the growth of chemically induced abnormal crypt foci in the intestine(KOMPRDA et al. 2005). Putrescine, and its higher metabolites spermidine and spermine, are currently classified as a separate group (traditionally constituents of BAs family) because 1) they can be formed also by an alternative metabolic pathway (''deureation'' instead of direct decarboxylation) and 2) due to their specific physiological (and pathophysiological) importance(Komprda et al. 2008).

Determination of toxicological threshold of BA is complicated because it relies on individual characteristics and the presence of other amines in food(Gezginc et al. 2013), for instance putrescine and cadaverine due to inhibition of detoxifying enzymes have been recognized as potentiators of toxic effect of other amines(Buňková et al. 2010). Despite of this a maximum total BA (the sum of tyramine, histamine, putrescine, and cadaverine) level of 750– 900 mg/kg has been recommended as a safety limit(Gezginc et al. 2013). But the most accepted threshold was establish for histamine which mainly if the concentration is >100 mg/kg (or >100 mg/L) have potential toxicity, and this is also approved by FDA.(Mah et al. 2002)

After fish, cheese is the most in histamine intoxication(Aliakbarlu et al. 2009). Many factors can influence BA contents in foodstuffs such as bacterial density, synergistic effects between microorganisms, level of proteolysis (availability of substrate), salt-in-moisture level, ripeningand storage temperatures(Gezginc et al. 2013), starter cultures, pasteurization, physico-chemical factors and water activity(Aliakbarlu et al. 2009; Kebary et al. 1999). Through the cheese ripening procedure proteolysis of casein leads to a steady increase of amino acids content so these free amino

acids can be subjected to decarboxylation reactions(Kebary et al. 1999), which are catalyzed by specific bacterial decarboxylases (i.e. lactic acid bacteria(Linares et al. 2012), enterococci and lactobacilli) and resulting production of amines(Rabie et al. 2011).

For the determination of amines thin layer chromatography (TLC), ion exchangechromatography (IEC), gas chromatography (GC) and especially high performance liquid chromatography (HPLC) have been proposed(Ladero et al. 2009). HPLC has been in use for biogenic amines in chocolate. This technique is beneficial since it is nondestructive and allows analysis of nonvolatile and highly polar compounds(Lanciotti et al. 2007).

Liqvan cheese is one of the specific cheeses which produce in Iran. This cheese produces in Azerbaijan Province of Iran. Until now there's no experiment on evaluation of ripening period on the amines contents in this cheese. The main objective of the present experiment was to evaluate the effect of ripening period on the biogenic amine and polyamine content in the Liqvan cheese in the comparison of ultrafiltrate cheese which produced in Azerbaijan.

MATERIALS AND METHODS

Chemicals

All reagents were of analytical grade or of the highest grade available. Water (HPLC-grade) used for chromatographic separation, was supplied by Merck (Germany) and other solution for HPLC containing THF (TetraHydroFuran) for HPLC and Methanol for HPLC obtained from CALDEON USA. The standards of biogenic amines containing Histamine dihydrochloride, Triptamine hydrochloride, and Spermidine trihydrochloride were purchased from AcrosUSA and Cadaverine dihydrochloride and Sperminetetrahydrochloride were applied by Fluka, USA. Other standards including, Tyramine, Putrescine dihydrochlorid 1, 7-heptanediamine (HEP- as internal standard) purchased from Merck, Germany. Also 2-Phenylethylamine hydrochloride, were obtained from Sigma-Aldrich, Canada. Other solutions such as O-Phthaldialdehyde, Hydrochloric acid 37%, Disodium tetraborate, Disodium hydrogen phosphate and Sodium dihydrogen phosphate were supplied by Merck, Germany. The mobile phase was filtered through a Whatman membrane filter (47mm diameter and 2 μm pore size).

Standards and Reagents

Stock solution of amines standards and internal standard was made by dissolving apt amount (100mg) of standards in 100 ml distilled water for preparing 1mg/ml stock solution and kept at -200C until use. The solutions for the calibration curve were achieved by diluting the stock solutions to different concentrations. Working standard solutions of each compound were prepared daily by serial dilution of 1mgL -1 stock standard solution.

Samples

Main samples (Liqvan cheese) were purchased from local factories in Liqvan city, Azerbaijan. So that all the factories which produce Liqvan cheese and also approved by Medical and Hygiene Ministry were explored and according to our investigation, there are six factories which approved and so they have chosen for following campaigns. Each factory has 4 Whet (Special pans for cheese production) and sampling started with these Whets. At the beginning of experiment (Day 0) two whets were chosen randomly. The whole experiment duration was 60 days and sampling has done each 15 days (Day 0, 15, 30, 45 and 60). After this time, each 15 days for all factories 2 samples of these 4 samples were obtained.Ultrafiltrate cheese samples were purchased from factories which using natural milk for producing cheese (and not powder milk) and according to our findings in this area there are three factories which use natural milk and these three factories were chosen. These samples (Ultrafiltrate) were randomly assigned for production line.

For these samples also sixty day study period and 15 day intervals work (Day 0, 15, 30, 45 and 60) was considered. On the whole there were nine brands (Six Liqvan and Three Ultrafiltrate cheese) and according to 5 ripening periods and in each period 2 samples were obtained, altogether 90 samples were obtained.

Apparatus and software

The liquid chromatographic system containing a KNAUER (Germany) series for HPLC equipped by a quaternary pump(K-1000, KNAUER-Germany) with vacuum degasser(BIOTECH model 2003, USA),temperature controlled column oven, DAD and auto sampler(TRIATHLON,Spark-Netherland) and also geared up with UV/Vis detector with the variable wave-length and a fluorescence detector.The Spectroflorometric detector was RF-551,purchased from KNAUER,Germany. A C18 Hichrom HIRPB-250Acolumn (250mm×4.6 mm×5 µm) purchased from Germany was used for all separations. Data assortment was attained by means of ChromGate client Version 3.1programmed software for chromatography. Methodical blending of solutions was done with HeidolfModelunimaylelo, Germany. A BECKMAN Superspeed Centrifuge (USA) was use for centrifugal separations. The sensitive A&DModel GR-200 (Japan) with the sensitivity of 0.0001 g was used for weighing purposes.

GENERAL PROCEDURE

Sample Preparation

The extraction method is based on Innocent et al with some changes. The sample was thawed overnight; 50 g of sample was weighed and homogenized. From each homogenized samples 10g weighed and added into the 50 mL test tube, after that 25 µL of an internal standard (1,7-diaminoheptane; concentration 1 mg mL-1) was added. For extraction of amines samples have shaken for 2 min with 20 mL of 0.1 M hydrochloric acid (HCl). Suspension was centrifuged at 12000rpm 20 min at 4 0C. The supernatant was filtered through paper filter and the solid residue was extracted with 20ml 0.1 M hydrochloric acid (HCl) the second time as above. The combined extracts were made up to 50 mL with 0.1 M hydrochloric acid (HCl) and filtered through a disposable nylon membrane filter (13 mm, 0.45 lm, Chromatography Research Supplies, Addison, USA).

Derivatisation

Each 100 µl of samples blended with 100 µl of Disodium tetraborate. An aliquot of either extract was derivatized by Ortho-phataldialdehyde (OPA). The derivatizing agent was prepared by dissolving of 50 µl of OPA. Derivatisation procedure was stopped by adding 25 µl of 0.7 M hydrochloric acid (HCl). The organic phase was evaporated to dryness under nitrogen, and the solid residue was dissolved in 0.5 ml of acetonitrile (ACN).

HPLC–DAD analysis

An isocratic elution model was supported for the separation of the analyte, during the regular analyses of samples, the flow rate of water was maintained at 1.0 ml/min and the injection volume was 20 µL. The column temperature was set at 30°C in a column oven

The HPLC was equipped with UV-VIS and fluorescence detector and determination of derivatized biogenic amines was conducted with fluorescencedetector at excitation wavelength 330nm and emission wavelength 460 nm.

The gradient applied consists of a step of 8% (v/v) B in A during the first 2 min, and following, this percentage linearly enhanced from 8% to 20% (v/v) B in A within 5 min (A=80%). The content of A decreased from 80% to 55% in

Hossein Khadem Haghighian *et al.*

1 min, maintaining these conditions for 5 min. After that the content of B increases to 80% for 5 min. Between min 15 to 17 the content of A was 15% and B was 85%. After that within 10 min A was 10% and B was 90%. In 3 minutes following A was 60% and B 40%.In the last 3 min A was 80% and B was 20%. Elution was carried out at a flow rate of 1.0 ml/min, using a volumetric gradient of solution; solution A was phosphate buffer to methanol (v/v) 90: 10 (adjusted to pH 6.55), and solution B was methanol to tetrahydrofuran (v/v) 3.7: 0.99.(Innocente et al. 2007).

Cheese making

Liqvan cheese was produced using ovine milk, respectively, collected from a local dairy factory. Milk barrels collected in receiving containers and immediately heated to 37 0C. Then thermized milk was cooled after treatment by putting them in big tanks of water with 19 0Cuntil it reached the same temperature.(Decrease temperature to 23-25). The ovine treated milk was added with natural fungal starter which call Metto (Adding 1 g of dry inoculators to about 25L milk). After inoculation, keep milk in static condition for about 2 hours. After that flocculation were put to big pan with Jaconet and rinsing the flocculation for 5 hours. Then rinsed flocculation was cut to cubes and put this cubes in the 24% saturated brine for 24 hours. Then strewing salt on the cubes and rummaging cubes every half hour for 24 hours. At last put this cubes in 11% saturated brine and solder the pans and keep them in 7-8 0 C for 3 months.

Statistical Analysis

The effect of time of ripening on BA content of the cheeses was assessed by analysis of variance (ANOVA) using the SPSS 14 for Windows software. Results were statistically evaluated by nonparametric Wilcox on (Comparison the parameters within the Liqvan cheese or within the Ultrafiltrate cheese) and Manne Whitney (Comparison the parameters between Liqvan and Ultrafiltrate cheese) tests.

Result

The results obtained for liqvan and ultrafiltrate cheese are shown in Table 1.All the measured BAs in the Liqvan cheese were in higher amount in comparison to Ultrafiltrate Cheese. All the Liqvan samples contained BAs in all ripening period but 5.7% of Ultrafiltrate samples were without BAs Peutresine and 2-phenylethylamine in the ripening periods.

As shown in Fig. 1, the total BA content at the end of ripening was increased in both Liqvan and Ultrafiltrate cheeses. Comparison of BAs contents in Liqvan Pasteurized cheese indicate that BAs contents of samples were increased during ripening were statistically significant (P>0.05) except:

Change in Cadaverine content between Day 30 to Day 45
Change in Cadaverine content between Day 45 to Day60
Change in Puetresine content between Day 30 to Day 45

Also in Ultrafiltrate cheese shows that this increase was not statistically significant in any sample.In the Table 2 all the statistical correlations between these two types of cheese was indicated. Except tyramine and putrescine after Day 15 approximately all the other correlations were statistically significant.Total measured BAs were indicated in Table 3. In fact total biogenic contents of ultra-filtrated cheese were lower than Liqvan cheese.Most BAs which measured were tyramine and Histamine and least measured were Cadaverine and2-phenylethylamine.

Hossein Khadem Haghighian *et al.*

DISCUSSION

Biogenic amines contents in foods can be considered as anindicator offoods contaminationwithmicroorganisms so that the levels ofbiogenicaminesinfoodsare important tofollow. BAs biosynthesis is essential since these compounds act as precursor of the synthesis of hormones, alkaloids, nucleic acids, and proteins in eukaryotic cells(Gezginc et al. 2013) and have human physiological functions such as brain activity, gastric acid secretion and the immune response(Herrero-Fresno et al. 2012).

Cheese especially which made from raw milk is definitely one of the microorganism sources and its amino acids content provide carbon, nitrogen and energy sources for bacterial cells. Some amino acids can be decarboxylated leading to the formation of BAs, the accumulation of which in food is undesirable(Kebary et al. 1999).

As mentioned before; many factors can influence BA contents in foodstuffs such as bacterial density, levelof proteolysis (availability of substrate) and ripening(Gezginc et al. 2013). The length of the ripening period is one of the important factors(Herrero-Fresno et al. 2012) and as a known fact the content of biogenic amines increases during cheese ripeningand this fact was proved in some cheese types like, Czech Blue-vein Cheese(Rabie et al. 2011), Pecorino di Farindola cheese(Schirone et al. 2011), Dutch-type hard cheese(Mah et al. 2002), Edam-cheese(Buňková et al. 2010) and also was confirmed in the present experiment in Liqvan Cheese. Our results indicate that all BAs increase during ripening periods and all of them are in higher level in comparison to ultrafiltrate cheese. Some factors which can affect amine content like physico-chemical properties (free amino acids availability, water activity, pH, salt, moisture and temperature total nitrogen(Aliakbarlu et al. 2009; Gezginc et al. 2013; Kebary et al. 1999) in dry matter (TN/ DM) and water soluble nitrogen in total nitrogen (WSN/TN) concentration(Karami et al. 2009) and salt-moisture ratio) can change during ripening. As far as the possible explanation for the increase in BAs contents distribution within the Liqvan cheese during ripening in the present experiment is concerned, the conclusions of several other research groups can be mentioned(Rabie et al. 2011). Studies present that proteolysis increase during Liqvan cheese ripening but the rate of proteolysis and lipolysis was slow because environmental conditions such as salt and lactic acid concentration can affect the proteolytic and lipolytic activities of the indigenous microbial enzymes in Liqvan cheese(Lavasani et al. 2012). Liqvan cheese also have been showed change in some physico-chemical characteristics during ripening including increase in fat percent, ash remain and also salt percent in comparison to which milk that have been used for production. Also protein percent also increased during ripening but is in lower amount in comparison to Orgu, Sikma and Cameros and also Liqvan cheese dry matter (DM) alteration during ripening is equal with Cameros and lower than Pecorino del pro cheese(Madadlou et al. 2007). Other studies also have been showed that the ripening process (involving proteolysis) causes elevated amino acid availability in cheeses and the moisture content of the cheese decreased during storage and the salt-in-moisture ratio increased during this period. The water-soluble nitrogen to total nitrogen ratio increased significantly during ripening in Liqvan cheese(Aminifar et al. 2010).

A side from this a crucial factor in BA production in cheese is the presence of microorganisms with decarboxylation activity including some strains of starter lactic acid bacteria (SLAB) and non-starter lactic acid bacteria (NSLAB) like Enterococcus and Lactobacillus (a major part of the lactic acid bacteria group) which mainly responsible for BA production in cheeses(Herrero-Fresno et al. 2012). Also Enterobacteriaceae are usually considered as microorganisms with a high decarboxylase activity, chiefly in relation to the production of cadaverine and putrescine(Schirone et al. 2013). Analyses in other micro biotical activity studies showed that dominant amplicon (PCR production) in Liqvan Cheese are Lactococcuslactis. Also Enterococcus faecium and Enterococcus faecalishave been isolated in Liqvan cheese(Edalatian et al. 2012).Other bacterial species which were identified as the producers of biogenic amines including Lb. casei,Lb. paracasei, Lb. paraplantarum andLb. Plantarum(Buňková et al. 2010) also have been isolated from Liqvan cheese(Abdi et al. 2006; Mirzaei et al.). During cheese ripening, released amino acids raise pH value to a

somewhat higher level(Schirone et al. 2011); It is hence obvious that the pH values could significantly affect the activity of enzymes of LAB(Buňková et al. 2010).

Some publications describe histamine as a biogenic amine with a high incidence in cheeses(Herrero-Fresno et al. 2012). According to our findings this amine is also the most incident amine in Liqvan cheese. Without microbiological analysis, we can only assume higher counts of histamine-decarboxylating microorganisms(Ladero et al. 2009).The possible reason of the high histamine content in our experiment can be the fact, that Liqvan cheese contained Lactobacillus casei, an acknowledged strong histamine producer, in high counts(Komprda et al. 2007). Also a maximum total BA (the sum of tyramine, histamine, putrescine, and cadaverine) level of 750– 900 mg/kg has been recommended as a safety limit and according to our findings in both cheese types is the total BA level is under this limit(Table 3) at the end of ripening period. What we have find showed lower histamine content than what have approved FDA for histamine threshold (>100 mg/kg).

Although we have explored all possible Liqvan cheese and ultrafiltrate factory in the region for accurate sample size, but our study have some limitations which can be corrected in future studies. At first we haven't done any microbiological analysis for determining the definite bacterial load(Herrero-Fresno et al. 2012) which is responsible for our findings. A part from this some studies have been evaluated the BAs contents in different layer of other cheese and this can be held in Lighvan cheese during ripening period. Other limitations including assessment of above-mentioned physico-chemical factors which can influence BAs production and the ripening period must be long enough.

CONCLUSION

Comparing thepasteurizedsamplesof Liqvan and UFshoweda significant differencein the amount ofhistamineatalltimesbutthere wasno significantdifference betweenthe amounts oftyramine. In allripening periods in both types of samples, histamine and tyramine levels were below the limit. Considering the amount of biogenic amine in all samples were below the safety limit, but due to side effects in susceptible consumers need special attention in the control cheese production.

ACKNOWLEDGMENTS

REFERENCES

1. Abdi R, Sheikh-Zeinoddin M, Soleimanian-Zad S. 2006. Identification of lactic acid bacteria isolated from traditional Iranian Lighvan cheese Pakistan Journal of Biological Sciences 9:99-103
2. Aliakbarlu J, Alizadeh M, Razavi-Rohani SM, Vahabzade Z, Saei SS, Agh S. 2009. Effects of processing factors on biogenic amines production in Iranian white brine cheese Research Journal of Biological Sciences 4:23-28
3. Aminifar M, Hamedi M, EMAM-DJOMEH Z, Mehdinia A. 2010. Microstructural, compositional and textural properties during ripening of Lighvan cheese, a traditional raw sheep cheese Journal of texture studies 41:579-593
4. Buňková L et al. 2010. The effect of ripening and storage conditions on the distribution of tyramine, putrescine and cadaverine in Edam-cheese Food microbiology 27:880-888

5.　Edalatian MR, Najafi MBH, Mortazavi SA, Alegría Á, Nassiri MR, Bassami MR, Mayo B. 2012. Microbial diversity of the traditional Iranian cheeses Lighvan and Koozeh, as revealed by polyphasic culturing and culture-independent approaches Dairy science & technology 92:75-90

6.　El-Zahar KM. 2014. Biogenic amines and microbiological profile of egyptian cheeses African Journal of Food Science 8:130-139

7.　Gezginc Y, Akyol I, Kuley E, Özogul F. 2013. Biogenic amines formation in< i> Streptococcus thermophilus</i> isolated from home-made natural yogurt Food chemistry 138:655-662

8.　Herrero-Fresno A et al. 2012. < i> Lactobacillus casei</i> strains isolated from cheese reduce biogenic amine accumulation in an experimental model International journal of food microbiology 157:297-304

9.　Innocente N, Biasutti M, Padovese M, Moret S. 2007. Determination of biogenic amines in cheese using HPLC technique and direct derivatization of acid extract Food Chemistry 101:1285-1289

10.　Karami M, Ehsani M, Mousavi S, Rezaei K, Safari M. 2009. Changes in the rheological properties of Iranian UF-Feta cheese during ripening Food chemistry 112:539-544

11.　Kebary K, El-Sonbaty A, Badawi R. 1999. Effects of heating milk and accelerating ripening of low fat Ras cheese on biogenic amines and free amino acids development Food chemistry 64:67-75

12.　Komprda T, Burdychová R, Dohnal V, Cwiková O, Sládková P. 2008. Some factors influencing biogenic amines and polyamines content in Dutch-type semi-hard cheese European Food Research and Technology 227:29-36

13.　KOMPRDA T, NOVICKÁ K, KALHOTKA L, SMĚLÁ D. 2005. Biogenic amine content in sterilised and pasteurised long-term stored processed cheese Czech J Food Sci Vol 23:209-216

14.　Komprda T, Smělá D, Novická K, Kalhotka L, Šustová K, Pechová P. 2007. Content and distribution of biogenic amines in Dutch-type hard cheese Food chemistry 102:129-137

15.　Ladero V, Fernández M, Alvarez MA. 2009. Effect of post-ripening processing on the histamine and histamine-producing bacteria contents of different cheeses International dairy journal 19:759-762

16.　Lanciotti R, Patrignani F, Iucci L, Guerzoni ME, Suzzi G, Belletti N, Gardini F. 2007. Effects of milk high pressure homogenization on biogenic amine accumulation during ripening of ovine and bovine Italian cheeses Food chemistry 104:693-701

17.　Lavasani A, Ehsani M, Mirdamadi S, Mousavi S. 2012. Study of proteolysis and lipolysis of probiotic Lighvan cheese International Journal of AgriScience 2:341-352

18.　Linares DM, del Río B, Ladero V, Martínez N, Fernández M, Martín MC, Álvarez MA. 2012. Factors influencing biogenic amines accumulation in dairy products Frontiers in microbiology 3

19.　Madadlou A, Mousavi ME, Farmani J. 2007. The influence of brine concentration on chemical composition and texture of Iranian White cheese Journal of food engineering 81:330-335

20.　Mah J-H, Han H-K, Oh Y-J, Kim M-G, Hwang H-J. 2002. Biogenic amines in Jeotkals, Korean salted and fermented fish products Food Chemistry 79:239-243

21.　Mirzaei H, Javadi A, Alimohammadi Bastami O. Technological properties of candidate probiotic Lactobacillus plantarum strains isolated from Iranian traditional Lighvan cheese

22.　Önal A, Tekkeli SEK, Önal C. 2013. A review of the liquid chromatographic methods for the determination of biogenic amines in foods Food chemistry 138:509-515

23.　Rabie MA, Elsaidy S, el-Badawy A-A, Siliha H, Malcata FX. 2011. Biogenic amine contents in selected Egyptian fermented foods as determined by ion-exchange chromatography Journal of Food Protection® 74:681-685

24.　Schirone M et al. 2013. High content of biogenic amines in Pecorino cheeses Food microbiology 34:137-144

25.　Schirone M, Tofalo R, Mazzone G, Corsetti A, Suzzi G. 2011. Biogenic amine content and microbiological profile of Pecorino di Farindola cheese Food microbiology 28:128-136

26.　Szterk A, Roszko M. 2014. Simultaneous determination of free amino acids, l-carnosine, purine, pyrimidine, and nucleosides in meat by liquid chromatography/single quadrupole mass spectrometry Journal of Liquid Chromatography & Related Technologies 37:664-680

Hossein Khadem Haghighian *et al.*
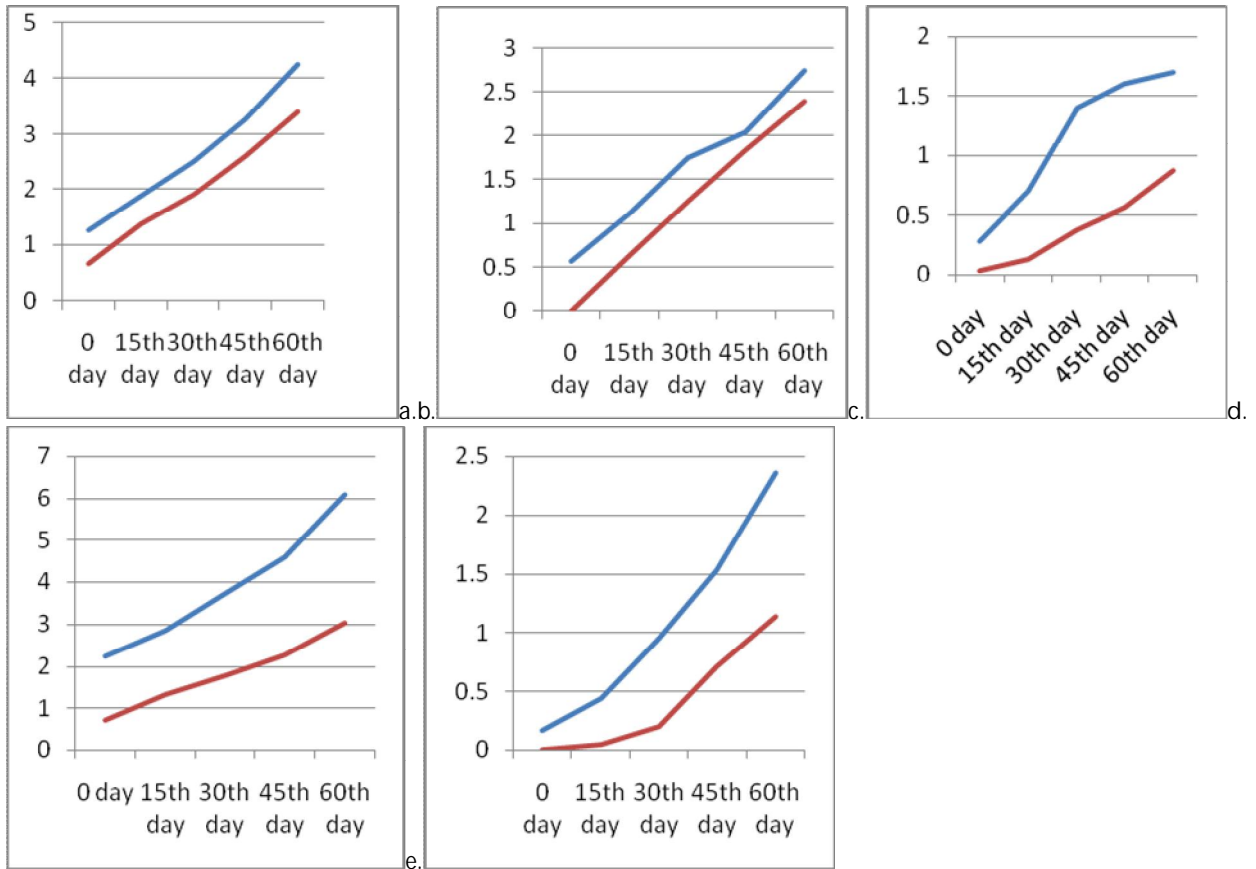
Fig 1. The BAs content in Liqvan and Ultrafiltrate Pasteurized cheese in ripening periods:
A: Tyramine Content in both Cheeses in ripening periods B: Putrecsine Content in both Cheeses in ripening periods; C: Cadaverine Content in both Cheeses in ripening periods
D: Histamine Content in both Cheeses in ripening periods; E: 2- phenyl ethylamine Content in both Cheeses in ripening periods.

Table 1- BAs content (original measured values inmg.kg-1) in Lighvan and Ultrafiltrate Pasteurized cheese in ripening periods.

BAs (Means ± SD)	Cheese	Day 0	Day 15	Day 30	Day 45	Day 60	P Value	P Value
Histamine	Lighvan	2.23 ± 0.63	2.83±0.72	3.73±0.54	4.58±0.59	6.08±0.82	P<0.05	P<0.05
	UF	0.71±0.61	1.31±0.43	1.78±.29	2.26±0.27	3.03±0.13	P>0.05	
Cadaverine	Lighvan	0.28±0.11	0.7±0.45	1.4±0.48	1.6±0.85	1.7±1.11	P<0.05	P<0.05
	UF	0.4±0.6	0.14±0.12	0.38±0.26	0.56±0.15	0.87±0.23	P>0.05	
Putrescine	Lighvan	0.57±0.11	1.12±0.337	1.75±0.47	2.05±0.58	2.75±0.43	P<0.05	P<0.05

Hossein Khadem Haghighian *et al.*

	UF	**0.00**	**0.64±0.33**	**1.26±0.22**	**1.83±0.21**	**2.39±.0.27**	**P>0.05**	
2-phenylethylamine	Lighvan	0.17±0.17	0.44±0.31	0.95±0.44	1.53±0.5	2.36±0.44	P<0.05	P<0.05
	UF	0.00	0.04±0.05	0.2±0.12	0.71±0.18	1.14±0.17	P>0.05	
Tyramine	Lighvan	1.26±0.41	1.89±0.59	2.51±0.81	3.27±0.85	4.26±0.97	P<0.05	P<0.05
	UF	0.66±0.57	1.37±0.36	1.9±0.19	2.59±0.55	3.4±0.72	P>0.05	

Table 2 - Statistical correlations between BAs content in Lighvan and Ultrafiltrate Cheese in ripening periods.

BAs	Day 0	Day 15	Day 30	Day 45	Day 60
Histamine	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
Cadaverine	P<0.05	P<0.05	P<0.05	P<0.05	NS
putrescine	P<0.05	NS	NS	NS	NS
2-phenylethylamine	P<0.05	P<0.05	P<0.05	P<0.05	P<0.05
tyramine	NS	NS	NS	NS	NS

Table 3 – Total BAs content in Day 60 in Lighvan and Ultrafiltrate cheese.

Cheese	Histamine Day 60	Cadaverine Day 60	Putrescine Day 60	2 phenyl ethylamine Day 60	Tyramine Day 60	Total
Lighvan	36.49 ±0.82	10.43±0.11	16.50±0.43	14.20±0.44	25.57±0.97	103.19±3.77
Ultrafiltrate	9.11±0.13	2.61±0.23	7.17±0.27	3.42±0.17	10.32±0.72	32.63±1.53

RESEARCH ARTICLE

Environmental Effects on Semen Characteristics of Water Buffalo in Breeding Station of Northwest of Iran

Z Abdi[1], S A Rafat[2*], Ghmoghaddam[3] and F Nazari[4]

[1] M.Sc Student ,Department of Animal Science, Faculty of Agriculture, University of Tabriz, Iran
[2*] Associate Professor- Department of Animal Science, Faculty of Agriculture, University of Tabriz, Iran
[3] Professor- Department of Animal Science, Faculty of Agriculture, University of Tabriz, Iran
[4] PhD student of Animal Physiology, Department of Animal Science,Faculty of Agriculture, University of Tabriz.

*Address for correspondence
S A Rafat
Associate Professor- Department of Animal Science,
Faculty of Agriculture,
University of Tabriz, Iran
E-mail: abbasrafat@hotmail.com

ABSTRACT

Reproductive traits are one of the most important economic traits in breeding of buffalo. Male animal plays an important role in the genetic improvement of these traits. The purpose of this study was to evaluate the effects of season on some characteristics of buffalo sperm in Azerbaijan province of North West of Iran. For this purpose, characteristics were evaluated on n=20 male buffaloes. Ejaculate volume (ml), number of spermatozoa ($*10^6$), sperm concentration ($*10^6$/ml), motility (%) and sperm viability (%) were statistically analyzed. Season factorsincluded the length of the day, humidity, temperature, quality and quantity of feed composition which affect semen output. The results of the data collected during the years 2007-2011 showed a positive correlation between number of spermatozoa and volume level (r=89 %, P<0.001). Positive correlation was found between number of spermatozoa and viability (0.76) (P<0.05). The effect of season on number of spermatozoa and semen volume was significant (P<0.05). The ejaculate volume, sperm concentration, proportion of normal morphological spermatozoa was higher in the spring and winter than summer (P<0.001). The results showed that the sperm of Azerbaijan Buffalo in summer may be damaged and are unable to tolerate cold stress.It is important to recommend that the sperm are frozen in the winter and spring season.

Key words: Buffalo, Reproduction, Season, Sperm Characteristics

INTRODUTION

Iran having limit 480000 water Buffalo, ranks sixteenth in the world in this respect. Most of the animals are kept in the south and the North West of Iran (FAO 2005). Ancestry of Iranian Buffalos is not clearly know, it has been proposed that the main progenitor of the animals are Indian Buffalos such as Murrah and so, because of the phenotypic similarity. Iranian water Buffalo have also some similarity to Iraqi Buffalos. Iranian Buffalos in North West of the country (West Azerbaijan) have close appearance to Mediterranean water Buffalos. Thus, it's thought they have descended from the some ancestor. All of the Iranian Buffalos are riverine (Naserian 2007). Despite the lack of sufficient information on reproduction in this species in Iran, several stations using artificial insemination have been established in various provinces for the genetic improvement of local sheep breeds (Mayahi et al .2014). The water buffalo is an ineffectively reproductive animal due to several features including late puberty, low population of ovarian follicles, silent heat, variable time of ovulation, seasonal breeding and long postpartum anestrous. To improve the poorly reproductive efficiency of the water buffalo, several techniques such as artificial insemination, super ovulation, ovum pick-up, in vitro maturation, in vitro fertilization and embryo transfer have been applied with various achievements. The water buffalo is the multi-estrus animal and the sexual activities can occur all round year. In the summer, while the temperature is high, pools of water become disappear, grass is also scarce those factors contribute to a decrease in activities in the buffalo which results in weak libido in the male and poor reproductive performance in the female. In male African buffaloes, the level of hormone testosterone and LH-receptors were higher in the breeding season compared to those in the low breeding season (Brown et al. 1991). This suggested that the sexual activities of those buffaloes in the breeding season were at peak. Moreover, the ejaculate volume, sperm motility, proportion of normal morphological spermatozoa was much higher in the breeding season than those in the low breeding season though the total amount of spermatozoa was the same (Koonjaenak et al. 2007).The seasonal reproductive characteristic in water buffalo also depends on melatonin excreted from pineal gland during the night and represents the endocrinal signal of the light-dark rhythm in the environment (Zicarelli et al. 1997). Therefore, the major aim of the present experiment was to obtain information concerning the environmental variations in seminal characteristics of Iranian Buffalo breeds.

MATERIALS AND METHODS

Sperm evaluation was conducted on 20 mature buffalos (Bubalusbubalis) 4-5 years of age with similar nutrition and nearly the same weight (430 ± 20 kg) at the breeding station of North West .The station is 1332 m above sea level with a longitude 45o4' E of and a latitude of 37o32' N. The mean temperature and duration of light in different months are shown in Table 1. This experiment was during five years of 2007 to 2011. Semen was collected from all buffalos twice monthly using an artificial vagina in the all of months the 5 years. Ejaculate volume (ml) was determined using calibrated collecting tube and motility of spermatozoa in fresh, undiluted semen was evaluated and scored by contrast microscope at 40× magnification. Sperm concentration (*10^6 /ml) andnumber of spermatozoa (*10^6) per ejaculate were determined by cell counting, using a haemocytometer chamber. For the morphological examination of spermatozoa a semen smear was provided and stained according to the method of Cerovsky (1976), and then the ratio of morphologically viability sperm cells (%) was determined under a light microscope at 1000× magnification.

Statistical analysis

The data from ejaculate and correlation between parameters were analyzed by the GLM and correlation procedures of SAS in unbalanced design.

S A Rafat *et al.*

RESULTS

Average reproductive traits (Ejaculate volume, sperm concentration, number of spermatozoa, Motility, Viability) in different season of five years have been shown in table 2.Ejaculate volume continuously increased from the minimum volume in summer(3.88±0.03ml) to the maximum in spring(4.92±0.013ml) (p<0.0001). Ejaculate volume was the lowest in August (3.75±0.05ml) and the highest in April (5.11±0.02ml). The lowest sperm concentration was recorded in summer (251.11*10^6/ml±16.4) and the highest in spring (299.67*10^6/ml±13.2)(p<0.001).number of spermatozoa in each 1 ml ejaculate was the lowest in summer (974.33*10^6 ± 40.2) and the highest in spring (1475.77*10^6 ± 7.1)(p<0.001). Motility was high in the spring (91.8±0.8%) and low in summer(90±6.1%)and Autumn (90.5%) but was not significant different .A significant correlation was found between volume and number of spermatozoa and concentration of sperm (r=89 %,p<0.001). The rate of viability was the highest in winter (59±3.23%) and the lowest in summer (45.33±1.61%) (p<0.001) and it was significantly higher in February than in other month of the year (65±1.58%) (p<0.001). The correlation between number of spermatozoa and viability was 0.76 (p<0.003).

DISCUSSION

Seasonality in buffalo reproduction has been reported from India, Pakistan and many other parts of the world (Barile, 2001) which has been attributed to environmental factors more directly than the genetic factors (Zicarelli, 1997). Seasonal high environmental temperatures were found to be associated with low breeding efficiency, when estimating the relationship between ambient temperature and breeding efficiency (Cavestany et al.,1985).In this study, there were significant differences for semen quality parameters of buffaloes between winter and spring with summer seasons(P<0.001). The ejaculate volume, sperm concentration, proportion of normal morphological spermatozoa was much higher in the breeding season (spring and winter) than those in the non- breeding season (summer) (P<0.001). This area has cold winters with temperature around 6 degrees during the day and night. In contrast, temperatures in the spring in this area varies between 16-27 degrees, in this study, sperm buffalo that were in the spring of sperm quality were better, although viability was higher in the winter. Heat stress has a direct effect on the neuroendocrine setup in buffalo (Razdan, 1988). Concerning heat stress, it is usually affects inversely the processes of spermatogenesis and metamorphosis of sperms which cause semen degeneration (Coser et al., 1979).in this study the lower of viability was in summer and higher in winter(P<0.001). This finding is in agreement with the observations in swamp buffalo (KoonjaenakS., 2007) and is in contrast with results in the Murah buffaloes (Mandal DK.,2003). This could be due to differences in breed and environmental factors (Koonjaenak S., 2007). The maximum and minimum temperatures for optimum spermatogenesis are 29.4 and 15.6 °C and minimal spermatogenesis occurring during summer that is referred to as "summer sterility" (Akpokodje et al., 1985). Despite the thermoregulatory mechanism of the testes, sexual desire (libido), ejaculate volume, live sperm percentage, sperm concentration, viability and motility (Gamcik et al., 1979) are negatively affected by high environmental temperature during summer. Achieved datashowed that the spring had the highest sperm quality. Zeidan(1989) and Marai et al. (2008) showed that semen-ejaculate volume decreased, while studies ofFawzy (1982) showed remarkable increase with heat elevation. Some studies showed that the initial motility of spermatozoa decreased in hot climate conditions (Zeidan, 1989) and the other studies indicated that motility of spermatozoa either increased (El-Azab, 1980) or did not show any change due to season of the year or elevation of temperature (Silva et al., 1991). The results showed that the sperm of Azerbaijan on Buffalo in summer may be damaged and are unable to tolerate cold stress. It is essential that the sperm are frozen in the winter and spring. Therefore, although the mating of male Azerbaijan buffalo could be done throughout the year, reproductive performance and fertile potential of animal according to seasonal variations.

REFERENCES

1. Akpokodje JU, Dede T I, Odili P I (1985). Seasonal variations in seminal characteristics of West African Dwarf sheep in the humid tropics. Tropics Veterinarian. 3: 61-65.
2. Barile, V.L., Galasso, A., Marchiori, E., Pacelli, C., Montemurro, N. and Borghese, A. (2001). Effect of PRID treatment on conception rate in Mediterranean buffalo heifers. Livest. Prod.Sci., 68: 283-287.
3. Brown, J. L., Wildt, D. E., Raath, J. R., de Vos, V., Howard, J. G., Janssen, D. L., Citino, S. B., and Bush, M. (1991). Impact of season on seminal characteristics and endocrine status of adult freeranging African buffalo (Synceruscaffer). JReprodFertil92, 47-57.
4. Cavestany D, El-Wishy AB, Foote RH (1985). Effect of season and high environmental temperature on fertility of Holstein cattle. Journal of Dairy Science. 68:1471-1478.
5. Coser AME, Godinho HP, Fonseea VO (1979). Effect of high temperatures on spermatogenesis in Brazilian Wooless rams under experimental conditions. Arquivos ad Escola de Veterinaria da Uitiversidad Federal de Minas Gerais. 31:147-154.
6. El-Azab AI (1980). The interaction of season and nutrition on semen quality in buffalo bulls. PhD Thesis. Faculty of Veterinary Medicine, Cairo University. Cairo , Egypt.
7. FAO. 2005. Water buffalo. Rome. Italy
8. Fawzy SAH (1982). Effect of feeding elephant grass to bulls on their performance and semen quality. MSc dissertation, Faculty of Agriculture, Tanta University, Tanta, Egypt
9. Gamcik P, Mesaros P, Schvare F (1979). The effect of season on some semen characters in Slovakian Merino rams. ZivocisnaVvrobo. 24:625-630.
10. Koonjaenak S,.(2007). Seasonal variation in semen quality of swamp buffalo bulls (Bubalusbubalis) in Thailand. Asian J Androl. 9 (1): 92- 101.
11. Naserian A A,Saremi B,.(2007), Water buffalo industry in Iran. Ital. J. anIm.ScI. vol. 6, (Suppl. 2), 1404-1405.
12. Mandal DK, Nagpaul PK, Gupta AK(2003). Motion characteristics of Murrah buffalo bull spermatozoa in various seasons and its relationship with functional integrity of the plasmallema. Theriogenology. 60: 349-358.
13. Marai IFM, El-Darawany AA, Fadiel A, Abdel-Hafez MAM (2008). Reproductive performance traits as affected by heat stress and its alleviation in sheep - a review. Tropical and Subtropical Agroecosystems. 8:209-234.
14. Razdan MN (1988). Buffalo performance in relation to climatic environment. In : Proceedings of Second World Buffalo Congress, Vol 2, Part 1, New Delhi, India, pp 173-186.
15. Silva AEDF, Dode MA, Porto JA, Abrea UGP (1991). Seasonal sexual activity of Nellore bulls and their crossbreed with Fleckvieh and Chianina. Biometric testicular characteristics. Psquisa Agriculture Brazil. 26:1745-1750.
16. Zicarelli, L. (1997). Reproductive seasonality in buffalo. Bubalusbubalis, 4, Suppl.: 29 - 52.
17. Zeidan AEB (1989). Physiological studies on Friesian cattle. M.Sc. Thesis. Faculty of Agriculture, Zagazig University, Zagazig, Egypt.

Table1: The mean temperature in different months in the west Azerbaijan.

Month	January February March April May June July August September October November December											
$^\circ$C	2.6	4.8	10.5	16.8	22.2	27.5	31.2	31	27.1	20.1	12.2	5.7

Table2: Average reproductive traits (Ejaculate volume, sperm concentration, number of spermatozoa in ejaculate, Motility, Viability) in different season of five years.

Volume (ml)	sperm concentration ($*10^6$/ml)	number of spermatozoa ($*10^6$)	Motility%	viability%
Winter	4.87±0.06	295.78±10.4	1439.33±20.4	91±1.2	59±3.23
Spring	4.92± 0.013	299.67±13.2	1475.77±7.1	91.8±0.8	53.83±1.12
Summer	3.88±0.03	251.11±16.4	974.33±40.2	90±6.1	45.33±1.6
Autumn	4.04±0.014	278.13±9.8	1123.66±12.4	90.5	47±2.3
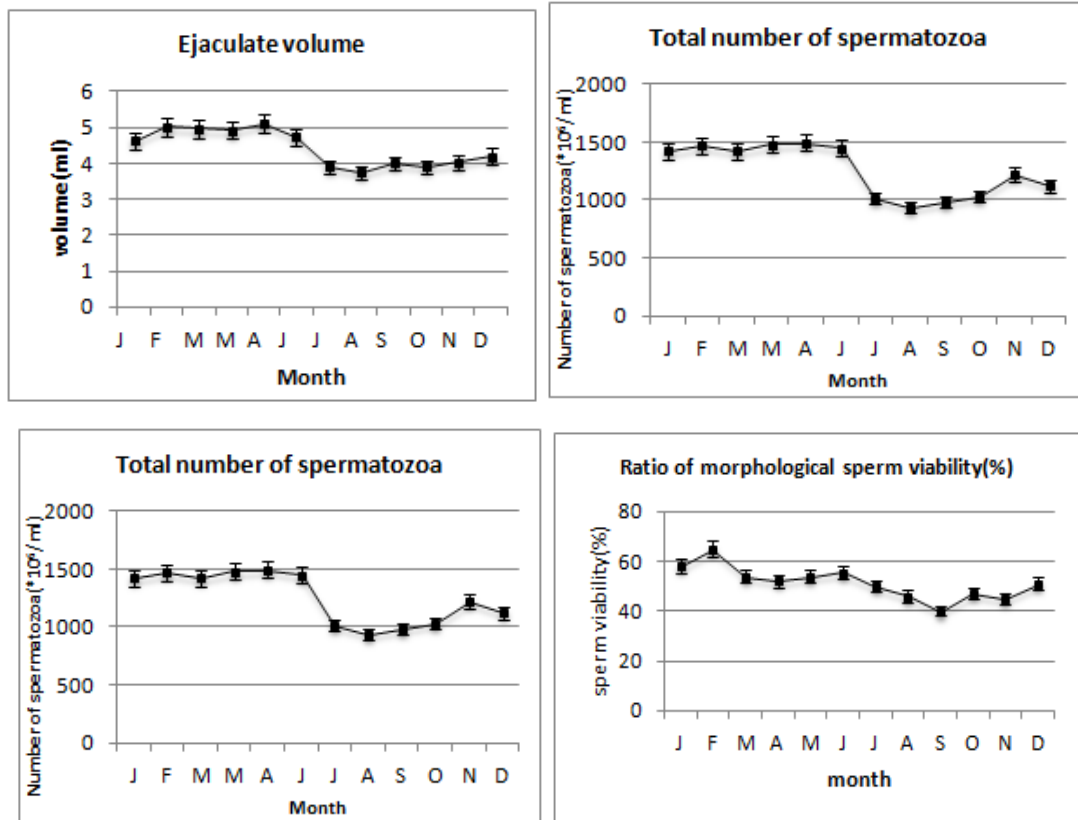
Figure1: Mean ± SEM monthly values of some semen characteristics in 5year.

Comparison of Dose Rate and Energy Dependence of Soft Tissue Equivalence Dosimeter with Electron and Photon Beams Using Magnetic Resonance Imaging

Hadi Chahkandi Nejad[1], Fereidoun Nowshiravan Rahatabad[2], Meisam Mohammadnia[3], Omid Khayat[4]*

[1]Department of Electrical Engineering, Birjand Branch, Islamic Azad University, Birjand, Iran.
[2]Biomedical Engineering Department, Science and Research Branch, Islamic Azad University, Tehran, Iran.
[3]Department of Nuclear Engineering, East Tehran Branch, Islamic Azad University, Tehran, Iran.
[4]Young Researchers and Elite Club, South Tehran Branch, Islamic Azad University, Tehran, Iran.

*Address for correspondence
Omid Khayat
Young Researchers and Elite Club,
South Tehran Branch,
Islamic Azad University,
Tehran, Iran
Email: khayat@aut.ac.ir

ABSTRACT

The purpose of this study was to evaluate dependence of PAGAT soft tissue equivalent dosimeter 1/T2 on different electron and photon energies as well as on different mean dose rates for a standard clinically used Co-60 therapy unit and an ELECTA linear accelerator.A multi echo sequence with 32 equidistant echoes was used for the evaluation of irradiated polymer gel dosimeters.The optimal post-manufacture irradiation and post imaging times were both determined to be one day. The sensitivity of PAGAT polymer gel dosimeter with irradiation of photon and electron beams was represented by the slope of calibration curve in the linear region measured for each modality. The response of PAGAT gel with photon and electron beams is very similar in the lower dose region. The R2-dose response was linear up to 30Gy. In electron beams the R2-dose response for doses less than 3Gy is not exact, but in photon beams the R2-dose response for doses less than 2Gy is not exact. Dosimeter energy dependence was studied for electron energies of 4, 12 and 18MeV and photon energies of 1.25, 4, 6 and 18MV. Dose rate dependence was studied in 6MeV electron beam and 6MV photon beam with the use of dose rates 80, 160, 240, 320, 400 and 480cGy/min. Evaluation of dosimeters were performed on Siemens Symphony, Germany 1.5T Scanner in the head coil. In this study no trend in soft tissue quivalent dosimeter 1/T2 dependence was found on mean dose rate and energy for electron and photon beams but the response of R2-dose for low

doses (e.g. 0-2Gy for photon and 0-3Gy for electron beams) is not exact, therefore the response of PAGAT soft tissue equivalent must be verified in different compositions, chemicals and percent weights.

Key words: polymer gels, PAGAT gel, electron and photon beams, MRI.

INTRODUCTION

Gel dosimetry systems are the only true 3-D dosimeters. The dosimeter is at the same time a phantom that can measure absorbed dose distribution in a full 3-D geometry [1]-[2]-[3]-[4]. Gel dosimeters are integrating dosimeters with the capability of capturing the whole dose distributions inside them and with versatility to be shaped in any humanoid form that makes them unique in their kind and potentially very suitable for the verification of complex dose distributions as they occur in clinical settings such as radiotherapy [2]-[5]-[6]. In 1984, magnetic resonance imaging (MRI) demonstrated great potential in visualizing three dimensional (3D) dose distributions of ferric or ferrous sulphate gel dosimeters [7]. Subsequently, studies were undertaken to investigate the feasibility of using Ferric gel as a 3D dosimetry system in radiation oncology [8]. The major limitation in Ferric gel dosimetry is that it suffers from blurriness of dose with time which is due to the migration of ferrous and ferric ions in gel matrix, known as diffusion [9]. In 1993, a polymer gel dosimeter was developed that maintained spatial information following irradiation which could be visualized using MRI [10]. Polymer gel dosimetry is a technique that has the ability to map absorbed radiation dose distribution in three dimensions (3D) with high spatial resolution. Polymer gel dosimeters offer a number of advantages over traditional dosimeters such as ionization chambers, thermo luminescent dosimeter (TLD) and radiographic film. These advantages include independence of radiation direction, radiological soft tissue equivalence, integration of dose for a number of sequential treatment fields, and perhaps most significantly, evaluation of a complete volume at once [11]-[12]. In 2001, the first normoxic gels were suggested that could be produced, stored and irradiated in a normal condition. Magnetic Resonance Imaging (MRI) has been most extensively used for the evaluation of absorbed dose distributions in polymer gel dosimeters. In the MRI evaluation of polymer gel dosimeters, changes in T2 are a result of physical density changes of irradiated polymer gel dosimeters. Many factors such as polymer gel composition, temperature variation during irradiation, type and energy of radiation, dose rate, temperature during MRI evaluation, time between irradiation to MRI evaluation, and strength of magnetic field have been studied by different authors [10]-[13]-[14]-[15]. All these factors can potentially affect polymer gel dosimeter response and significantly influence measured results. Consequently, it is important to evaluate and quantify each individual factor. In PAGAT polymer gel dosimeter, the gel itself forms both multi-dimensional phantom and the detector [16]. The gel can be modified to be almost completely soft-tissue equivalent. In this study, investigation of the PAGAT polymer gel dosimeter such as calibration curve, R2-dose response, dose rate and energy dependence in electron and photon beams has been undertaken. In this communication, MRI was used to determine the response of the normoxic PAGAT polymer gel dosimeter. Considering factors such as accuracy, sensitivity, the time needed for dosimetry, three-dimensional capabilities, energy independence, dose rate independence, and costs, we believe that PAGAT polymer gel dosimeter is the "closest to ideal" dosimetry method comparing with TLDs, ion chambers, film dosimetry, Fricke gels and anoxic gels.

MATERIALS AND METHODS

Preparation of PAGAT gel

The PAGAT polymer gel formulation by % mass consisted of 4.5% N,N'-methylen-bis-acrylamide (bis), 4.5% acrylamid (AA), 5% gelatin, 5 mMtetrakis (hydroxymethyl) phosphonium chloride (THPC), 0.01 mM hydroquinone (HQ) and 86% HPLC(Water) [16]. All components were mixed on the bench top under a fume hood. The gelatin was added to the ultra-pure de-ionized water and left to soak for 12 min, followed by heating to using an electrical heating plate controlled by a thermostat. Once the gelatin completely dissolved the heat was turned off and the cross-

linking agentbis was added and stirred until dissolved. Once the bis were completely dissolved the AA was added and stirred until dissolved. Using pipettes, various concentration of the polymerization inhibitor HQ and the THPC anti-oxidant were combined with the polymer gel solution. When the preparation of final polymer gel solution is completed, it is transferred into phantoms and allowed to set by storage in a refrigerator at about   [16].Table 1 lists the component with different percent weight in normoxic PAGAT polymer gel dosimeter.

B. Irradiation

Irradiation of vials was performed using electron beams by an ELECTA linear accelerator with SSD = 80cm and the depth was selected at 5cm. The optimal post-manufacture irradiation was determined to be 1 day.

C. Imaging

Before imaging, all polymer gel dosimeters were transferred to a temperature controlled MRI scanning room to equilibrate to room temperature. The PAGAT polymer gel dosimeters were imaged in a Siemens Symphony 1.5 Tesla clinical MRI scanner using a head coil. T2 weighted imaging was performed using a standard Siemens 32-echo pulse sequence with TE of 20ms, TR of 3000ms, slice thickness of 4 mm, FOV of 256 mm. The optimal post imaging times was determined to be 1 day. The images were transferred to a personnel computer where T2 and R2 maps were computed using modified radiotherapy gel dosimetry image processing software coded in MATLAB.The mean T2 value of each vial was plotted as a function of dose with the quasi-linear section being evaluated for R2-dose sensitivity.

RESULTS

R2-dose Sensitivity with electron beams

PAGAT gels with optimum value of ingredient was manufactured and irradiated to different doses. Polymer gel dosimeters in Perspex phantoms were homogeneously irradiated with 6MeV electron beam with an ELECTA linear accelerator located in Tehran. Delivered doses were from 0-6000cGy. The calibration curve (transverse relaxation rate (1/T2) versus applied absorbed dose) was obtained and plotted. Dependence of 1/T2 response to the absorbed dose in the range of 0-6000cGy is shown is figure 1. As it can be seen PAGAT has a linear response up to 30Gy. The response of the PAGAT gel is very similar in the lower dose region and The R2-dose response for doses less than 3Gy is not exact.

R2-dose Sensitivity with photon beams

Polymer gel dosimeters in Perspex phantoms were homogeneously irradiated with 1.25MV photon beam with a Co-60 therapy unit located in Tehran. Delivered doses were from 0-5000cGy. The calibration curve (transverse relaxation rate (1/T2) versus applied absorbed dose) was obtained and plotted. Dependence of 1/T2 response to the absorbed dose in the range of 0-5000cGy is shown is figure 2. As it can be seen PAGAT has a linear response up to 30Gy. The response of the PAGAT gel is very similar in the lower dose region and The R2-dose response for doses less than 2Gy is not exact. The R2-dose response of the PAGAT polymer gel dosimeter is linear between 10-30Gy and 2-10Gy. Figure 2 shows that PAGAT polymer gel has a dynamic range of at least   for doses up to 30Gy compared with less than   for doses up to 30Gy in the preliminary study of the PAGAT polymer gel dosimeter [11].

R2-dose response with different electron energies

Response of the energy dependence was obtained for 4, 12 and 18 MeV nominal electron energy and is shown in figure 3. A linear function is fitted to each set of data and their slope and correlation were found. As it can be seen dependence of PAGAT polymer gel response to the energy of electron is shown. As the energy increases from 4 to 18 MeV the sensitivity is nearly stable:

$$\left(\frac{0.0558 - 0.0546}{0.0558} \right) \times 100 \cong 2\%$$

That is 2% variation energy.

Due to the large proportion of water (86%), the PAGAT polymer gel is nearly soft-tissue equivalent and no energy corrections are required for electron beams in radiotherapy.

R2-dose response with different photon energies

Response of the energy dependence was obtained for 1.25, 4, 6 and 18 MV nominal photon energy and is shown in figure 4. A linear function is fitted to each set of data and their slope and correlation were found. The energy increases from 1.25 to 18 MV the sensitivity is nearly stable:

$$\left(\frac{0.1043 - 0.0905}{0.1043} \right) \times 100 \cong 13\%$$

That is 13% variation energy.

Due to the large proportion of water (86%), the PAGAT polymer gel is nearly soft-tissue equivalent and no energy corrections are required for photon beams in radiotherapy.

Dose rate dependence with photon and electron beams

Dose rate dependence for PAGAT gel was verified in figure 5 with a 6MeV electron beam 20Gy dose was delivered to the gel phantoms with dose rates varying from 80, 160, 240, 320, 400 and 480cGy/min. A line was fitted to the data which shows no significant dependence of R2 to dose rate.

Figures 6 show the PAGAT polymer gel dosimeter sensitivity with different dose rates in photon beams, therefore no significant dose rate effects in PAGAT polymer gel have been observed using NMR evaluation when dose rate is changed from 80cGy/min to 480cGy/min in photon and electron beams.

CONCLUSION

According to the best knowledge of the authors only a few studies were published to evaluate energy and dose rate dependence for the polymer gel dosimeters. Ibbott et al. which worked on BANG polymer gel concluded that the polymer gel dose response is independent of both dose rate and beam modality and used the polymer gel calibration curve determined with 6 MV x rays for evaluation of the gel dosimeter irradiated with 60Co without any limitations or approximations [17].

Similarly De Wagter et al. which worked on polymer gel stated in their study that polymer gel responds practically independently of beam quality [18].

Another study was also focused on the BANG polymer gel dosimeter response in different physical (Farajollahi et al.). They studied the dosimeter response for four different energies: 300 kV x rays, 1.25 MeV 60Co gamma rays, 6MV X rays, and 8MV x rays. They homogeneously irradiated gel dosimeters with the same dose by four mentioned photon beams and compared the dosimeter response to conclude that there is no energy dependence [19]-[20].

Baldock et al. studied PAG (poly acrylamide gelatin) polymer gel dosimeter response for a range of electron and photon energies. They used incident nominal electron energies of 5, 7, 9, 12, 15, 17, and 20 MeV and photon energies of 660 Kev from 137Cs, 1.25 MeV from 60Co, 6MV and 16MV to deliver the dose of 20Gy in each sample. Based on measured polymer gel dosimeter response they concluded that the energy response of the polymer gel retains suitable characteristics for a range of commonly used electron and photon beams [21].

Maryanski et al., used central axis percentage depth dose of 6 MV x-ray and 15 MeV electron beams measured in the BANG-2 gel dosimeter (composed of: 5% Gelatin, 3% N,N'-methylene-bis-acrylamide(BIS), 3% Acrylic acid, 1% NaOH& 88% Water) and compared them with diode measurements in water. They concluded that there is no energy as well as dose rate dependence of gel dosimeter for electron beams in the range 2-15MeV and dose rates in the range 20-400[14].

They found that gel response is independent to the dose rate. This is similar to our work however the ingredients in BANG-2 and PAGAT are totally different.

The sensitivity of PAGAT polymer gel dosimeter for electron energies of 4, 12 and 18MeV and photon energies of 1.25, 4, 6 and 18MV we homogeneously irradiated gel dosimeters with the same dose(10-30Gy) by mentioned electron and photon beams and compared the dosimeter response to conclude that there is no energy dependence. To verification of dose rate dependence, different phantom of PAGAT gels was irradiated to 20Gy of doses by 6MeV electrons and 6MV photons with different dose rates (e.g. 80, 160, 240, 320, 400 and 480cGy/min). Therefore no significant dose rate effects in PAGAT polymer gel have been observed using NMR evaluation when dose rate is changed from 80cGy/min to 480cGy/min. To avoid potential problems with different dosimeter response in different physical conditions one should perform calibration of polymer gel dosimeter and exposure of test phantom under the same or very similar physical conditions. PAGAT polymer gel dosimeter displayed good energy and dose rate responses, which are important consideration when developing polymer gel dosimeters. Since the response of PAGAT normoxic soft tissue equivalent dosimeter is not exact in low ranges of doses (e.g. 0-2Gy for photon and 0-3Gy for electron); therefor the response of PAGAT soft tissue equivalent must be verified with differnt composition, chemical and percent weight.

REFERENCES

1.   E.B.Podgorsak, "Radiation Oncology Physics: A Handbook for Teachers and Students". ISBN 92-0-107304-6. International Atomic Energy Agency (IAEA), Austria. 2005.
2.   K. Vetgote,"Development of polymer gel dosimetry for applications in intensity-modulated radiotherapy", PhD. Thesis. Department of radiotherapy and Nuclear medicine .faculty of medicine and health sciences . university of Gent . Belgum .2005.
3.   A.J. Venning,S.Brindha,B.Hill, and C.Baldock,"Preliminary study of a normoxic PAG gel dosimeter with tetrakis (hydroxymethyl) phosphonium chloride as an antioxidant. Third International Conference on Radiotherapy Gel Dosimetry". Journal of Physics: Conference Series 3,2004,pp.155-158.
4.   M.H.Zahmatkesh, R.Kousari, Sh.Akhlaghpour, S.A.Bagheri, "MRI gel dosimetry with methacrylic acid. Ascorbic acid. Hydroquinone and Copper in Aharose (MAGICA) gel". Preliminary Proceedinges of DOSGEL 2004. Sep 13-16. 2004. Ghent. Belgium.
5.   M.Hilts, A.Jirasek and C.Duzenli, "Technical considerations for implementation of x-ray CT polymer gel dosimetry". Phys. Med. Biol. 50,2005,pp.1727-1745.
6.   B.Hill,A.Venning,C.Baldock, "The dose response of normoxic polymer gel dosimeters measured using X-ray CT". The British Journal of Radiology, 78 ,2005, pp. 623-630.
7.   J. C.Gore, Y.S.Kang, R.J.Schulz, "Measurement of radiation dose distributions by nuclear magnetic resonance (NMR) imaging". Phys. Med. Biol. 29, 1984, pp. 1189-97.

8.   L. E.Olsson, A.Fransson,A.Ericsson, S.Mattsson "MR imaging of absorbed dose distributions for radiotherapy using ferrous sulphate gels". Phys. Med. Biol. 35, 1990, pp. 1623-31.

9.   R. J.Schulz, J. C.Gore, "Reported in Imaging of 3D dose Distributions by NMR National Cancer Institute Grant Application". 2RO1CA46605-04. 1990.

10.   M. J.Maryanski, J. C.Gore, R.Kennan R. J.Schulz "NMR relaxation enhancement in gels polymerized and cross linked by ionizing radiation: a new approach to 3D dosimetry by MRI (Magn. Reson. Imag.)". 11, 1993, pp. 253-258.

11.   Y. De Deene "Essential characteristics of polymer gel dosimeters". Third International Conference Radiotherapy Gel Dosimetry. Journal of Physics: Conference Series 3, 2004, pp. 34-57.

12.   S.Brindha, A.J.Vennin, B.Hill, C.Baldock "Experimental study of attenuation properties of normoxic polymer gel dosimeters". Phys. Med. Biol. 49,2004, N353-N361.

13.   M. J.Maryanski, R. J.Schulz, G. S.Ibbott, J. C.Gatenby, J.Xie, D.Horton, J. C.Gore "Magnetic resonance imaging of radiation dose distributions using o polymer gel dosimeter". Phys. Med. Biol. 39, 1994, pp. 1437-1455.

14.   M. J.Maryanski, G. S.Ibbott, P.Estman, R. J.Schulz, J. C.Gore "Radiation therapy dosimetry using magnetic resonance imaging of polymer gels". Med. Phys. 23, 1996, pp. 699-705.

15.   R. P.Kennan, K. J.Richardson, J.Zhong, M. J.Maryanski, J. C.Gore "The effects of cross-link density and chemical exchange on magnetization transfer in polyacrylamide gels". J. Magn. Reson., Ser. B110,1996, pp. 267-277.

16.   A.J.Venning, B.Hill, S.Brindha, B.J.Healy, C.Baldock, "Investigation of the PAGAT polymer gel dosimeter using magnetic resonance imaging". Phys. Med. Biol. 50, 2005, pp. 3875-3888.

17.   G. S.Ibbott, M. J.Maryanski, P.Eastman, S. D.Holcomb, Y. Zhang, R. G.Avison, M.Sanders, J. C.Gore "Three-dimensional visualization and measurrment of conformal dose distributions using magnetic resonance imaging of BANG polymer gel dosimeters" Int. j. Radiat. Oncol., Biol., Phys., 38, 1997, pp. 1097-1103.

18.   C.De Wagter, Y.De Deene, B.Mersseman, W. De Neve "Comparison between polymer gel and film dosimetry in anthropomorphic phantoms" Abstract No. 21, 15th Annual ESTRO Meeting, Vienna, Austria, 1996, pp. 23-26 September.

19.   R.Farajollahi, D. E.Bonnett, A. J. Ratcliffe, R. J.Aukett, J. A.Mills "An investigation into the use of polymer gel dosimetry in low dose rate brachytherapy" Br. J. Radiol. 72, 1999, pp.1085-1092.

20.   R. Farajollahi "An investigation into the applications of polymer gel dosimetry in radiotherapy" abstract of Ph.D. thesis, Med. Phys. 26, 493,1999.

21.   C.Baldock, A. G.Greener, N. C.Billingham, R.Burford, S. F.Keevil "Energy response and tissue equivalence of polymer gels for radiation dosimetry by MRI" Proc. Eur. Soc. Magn. Resonance Med. Biol. 2, 312 1996.

Table 1: Different chemicals and percent weight of PAGAT gel

Component	Percent Weight
Gelatine(300Bloom)	5%
N,N'-methylen-bis- acrylamide(bis)	4.5%
Acrylamide(AA)	4.5%
Tetrakis-phosphonium chloride(THPC)	5mM
Hydroquinone(HQ)	0.01mM
HPLC(Water)	86%

Hadi Chahkandi Nejad *et al.*
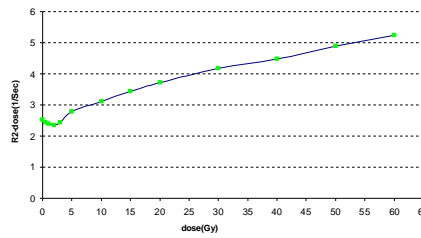
Fig.1 Sensitivity of PAGAT gel with different range of doses

Table 2 Sensitivity of PAGAT gel with different range of doses

dose(Gy)	R2- dose sensitivity ($S^{-1}Gy^{-1}$)	Correlation coefficient
0-3	-0.026	0.1997
3-10	0.89	0.9421
10-30	0.0526	0.9921
30-60	0.0359	0.9975
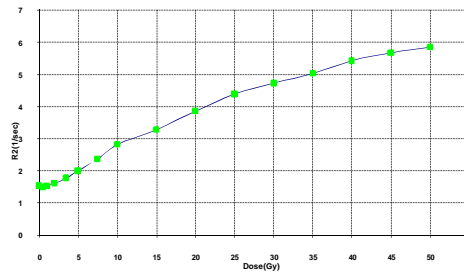
Fig. 2 PAGAT polymer gel dosimeter R2-dose response

Table 3 Sensitivity of PAGAT with different range of doses

dose(Gy)	R2- dose sensitivity ($S^{-1}Gy^{-1}$)	Correlation coefficient
0-2	0.0456	0.6175
2-10	0.1512	0.9949
10-30	0.0983	0.9939
30-50	0.0577	0.9825
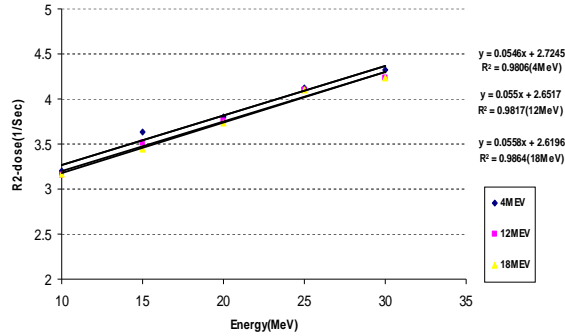
Fig. 3Verification response of PAGAT polymer gel dosimeter with different energies (e.g. 4, 12 and 18MeV)
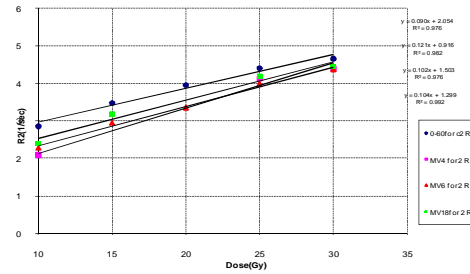
Fig. 4 The response of PAGAT polymer gel dosimeter with different energies (e.g. 1.25, 4, 6 and 18 MV)
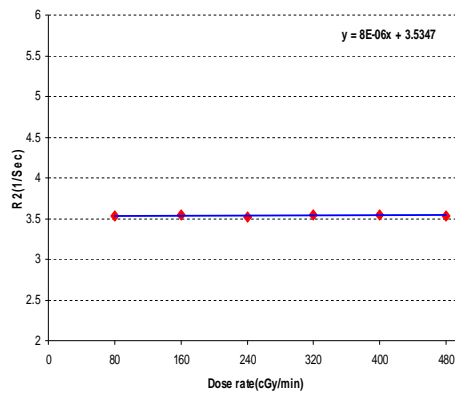
Fig. 5The response of PAGAT gel dosimeter with differentdose ratesin electron beams

4061
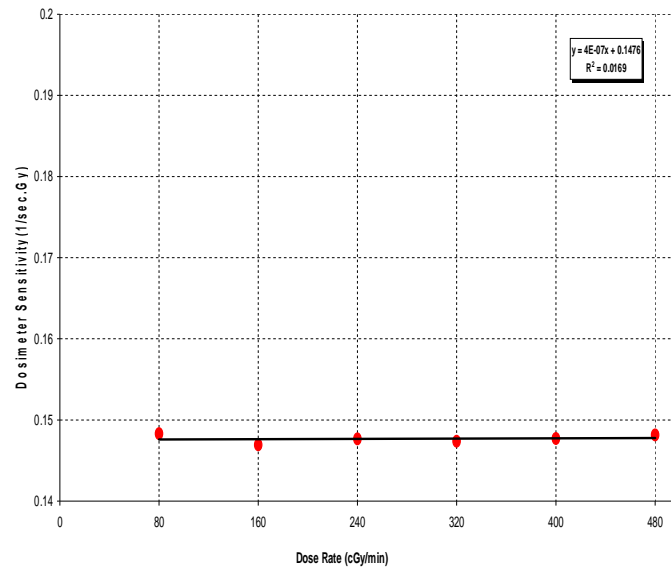
Fig. 6 The response of PAGAT gel dosimeter with differentdose ratesin photon beams

RESEARCH ARTICLE

GC/MS Analysis and Invitro Antibacterial Activity of the Essential Oil Isolated From Leaf of Phlomis Brachydon Growing In Jordan

J M Al-Shuneigat[1]*, I N Al-Tarawneh[2], M A Al-Qudah[3], S A Al- Sarayreh[1] and Y M Al–Saraireh[4]

[1] Department of Biochemistry and Molecular Biology, Faculty of Medicine, Mutah University, Mutah, Jordan.
[2] Department of Chemistry, Faculty of Science, Albalqa' Applied University, Albalqa, Al-Salt, Jordan.
[3] Department of Chemistry, Faculty of Science, Yarmouk University, Irbid, Jordan.
[4] Department of Pharmacology, Faculty of Medicine, Mutah University, Mutah, Jordan.

*Address for correspondence
J M Al-Shuneigat
Department of Biochemistry and Molecular Biology,
Faculty of Medicine, Mutah University,
Mutah, Jordan.
Phone: 962-3-2372380 ext: 3210,
Fax: 962-3-2397180,
E-mail: alshuneigat@yahoo.com

ABSTRACT

Currently there is no report available on the essential oil constituents of Phlomis brachydon world wide. This study is the first to report on the essential oil constituents of Phlomis brachydon. The aim of the study was to report on the chemical composition of the essential oil from the aerial parts of Phlomis brachydon grown in north Jordan using gas chromatography/mass spectrometry (GC-MS) and its biological activity using disc diffusion method.

Forty components accounting for 90.21% of the oil were identified with sesquiterpene hydrocarbons 60.32%, oxygenated sesquiterpenes 27.27%, and monoterpene hydrocarbons 2.62%. The major identified compounds were δ-cadinene 16.36%, γ-muurolene 12.76%, epi-alpha-cadinol 8.49%, 1-epi-cubenol 8.14%, 7-epi-alpha-selinene 5.4%, trans-muurola-4(14),5-diene 4.56%, and Ar-curcumene 3.52%.
Disc diffusion results indicate a good activity of the Phlomis brachydon essential oil against isolates used including MRSA and P. aeruginosa. It was found to be more active on Gram positive bacteria than on Gram negative bacteria.

Key words: resistant bacteria; Phlomis brachydon (Boiss.) Zohary; essential oil.

J M Al-Shuneigat *et al.*

INTRODUCTION

Bacteria resistant to commonly used antibiotics have become a major health problem worldwide. There are bacteria that have developed resistance to nearly all currently used antibiotics [1, 2]. Hence there is an urgent need for antibiotics alternatives. It is believed that essential oils may provide efficient and affordable alternatives to antibiotics.

Essential oils may be defined as the volatile, oily liquids extracted from different parts of plants by several methods including steam distillation, expression, and others [3]. They have been used for thousands of years in medicine, perfumery, cosmetic, and as foods additives [4]. Chemically, essential oils are secondary metabolites that are produced by plants and act as defense chemicals. They have been shown to possess antibacterial, antiparasitic, antiviral, antifungal, and antioxidant proprieties [5, 6]. The active compounds in essential oil can be divided into four groups according to their chemical structure: terpenes, terpenoids, phenylpropenes, and others. Most of the antibacterial properties of essential oils come from phenolic components [7]. The primary target of essential oils is pathogens' cell membrane [8].

The genus Phlomis consists of about 100 species, they are herbaceous perennials or evergreen shrubs and often have woolly leaves [9]. Some Phlomis species are used for the treatment of ulcers and hemorrhoids while others are used for their anti-inflammatory, wound healing, and pain relief properties [10]. In the traditional medicine in Jordan Phlomis brachydon (Boiss.) Zohary is used to treat stomach and intestine pain [11]. There are a few reports about the essential oil constituents of Phlomis brachydon and according to our knowledge the essential oil constituents of Phlomis brachydon have never been reported Jordan. The aim of the present study was to report on the chemical composition of the essential oil from the aerial parts of Phlomis brachydon (Boiss.) Zohary grown in north Jordan and its biological activity.

MATERIALS AND METHODS

Collection and authentication of plants

Fresh amount of Phlomis brachydon before flowering was collected from Qumeim town, Irbid, north Jordan. The plant materials were taxonomically identified and authenticated by the Botanical Survey of Yarmouk University.

Isolation of essential oil

Fresh aerial parts of Phlomis brachydon was finely chopped and subjected to hydrodistillation for 4 h using a Clevenger-type apparatus, yielding 0.18% (v/wt), yellowish oil. Subsequently, oil was dried over anhydrous sodium sulfate and immediately stored in GC-grade hexane at 4ºC until the analysis by gas chromatography/mass spectrometry (GC/MS) was done.

Essential oil composition

GC–FID analysis

The oils were analyzed in an Agilent (Palo Alto, USA) 6890N gas chromatograph fitted with a 5% phenyl–95% methylsilicone (HP5, 30 m × 0.25 mm × 0.25 μm) fused silica capillary column. The oven temperature was programmed to run from 60°C to 240°C at 3°C/min with hydrogen being used as the carrier gas (1.4 mL/min). 1.0 μL of a 1% solution of the oils in hexane was injected in split mode (1:50). The injector was kept at 250°C and the flame ionization detector (FID) was kept at 280°C. Concentrations (% contents) of oil ingredient for Phlomis brachydon were determined using their relative area percentages obtained from GC chromatogram, assuming a unity response by all components.

4064

GC–MS analysis

Chemical analysis of the essential oils was carried out using gas chromatography–mass spectrometry (Agilent (Palo Alto, USA) 6890N gas chromatograph). The chromatographic conditions were as follows: column oven program, 60ºC (1 min, isothermal) to 246ºC (3 min, isothermal) at 3ºC/min, the injector and detector temperatures were 250ºC and 300ºC, respectively. Helium was the carrier gas (flow rate 0.90 ml/min) and the ionization voltage was maintained at 70 eV. A HP-5 MS capillary column (30 m × 0.25 mm i.d., 0.25 μm film thicknesses) was used. A hydrocarbon mixture of n-alkanes (C_8-C_{20}) was analyzed separately by GC-MS under same chromatographic conditions using the same HP-5 column. Kovats Retention Indexes (KRIs) were calculated by injection of a series of n-alkanes (C_8–C_{20}) in the same column and conditions as above for gas chromatography analyses.

Identification of the oil components were based on computer search using the library of mass spectral data and comparison of calculated Kovats retention index (KRI) with those of available authentic standards and literature data.

Maintenance and preparation of cultures

Six clinical isolates antibiotics resistant bacteria were used in this study. Three strains of Gram positive bacteria: Methicillin-resistant Staphylococcus aureus (MRSA), Staphylococcus epidermidis, and Bacillus subtilis, and three strains of Gram negative bacteria: Escherichia coli, Enterobacter aerogenes, and Pseudomonas aeruginosa, were studied. Isolates were purified on specific nutrient agar plates and characterized by standard microbiological and biochemical methods like Gram stain, catalase test, coagulase test and an API system (bioMerieux, France).

The bacteria were incubated at 37°C for 24 h by inoculation into broth. Inoculums (1 mL) per plate containing 10^6 cfu/mL were spread on Mueller Hinton agar (Oxoid, Hampshire, England).

Disc diffusion assay

The antibacterial activity of the Phlomis brachydon essential oil was determined by the disc diffusion method according to the National Committee for Clinical Laboratory Standards. Sterile paper discs of 6 mm in diameter were impregnated with 10 μL essential oil and deposited on the agar surface. Petri dishes were placed at 4°C for 2 h to facilitate the dissemination of extract on the culture medium followed by incubation at 37°C for 24 h. For each sample, negative water control and positive antibiotic disc (Oxoid, Hampshire, England) control were used. At the end of the period, inhibition zones formed on the medium were evaluated in mm. Studies were performed in triplicate in three independent experiments.

RESULTS AND DISCUSSION

Chemical composition of the essential oil

Hydrodistillation of the aerial parts of the Phlomis brachydon sample gave yellowish oil with a yield of 0.18%. The chemical composition of the oil was investigated using GC-MS techniques. The identified components of the essential oils, their percentages and retention indices are given in Table 1. Forty components accounting for 90.21% of the oil were identified with sesquiterpene hydrocarbons 60.32%, oxygenated sesquiterpenes 27.27%, and monoterpene hydrocarbons 2.62%. The major identified compounds were δ-cadinene 16.36%, γ-muurolene 12.76%, epi-alpha-cadinol 8.49%, 1-epi-cubenol 8.14%, 7-epi-alpha-selinene 5.4%, trans-muurola-4(14),5-diene 4.56%, and Ar-curcumene 3.52%. Other oil component included: germacrene D 2.43%, b-phellandrene 2.32%, himachalene epoxide 2.22%, β-curcumene 2.16%, cis-muurola-4(14),5-diene 2.08%, zonarene 1.82%, α-acorodiene 1.57%, khusinol 1.56%, E-Caryophyllene 1.36%, α-copaene 1.52%, epi-alpha-muurolol 1.15%, β-Bisabolol 1.14%, α-muurolol 1.06%, Cis-muurola-3,5-diene 1.04%, and β-boubonene 1.0%.

As stated earlier there has been no report on the essential oil constituents of Phlomis brachydon world wide. This study is the first to report on the essential oil constituents of Phlomis brachydon. However, there have been reports on other Phlomis species essential oil. Celik et al [12] reported on the essential oils of three species of Phlomis from Turkey, Phlomis leucophracta, Phlomis chimerae and Phlomis grandiflora var. grandiflora. They found the major constituents of P. leucophracta essential oil were β-caryophyllene (20.2%), α-pinene (19.2%) and limonene (11.0%). While for P. chimerae the principal compounds were β-caryophyllene (31.6%), α -pinene (11.0%), germacrene D (6.1%), limonene (5.5%) and linalool (4.7%). Finally in P. grandiflora var. grandiflora, the main constituents were germacrene D (45.4%), β-caryophyllene (22.8%) and bicyclogermacrene (4.9%). Demircia et al [13] reported that the major constituents of Phlomis linearis essential oil were β-caryophyllene (24.2%), germacrene D (22.3%) and caryophyllene oxide (9.2%).

The results of the present study show that Phlomis brachydon essential oil constituents are unique and different from other Phlomis species.

Antimicrobial activity

The results in Table 2 show the activity of Phlomis brachydon essential oil against some clinical antibiotic resistant bacteria. It can be seen that Phlomis brachydon essential oil has potent activity as compared to currently used antibiotics against MRSA, P. aeruginosa, B. subtilis, and S. epidermidis and a good activity against E. aerogenes and E. coli. The essential oil of Phlomis brachydon also showed potent activity towards the well-known antibiotics resistant MRSA and P. aeruginosa. Against MRSA the essential oil was found to be more active than vancomycin but less active than rifampicin. Against P. aeruginosa the essential oil showed greater activity than the antibiotics ceftazidime and cefotaxime.

The essential oil of Phlomis brachydon was more active against Gram positive bacteria than Gram negative bacteria. Generally, Gram-negative bacteria are more resistant to essential oil than Gram-positive bacteria due to difference in the structures of the cell walls [14]. About 90%–95% of the cell wall of Gram-positive bacteria consists of peptidoglycan. Essential oils are able to penetrate the cell wall of Gram-positive bacteria and destroy bacteria cell [15, 16].

In Gram-negative bacteria the peptidoglycan layer is covered by an outer membrane. The outer membrane is hydrophilic in nature; and this is the reason why it is relatively impermeable to hydrophobic substances like essential oil [16, 17, 18, 19]. Gram-positive bacteria do not have this outer membrane. Thus, the presence of this outer membrane is what makes Gram-negative bacteria more resistant to essential oil than Gram-positive bacteria. In addition, efflux systems pump in Gram-negative bacteria is a more complex so that more of the drug is pumped out of the cell thus making them more resistant to drugs than Gram-positive bacteria [2].

CONCLUSION

This study paper reports for the first time on the essential oil constituents of Phlomis brachydon grown in Jordan. The essential oil of Phlomis brachydon showed good activity against antibiotic resistant bacteria including MRSA and P. aeruginosa.

REFERENCES

1. Alanis AJ. Bacterial resistance to antibiotics: Active efflux and reduced uptake. Adv Drug Deliv Rev 2005;57:1486-1513.

4066

J M Al-Shuneigat *et al.*

2. Kumar A, Schweizer HP. Bacterial resistance to antibiotics: Active efflux and reduced uptake. Adv Drug Deliv Rev 2005;57:1486-1513.

3. Tongnuanchan P, Benjakul S. Essential Oils: Extraction, Bioactivities, and their uses for food preservation. J Food Sci 2014;79:1231-1249.

4. Abad MJ, Bedoya LM, Apaza L, Bermejo P. The Artemisia L. Genus: A Review of Bioactive Essential Oils. Molecules 2012;17:2542-2566.

5. Burt S. Essential oils: their antibacterial properties and potential applications in foods- a review. International Journal of Food Microbiology 2004;94:223-253.

6. Hyldgaard M, Mygind T, Meyer RL. Essential oils in food preservation: mode of action, synergies, and interactions with food matrix components. Front Microbiol 2012;3:1-24.

7. Cosentino S, Tuberoso CIG, Pisano B, Satta M, Mascia V, Arzedi E, et al. In-vitro antimicrobial activity and chemical composition of Sardinian Thymus essential oils. Lett Appl Microbiol 1999;29:130-135.

8. Stammati A, Bonsi P, Zucco F, Moezelaar R, Alakomi HL, von Wright A. Toxicity of selected plant volatiles in microbial and mammalian short-term assays. Food Chem Toxicol 1999;37:813-823.

9. Albaladejo RG, Aparicio A, Silvestre S. Variation patterns in the Phlomis · composita (Lamiaceae) hybrid complex in the Iberian Peninsula. Bot J Linn Soc 2004;145:97-108.

10. Calis I, Kırmızıbekmez H. Glycosides from Phlomis lunariifolia. Phytochemistry 2004;65:2619-2625.

11. Darwish RM, Aburjai TA. Effect of ethnomedicinal plants used in folklore medicine in Jordan as antibiotic resistant inhibitors on Escherichia coli. BMC Complement Altern Med 2010;10:1-8.

12. Celik S, Gokturk RS, Flamini G, Cioni PL, Morelli I. Essential oils of Phlomis leucophracta, Phlomis chimerae and Phlomis grandiflora var. grandiflora from Turkey. Biochem Syst Ecol 2005;33:617-623.

13. Demircia B, Dadandi MY, Paper DH, Franz G, Baser KHC. Chemical composition of the essential oil of Phlomis linearis Boiss. & Bal and biological effects on the CAM-Assay: a Safety evaluation. Z Naturforsch 2003;58:826-829.

14. Trombetta D, Castelli F, Sarpietro MG, Venuti V, Cristani M, Daniele C, et al. Mechanisms of antibacterial action of three monoterpenes. Antimicrob Agents Chemother 2005;49:2474-2478.

15. Kavanaugh NL, Ribbeck K. Selected Antimicrobial Essential Oils Eradicate Pseudomonas spp. and Staphylococcus aureus Biofilms. J Appl Environ Microbiol 2012;78:4057-4061.

16. Nikaido H. Molecular basis of bacterial outer membrane permeability revisited. Microbiol Mol Biol Rev 2003;67:593-656.

17. Nazzaro F, Fratianni F, De Martino L, Coppola R, De Feo V. Effect of essential oils on pathogenic bacteria. Pharmaceuticals 2013;6:1451-1474.

18. Gao Y, Van Belkum MJ, Stiles ME. The outer membrane of Gram negative bacteria inhibits antibacterial activity of brochocin-C. J Appl Environ Microbiol 1999;65:4329-4333.

19. Nikaido H. Prevention of drug access to bacterial targets: Permeability barriers and active efflux. Science 1994;264:382-388.

Table 1. Constituents (%) of the essential oil of *Phlomis brachydon* grown in Jordan.

t_R	KI	Compound	%A
7.463	988	myrcene	0.1
7.92	1003	α-phellandrene	0.1
8.589	1021	p-cymene	0.1
8.778	1026	b-phellandrene	2.32
21.974	1347	α-cubebene	0.56
23.072	1373	α-copaene	1.52
23.432	1382	β-boubonene	1.0
23.655	1388	iso-lonifolene	0.22
24.197	1400	isoitalicene	0.12
24.44	1406	α-gurjunene	0.2
24.832	1416	E-Caryophyllene	1.36
25.232	1425	β-cedrene	0.11
25.541	1433	cis-thujopsense	0.10
26.095	1447	Cis-muurola-3,5-diene	1.04
26.209	1450	α-humulene	0.32
26.655	1461	α-acorodiene	1.57
27.067	1471	cis-muurola-4(14),5-diene	2.08
27.398	1479	γ-muurolene	12.76
27.461	1481	Ar-curcumene	3.52
27.781	1488	germacrene D	2.43
27.958	1492	trans-muurola-4(14),5-diene	4.56
28.152	1498	α-muurolene	0.75
28.507	1507	β-bisabolene	0.36
28.65	1510	β-curcumene	2.16
28.735	1519	7-epi-alpha-selinene	5.4
29.136	1523	δ-cadinene	16.36
29.41	1530	zonarene	1.82
30.05	1546	silphiperfol-5-en-3-one B	0.25
31.187	1576	ar-turmero l	0.79
31.387	1581	gleenol	0.65
31.485	1583	himachalene epoxide	2.22
31.736	1590	*cis*-arteannuic alcohol	0.92
33.033	1625	1-epi-cubenol	8.14
33.571	1639	epi-alpha-cadinol	8.49
33.656	1641	epi-alpha-muurolol	1.15
33.959	1647	α-muurolol	1.06
34.554	1666	ar-turmerone	0.63
34.645	1668	β-Bisabolol	1.14
35.068	1680	khusinol	1.56
44.675	1970	Z-α-trans-bergamotol	0.27
		Total	90.21
		Monoterpene hydrocarbons	2.62
		Sesquiterpene hydrocarbons	60.32
		Oxygenated sesquiterpenes	27.27

Table 2. Antibacterial activity of *Phlomis brachydon* essential oil grown in Jordan.

Name of Bacteria used	Zone of inhibition of Phlomis brachydon essential oil in mm	Antibiotic used	Zone of inhibition by antibiotic in mm
MRSA	14±0.15	Vancomycin Rifampicin	5±0.15 16±0.19
P. aeruginosa	12±0.20	Ceftazidime Cefotaxime	6±0.10 10±0.14
E. aerogenes	13 ±0.16	Neomycin Nitrofurantoin	20±0.40 22±0.25
E. coli	9±0.14	Neomycin and Nitrofurantoin	12±0.29 16±0.15
B. subtilis	20±0.22	Vancomycin Chloramphenicol	20±0.45 26±0.21
S. epidermidis	13±0.24	Cefuroxime Cefotaxime	5±0.011 11±0. 17

RESEARCH ARTICLE

In Vitro Antibiofilm Effect of Ruta Graveolens Essential Oil

J M Al-Shuneigat[1]*, I N Al-Tarawneh[2], M A Al-Qudah[3], S A Al- Sarayreh[1] and Y M Al–Saraireh[4]

[1] Department of Biochemistry and Molecular Biology, Faculty of Medicine, Mutah University, Mutah, Jordan.
[2] Department of Chemistry, Faculty of Science, Albalqa' Applied University, Albalqa, Al-Salt, Jordan.
[3] Department of Chemistry, Faculty of Science, Yarmouk University, Irbid, Jordan.
[4] Department of Pharmacology, Faculty of Medicine, Mutah University, Mutah, Jordan.

*Address for correspondence
J M Al-Shuneigat
Department of Biochemistry and Molecular Biology,
Faculty of Medicine, Mutah University,
Mutah 61710, Jordan.
Phone: 962-3-2372380 ext: 3210,
Fax: 962-3-2397180,
Email: Dr.Jehad@mutah.edu.jo.

ABSTRACT

Microbial biofilms pose a challenge in clinical world as it causes untreatable and chronic infections. The hallmark of biofilm infections is extreme resistance to antibiotics and ability in evading the host defence mechanisms. Failure of antibiotic treatment in eradication of bacterial biofilm led researchers to look for alternatives. Essential oils are promising alternatives to antibiotic treatment. Many studies have reported that certain essential oils succeeded where antibiotics failed.

The aim of the present study was to determine the effects of essential oil of Ruta graveolens grown in north Jordan on biofilm-forming bacteria. Six bacterial clinical isolates were used in this study. The minimum inhibitory concentration (MIC) and biofilm inhibitory concentration (BIC) assays were performed in microtitre plates using a twofold dilution series. The most tolerant isolate were then used to test the effectiveness of Ruta graveolens essential oil in preventing initial adherence to polystyrene surface.

The results showed that the essential oil of Ruta graveolens produced inhibitory effects against all isolates with considerable variation in susceptibility. The MIC values were found to be in the range of 0.5-2 mg/mL while BIC values where between 0.5-8 mg/mL. In addition Ruta graveolens essential oil was able

to inhibit initial adherence in the most tolerant isolate (Pseudomonas aeruginosa) at sub-inhibitory concentrations.

Conclusions: Ruta graveolens essential oil showed a good activity against all isolates. It inhibited the initial adherence in the most tolerant isolate at sub-inhibitory concentrations.

Key words: essential oil, Ruta graveolens, resistant bacteria, biofilm.

INTRODUCTION

Bacterial biofilm is a group of bacteria that stick to each other and are attached to a surface. Bacteria in a biofilm form a protective matrix around their group made mainly of exopolysaccharide [1]. The biofilms can be formed from a single species, or from multiple microbial species. For bacteria, the advantages of biofilm formation lie in protection from the environment metabolic cooperation, and the gaining of new genetic traits [2].

Biofilm bacteria show extreme tolerance to antimicrobial agents with minimal inhibitory concentration (MIC) for antibiotics to biofilm-growing bacteria being about 100–1000 fold higher than of planktonic bacteria [3]. It is estimated that 65% of microbial infections are associated with biofilms [4].

Infections caused by biofilm including endocarditis, cystic fibrosis, and indwelling device-mediated infections are often untreatable and develop into a chronic state [4]. The hallmarks of chronic biofilm infections are extreme resistance to antibiotics and other conventional antimicrobial agents, and an extreme capacity for evading the host defenses [5].

The microbial resistance to antibiotics coupled with side effects of the existing drugs increase the need for new drugs that are structurally and functionally different from the currently used ones.

Essential oils derived from aromatic medicinal plants have been reported to exhibit excellent antimicrobial activity on different pathogens. The primary advantage of using plant-derived antimicrobials is that they are cheap, easily available, do not exhibit side effects and resistance to these plant-derived antimicrobials due to their multiple mechanisms of action [6].

Ruta graveolens is a plant used in traditional medicine with a variety of therapeutic effects.
It is used as analgesic, antipyretic, anti-inflammatory, in menstrual problems,
antispasmodic, anthelmintic and abortifacient, relief of rheumatic pain and mental disorders [7, 8, 9].
The aim of the present study was to determine the effects of essential oil of wild Ruta graveolens grown in Jordan on the growth of biofilm-forming bacterial clinical isolates.

MATERIALS AND METHODS

Essential oil of Ruta graveolens:

Fresh amount of the Ruta graveolens was collected from mountains of Qumeim, Irbid, north Jordan, before the flowering period. The plant materials were taxonomically identified and authenticated by the Botanical Survey of Yarmouk University.

The composition of the essential oil from Ruta graveolens was determined using gas chromatography-mass spectrometry (GC-MS). Thirty five components accounting for 98.1% of the oil were identified with ketones 43.02%, aldehydes 37.12%, esters 9.33% and sesquiterpene hydrocarbons 5.22% as being the major constituent. The major compounds identified were 2-nonanone 37.13%, undecanal 34.69%, 2-acetoxydodecane 5.0%, and 2-decanone 3.31% [10].

Cultures and media:

The effect of Ruta graveolens essential oil on bacterial biofilm formation was examined using six bacterial clinical isolates including: three strains of Gram positive bacteria: Methicillin-resistant Staphylococcus aureus (MRSA), Staphylococcus epidermidis, and Bacillus subtilis, and three strains of Gram negative bacteria: Escherichia coli, Enterobacter aerogenes, and Pseudomonas aeruginosa. These clinical isolates were isolated from human patients. Cultures were stored on tryptone soya agar (TSA) (Oxoid, Hampshire, UK) at 2-4ºC and subcultured every 2 months or whenever required. Isolates were purified on specific nutrient agar plates and characterized by standard microbiological and biochemical methods like Gram stain, catalase test, coagulase test and an API system (bioMerieux, France).

Biofilm formation and broth microdilution assays:

Biofilm formation was quantified in microtitre plates using the method described by Rachid et al [11]. Bacteria were grown overnight to mid-log phase by inoculating in 10 ml tryptone soya broth (TSB) and incubating at 37ºC until the OD at 600 nm (OD_{600}) reached approximately 0.6. Strains were then diluted in fresh TSB supplemented with 0.5% glucose to give cell density of approximately 10^6 cfu/mL. For each test strain 200 µl of inoculum was added to 72 wells of a 96-well plate. A quantity of 200 µl TSB was added to the remaining 24 wells and the plate incubated for 24 h at 37ºC. Following this the optical density at 600 nm (OD_{600}) was measured as an indication of bacterial growth, the plate contents emptied out and washed three times with phosphate-buffered saline (PBS) (Sigma Aldrich). The plates were air-dried and the cells that remained adhered to microwells stained with 0.4% crystal violet (Sigma Aldrich). Optical density at 490 nm (OD_{490}) nm was measured using microplate reader (Synergy™ HTX Multi-Mode Microplate Reader USA) to quantify the amount of crystal violet-stained biofilm. Each strain was assayed in triplicate.

Minimum inhibitory concentration (MIC) assay:

MIC was determined using 96 well microtitre plates as described by Rachid et al [11]. Serial two fold dilutions of Ruta graveolens essential oil in TSB were carried out in microtitre plates, 100µl of bacterial cells with density of approximately 10^6 cfu/mL were added to the wells, mixed and then incubated at 37ºC for 24 h aerobically. The MIC was read as the concentration of antibiotic that inhibited visible growth of the strain. The MIC for each antibiotic/strain was carried out in triplicate in three independent experiments. The positive control used for MRSA, Staphylococcus epidermidis, and Bacillus subtilis was vancomycin, for E. coli and Enterobacter aerogenes was chloramphenicol for P. aeruginosa was ceftazidime. The absorbance was measured at 600 nm as an indication of bacterial growth.

Biofilm inhibitory concentration (BIC) assay:

BIC was determined using 96 well microtitre plates as described by Rachid et al [11]. Serial two fold dilutions of Ruta graveolens essential oil in TSB were carried out in microtitre plates, 100 µl of the diluted bacterial cells were added to the wells, mixed and then incubated at 37ºC for 24 h aerobically. The wells were washed three times with PBS. The plates were dried using air, and the remaining surface-adsorbed cells of the individual well were stained with 0.1% (w/v) crystal violet. The wells were then washed three times with PBS and allowed to air-dry for 60 min. The crystal

violet-stained biofilm was solubilized using 95% (v/v) ethanol and the absorbance read at 490 nm. A well, with no cells and sterile TSB was used as blank (negative control), and a well with cells and TSB but without Ruta graveolens essential oil was used as a control. The positive control used for MRSA, MSSA, and S. epidermidis was vancomycin, for E. coli and K. pneumonia was chloramphenicol for P. aeruginosa was ceftazidime and finally for P. mirabilis was ampicillin. BIC was determined as the minimum concentration that caused 30% decrease in optical density. Assays were performed three times on different days for each individual strains and the same result was obtained on each occasion.

Adherence of bacterial cells to polystyrene:

Initial adherence of bacterial cells to polystyrene was determined using a previously reported method [12]. Briefly, bacteria were grown overnight in 10 ml TSB at 37⁰C and then diluted 1 : 100 in fresh TSB containing Ruta graveolens essential oil at the required concentration. A quantity of 5 ml of the bacterial suspensions were then poured into Petri dishes and incubated for 30 min at 37⁰C. The plates were washed five times using 5 ml PBS, air dried and stained for 1 min with 0.4% crystal violet. The number of adhered cells was determined microscopically (CETI 60243T UK) by counting the number of bacteria in 20 fields of view. The essential oil concentrations tested were 1/10 of MIC, 1/2 MIC, and the MIC concentration. Adherence was calculated as the total number of cells adhered per square centimetre examined. Each Ruta graveolens essential oil concentration was assayed in triplicate and the adherence of Ruta graveolens essential oil treated cells compared with untreated controls.

RESULTS

MIC and BIC:

Ruta graveolens essential oil produced inhibitory effects against all isolates but with considerable variation in susceptibility (Table 1). The MIC values were in the range of 0.5-2 mg/mL while the BIC values were in the range of 0.5-8 mg/mL. The most susceptible in planktonic growth were MRSA with an MIC value of 0.5 mg/mL. In biofilm the most susceptible were MRSA with MIC value of 0.50 mg/mL while the most resistant were P. aeruginosa with MIC value of 8 mg/mL. In general the BIC results were higher than MIC results.

In addition to the above there is a direct link between the concentration of Ruta graveolens essential oil and number of cells in a biofilm represented here by the optical density 490nm. As shown in Figure 1 the higher the concentrations of Ruta graveolens essential oil the lower the optical density at 490 nm (OD_{490}) nm. This confirms the effectiveness of Ruta graveolens essential oil on biofilm forming bacteria on all isolates used.

Inhibition of P. aeruginosa adherence to polystyrene by Ruta graveolens at sub-MIC levels:

P. aeruginosa was the most resistant in biofilm growth to Ruta graveolens essential oil. This is why P. aeruginosa was chosen to test the effect of sub-inhibitory concentrations (sub-MIC_{plank}) on its adherence to polystyrene. Adding sub-inhibitory concentrations (sub-MIC_{plank}) of Ruta graveolens to polystyrene Petri dishes containing a suspension culture of the P. aeruginosa strain reduced the number of individual cells adhering to the polystyrene surface after 30 minutes incubation period (Fig. 2).

DISCUSSION

Bacterial biofilms infections show high tolerance to antibiotics, disinfectant chemicals as well as body's defense system. Biofilms are responsible for a several chronic infections including formation of dental plaques, infections in cystic fibrosis, periodontitis, endocarditis, child middle-ear infections, urinary tract infections, indwelling devices

such as joint prosthesis & heart valves [13, 14]. With the failure of antibiotics to treat biofilms there is a need for alternatives. A possible alternative is plants derived essential oils. Essential oils have been shown to possess broad-range of antibacterial properties [15, 16].

According to our knowledge, the activity of essential oil of Ruta graveolens against biofilm has never been tested. In the present study Ruta graveolens essential oil was found to be active against all tested pathogens in both planktonic and biofilm. The most susceptible to Ruta graveolens essential oil were MRSA with an MIC value of 0.50 mg/mL for both plankonic and biofilm growth. MRSA is well known for its resistance to antibiotics. The mechanisms of action of the essential oils include the degradation of the cell wall, damage of the cytoplasmic membrane, cytoplasm coagulation, damage to membrane proteins, increased permeability leading to leakage of the cell contents, reduction in the intracellular ATP pool via decreased ATP synthesis. The hydrophobic nature of essential oils allows them to penetrate into microbial cells and cause alterations in its structure and functionality [17, 18]. It appears that Ruta graveolens essential oil was able to overcome the resistance mechanisms of this pathogen. Essential oils, unlike antibiotics that has only have a single target site, are complex mixtures of a wide diversity of components so that they are endowed with different mechanisms of action enabling them to overcome microbial resistance [19].

The most resistant biofilm growth was P. aeruginosa with BIC value of 8 mg/mL. P. aeruginosa causes cystic fibrosis (CF), acute and chronic lung infections that cause lung tissue damage that may lead to death [20]. Low antibiotic penetration, increased frequency of mutations, nutrient limitation and slow growth, adaptive stress responses, formation of persister cells beside up-regulated efflux pumps, and mutations of antibiotic target molecules in the bacteria are thought to be behind high resistant of biofilm to antibiotic [21]. The results of the present study agree with those of Kavanaugh and Ribbeck [22]. They reported that some essential oils were able to eradicate Pseudomonas spp. and Staphylococcus aureus biofilms with higher efficiency than important antibiotics in use, making them interesting candidates for the treatment of biofilms. Essential oils were effectively able to penetrate and kill biofilm.

Ruta graveolens essential oil was able to inhibit Pseudomonas aeruginosa adherence to polystyrene at subinhibitory level. Essential oils and their components have activity against a variety of targets, particularly the membrane and cytoplasm [17]. It is believed that the subinhibitory level of Ruta graveolens essential oil that did not cause killing of the microorganism might have caused damage and changes to Pseudomonas aeruginosa cell membrane and prevented it from adhering to the polystyrene surface.

CONCLUSION

In conclusion, the present study has demonstrated the antimicrobial efficacy of Ruta graveolens essential oil against six bacterial clinical isolates in vitro. Ruta graveolens essential oil shows a good antimicrobial activity against all tested clinical isolates. In addition Ruta graveolens essential oil is able to inhibit initial adherence in the most tolerant isolate (P. aeruginosa) at subinhibitory concentrations.

REFERENCES

1. Garrett TR, Bhakoo M, Zhang Z. Bacterial adhesion and biofilms on surfaces. Prog Nat Sci 2008;18:1049-1056.
2. Davey ME, O'Toole GA. Microbial biofilms: From ecology to molecular genetics. Microbiol Mol Biol Rev 2000;64:847-867.
3. Mah TFC, O'Toole GA. Mechanisms of biofilm resistance to antimicrobial agents. Trends Microbiol 2001;9:34-39.
4. Costerton JW, Stewart PS, Greenberg EP. Bacterial biofilms: a common cause of persistent infections. Science 1999;284:1318-1322.
5. Bjarnsholt T. The role of bacterial biofilms in chronic infections. APMIS 2013;121:1-51.

6. Burt S. "Essential oils: their antibacterial properties and potential applications in foods-a review". Int J Food Microbiol 2004;94:223-253.

7. Ciganda C, Laborde A. Herbal infusions used for induced abortion. J Toxicol Clin Toxicol 2003;41:235-239

8. Iauk L, Mangano K, Rapisarda A, Ragusa S, Maiolino L, Musumeci R, et al. Protection against murine endotexemia by treatment with Ruta chalepensis L., a plant with anti-inflammatory properties. J. of Ethnopharm 2004;90:267-72.

9. Shehadeh MB, Afifi FU, Abu-Hamdah SM. Platelet Aggregation Inhibitors from Aerial Parts of Ruta Chalepensis Grown in Jordan. Integr Med Insights 2007; 2:35-39.

10. Al-Shuneigat J, Al-Tarawneh I, Al-Qudah M, Al- Sarayreh S, Al–Saraireh Y. Chemical composition and antibacterial properties of Ruta graveolens L. essential oils grown in Jordan. Jordan Journal of Biological Sciences 2015 (In press).

11. Rachid S, Ohlsen K, Witte W, Hacker J, Ziebuhr W. Effect of subinhibitory antibiotic concentrations on polysaccharide intercellular adhesion expression in biofilm-forming Staphylococcus epidermidis. Antimicrob Agents Chemother 2000;44:3357-3363.

12. Heilmann C, Gerke C, Premington FP, Gotz F. Characterization of Tn917 insertion mutant of Staphylococcus epidermidis affected in biofilm formation. Infect Immun 1996;64:277-282.

13. Abdel-Aziz SM, Aeron A. Bacterial Biofilm: Dispersal and Inhibition Strategies. SAJ Biotechnol 2014;1:105-115.

14. Parsek MR, Singh PK. Bacterial biofilm: An emerging link to disease pathogenesis. Ann Rev Microbiol 2003;57:677-701.

15. Hyldgaard M, Mygind T, Meyer RL. Essential oils in food preservation: mode of action, synergies, and interactions with food matrix components. Frontiers in Microbiology Antimicrobials, Resistance and Chemotherapy 2012;3:1-24.

16. Oussalah M, Caillet S, Saucier L, Lacroix M. Inhibitory effects of selected plant essential oils on the growth of four pathogenic bacteria: E. coli O157:H7, Salmonella typhimurium, Staphylococcus aureus and Listeri amonocytogenes. Food Control 2007;18:414-420.

17. Nazzaro F, Fratianni F, De Martino L, Coppola R, De Feo V. Effect of essential oils on pathogenic bacteria. Pharmaceuticals 2013;6:1451-1474.

18. Bajpai VK, Sharma A, Baek KH. Antibacterial mode of action of the essential oil obtained from Chamaecyparis obtusa sawdust on the membrane integrity of selected foodborne pathogens. Food Technol Biotechnol 2014;52:109-118.

19. Yap PSX, Yiap BC, Ping HC, Lim SHE. Essential Oils, A new horizon in combating bacterial antibiotic resistance. Open Microbiol J 2014;8:6-14.

20. Høiby N, Ciofu O, Bjarnsholt T. Pseudomonas aeruginosa biofilms in cystic fibrosis. Future Microbiol 2010;5:1663-1674.

21. Harmsen M, Yang L, Pamp SJ, Tolker-Nielsen T. An update on Pseudomonas aeruginosa biofilm formation, tolerance, and dispersal. FEMS Immunol Med Microbiol 2010;59:253-268.

22. Kavanaugh NL, Ribbeck K. Selected Antimicrobial Essential Oils Eradicate Pseudomonas spp. and Staphylococcus aureus Biofilms. J Appl Environ Microbiol 2012;78:4057-4061.

J M Al-Shuneigat *et al.*
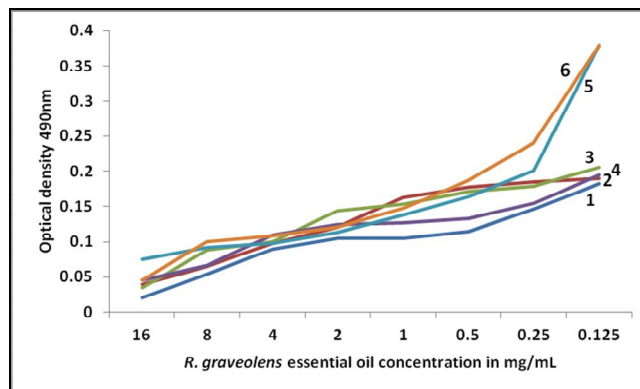
Fig. 1: The relationship between increasing Ruta graveolens concentrations and optical density 490nm for isolates 1, 2, 3, 4, 5, and 6.
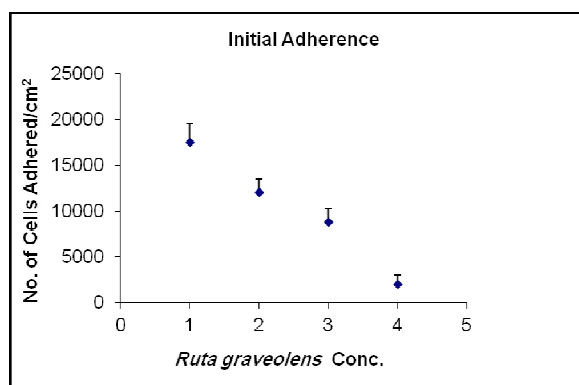
Fig 2. Effect of Ruta graveolens on initial adhesion; 1: without EO, 2: 1/10×MIC 3: 1/2×MIC, 4: MIC.

Table 1. MIC and BIC of Ruta graveolens (mg/mL) for the bacterial isolates.

Isolate Number	Isolate name	MIC_{plank} %v/v	$BIC_{biofilm}$ %v/v
1	MRSA	0.50	0.50
2	P. aeruginosa	2	8
3	E. aerogenes	2	2
4	E. coli	2	2
5	B. subtilis	1	1
6	S. epidermidis	1	2

RESEARCH ARTICLE

Presenting a Fuzzy Model for Inventory Control Using MATLAB Graphical User Interfaces (GUI) (Case study: Sistan cement factory)

Seyed farshad forghani[1] and Mohammad Masoud Azhdari Moghaddam[2*]

[1]Department of Industrial Engineering, Faculty of Engineering, Islamic Azad university, Zahedan branch, Zahedan, Iran. (seyedfarshadforghani@gmail.com)
[2]Department of Industrial Engineering, Faculty of Engineering, Islamic Azad university, Zahedan branch, Zahedan, Iran. (mohammadazhdary@yahoo.com)

*Address for correspondence
Mohammad Masoud Azhdari Moghaddam
Department of Industrial Engineering,
Faculty of Engineering, Islamic Azad university,
Zahedan branch, Zahedan, Iran.
Email: mohammadazhdary@yahoo.com

ABSTRACT

Complexities of most theories in terms of inventory control have led lack of its application in a considerable number of organizations. Expert Systems, presented in this model aims to link this gap between theorists and experts. Since recommended architecture system is general, ordering it for various inventory-control issues with complex spaces is possible. One ES based on fuzzy law was used in this case study to support managers in management section for decision making in terms of amount of order and time or order. An individual newly employed in an organization faces lack of experience and these systems can help such individuals to take advantage of experts` experience. Furthermore, existing such systems help maintain experiences of retired people or ones who have left the organization with any reasons. Experts usually make decision and judge according to evidence, documents, qualitative information, and their experiences using mostly verbal words. In this research, taking advantage of fuzzy logic and fuzzy Expert System, one fuzzy ES has been presented to solve the mentioned issue determining the amount and time of order applying Mamdani inference method and input fuzzification, output defizzification.

Key words: Inventory control, Fuzzy, MATLAB GUI

Mohammad Masoud Azhdari Moghaddam

INTRODUCTION

Most organizations involved with inventory management face decision making for thousands of items. These items are different in a noticeable number of key specifications such as cost, demand pattern, time of implementing by providers, number of stock points in organization, and the effect of inventory policies on other issues. These factors impact operational inventory policies noticeably. These optimum policies require them to be analyzed and put in accurate mathematical formulas. This modeling knowledge lies in the experts of this field like Operational Research analysts which is in relation with mathematical aspects of inventory theory. [11]

Mangers are always facing frequent number of challenges such as guaranteeing accessibility to sufficient commodities or materials, identifying too fast and slow, providing accurate and timely reports to executives, and applying the lowest resources to reach the goals. Since decision makers of inventory control lack satisfaction level in this theory to along with optimum solution, simple models are replaced with actual ones. This issue is normally presenting a non-optimum solution leading to costly inventory control and it limits organization`s profit.

The aim of this research is to reduce the gap between theory and action in terms on inventory control. To achieve this goal, we intend to design and implement one artificial expert system for inventory control. This ES can be used by any given inventory-control manager seeking to make informed decisions without complexities and detailed theories of inventory control. Users can simply consult with ES for advice. Presented pieces of advice will be based on optimum solution and unnecessary compromise will not be made. ES includes all skills of analyst`s operational research as well as innovations being used by successful mangers of inventory control. In other words, the basis of knowledge for ES includes a basic model enjoying various models used in inventory control as well as ruling rules for justifications of such models. ES is not only a mathematical model but it also contains reasoning knowledge to select the most appropriate models for definite conditions of the issue. Conceptual designing of ES is based on propositional calculus and separation principle. Using propositional calculus in this field enjoys a substantial number of advantages. Their brevity, absences of ambiguity and conformity with other existing artificial- intelligence tools have high importance for us. Separation principle is a method for inference of propositional calculus. [11]

The theory of fuzzy set was formed by Dr. Lotfizadeh in 1962 with the supposition that traditional techniques of system analysis, when the relationship between the variables is too complicated, are not helpful. Such complications are common in different sciences of biology, economics, psychology, linguistics, and many others. A common point which can be found in all of them and which makes them related to each other is that the reality in them is inexact, ambiguous, and unspecific. [10] The meaning of fuzzy systems is a reflection of this reality. It is a reflection shared in the formation of the theories which are capable of modeling in the world of inexact and unspecific reality. Most of the primary applications of the theory of fuzzy set or fuzzy logic dealt with languages, theory of automation, learning systems. However, in 1970s, the concepts of language variables and fuzzy rules (if…, then…) paved the way for many other applications, especially in the field of "control". Nowadays, "control" is regarded as the higher application of fuzzy logic, and inventory control is considered as one of the applicable subjects in this regard. [7, 14, 19]

The expense of storage is among the main concerns of production managers. [2, 6] Different classic models of inventory control have been made to minimize storage expense. The aim of such models is to keep the stocks required for production without being obliged to pay for the extra expenses of storage. [25] Optimality of product is a fulfillment of market's demand. The main issue of inventory control management is taking a decision on the time when new stocks should be ordered and on the amount of stocks to be kept in stores in such a way that storage expense is kept at its lowest level. [2] This is a thorny and complicated organizational issue. Unfortunately, current classic mathematical models might come to a result which is totally different from the real conditions. [22] A suitable alternative for such models is a fuzzy model, which has been the point of discussion in this article. The goal of such a model is not directly lessening the expenses, but it aims at maintaining a consistent level of inventory which fulfills

Mohammad Masoud Azhdari Moghaddam

the market's demand in a specific time by taking advantage of the involved managers' experiences and knowledge. Managers' experiences are collected in some rules in the form of (If …, then…), and these rules are changed into a matrix of R. This matrix will be then a criterion for our inventory control. Based on this matrix, a software program with the G.U.I of MATLAB has been made, which does the task of inventory control in a more scientific and realer way. [17, 27]

Research Literature and Methodology

Production planning and inventory control

Production Planning and Inventory Control (or commonly abbreviated as PPIC) is part of the production and inventory management activities. The purposes of PPIC activities is to perform production and inventory planning in utilizing resources effectively and carry out production and inventory control by making adjustment between the plan that has been made and the daily production activities. The problems that must be faced in the PPIC include: what adjustments, how many, when, who and how the adjustments should be done. [5]

PPIC scope of activities begins with the demand management followed by planning quantity of production based on demand as well as considering the production capacity with economical production costs. The PPIC activities then proceed with planning and controlling the inventory of raw materials and finished products to meet production needs, which can minimize inventory costs as well as make span scheduling for timely delivery of finished products to meet the customer's needs. In general, the main sub functions in PPIC activities include: Demand Management, Master Production Scheduling, and Material Requirements Planning, Scheduling and Distribution Requirements planning that can represent the company's scope of PPIC activities. [5]

Expert Systems

An ES is a computer system, which contains a well-organized body of knowledge that imitates expert's problem-solving skills to solve complex decision problems in a specific domain. An ES is not based on black-box formulation and it is easier for users to understand its structure. By using ES technology, it becomes possible to obtain more realistic, flexible and practical solutions to the evaluation and portfolio construction problem. In addition, an ES reduce the time required by portfolio managers for decision-making, and standardize the decision making process. Consequently, the quality of the decision can be improved. The readers who are interested in ES applications in finance may refer to. [3, 20, 23] Due to the characteristics of the problem handled in this study, a fuzzy rule-based ES is considered as an appropriate solution approach. The number of studies that use rule-based ESs in portfolio management is scarce. The ES applications in portfolio management are introduced in the following. The earliest study in this domain is the development of Port- Man [8, 25] that is an ES for portfolio management in banking system. The main goal of this ES is to give advices to personal investment in a bank. In general, the consultation process of Port-Man is consisted of four stages; information acquisition, product selection, choice refinement and explanation. [3] In Port-Man, frames are the major components of knowledge representation, while production rules are used to represent the control knowledge of product selection. Rules are used to guide the system selection of the investment products and are attached to various slots in the frames. Hence, the control becomes modular and local to the frames. [20, 25]

Fuzzy expert systems

Most of world knowledge is inaccurate and uncertain. While facing such situations, fuzzy approach seems the most appropriate solution. [9, 25] In recent years, a considerable number of researches have been conducted on fuzzy approach in that, from 1965 tom 2011, more than 7000 researches, reports, thesis, and books were published about

Mohammad Masoud Azhdari Moghaddam

fuzzy logic and its applications in fields such as production management, financial forecasts, marketing researches, product development, supply chain management, quality and cost-and-profit analysis. [15]

Rules need to be defined for inference in that these rules link input and output variables and are defined in the form of "if….then….." [1] According to general nature of fuzzy logic rules, definition methods of fuzzy logic are a different alternative applied for reflecting knowledge in fuzzy systems. [16] In this research, standard form of fuzzy of Mamdani method rules have been used which are the defaults of MATLAB software in fuzzy section.

Expert systems relying on inference from fuzzy logic are called fuzzy expert systems Baraldi et al). Fuzzy expert systems are expert systems simply using a collection of membership functions and fuzzy rules instead of Boolean rules to infer from data. [21]

Generally, a fuzzy expert system is made up of five sections [4]:

1. Fuzzifier: It links input numbers to a degree of verbal.
2. Dictionary: the membership functions of fuzzy collections used in rules are defined.
3. Rule base: Fuzzy "if-then" rules along with the dictionary form fuzzy knowledge data base.
4. Decision maker: implements inference operation on rules.
5. Defuzzifier: The results of fuzzy inferences are converted in to numbers.

Generally, four fuzzifiers are used including:
Triangular fuzzifier, Trapezoid fuzzifier, Gaussian fuzzifier, and single fuzzifier. In this research, Trapezoid fuzzifier is used. [12]

There are different defuzzification methods including center of gravity, maximum mean method, zone bisector, and smallest maximum and biggest maximum.

The most common fuzzification method is called center of gravity which is based on center of gravity of a flat surface. This method is illustrated in equation (1). [1]

In this research, center of gravity defuzzification method is used. This has something to do with the fact that it is valid and frequently-used method providing a balanced and harmonic approach. [24]

$$z^* = \frac{\int_a^b \mu(z).zdz}{\int_a^b \mu(z).dz} \tag{1}$$

Mamdani inference method

In this algorithm, it called minimum-maximum or Mamdani. The abbreviation is as following. Rules for Mamdani inference method is according to the following equation. Assume that input fuzzy is X=A, then

Calculation of mentioned research degree through the following equation

$$B_i = \max_x \left[\mu_A(X) \wedge \mu_{Ai}(X) \right] \tag{2}$$

Calculation of output of fizzy collection

$$B_i' : \mu_{B_i}(y) = B_i \wedge \mu_{B_i}(y), \; y \in Y, 1 \le i \le k \tag{3}$$

4080

Mohammad Masoud Azhdari Moghaddam

Integrating outputs of fuzzy collections

$$B_i^{'} : \mu_{B_i}(y) = \max\ _{\max\ 1 \le i \le k}\ \mu_{B_i}(y),\ y \in Y \qquad (4)$$

Research Implementation

According to above explanations, we, in this research, intend to present a fuzzy expert system using graphical section of MATALB software for inventory control of warehouse of Sistan cement factory.

More than a hundred types of raw materials and tools exist in warehouse of a cement factory. In this research, we try to study more important items and vital ones for the factory. More effective variables are inserted in the model. After determination of variables and commodities in the field of inventory control, fuzzy rule base needs to be formed in order to enter the experiences of expertise and engineers in to the mentioned system. Only some items are pointed out due to frequent number.

As it was mentioned, experiences of expertise and engineers are entered in to system in the form of fuzzy rules. In this research, we created the graphical section of MATALB software. Figure (4) shows this system in MATLAB software. Now, in this system, we can obtain information output based on formed rule base through entering date at the stage of decision making.

CONCLUSION

Complexities of most theories in terms of inventory control have led lack of its application in a considerable number of organizations. Expert System (ES) presented in this model aims to link this gap between theorists and experts. Since recommended architecture system is general, ordering it for various inventory-control issues with complex spaces is possible. One ES based on fuzzy law was used in this case study top support managers in management section for decision making in terms of amount of order and time or order. An individual newly employed in an organization faces lack of experience and these systems can help such individuals to take advantage of experts` experience. Furthermore, existing such systems help maintain experiences of retired people or ones who have left the organization with any reasons

REFERENCES

1. Asmuni, Hishammuddin Bin. Fuzzy Methodologies for Automated University Timetabling Solution Construction and Evaluation, thesis of Doctor of Philosophy, University of Nottingham. 2008.
2. Axsater. S, Inventory Control, Springer -Verlag, New York, LLC, Write a Review. 2006
3. Bahrammirzaee, A. A comparative survey of artificial intelligence applications in finance. Artificial neural networks, expert system, and hybrid intelligent systems. Neural Computing & Applications, 2010, 19, 1165–1195
4. Baraldia, P., Librizzia, M., Zioa, E., Podofillinib, L., Dangb, V.N. Two techniques of sensitivity and uncertainty analysis of fuzzy expert systems, Expert Systems with Applications, Volume 36, Issue 10, Pages, 2009, 12461–12471.
5. Bedworth, David D. and Bailey, James E, Integrated Production Control Systems : Management, Analysis, Design 2/E. Canada. John Wiley & Sons, Inc, 1987.
6. Bragg. S.M, Inventory Best Practices (Wiley Best Practices), Wiley, 2004.
7. Buckley J.J, Eslami. E, an Introduction to Fuzzy Logic and Fuzzy Sets (Advances in Soft Computing), Physica-Verlag Heidelberg, 1 edition, 2002.

Mohammad Masoud Azhdari Moghaddam

8.　Chan, Y. Y., Dillon, T. S., & Saw, E. G. Port-man – An expert system of portfolio management in banks. In L. F. Pau (Ed.), Expert systems in economics, banking and management, 1989 (pp. 87–96).

9.　Chang, D.-Y. Extent Analysis and Synthetic Decision Optimization Technology and Applications, World Scientific, Singapore, 1992, 1, 352.

10.　Di Nola. A, Sessa. S, Pedrycz. W, Sanchez. E, Fuzzy Relations and their Applications to knowledge Engineering, Kluwer Academic Publishers, Dordrecht, Boston, London, 1989.

11.　Diptendu sinha, nasir ghiaseddin, khalil matta, expert system for inventory management_ computer sind engng, 1989, vol 17 nos 1_4 pp 425-429

12.　Djam, X.Y. and Kimbi, Y. H. A Decision Support System for Tuberculosis Diagnosis. The Pacific Journal of Science and Technology, 2011, 12 (2): 410-425.

13.　Iveline Anne Marie, Eriyatno, Yandra Arkeman, Dadan Umar Daihani, Model Design of Adaptive Production Planning and Inventory Control (PPIC) in the Food Industry Asian Transactions on Engineering, 2011, Volume 01 Issue 04, ATE ISSN: 2221-4267

14.　Kosko. B, Fuzzy Thinking: The New Science of Fuzzy Logic, Hyperion, 1994.

15.　Lin, L.Z., Hsu, T.H. A modular fuzzy inference system approach in integrating qualitative and quantitative analysis of store image.Qual Quant DOI, 2011, 10.1007/s11135-011-9561-7.

16.　Mamdani, E.H. and Assilian, S, An Experiment in Linguistic Synthesis with a Fuzzy Logic Controller. International Journal of Man-Machine Studies, 1975, 7 (1): 1–13.

17.　McNeill. D, Fuzzy Logic: The Revolutionary Computer Technology That Is Changing Our World (Paperback), Simon & Schuster, 1994.

18.　Mualla Gonca Yunusoglu, Hasan Selim, A fuzzy rule based expert system for stock evaluation and portfolio construction: An application to Istanbul Stock Exchange   Expert Systems with Applications, 2013, 40 908–920

19.　Mukaidono. M, Fuzzy Logic for Beginners (Paperback), World Scientific Publishing Company, 2001.

20.　Nedovic´, L., & Devedzˇic´, V, Expert systems in finance – A cross-section of the field. Expert Systems with Applications, 2002, 23(1), 49–66.

21.　Nosratabadi, H.E., Pourdarab, S., Abbasian, M, Evaluation of Science and Technology Parks by using Fuzzy Expert System, The Journal of Mathematics and Computer Science, 2011, 2 (4): 594-606.

22.　Piasecki. D.J, Inventory Accuracy: People, Processes, &Technology, Ops Pub, 2003.

23.　Rada, R, Expert systems and evolutionary computing for financial investing: A review. Expert Systems with Applications ,2008, 34(4), 2232–2240.

24.　Ross, T.J, Fuzzy Logic with Engineering Application, John Wiley & Sons., Ltd, The Atrium, Southern Gate, Chichester, West Sussex, P019 8SQ, United Kingdom, 2005.

25.　Waters. D, Inventory Control and Management (Paperback), Wiley, 2002.

26.　Yunusoglu Mualla Gonca, Selim Hasan, A fuzzy rule based expert system for stock evaluation and portfolio construction: An application to Istanbul Stock Exchange, Expert Systems with Applications, 2013, 40 908–920. 27.Zhang. R, Phillis, Yannis. A, Kouikoglou, Vassilis. S, Fuzzy Control of Queuing Systems, Springer; 1 edition, 2004.

Mohammad Masoud Azhdari Moghaddam
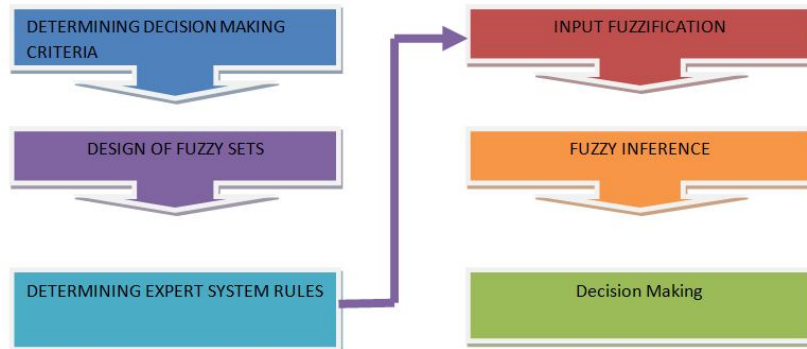
Figure (1) Expert System and Decision Making
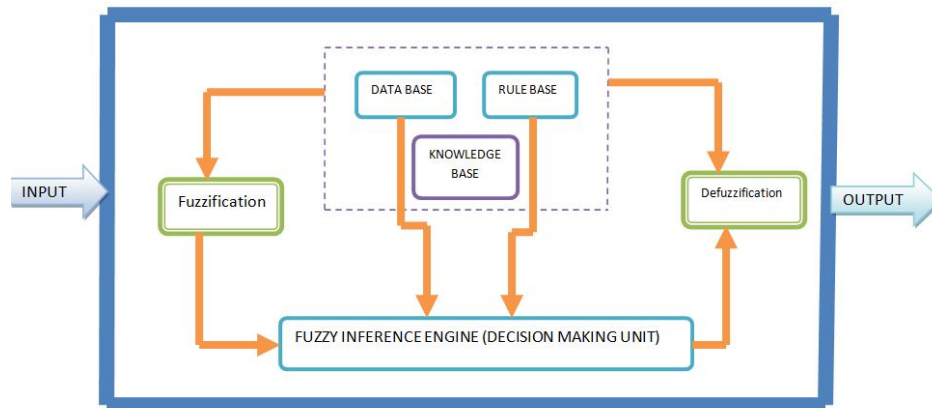
Figure (2): general design and maim steps of fuzzy inference system
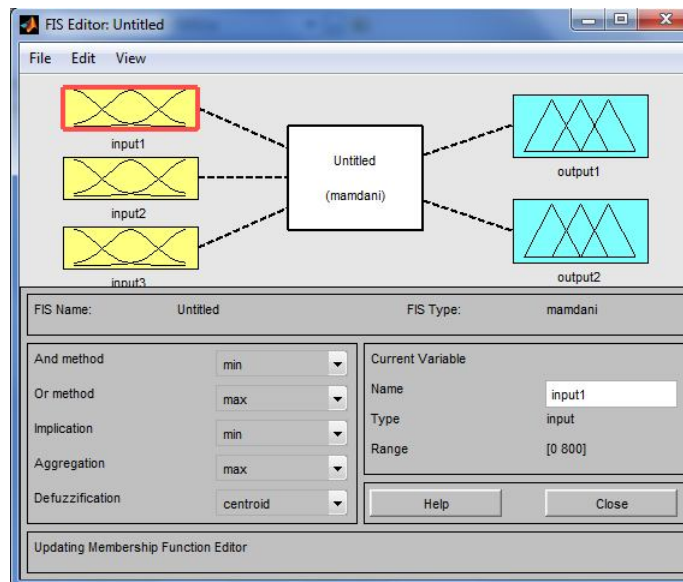
Figure (3) General information input of fuzzy inference system
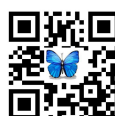
Mohammad Masoud Azhdari Moghaddam

Table (1): System variables of inventory control

Number	Variable Name	Symbol	Type
1	Inventory	I	INPUT
2	Market economy status	E	INPUT
3	Speed of the production line	S	INPUT
4	Order quantity	Q	OUTPUT
5	Order time	T	OUTPUT

Table (2) Fuzzy rules

rule 1	I is low, and, E is good, and, S is high, THEN Q is high, or, T is low
rule 2	I is very low, and, E is good, and, S is high, THEN Q is very high, and, T is low
rule 3	I is medium, and, E is good, and, S is high, THEN Q is medium, and, T is low
rule 4	I is very low, and, E is medium, and, S is high, THEN Q is very high, and, T is low
rule 5	I is very low, and, E is bad, and, S is high, THEN Q is very high, and, T is low
rule 6	I is low, and, E is very bad, and, S is high, THEN Q is very high, and, T is medium
rule7	I is high, and, E is very bad, and, S is medium, THEN Q is very high, and, T is very high
rule 8	I is medium, and, E is medium, and, S is very high, THEN Q is high, and, T is medium
rule 9	I is low, and, E is good, and, S is high, THEN Q is high, and, T is low
rule 10	I is very low, and, E is very bad, and, S is very high, THEN Q is very high, and, T is very low
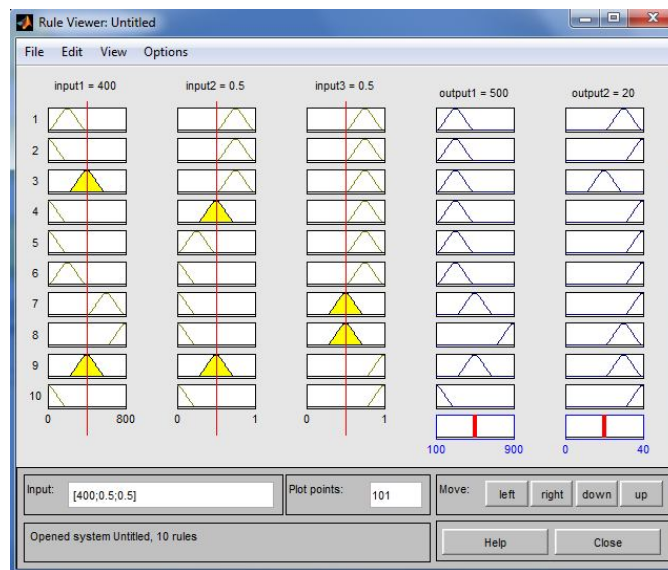
Figure (4) Creation system in graphical section of MATALB

RESEARCH ARTICLE

The Relationship between Intellectual Capital and Productivity of Private Sector Business Organizations (Hamedan Province)

Ali Sohrabi[1] and Mahmoud Firouzian[2]*

[1]Department of Agricultural Management, Sanandaj Branch, Islamic Azad University, Sanandaj, Iran.
[2]International Aras Campus, University of Tehran, Iran.

*Address for correspondence
Mahmoud Firouzian
International Aras Campus,
University of Tehran,
Iran.

ABSTRACT

Intellectual capital is an interdisciplinary subject that has been increasingly regarded by experts in various fields of science, especially in the field of management and economics in recent years. In the meantime, organizations such as business organizations can improve their effectiveness and efficiency by creating, strengthening and extending these intangible, yet valuable, assets. Hence, the purpose of this study is to evaluate the effects of intellectual capital on productivity in private business organizations of Hamedan province. The methodology is descriptive and correlational. The studied group includes 232 managers (general, export and marketing) of business organizations in Hamedan province. A random stratified sampling is used. Data is collected by two questionnaires measuring intellectual capital and productivity. The results indicate a significant positive relationship between structural, cognitive and relational dimensions and productivity in private business organizations of Hamedan.

Key words: intellectual capital, human, structural, relational, productivity

INTRODUCTION

The introduction of intellectual capital in development of organizations gave birth a new economic knowledge called as knowledge-based economy. Knowledge-based economy is an economy in which knowledge production and its application play a decisive role in creation of wealth. In such an environment, intellectual capital and intangible assets are an important factor for success. Many companies today are engaged in a complex business environment which requires higher performance, effectiveness and competitiveness based on innovation and competition. Due to the rapid advancement of technology and the changing economic environment, the creation of knowledge

management and intellectual capital is essential for improving corporate performance. The problem of this study is effectiveness of intellectual capital on organizational productivity. This means that intellectual capital has a significant influence on productivity and organizational performance. Development of intellectual capital associated with learning and productivity in organizations is symmetrical with economic development. Many companies have neglected the value of intellectual capital. Meanwhile, research shows that organizations which had instituted intellectual capital have currently achieved remarkable success and have a greater share of the market. The correlations of this research have been less addressed. This study addresses the relationship between intellectual capital and organizational learning and organizational productivity in business organizations of Hamedan province and explains the role of each components of intellectual capital in relation to the productivity of organizations. The purpose of this study is to determine the relationship between intellectual capital and productivity in the business organizations of Hamedan province.

LITERATURE REVIEW

Intellectual Capital

The concept of intellectual capital has always been vague and varying definitions have been used to interpret the concept. Many tend to use terms such as assets, resources or incentives of performance rather than the word capital; they replace the term intellectual by words such as intangible, knowledge-based or non-financial. Some professions (financial accounting and legal professions) have presented different definitions, such as non-financial fixed assets, which are not objective and physical entities.

Stewart believes that intellectual capital is a set of knowledge, information, intellectual property, experience, competition and organizational learning which can be used to create wealth. In fact, intellectual capital involves staff, organizational knowledge and its ability to create added value and causes the continuous competitive advantage (Qelichli & Moshabaki, 2006). Bnteis defines intellectual capital as a collection of intangible assets (resources, capabilities, and competition) obtained from organizational performance and creation of value (Qelichli & Moshabaki, 2006). Edvison et al define intellectual capital as knowledge applied to work in order to create value (Beigi, 2007).

Bnteis and Holland (2002) define intellectual capital as a reservoir of knowledge at a particular point in time. The definition considers the relationship between intellectual capital and organizational learning (Dastgir & Mohamadi, 2009). Reviewing the literature of intellectual capital, most models seem to consider three components of intellectual capital with some common features.

Human Capital

Human capital is one of the most important knowledge or intellectual assets of the organization, because this property is the source of creativity. This type of asset is the tacit knowledge of individuals within an organization as one of the critical factors influencing the performance of an organization. However, note that these knowledge assets alone are not sufficient to achieve performance. The goal should be to convert these tacit knowledge assets into explicit knowledge for all levels of organization. Otherwise, it is not possible to create organizational value. Human capital is a composition of general and professional knowledge, leadership skills, problem solving abilities and risk taking. Clearly, it is very difficult to measure this kind of capital by these components. This type of capital promotes operational innovation of tangible assets (equipment) and enables intangible assets. The successful companies invest on their employees in order to improve vision, abilities and experiences to compete in modern changing environment. It is important to add that businesses do not own this type of capital. Leaving staff leads to the loss of

4086

Ali Sohrabi and Mahmoud Firouzian

organizational memory which is a threat to the organization (Fotros & Beigi, 2009). Experience has shown that increased capabilities of employees has a direct effect on financial results. In addition, there is a direct relationship between human capital and performance.

Relational Capital

Relational capital (customer) is the sum of all assets which organize and manage the relationship between organization and the environment. This capital involves the relationship between organization and its customers, shareholders, suppliers, competitors, government, public institutions and society. Although the most important part of relational capital is customer relations, they are not the only thing to consider. This relational capital is in fact a reflection of the organization. Relational capital measurement is related to the fact that how environment understands the organization. Relational capital includes brands, scales of customer loyalty, reputation of the organization and suppliers and customer feedback systems.

In a value chain, organizations are committed to communicate with all sectors of the environment ranging from customer to the supplier. Research has shown that market directly influences the profitability rate and increases the market share.

Customer capital involves the present and future value of relationships with customers; it indicates potentials of an organization due to the external unknowns. Market capital refers to competence of an organization for management and integration of foreign relations with external stakeholders (Talebi, et al., 2013).

Organizational Capital

Organizational capital is defined as structural capital. Organizational capital is defined as total assets which enable the organization to innovate. Mission, vision, values, strategies, business systems and internal processes within of an organization can be counted as these types of assets. Organizational capital is a basis of learning organizations. Even if employees of an organizations have enough capabilities. If the organizational structure is composed of a series of weak laws and systems, these capabilities cannot be used to create value and for a good performance. However, if the organization considerably invests on technology but the employees are not able to use the technology, this investment and consequently organizational capital will not be effective.
Finally, it should be noted that these assets together influence the organizational performance. Therefore, the relationship between them is very important. The organizations must not only think about promoting these capitals separately. Research conducted in Canada, Malaysia, Taiwan and some other countries also supports this (nioloi, et al., 2011).

Organizational Productivity

The concept of productivity has long been considered by economists (Kaci, 2006). Productivity is one of the key subjects in both developing and developed countries. Developed countries are well aware of the importance of economic growth and social welfare. Developing countries facing unemployment, inflation and resource shortage have to explore ways to make better use of existing resources, and consequently improve economic growth and lives of their citizens. Improving productivity is a discussion which is particularly important in this regard (Enshassi et al., 2007). Increased productivity can be change the purchased products and raise living standards. Increased productivity can also increase wages and purchasing power. Above all, high productivity can improve the competition with other countries (Helms, 1996).
Low productivity in organizations, companies and institutions is due to various factors. Corresponding to these factors, there are different ways to solve problems (Taheri, 2004). Improved productivity enables institutions and

Ali Sohrabi and Mahmoud Firouzian

organizations to expand international competitions and growth and improve their social cooperation. Low productivity indicates that an organization is wasting its resources; this ultimately leads to the loss of international competitions and decreased scale of commercial activities. Low productivity reduces the growth in industries and the overall economy (Rana, 1997).

Increased productivity is not doing things better, but most importantly, it is doing right works better. The factors which increase productivity are key factors recognized by right things which are an interest of managers in productivity. Production is a social, complex, adaptable and persistent process. Interconnections between human capital, capital and organizational-social environment are of great importance to establish a balance and integrate in the production process. Increased productivity depends on the director to recognize the socio-productive factors successfully (Khaki, 2007).

Great efforts have been made to identify the source and origin of the increase in productivity. In general, most experts agree on six key factors which influence productivity (Djella, 2008): 1) Technical factors, 2) human factors, 3) organizational factors, 4) institutional and political factors, 5) economic factors, and 6) social factors.

Last three factors (economic, social, and institutional) are also considered as economic and social factors in the macro level. Moreover, they are considered as general environmental factors which are ineffective in mid-term, particularly in the short term and no organization can change them; however, they can influence microeconomic levels. The other three factors (technical, human, organizational) are considered in both macroeconomic and microeconomic levels. By these factors, organizations can change their productivity. This study focuses on technical, human and organizational factors which are more flexible, and openly interrelated (Djella, 2008).

Intellectual Capital and Organizational Productivity

Nowadays, the development of human resources, skills, creativity and knowledge of the workforce at all levels of the organization is a strategic priority for managers. In other words, the most sustainable competitive advantage is valuable work force. Becker (1962) argues that investment in intellectual capital is correlated to employee productivity. Planning to develop intellectual capital is not only a competitive advantage for the organization, but also provides opportunities to learn new techniques and improve performance (Chen et al, 2010). In fact, there is a realization that investment in training and learning will improve the performance of human resources. The fundamental importance of intellectual capital and labor productivity for the current organizations reveals many gaps on this discussion. Literature review shows that very little empirical research has been done on these two variables together; thus, there is a need for further studies to clarify the subject.

MATERIALS AND METHODS

Methods

The study used a descriptive and correlational methodology by regression.

Participants

Participants included 232 CEOs, export managers and marketing managers in the private business organizations of Hamedan in 2014. Based on the data released by the Department of Industries, Mines and Commerce of Hamedan province, there are 734 active companies in the province.

Materials

Intellectual Capital

To measure intellectual capital, a questionnaire developed by Ricardo Ramirez et al (2007) was used. The questionnaire consisted of 15 items scaled on a seven-point Likert type ranging from totally disagree (1) to totally agree (7). The reliability of the questionnaire was determined using Cronbach's alpha (0.83).

Productivity

To measure productivity, a questionnaire developed by Moghimi et al (2011) was used. The questionnaire consisted of 15 items scaled on a seven-point Likert type ranging from totally disagree (1) to totally agree (7). The reliability of the questionnaire was determined using Cronbach's alpha (0.86).

Data Analysis

For data analysis, descriptive parameters (mean and standard deviation), correlation coefficient, and regression were used by SPSS software.

RESULTS

Table 1 presents mean and standard deviation of intellectual capital and its dimensions.

As shown in Table 1, the highest and the lowest means belong to customer capital and human capital, respectively.

Table 2 presents the mean and standard deviation of productivity and its dimensions.

According to Table 2, the highest and the lowest means belong to valid actions and environmental fitness.
Table 3 shows the correlation between intellectual capital and its dimensions and organizational productivity. Obviously, intellectual capital and its dimensions and human capital, structural capital and relational capital are positively and significantly related to organizational productivity.

To predict productivity by human capital, structural capital and relational capital, the stepwise regression was used. In regression analysis of productivity, first human capital and then structural capital were inserted in the equation; they maintained their significance through two steps and remained in the equation. Relational capital was not significant; therefore, it was eliminated, as shown in Table 3.

Human capital explains 10.5% variation in productivity and structural capital explains 2.8% variance in productivity. In total, they explain 13.2% variance in productivity. According to this table, relational capital is not able to predict productivity.

DISCUSSION AND CONCLUSION

This study examined the relationship between intellectual capital and productivity in the private business organizations of Hamadan province. The results showed that the correlation between intellectual capital and productivity is significant (r=0.710) at 99%. Therefore, there is a significant relationship between intellectual capital and productivity. This means that the high intellectual capital leads to a high productivity of employees. Given that our results are consistent with findings from the literature, the theory of this study is strongly supported and assumptions are based on reliable theoretical foundations. As the results show, intellectual capital can be considered

as one of the assets and capabilities of the organization, contributing to the creation and sharing of knowledge in its productivity.

The results showed that the correlation between human capital and productivity is significant (r=0.449) at 99%.
Other findings showed that the correlation coefficient between structural capital and productivity is significant (r=0.515) at 99%. That is, productivity is high in an organization in which structural capital involving proper configuration of network relations is high. If the directors of this organization encourage and facilitate this network of relationships, friendships and informal relationships will spread through communications, data leakage and team support and cause the development of productivity. By expanding the network of relationships, knowledge, experience and information in addition to social skills, can be exchanged between them; this can provide the opportunity for innovation and employees can create more value. On the contrary, if the directors neglect these relationships, they should expect devastating effects on communications as the vital factor of the organization; thus, the network of relationships will be small, closed, cognate and uniform, which will lead to fewer opportunities to access information or exchange knowledge.

The results showed a significant relationship relational capital and productivity (r=0.462) at 0.99%. That means intellectual capital is high in organizations in which the relational capital including trust, norms, identity, requirements and expectations are high. In other words, employees more likely to exchange information in organizations with higher levels of trust. In addition, trust is essential to create knowledge in ambiguity and uncertainty. When directors encourage trust, cooperation and common identity in the organization, they indeed provide a strong basis for productivity. By creating a valuing environment, responding to diversity and criticism, tolerating failure and motivating employees to exchange the knowledge, directors of business organizations can move toward creation and development of productivity.

The results of this study showed a significant relationship between dimensions of intellectual capital and productivity. High intellectual capital is followed by higher productivity. In other words, intellectual capital is essential for successful implementation of productivity. When people have special abilities and skills, proper channels of communication are used in an appropriate organizational structure, productivity will be improved and all people will be committed to the organizational ideals and use any opportunity to improve organizational performance, which is certainly to attract more customers and profit for the organization.

REFERENCES

1. Beigi, T., 2007. competitive analysis of effects of intellectual capital on organizational performance in banking industry of Iran, s.l.: s.n.
2. Chen, F., Hope, O.K., Li Q. and Wang, X. (2010). Financial reporting quality and investmet efficiency. www.ssrn.com.
3. Dastgir, M. & Mohamadi, K., 2009. intellectual capital as a wealth of organization. Tadbir, Issue 214, pp. 28-34.
4. Djellal, F .and Gallouj, F .(2008). Measuring and Improving Productivity in Services (Issues, Strategies and Challenges) . Edward Elgar Publishing, Inc. UK.
5. Enshassi, A. Sherif, M., Peter, M., Karem, A.(2007). Reflective Practice Benchmarking masonry labor productivity. International Journal of Productivity and Performance Management. Vol. 56 No. 4, pp. 358-368.
6. Fotros, M.-H. & Beigi, T., 2009. intellectual capital measurement; a glance at service industry. Tadbir, Issue 203, pp. 27-33.
7. Ghabezi, R.-a., 2012. effective factors on productivity of human capital. innovation and value creation, 1(3), pp. 111-121.
8. Helms, M. (1996). Perspectives on Quality and Productivity for Competitive Advantage, The TQM Magazine, Vol 8 · No 3

9.   Kaci ,M. (2006). Understanding Productivity: A Primer, Published by authority of the Minister responsible for Statistics Canada

10. Khaki, G., 2007. productivity management. 1st ed. s.I.:Koohsar.

11. nioloi, F., Rahimi, G. & Behluli, N., 2011. comparative analysis of intellectual capital management in universities. innovation in human sciences, 1(3), pp. 54-96.

12. Pirayesh, R., 2008. productivity of management. Tehran: Zanjan university.

13. Qelichli, B. & Moshabaki, A., 2006. the role of social capital in creation of intellectual capital. knowledge of management, Issue 75, pp. 125-147.

14. Rana, A.I. (1997). common factors in productive firms: lessons from four case studies, cmer working paper series centre for management and economic research

15. Taheri, S., 2004. productivity and its analysis in organizations. Tehran: Hastan.

16. Talebi, K., Davari, A. & Najmabadi, A., 2013. effect of intellectual capital on recognition of Entrepreneurial opportunities in knowledge-based companies. management studies, 23(71), pp. 19-48.

Table 1: mean and standard deviation of intellectual capital and its dimensions

Variable	Mean	Standard deviation
Human Capital	2.23	0.69
Structural capital	2.71	1.11
Customer capital	2.88	0.98
Intellectual Capital	2.90	0.99

Table 2: mean and standard deviation of productivity and its dimensions

Factor	Mean	Standard deviation
Organizational support	2.10	1.0
Performance feedback	2.37	1.0
Valid actions	2.47	1.0
Motivation	2.13	1.1
Environmental fitness	2.07	1.1
Organizational efficiency	2.50	1.0

Table3: correlation coefficient of the intellectual capital and its dimensions and productivity

Variable	Intellectual Capital	Human Capital	Capital structure	Investor relations
Organizational productivity	0.71	0.45	0.51	0.46

Ali Sohrabi and Mahmoud Firouzian

Table 4: Results of stepwise regression analysis of productivity by human capital and structural capital

Predicting variable	R	R^2	Adjusted R^2	Standard error	$R^2\Delta$	F
1. Human Capital	0.323	0.105	0.10	2.71	0.105	[**]24.981
2. Structural Capital	0.363	0.132	0.124	2.67	0.028	[**]16.233

RESEARCH ARTICLE

Presenting a Model to Readiness Assessment for implement Enterprise Resource Planning through Adaptive Neuro Fuzzy Inference System

Nazanin Pilevari[1]* and Farzaneh zafariAsheghdoost[2]

[1]Department of industrial management ,college of management and accounting ,yadegar-e- Imam Khomeinibranch, Islamic Azad University, Tehran, Iran. Email: nazanin.pilevari@gmail.com
[2]Master student , Islamic Azad university of Iran -E-campus

*Address for correspondence
Nazanin Pilevari
Department of industrial management,
College of management and accounting,
Yadegar-e- Imam Khomeinibranch,
Islamic Azad University,
Tehran, Iran.
E-mail: nazanin.pilevari@gmail.com

ABSTRACT

We cannot gain huge advantages out of integrated information systems like enterprise resource planning (ERP) without proper infrastructures & successful implantation; ERP implementation is a complex process in which the first step to be taken is assessing the readiness of enterprise for deploying such system. This process comes up with solutions to implementation problems through assessing enterprise readiness from various dimensions & spotting possible problems occurring while implementing it. This research develops & presents a model to assess & improve readiness of distributors based on fuzzy inference system after identifying whole set of effective factors on successful implementation of ERP. This model allows given companies possibility to assess their readiness by taking their internal & environmental conditions as well as most important factors contributing to successful implementation into account. Therefore they can measure their level of success & lessening the possibility of failure to adapt ERP system.

Key words: Enterprise Resource Planning (ERP) systems, enterprise resource planning readiness assessment, critical success factors, adaptive neuro fuzzy inference system (ANFIS).
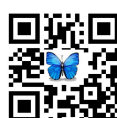
Nazanin Pilevari and Farzaneh zafari Asheghdoost

INTRODUCTION

Enterprises have been under considerable pressure to adapt themselves to the changing business environment over the recent years. They must be able to do so promptly if they want to survive in the modern markets. Large corporations are seeking to have great agility & flexibility so as to overcome this problem; they also have turned into business management systems to be able to accommodate internal as well as external organizational changes. ERP has received particular attention over the previous years as it has covered entire organizational dimensions & markedly increased managerial decision-making competence. The projects to implement ERP system are of complicated nature & making enterprise resource planning readiness assessment is one of its primary phases to go through which is abbreviated as ERA.

This research aims at clarifying statues of enterprise regarding ERP readiness assessment through taking advantage of critical success factors & ANFIS model besides offering a framework involving those success factors based on which enterprises could recognize their current status to detect & introduce necessary changes before implementing the system.

MATERIALS AND METHODS

Theoretical principles and reviewing the literature

It seems that there is a huge research gap regarding the status of organizations "before implementation of ERP" & also "measuring ERP implementation readiness", as most researches conducted in the recent years were mainly focusing on issues arising after implementing the system & gauging success of item in organization. This gap has been addressed in works of Dori& colleagues as well. Reviewing related articles issued throughout the period 2000-2001, they found that only 2 percent of which examining statues of organizations before implementing ERP or making decision to adapting it. Researchers presented various frameworks based on ERP readiness assessment in these studies. But what was obvious was that almost all models developing same method in which the process has been divided into four phases:
Phase I: Identify effective factors on ERP readiness assessment
Phase II: Provide assessment tools based on factors identified in the phase I.
Phase III: Determine the importance (weights) of each factor (metric).
Phase IV: Devise an assessment plan for each effective factor on ERP readiness assessment.

- **Enterprise Resource Planning (ERP) systems:**

Given international research literature, ERP refers to systems which:

- Have a set of standard functional modules (finance, human resources, production, & sales & distribution.
- All modules function based on an integrated, common data base.
- Cover enterprise main business processes & is of process-based type
- Deliver official, analytic & managerial reports on different modules
- Serve better based on web or the cloud storage II. This feature is not pointed out internationally & the systems have begun to incorporate them.

(Bernroider, 2008; Enquist & Juell-Skielse, 2010; Kayas et al., 2008; Sawah et al., 2008).
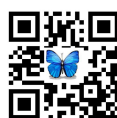
Nazanin Pilevari and Farzaneh zafari Asheghdoost

ERP systems is a business management software including performance assistance applications for planning, manufacturing, marketing, sales, distribution, accounting, finance, human resource management, project management, inventory management, maintenance & service, shipping & e-business (Gracheva, 2010).
Critical success factors(CSF)

CSFs are factors contributing to achieving managerial goals & organizational progress if they are taken into account. Organization success is dependent on better understanding of them in implementing ERP system (Ngai, 2008).Researchers identified a total number of 42 metrics as the most critical success factors in their researches on CSFs in implementing ERP system, some of which are as follow: management commitment & support, implementation team (full-time), project planning, defining goals & requirements, competent project team, user consultant, user acceptance, competition, cooperation among the diverse groups in the organization, project champion, vendor support, careful selection of proper package, change management program & culture, business plan & vision, business process reengineering, effective communication, project management, user education/training, quality of information & system, accuracy of information.

Assessing the readiness of the organization for implementing ERP system

Assessing the readiness of organization in order to appropriately using & taking advantages of ERP system, which is a decision to adapt according to Steves & Pastor Model, is one of the first steps to implement ERP system. The readiness of organization are investigated from dimensions of structure, management, people, technology, infrastructure & culture during this process & potential problems emerging while applying the system are also identified to facilitate implementing ERP system through finding solutions to remove those problems.

This is a method which examines different organizational dimensions & assesses readiness of each organization units to accept the system. Since ERP implementation project is considered as a large & important one in the organization, it is essential to make use of this tool to measure the readiness of the organization for implementing ERP. This process assesses readiness of the organization to implement ERP by looking at managerial & organizational, human resource, structural, procedural, technological, infrastructural & cultural dimensions of respective organization.

Considering outputs of this tool, we can detect deficiencies in the system acceptance & planning to find remedy for them (Stewart et al, 2001).

Assessing the readiness is an operation determining readiness level of an organization to initiate & carry out a large-scale project & a huge help to identify & define specific points for further focusing on the readiness processing (Gartner, 2011).

Models presented by previous researchers have determined organization readiness for implementing ERP system after identifying & evaluating CSFs. We summarized the respective models in table (1) after reviewing the literature. The table showed area of studies conducted by the previous researchers as well as strengths & weaknesses of their models separately.

Adaptive Nero Fuzzy Inference System (ANFIS)

It is an abbreviation stands for Adaptive Neuro Inference System. It builds a Fuzzy Inference System (FIS) by using a set of outputs/inputs.
Membership function parameters are estimated through back propagation algorithm or acombination ofleast square estimation in this system. This operation allows fuzzy system to learn their structures from a set of inputs.

Nazanin Pilevari and Farzaneh zafari Asheghdoost

Fuzzy systems have been used to build intelligent system along with neural networks as their complement over the past decade. Fuzzy logic has got wide application so as to reason & simulate how human brains think at a more abstract level while neural networks have been generally used in lower level calculating structures for learning from raw input. Fuzzy systems do not have the ability to learn independently; but along with neural networks they will possess it. In deed a neuro fuzzy system is a neural network working in coordination with fuzzy inference system & it has the ability to learn in addition to those of fuzzy systems (Ata & Kocyigit, 2010).

FIS is able to produce outputs of three-dimensional analysis based on given inputs. The analytic outputs help enterprises to assess level of output sensitivity to input variable through changing each one of input variables & reforming & investing in organizational processes & activities based on the highest sensitivity of inputs to outputs.

ANFIS includes three phases as follow:

- Determining rules: defining data & input variables
- Generating data & creating a training system
- Validation

The diagram in figure (1) illustrates the characteristic structure of this learning system:

Key benefits of ANFIS system over others have been highlighted as follow:

- It makes use of neural networks to rank & identify models.
- It creates a simple FIS with a few drawbacks which makes less error in calculation on par with neural networks.
- It maintains the same benefits as fuzzy expert system while reducing system's dependence on experts.
- It eases the problems emerging in modeling & analyzing complex inputs through fuzzy logic.
- It creates possibility for adding qualitative dimensions of human experiences to the system.
- & finally fuzzy system has the ability to learn while maintaining benefits of the FIS. (Ata & Kocyigit, 2010)

Research methodology

Firstly some of frequently-cited CSFs in the works of previous researchers have been identified by reviewing the literature widely & thoroughly, secondly number of metrics & prioritizing rules used as inputs to FIS were reduced through Delphi technique. Then FIS was designed to assess readiness level of enterprise to implement ERP system through determining fuzzy sets, including effective factors on successfully implementing ERP system, as well as membership functions & fuzzy rules.
The research has been conducted in the following order:

Phase I: Developing a conceptual model

Identifying variables

15 factors (Organizational, managerial, technological) have been initially analyzed as the critical factors in the successful implementation of ERP through reviewing the documentation. Table (2) shows each one of those factors besides researchers identifying them: Then we filtered out the variables through Delphi technic to use them for designing ANFIS. It has been done to reduce the number of rules in the system; otherwise there would be a large number of illogic rules which made determining the fuzzy rules impossible.

Nazanin Pilevari and Farzaneh zafari Asheghdoost

Phase II: Designing FIS

Four adaptive-fuzzy systems have been designed in this structure given the primary & secondary factors. First three systems have received inputs from a selected enterprise which has not implemented the system yet & got trained based on which, then inputs of the final system werefed in on the basis of these systems outputs though which we could measure the readiness of enterprise. Therefore three sub-ANFIS were used to provide our three metrics, namely management, organization & technology readiness level which their outputs were also used in the final ANFIS as the readiness of the enterprise. Additionally a questionnaire has been prepared to collect data from the distributors under study; we sent out the questionnaire to 85 experts & got 80 back among which 50 inputs were used for training ANFIS & rest of them forvalidatingthe model.

So the First ANFIS received continuous top management support, effective change management & project management as inputs & produced ERP readiness assessment as outputs. The second ANFIS analyzed the organizational dimensions & received business process reengineering & sound implementation strategy as inputs.& the third ANFIS received comprehensive IT plan & data integrity as inputs while produced technology readiness level as output.

Then the final network, the ANFIS to measure readiness of organization, have been fed in with the outputs produced by these three networks & begun to assess the readiness of the respective organization to implement ERP.

There are methods to determine rules in the ANFIS; the most popular one is usinggrid partitioning whichseparates input space & set of membership function.Another one is using rules determined by experts & feed them into the system. If it is possible, the speed of training system will be improved & FIS can be trained by the minimum number of observations. Data clustering also constitutes another effective method to determine the fuzzy rules.

We have adapted Sugeno FIS in our study. Fuzzy rules have been determined by taking experts views & using grid partitioning. Gaussmf also used to define FIS membership function. Each one of membership functions have been described by three linguistic variables, namely low, medium, high. & MF was of linear type.

Training process was completed by epochs 70 & its error tolerance taken into account as well. The figure (3) shows the input membership function in this structure:

Data Generation & Training the ANFIS

Initially the data, collected through the questionnaire, have been fed into the system according to each subset of organizational, managerial & technological factors to train the data. The figure (4) shows error-checking results: Therefore 27 rules have been determined & experts view taken for ANFIS of assessing the readiness.

Phase III: Validation

As was mentioned before 15 inputs, obtained through questionnaire, have been used for examining ANFIS while the rest of which for checking the system. Therefore checking & examining data, not involved in training process, has been used to validate the model.

The case study
According to the figure 5, (*) indicates the system output & (+) checking data in the ANFIS designed for assessing the readiness of the organization between which there is a sensible overlap indicating that there is no over-fitting in out model. In this case, average error has calculated (0.023).

The proposed model has been adapted to one of food distribution holding companies in Iran to assess its readiness for implementing ERP. This company has attempted to implement the ERP system recently. It has 24 branches across the country & 2500 people works in its 20 units. Company's top management initially decided to implement the system in its central branch (Tehran) & would plan to employ it in other braches if it yielded the positive results. Necessary documents had been analyzed before carrying out the project then the company's readiness was measured thorough considering CSFs in implementing ERP & feeding date, collected by questionnaire & interview, into the ANFIS.

CONCLUSION

Figure (6) illustrates the results achieved by each one of FISs designed for the study. The columns on the left refer to membership function related to the rules (if) & the last one shows membership function related to outputs of the rules (then). The last column on the right shows the outputs of the fuzzy rules on that rule according to value, calculated by software program using theCenter of Mass, for each one of factors. Finally defuzzified output (readiness level) is illustrated as a vertical line on the diagonal of the last column on the right side.

Figure (6) illustrates the output of final FIS (0.492) which is at the intermediate level in the membership function.

According to the figure the readiness of organization to implement ERP measured (0.492) throughfeeding outputs of organization (0.376), management (0.629) & technology (0.5) readiness into the ANFIS & its scale value is at intermediate level in the membership function.

This means that the company should first increase its readiness in reengineering business process & developing proper implementation strategy before increasing its technology & management readiness should the company seeks to implement EPR system.

Given the results achieved through FIS in the mentioned enterprise, it was revealed that it was at low level of readiness of organizational factors in order to implement ERP. Accordingly it is highly recommended that itfirst develops an effective ERP implementation strategy based on which taking the next measures & reengineering business processes to successfully adapt itself to st&ard processes conforming to selected ERP system through checking & reviewing its existing processes. Given the company's low level of management & technology readiness it is suggested that it should increases its readiness in both dimensions through attracting top management support & enhancing project & change management (management readiness) & developing comprehensive IT plan &further focusing on data integrity (technology readiness). & finally, changing the inputs to final ANFIS & observing how they affected the outputs through performing sensitivity analysis, it was found that the small changes in inputs of management readiness would lead to big ones in outputs of organization readiness. Therefore we could expressly state that the managerial factors are the most effective ones on increasing readiness of organization to implement ERP.

REFERENCES

1. Shafia, M.A. , Manian, A. , Raesi, I. (2014) "Designing FIS to Predict Success of The ERP Strategy", IT Management, Faculty of Management, Tehran University, No. 1, Spring 2014, pp 89-106.
2. Vakili Fard, H.R. , Pile Vari, N. , Zeyedi, S.S. (2014) "Presenting a Model to Predict Bankruptcy of Listed Companies in Stock Exchange thorough ANFIS",
3. Sohrabi, B. & Shami, Z.M. , Farzaneh, M. , Raesi, I. (2013) "Presenting a Model to Assess Success of ERP implementation through Fuzzy Inference Approach".

4. Zohri, M., Afshar Kazemi, M.A. (2013) "Designing a Model to Predict Bankruptcy of Companies based on Fuzzy Neural Networks".

5. Momeni, M. , Sharifi, A. (2012) "Multi-criteria Decision-Making Models , Software Programs". Tehran.

6. Khedmat Gozar, H.R. (2011) "Critical Factors in Behavior of Frequent Users of Online Bank Services in Iran", A Master Thesis, Science & Culture University.

7. Jalali, A.A., Zareh, M.A., Rohani, S. (2010) "ERP Management", Rahbar Information Service Company.

8. Sarmad, A., Bazargan, A. (1998) "Research Methodology in Behavioral Science", Vol. 1, Agaheh publication, Tehran.

9. Azar, A., Momeni, M. (2001) "Statistics & its Application in Management", Vol. 2, 4th edition, Samt publication, Tehran.

10. Sarokhani, B. (2003) "Research Methodology in Social Science", Vol. 1, 7th edition, Institute for Humanities & Cultural Studies, Tehran.

11. Bani Jamali, S.M., Jafar Nejad, A. (2006) "Presenting a Framework to Assess Readiness of Iranian Enterprises to Implement ERP", 3rd International Conference on Management.

12. Jassbi, J.,Seyedhosseini, S.M., Pilevari, N.(2010) "An Adaptive Neuro Fuzzy Inference System for Supply chain Agility Evaluation", International Journal of Industrial Engineering & Production Research [Online] Available: Journal Website: http://IJIEPR.iust.ac.ir/.March 2010, Volume 20, Number4

13. Hanafizadeh, P., Zare Ravasan, A. **(**2011**) "**A McKinsey 7S Model-Based Framework for ERP Readiness Assessment", International Journal of Enterprise Information Systems, 7(4), 23-63, October-December 2011 23

14. Allahyari,A.,Ramezani,M. (2012) "Assessment of Effective Factors in ERP Acceptance", Case study of manufacturing & service companies (LME) of Iran, Asian Journal on Quality,Vol. 13 No. 2, 2012,pp. 177-184

15. Dezdar, S. , Ainin, S. (2010) "ERP Implementation Success in Iran: Examining the Role of System Environment Factors", World Academy of Science, Engineering & Technology,Vol. 66 pp. 449-55.

16. Ahmadi, F. , Mahmoudi, J. , J,aghi, G. (2011) "Determining Enterprise Resource Planning(ERP) Success Factors in Iranian Companies", European Journal of Economics, Finance & Administrative Sciences, Vol. 5 No. 34, pp. 122-33.

17. Taylan, O. Karagozogˇlu, B.(2009) "An Adaptive Neuro-Fuzzy Model for Prediction of Student's academic Performance", Computers & Industrial Engineering 57 (2009) 732–74.

18. Mottaghi,H.Akhtardanesh,H(2010) "Applying Fuzzy Logic in Assessing the Readiness of the Company for Implementing ERP",World Applied Sciences Journal 8 (3): 354-363, 2010

19. Razmi, J.,Sangari,M.,Ghodsi,R. (2009) "Developing a Practical Framework for ERP Readiness Assessment Using Fuzzy Analytic Network Process. Department of industrial Engineering University of Tehran

Table 5-comparison between the present models

7s McKinsey	Razmi & Colleagues	Best	Soysa & Nanayakkara
Strategy	Scopes & Goals	Strategy & objective	Organizational Dimensions
Structure		Structure	Organizational dimensions
Systems	Systems & Processes	Procedures	Technological-informational Dimension
Skills		Knowledge & skills	
Management skills	Project	Management	Human Dimensions
Staff	Human Resource		Human Dimensions
Shared Values	Culture & Structure	Social Dynamic	

Nazanin Pilevari and Farzaneh zafari Asheghdoost

Table 6- list of factors & metrics & their references

Primary Factor	Researchers	Secondary Factors	Researchers
Organizational Factors	Steves & Pastor (2000) Zhe Zhang et al (2004) Soysa & Nanayakkara (2006) Ngai et al (2008)	Thorough knowledge of the existing systems in the organization	Steves & Pastor (2000))2001(Al-Mudimigh et al Nah et al. (2001) Zhe Zhang et al.(2004) Finney & Corbett (2007) Ngai et al.(2008)
		Business process reengineering	Al-Mudimigh et al (2001)
		Same project experience in the organization	Al-Mudimigh et al (2001)
		Consultants & staff availability	Al-Mudimigh et al (2001) Finney & Corbett (2007)
		Effective internal/external communication	Al-Mudimigh et al (2001) Finney & Corbett (2007) Ngai et al (2008)
		Common training process	
		Staff interference & participation	Al-Mudimigh et al (2001) Nah et al (2001) Somers & Nelson (2001) Zhe Zhang et al (2004)
		Careful ERP assessment & System selection process	Somers & Nelson (2001) Steves & Pastor (2000)
		Appropriate implementation strategy	Al-Mudimigh et al (2001) David Olson (2004) Finney & Corbett (2007)
Technological Factors	Holl& et al (1999) Steves & Pastor (2000) Al-Mudimigh et al (2001) Finney & Corbett (2007)	IT Master plan	Steves & Pastors (2000)
		Data integrity	Al-Mudimigh et al (2001) Zhe Zhang et al (2001) David Olson (2004) Finney & Corbett (2007)
		IT infrastructures	Al-Mudimigh et al (2001) Nah et al (2001) Finney & Corbett (2007)
Managerial Factors	Parr et al (1999)	Top management support	Parr & Shanks (1999))1999 (Holl& et al Steves & Pastor (2000 Al-Mudimigh et al (2001) Nah et al. (2001) Somers & Nelson (2000) Zhe Zhang et al.(2000)

Nazanin Pilevari and Farzaneh zafari Asheghdoost

			)David Olson (2004 Soysa &Nanayakkara (2006) Finney & Corbett (2007)
		Effective change management	Parr & Shanks (1999)2001(Al-Mudimigh et al Nah et al. (2001) David Olson (2004 Finney & Corbett (2007) Ngai et al.(2008)
		Project management	)2001(Al-Mudimigh et al Zhe Zhang et al.(2004))David Olson (2004 Finney & Corbett (2007) Ngai et al.(2008)
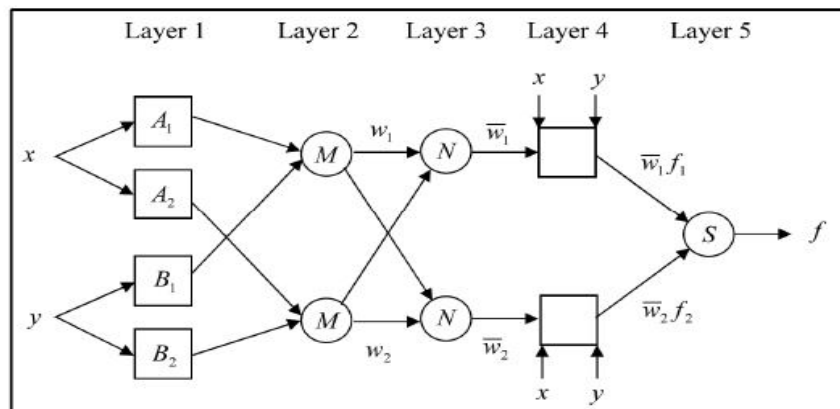
Figure 1- Characteristic structure of ANFIS
Assessment Framework
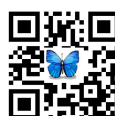
Nazanin Pilevari and Farzaneh zafari Asheghdoost
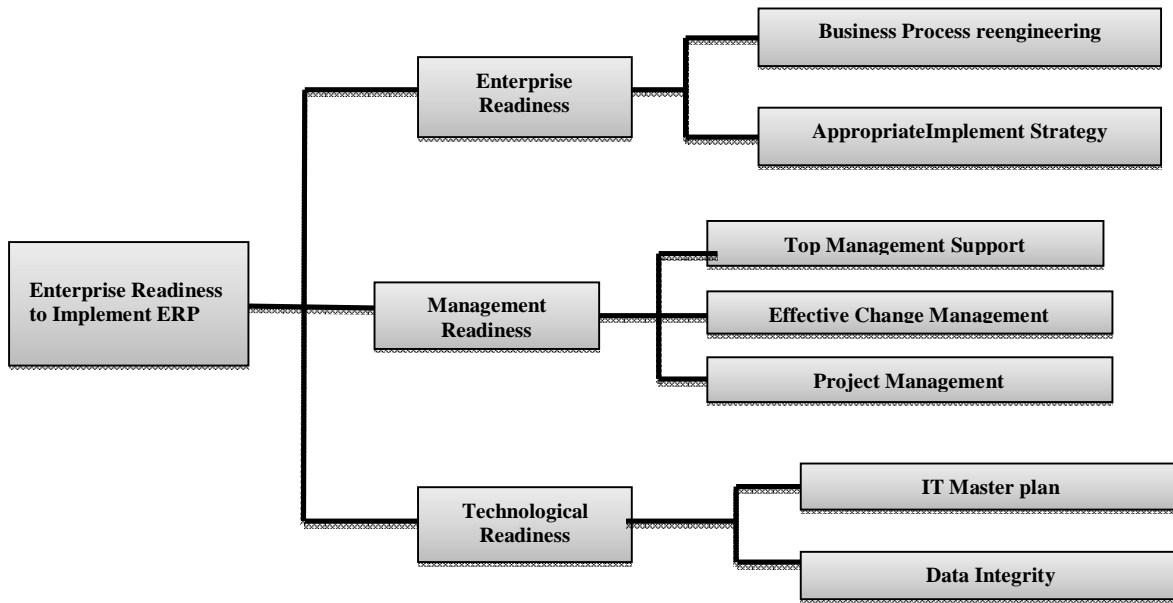
Figure 2- conceptual model of the ANFIS variables
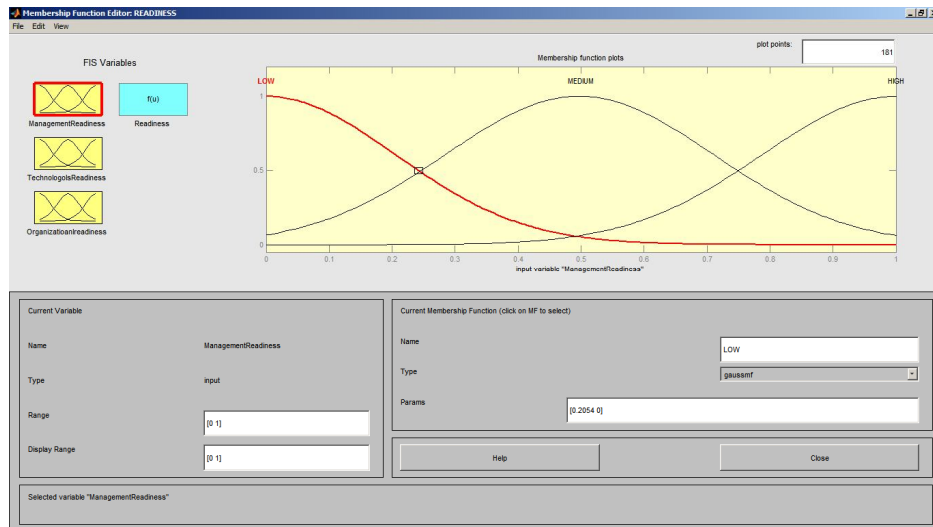
Figure 3- ANFIS membership function to assess readiness of organization

Nazanin Pilevari and Farzaneh zafari Asheghdoost
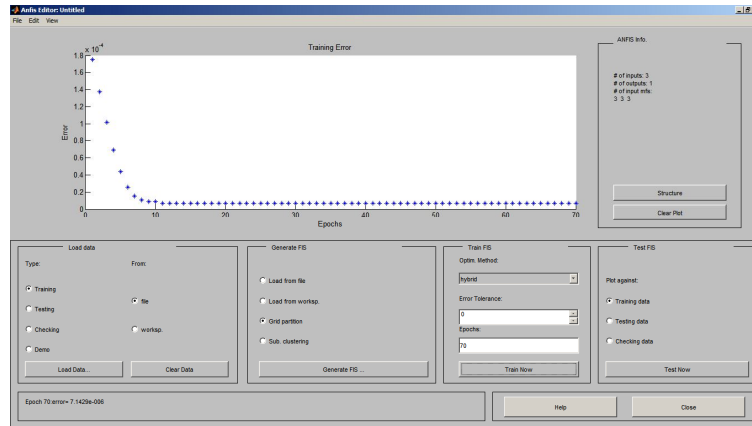
Figure 4- FIS error assessment
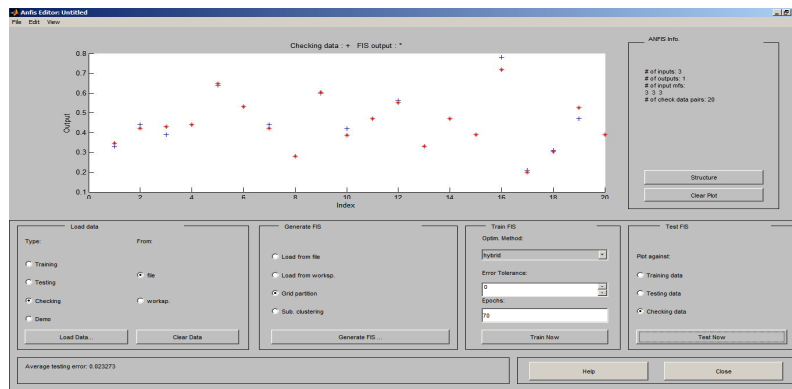
Figure 5- structure of checking data & their error
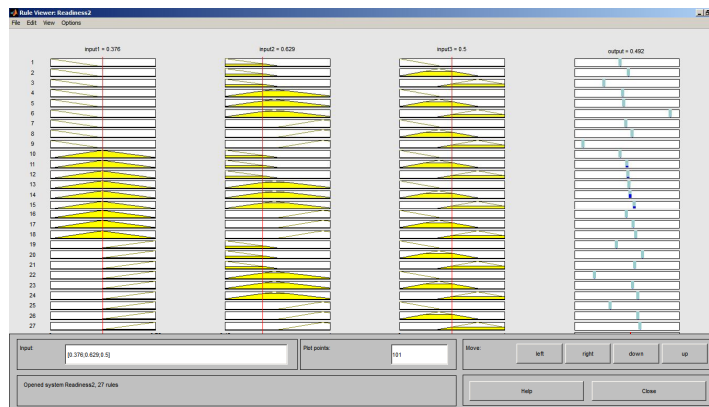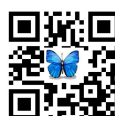
Figure 6- diagram of the final results of organization readiness level

RESEARCH ARTICLE

Identifying and Prioritizing Factors Affecting Implementation of Strategic Plans using AHP Technique (Case Study: Persian Gulf Petro Chemical Company)

Najmeh Yarigarravesh[1] and Saeed Hakami Nasab[2]*

[1]Department of Management, Faculty of Human Sciences, Semnan Science and Research Branch, Islamic Azad University, Semnan, Iran.

[2]Faculty of Industrial Engineering and Management, Department of Management, University of Shahrood, Shahrood, Iran.

*Address for correspondence

Saeed Hakami Nasab

Faculty of Industrial Engineering and Management,
Department of Management, University of Shahrood,Shahrood, Iran.

ABSTRACT

Current research aims at identifying and prioritizing the factors affecting the implementation of strategic plans. Research method is descriptive and it is analytical survey. Instead of using statistical methods and questionnaires this research, AHP pairwise comparisons are used. Five experts who were experiences in terms of organizational position, education, etc. in Persian Gulf Petrochemical Company were used as experts and decision makers. Computational stages of the research are classified into two parts; first, identification and selection of the most important factors affecting implementation of strategic plans and then prioritizing these factors. Factors were identified and selected based on library studies and interviews with experts, and they were classified. The initialclassification included 8 main factors: 1. determining strategy and objectives, 2. resource allocation, 3. organizational structure, 4. organizational culture, 5. communication and information, 6. competitive pressure, 7. Management, 8. control and technology. Findings for the second research question regarding prioritizing factors affecting implementation of strategic plans in Persian Gulf Petrochemical Company showed priorities include: 1. Organizational culture, 2. Communication and information, 3. Organizational structure, 4. Management, 5. Competitive pressure, 6. Resource allocation, 7. Control and technology, 8. Determining strategy and objectives.

Key words: Implementation, managers, planning, strategic plans

Najmeh Yarigarravesh and Saeed Hakami Nasab

INTRODUCTION

Aim of strategic planning process is formulating competitive strategies. the main part in formulation of strategies is proper selection of strategies, since no organization has infinite resources and implementing wrong strategy may conflict the company in a trouble which as no return path (Acur and Englyst, 2006; Searcy, 2004).

Strategy is a comprehensive plan for practice and action which specifies major orientations of the organization and provides guidelines for resource allocation in the path of achievement of long-term organizational objectives. Selection of suitable strategy is a complicated and even risky task, since every strategy directs the organization to a specific competitive environment. Strategy of the organization specifies that how the organization wants to create value for shareholders, customers, and citizens. Prior to developing strategies, managers should analyze dynamicity of the competitive market in the respective industry as well as the organization's resources and capabilities and gain clear understanding about them (LeeandSai On Ko, 2000).

Strategies can be defined from at least two views: 1. the organization tends to do what, 2. what the organization would do at last. In the first view, strategy is a comprehensive plan for defining and achieving objectives of the organization and implementing its mission and strategy formulation should be done within a process. In the second view, strategy is the pattern for organization'sresponses to its environment over the time (Ip and Koo, 2004; Lee et al., 2000).

Kordnaeech et al. (2010) studied formulation and implementation of strategic plans in Customs of Islamic Republic of Iran. To this end, they provided matrix of strengths, weaknesses, opportunities and threats (SWOT) for formulation of strategy and then used internal and external matrix with nine and hour boxes. Finally, Quantitative Strategic Planning Matrix (QSPM) was proposed for investigation the customs organization. Status of petrochemicals in Islamic Republic of Iran's 1404 outlook vision and basic capability of the energy in our country, centrality of energy economy in development of the land, 97 years of survival for oil reserves, sustaining gas reserves for several hundreds of years and particular geo-economic, geopolitical, and geostrategic position of Iran necessitate playing more appropriate role in regional management of energy. Describing this role and position requires some grounds and leverages. Proper implementation of projects in oil, gas, and petrochemical industries and integrated project design and management is considered as a main strategy. Implementation of strategic plans is one of the foundations for successful implementation of projects in petrochemical industries. Petrochemical industry as one of the greatest and major sectors of the country needs application of modern management tools in order to have strategic planning. Deficit in strategic axes in petrochemical company in terms of financial affairs, customer, internal processes and development and learning are determined which is used for translating strategies and specifying goals and performance measures and the way of performing processes.

Role of strategic planning in today organizations is clear to all. Strategic planning is an organized attempt for implementing major strategies of the organization and its application is necessary for realization of the organizational goals. Strategic planning identifies opportunities, threats, strengths, and weaknesses through environmental studies so that more realistic goals are set and implemented through which. Application of strategic planning by the managers can bring about positive outcomes for the organizations in long term.

Due to its nature, petrochemicals are able to force economic development and mobility by developing many industries. Also, this industry needs to be fed by many other industries in order to sustain its activities, thus such mutual interaction in the form of communications will have significant impact on the country's economy. The issue of strategic plans is one of the issues which have been topic for many studies and it can guarantee implementation of the organization's goals and its development and progress. New conditions in the global economy have caused formation of contradictory economic goals and expectations in the organization (Vadiee, 2009). Implementation of strategic plans identifies environmental opportunities and threats and internal strengths and weaknesses by

Najmeh Yarigarravesh and Saeed Hakami Nasab

investigating external and internal environment of the organization, and considering the organization's mission, they set goals for the organization, and in order to achieve these goals, choose strategies from strategic options which eliminate weaknesses by relying on strengths and utilizing opportunities, and avoid threats. If strategic plans are implemented properly, it leads to success of the organization in the competition. In electronic information and communication era, every organization at any size faces rapid changes and it should plan and manage its activities in such a way that it can succeed in the changing and highly competitive market and can survive. Considering concept of strategic plan implementation, it requires utilization of this kind of planning.

Implementation of strategic plans causes that organization matches its activities and services to meet changing needs of the environment. Such planning not only provides framework for improvement of the plans, but also proposes framework for restructuring plans, management, and cooperation and for evaluating organizational progress.

Regarding research works used in different parts of the petrochemicals, one reality is that many of these works have not been selected within a macro planning framework and it has caused research options are not directed with a comprehensive view within the day needs of the petrochemicals industries. Thus, conducting research in strategic plan and its affecting factors in these companies seems necessary.

Various papers have been written up to now regarding strategic planning and many research works have been allocated. In this section, domestic and foreign research works are reviewed. Rahmani (2012) studied barriers to implementation ofstrategy in Golestan Tax Organization. Using statistical analysis and sign test, 35 main barriers were identified out of 47 initialbarriers. Then, barriers were ranked using Friedman test. Eliminating these barriers reduces failure probability in strategy implementation. ManafSaberi (2013) studied impact of strategic planning implementation on performance of employees in social security organization's hospitals. His findings showed: 1. Considering obtained results from Spearman test, in comparison of components of strategic planning and performance of employees (effectiveness), sig level is 0.022, which is smaller than 0.05. Thus, there is significant relationship between strategic planning and performance of employees (effectiveness). 2. Considering results of Kruskal-Wallis test, sig level between strategic planning and quality improvement is smaller than 0.05, and there is significant relationship between strategic planning and quality improvement. 3. Considering results of Mann-Whitney and Wilcoxon test for finding relationship between strategic planning and performance of employees, sig level is smaller than 0.05 (0.043) suggesting relationship between strategic planning and performance of employees (effectiveness). Haghighi (2009) studied factors affecting strategic planning process in National Iranian Gas Company. Impact of five factors including senior management participation in the strategic planning process, senior management awareness of knowledge and importance of strategic planning, team participation of employees in the strategic planning process, change management in the strategic planning process and accurate environmental assessment in success of strategic planning in National Iranian Gas Company was supported. Rahimnia (2011) investigated elements of strategic planning for providing conceptual and practical model for small industrial companies. Findings showed 70 percent of the companies under study had coherent plans. Unlike previous studies, this study found no significant linear relationship between strength of strategic planning and environmental change. Arabi and Khodadadi (2007) studied process and models of strategic planning implementation at three stages including formulation, implementation, and control. This is a descriptive research and following description of models of strategic planning implementation, 8 factors were considered as important in implementing strategic planning: 1. Strategy and goal setting, 2. Resource allocation, 3. Organizational structure, 4. Organizational culture, 5. Communication and information, 6. Process, 7. Management, 8. Control and technology.

Current research aims at determining priority of factors affecting implementation of strategic plans. Thus, following specifying research subject and defining it, theoretical foundations and models are studied and domestic and foreign studies are reviewed. In the next stage, based on the literature, structured interview with the experts of petrochemical industry is used. According to the model proposed by Arabi and Khodadadi (2007), following components were

Najmeh Yarigarravesh and Saeed Hakami Nasab

selected as factors affecting implementation of strategic plans: 1. Strategy and goal setting, 2. Resource allocation, 3. Organizational structure, 4. Organizational culture, 5. Communication and information, 6. Competitive pressure, 7. Management, 8. Control and technology. Considering above facts regarding importance of strategic plans, current research aims at finding answer for this question: What are factors affecting implementation of strategic plans in Persian Gulf Petrochemical Company using AHP technique?

MATERIALS AND METHODS

Research method in this work can be examined in several views. In terms of purpose, it is applied research, because it is conducted in order to find rapid solution for problems so that barriers can be eliminated through systematic planning or they can be prevented. On the other hand, this research is descriptive and analytical survey in terms of research nature. In order to collect data in this work, library studies, interview, and questionnaire as AHP pair-wise comparisons were used. Instead of using statistical methods and questionnaires this research, AHP pairwise comparisons are used. Five experts who were experiences in terms of organizational position, education, etc. in Persian Gulf Petrochemical Company were used as experts and decision makers. Face and contentvalidity was used for determining validity of the questionnaire. Following designing and developing the questionnaire, ideas of the experts and professors were taken and following modifications, face validity and content validity will be supported. In order to examine reliability of the questionnaire, common questionnaires like Likert scale were not used, rather AHP pair-wise comparisons was used. Inconsistency rate of the questionnaire was smaller than 0.1 (0.001) and reliability of the questionnaire was confirmed.

$\lambda_{max}=1.036$

$I.I=(-\lambda_{max}-n)/(n-1)$

$I.R. = I.I/(I.I.R_{6*6}) = 0.001$

In this research, firstly main factors affecting implementation of strategic plans are identified and selected and then they are prioritized. Factors were identified based on library studies and interview with the experts and initial selection and classification was done.

Following specifying final factors for description, MADM model, AHP, was formulated. The reason for using AHP is solving multivariate decision making problems with hierarchical structure. Then, data needed for implementation of the model should be collected. This stage is the most important stage after model formulation, since all inferences, conclusions, recommendations, and suggestions will be made based on results of calculation of these data. To this end, necessary data were collected by developing, distributing and collecting questionnaires.

FINDINGS

Q1: What are factors affecting implementation of strategic plans in Persian Gulf Petrochemical Company?

Following gathering ideas and recommendations of the experts, 8 factors were determined as the main affecting factors in the current situation as follows:

1. Strategy and goal setting,
2. Resource allocation,

3.   Organizational structure,
4.   Organizational culture,
5.   Communication and information,
6.   Competitive pressure,
7.   Management,
8.   Control and technology

Q2: How is priority of factors affecting implementation of strategic plans in Persian Gulf Petrochemical Company?

AHP Model Design

Modeling in AHP is based in hierarchy tree which represents the problem under study. Its level 1 is the goal and last level is competing alternatives and intermediary levels are decision making criteria. In the problem modeling of the current research, the goal is determining and prioritizing factors affecting implementation of strategic plans in Persian Gulf Petrochemical Company, which is summarized in the tree, and competing alternatives are final affecting factors, which are selected following statistical analysis. 8factors including 1. Strategy and goal setting, 2.Resource allocation, 3. Organizational structure, 4. Organizational culture, 5.Communication and information, 6.Competitive pressure, 7.Management, 8. Control and technology are considered as decision making criteria for evaluating the alternatives. That is, implementation of strategic plans in Persian Gulf Petrochemical Company is affected by these 8 factors.

According to the calculations (available in appendix), weight of 8 main factors is given as Table1.
Result of prioritizing factors using AHP and Expert Choice software are given in Diagram 1.
Organizational culture has highest impact and strategy and goal setting has least impact onimplementation of strategic plans.
Prioritization of Sub-Criteria Affecting Implementation of Strategic Plans
Specifying goals of strategic plans for employees has highest impact and determining strategies for planning has least impact on implementation of strategic plans.

Enough resources to implement the strategic plans has highest impact and Constituting the Executive Committee for resource allocation has least impact on implementation of strategic plans.
Structural centralization impact has highest impact and organizational structure's formalization has least impact on implementation of strategic plans.
Presence of compliance culture has highest impact and presence of participatory culture has least impact on implementation of strategic plans.
Effective communication has highest impact and external communications has least impact on implementation of strategic plans.
Replacement threat has highest impact and competition among effective competitors has least impact on implementation of strategic plans.
Presence of executive manager in strategic plans has highest impact and manager's mastery over implementation of strategic plans has least impact on implementation of strategic plans.
Presence of modern technology in implementation of strategic plans has highest impact and manager's control over implementation of strategic plans has least impact on implementation of strategic plans.

Najmeh Yarigarravesh and Saeed Hakami Nasab

DISCUSSION AND CONCLUSION

Regarding research question 1, following gathering ideas and recommendations of the experts, 8 factors were determined as the main affecting factors in the current situation as follows: 1. Strategy and goal setting, 2. Resource allocation, 3. Organizational structure, 4. Organizational culture, 5. Communication and information, 6. Competitive pressure, 7. Management, 8. Control and technology.

Findings regarding research question 2 on prioritization of factors affecting implementation of strategic plans in Persian Gulf Petrochemical Company showed following prioritization: 1. Organizational culture, 2. Communication and information, 3. Organizational structure, 4. Management, 5. Competitive pressure, 6. Resource allocation, 7. Technology and control, 8. Strategy and goal setting.

Thus, it can be stated implementation of strategic planning means having clear and specific plan to achieve specific and clear goals, and determining these goals in advance influences implementation of strategic plans. Today all countries formulatelong-term and short-term plans for their development and progress. They plan for their future situation in global system and measures which should be taken.Since the stage of strategy formulation is done independently from implementation stage, most plans fail always in this stage, while plans stop rarely in the entry stage. In over 80 percent of cases, the plans are not transferred to the floor of the organization from the beginning which is mainly due to inadequate resource allocation.

Current business environment is environment of rapid changes. These changes have caused that experts in recent decades raise broad discussions on necessity for paying attention to organizational structure. Organizational structure may affect implementation of organization's plans including strategic planning.Organizational culture concept is regarded as an important factor in productivity and performance of the organization and if there is good working culture between management and employees, it would lead to strengthening organizational commitment, ethics promotion, higher performance and productivity, and better implementation of strategic plans.

Since planning is one of the major tasks of managers and it is closely related to other tasks, if there is planning-based attitude in the whole individual and organizational life, a kind of commitment to action based on futurist thinking and commitment to establish it is developed. Realization of individual and organizational goals requires planning. Need for planning is due to the fact that all organizations act in a dynamic environment and thus they seek for spending their limited resources to meet growing and various needs, and such environmental dynamicity and uncertainty results from environmental changes. It increases undeniable necessity for planning. Hence, it can be stated management has impact on implementation of strategic plans.

REFERENCES

1. Aker, D. (2006). Market Strategic Management, Tr. by H. Safarzadeh, A.A. Farhangi, and |M. Khademi, First Edition, PayamPooya Publication.
2. Ansof, I.H., McDonnell, E.J. (1996). Establishment of strategic management, Tr. by A. Zandiye, First Edition, Tehran, SAMT Publication, 58.
3. Aut, S.,Shefritz, J.I. (2000). Organization's Theories, Myths, Tr. by A. Parsaeeian, First Edition, Tehran: Farzaneh Publication.
4. Patrick, J., Bilu, G.L., Betty Morris, L., Kamp. (1997). Executive Guide to Strategic Planning, Tr. by M. SharifiKalouee, Tehran: Arvin Publication, 15-17.
5. Piers, J.A., Robinson, R.B. (2008). Strategic Management (Planning, Implementation and Control), Tr. by M. Hosseini, Third Edition, Tehran, SAMT Publication, 4-5.

6.   Pearce, Robinson. (2001). Strategic Planning and Management, Tr. by S. KhaliliShurini, Second Edition, Book Memory Publication, 307.

7.   Cobain, J.B., Henry Mintzberg, R.J. (1994). Strategic Management: Strategy Process, Tr. by M. Saebi, Tehran: Center for Public Management Education, 38-40.

8.   Haghighi, M. (2009).Factors influencing the success of strategic planning in National Iranian Gas Company. Business Management, 1: 3-4.

9.   Fardavar, D. (2000). Strategic Management, Tr. by A. Parsaeeianand M. Arabi, Tehran, Office of Cultural Research, First Edition, 24.

10. Gluk, W., Lawrence, J. (1992). Business Policy and Strategic Management, Tr. by S. KhaliliShurini, Tehran, Book Memory Publication, 16-18.

11. Acu, N., Englyst, L. (2006)"Assessment of strategy formulation:how to ensure quality in process and outcome", International Journal of production Management, 26:69-91.

12. Banker, R.D., Chang, H.,Janakiraman, S.N.,Konstans, C.(2004) "Abalanced scorecard analysis of performance metrics", European Journalof Operational Research, 154:423–436.

13. Lee, S. F., Sai On Ko, A.(2000)"Building BSC with SWOT and Sun Tzu The Art …on QFD methodology", Managerial AuditingJournal, 15: 68-76

14. Sallis, E.,Hingley, Peter. (2002). Total Quality Managemant in Education، 3rd edn،Kogan page، London.

15. Walters, B., Zaiyong, T. (2006).IT- Tnabled Strategic Management.Idea Group Publishing, 2006.

16. Yang, Y., Wu, W.W., Liang, D.P., Yu, B.(2010) "Strategic planning for management of technology of China's high technology enterprises",Journal of Technology Management in China, 5: 6-25

Table 1: Weights of main criteria

No.	Main Criterion	Weigh of Main Criterion
1	Organizational Culture	0.303
2	Communication and Information	0.205
3	Organizational Structure	0.131
4	Management	0.121
5	Competitive pressure	0.118
6	Resource allocation	0.085
7	Technology and Control	0.077
8	Strategy and goal setting	0.033

Table 2: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Determining strategies for planning	0.033	0.101	0.003
2	Determining policy of implementing strategic plans		0.255	0.008
3	Specifying goals of strategic plans for employees		0.643	0.021

Najmeh Yarigarravesh and Saeed Hakami Nasab

Table 3: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Enough resources to implement the strategic plans		0.426	0.036
2	Constituting the Executive Committee for resource allocation	0.085	0.248	0.021
3	Sufficient funds for implementation		0.326	0.028

Table 4: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Impact of structural complexity	0.131	0.385	0.050
2	Impact of organizational structure's formalization		0.110	0.014
3	Impact of structural centralization		0.505	0.066

Table 5: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Presence of participatory culture	0.303	0.221	0.067
2	Presence of adaptability culture		0.221	0.067
3	Presence of compliance culture		0.558	0.169

Table 6: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Effective communication	0.205	0.664	0.136
2	Communications for implementing strategic plans		0.190	0.039
3	External communications		0.146	0.029

Najmeh Yarigarravesh and Saeed Hakami Nasab

Table 7: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	entry of new investors	0.118	0.231	0.027
2	Competition among effective competitors		0.218	0.026
3	Replacement threat		0.551	0.065

Table 8: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Presence of executive manager in strategic plans	0.121	0.664	0.080
2	Manager's mastery over implementation of strategic plans		0.145	0.018
3	Manager's awareness about over implementation of strategic plans		0.191	0.023

Table 9: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Manager's control over implementation of strategic plans	0.077	0.102	0.007
2	Technology of implementation of strategic plans		0.255	0.019
3	Presence of modern technology in implementation of strategic plans		0.643	0.049

Table 10: Final prioritization

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
Organizational culture	Presence of adaptability culture	0.303	0.558	0.169
	Presence of compliance culture		0.067	0.221
	Presence of participatory culture		0.221	0.067

Najmeh Yarigarravesh and Saeed Hakami Nasab

Communication & information	Effective communication	0.205	0.664	0.136
	Communications for implementing strategic plans		0.190	0.039
	External communications		0.146	0.029
Organizational structure	Impact of structural centralization	0.131	0.505	0.066
	Impact of structural complexity		0.385	0.050
	Impact of organizational structure's formalization		0.110	0.014
Management	Presence of executive manager in strategic plans	0.121	0.664	0.080
	Manager's awareness about over implementation of strategic plans		0.191	0.023
	Manager's mastery over implementation of strategic plans		0.145	0.018
Competitive pressure	Replacement threat	0.118	0.551	0.065
	entry of new investors		0.231	0.027
	Competition among effective competitors		0.218	0.026
Resource allocation	Enough resources to implement the strategic plans	0.085	0.426	0.036
	Sufficient funds for implementation		0.326	0.028
	Constituting the Executive Committee for resource allocation		0.248	0.021
Technology & control	Presence of modern technology in implementation of strategic plans	0.077	0.643	0.049
	Technology of implementation of strategic plans		0.255	0.019
	Manager's control over implementation of strategic plans		0.102	0.007
Strategy & goal setting	Specifying goals of strategic plans for employees	0.033	0.643	0.021
	Determining policy of implementing strategic plans		0.255	0.008
	Determining strategies for planning		0.101	0.003

Decision Making Tree

Najmeh Yarigarravesh and Saeed Hakami Nasab

factors affecting implmentation of strategic plans

strategy & goal setting 0.033	resoruce allocation 0.085	organizational structure 0.131	organizational culture 0.303	information & communication 0.205	competitive pressure 0.118	management 0.121	technology & control 0.077
determing strategies for planning 0.101	Enough resources to implement the strategic plans 0.426	Impact of structural complexity 0.385	Presence of participatory culture 0.221	presence of effective communications 0.664	entry of new investors 0.231	Presence of executive manager in strategic plans 0.664	Manager's control over implementation of strategic plans 0.102
Determining policy of implementing strategic plans 0.255	Constituting the Executive Committee for resource allocation 0.248	Impact of organizational structure's formalization 0.110	Presence of adaptability culture 0.221	Communications for implementing strategic plans 0.190	Competition among effective competitors 0.218	Manager's mastery over implementation of strategic plans 0.145	Technology of implementation of strategic plans 0.255
Specifying goals of strategic plans for employees 0.643	Sufficient funds for implementation 0.326	Impact of structural centralization 0.505	Presence of compliance culture 0.558	external communication 0.146	Replacement threat 0.551	Manager's awareness about over implementation of strategic plans 0.191	Presence of modern technology in implementation of strategic plans 0.643

RESEARCH ARTICLE

Identifying and Prioritizing Factors Affecting Strategic Planning Success in Islamic Republic of Iran Customs using AHP Technique (Case Study: Tehran Province Customs)

Nasrin Heshmati Safa[1] and Saeed Hakami Nasab[2]*

[1]Department of Management, Faculty of Human Sciences, Semnan Science and Research Branch, Islamic Azad University, Semnan, Iran.
[2]Faculty of Industrial Engineering and Management, Department of Management, University of Shahrood, Shahrood, Iran.

*Address for correspondence
Saeed Hakami Nasab
Faculty of Industrial Engineering and Management,
Department of Management,
University of Shahrood,
Shahrood, Iran.

ABSTRACT

Current paper aims at identifying and prioritizing factors affecting strategic planning success. It is a descriptive study of analytical survey type. Data were collected using expert ideas. Following studying theoretical and research literature, factors affecting strategic planning success were identified and classified. Initial classification included 8 factors: 1. Participation of top management, 2. Impact of top management awareness about knowledge and its importance, 3. Team participation of employees, 4. Organizational commitment, 5. Employee acceptance, 6. Change management, 7. Proper environmental evaluation, 8. Suitable database and management information systems. Findings for second research question regarding prioritization of factors affecting strategic planning success in Tehran Province Customs showed priorities as follows: 1. top management awareness about knowledge and its importance, 2. Participation of top management, 3. Team participation of employees, 4. Employee acceptance, 5. Organizational commitment, 6. Suitable database and management information systems, 7. Change management, 8. Proper environmental evaluation.

Key words: managers, planning, strategic planning, Success.
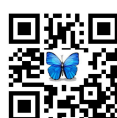
Nasrin Heshmati Safa and Saeed Hakami Nasab

INTRODUCTION

Strategic management is a process which is used by most successful and famous companies of the world for directing and progressing their plans and activities with long term horizon and achieving goals and realization of organizational mission. This type of planning which have been often used by great organizations would lead to selection of strategies which direct toward organizational excellence if they are properly formulated and timely implemented. Strategic planning is highly important for every organization in today competitive world, it has unique characteristics and various models have been proposed by theorists. Simply speaking, strategic plan can improve performance. Members of the organization got confused by the fixed tasks and daily challenges and they may lose direction of the organizational goals and their vision toward it. a strategic plan not only is able to improve understanding of the goals in members, but also it can create and stimulate futurist thinking based on a common understanding of the organizational mission. Cooperation among members of the organization will be effective if they work with shared assumptionstoward shared goals (ZareiMatin, 1992). Formulation of strategic planning in Tehran Province Customs is regarded as one of the major requirements of the success in Islamic Republic of Iran'scustoms, because performing any activity without considering its goal especially at organization dimensions may distort the organization and lead to its failure and recession. In strategic planning, macro goals and limitations for their realization is specified, and by analyzing needs of stakeholders and role of the organization in meeting these needs and analyzing weaknesses and strengths inside the organization and external opportunities and threats, it formulates strategies which facilitate realization of the depicted vision. Considering role and importance of Islamic Republic of Iran's customs in economic activities and global markets, and given the fact that it face severe competition like any other organization and always seeks for success, it needs utilization of strategic planning. Considering importance of strategic planning, current research aims at identifying factors affecting strategic planning success using AHP technique in Tehran Province Customs.

Theoretical background

Strategic Planning

According to some authors, planning is the process through which the organization combine and integrate all its activities and attempts regarding expected situation to achieve it and pas the way (Bello et al., 2008). Strategic planning is a kind of planning which requires consciously setting appropriate goals for the organization considering environmental conditions and application of suitable approach to meet these goals. Strategic planning includes a framework or ground for realization of strategic thinking and directing operations to achieve specific and planned outcomes (Bello et al., 2008). In other words, strategic planning is organized and ordered attempt for adopting fundamental decisions and performing basic measures which shape essence and orientation of the organization's activities within a legal framework (Bryson, 2011).

Research Background

Reviewing research background shows various studies have been allocated to strategic planning. Table 1 summarizes some of them.

Following specifying research subject and defining it, theoretical foundations and models are studied and domestic and foreign studies are reviewed. Then, following factors are selected as factors affecting strategic planning success: Participation of top management, Impact of top management awareness about knowledge and its importance, Team participation of employees, Organizational commitment, Employee acceptance, Change management, Proper environmental evaluation, Suitable database and management information systems. According to the model

Nasrin Heshmati Safa and Saeed Hakami Nasab

proposed by Haghighi (2009), impact of five factors including senior management participation in the strategic planning process, senior management awareness of knowledge and importance of strategic planning, team participation of employees in the strategic planning process, change management in the strategic planning process and accurate environmental assessment in success of strategic planning in National Iranian Gas Company was supported. These factors were selected as factors affecting strategic planning and were entered into finalmode

Methodology

Research method in this work can be examined in several views. In terms of purpose, it is applied research, because it is conducted in order to find rapid solution for problems so that barriers can be eliminated through systematic planning or they can be prevented. On the other hand, this research is descriptive and analytical survey in terms of research nature. In order to collect data in this work, following approaches were used: library studies: in this approach, information are collected through studying books, papers, journals, internet sources and information databases, and after selection of the sources, notes are taken and foreign texts are translated for research foundation. Interview: experts are interviewed for evaluating variables based on the author's experiences and other research variables are designed in order to collect information. Questionnaire: it is used as AHP pair-wise comparisons. Since statistical analysis is not used in this method, there is no discussion on statistical population, sampling and questionnaire in statistical population.

Five experts who were experiences in terms of organizational position, education, etc. in Tehran Province Customs were used as experts and decision makers. Face and content validity was used for determining validity of the questionnaire. Following designing and developing the questionnaire, ideas of the experts and professors were taken and following modifications, face validity and content validity will be supported. In order to examine reliability of the questionnaire, common questionnaires like Likert scale were not used, rather AHP pair-wise comparisons was used. Inconsistency rate of the questionnaire was smaller than 0.1 (0.001) and reliability of the questionnaire was confirmed.

$$I.I = (\text{-} \lambda_{max} - n)/(n-1)$$

$$I.R. = I.I/(I.I.R_{6*6}) = 0.001$$

In this research, firstly main factors affecting strategic planning success are identified and selected and then they are prioritized. Factors were identified based on library studies and interview with the experts and initial selection and classification was done.

Intial classification include 8 main factors as follows:

1. Participation of top management, 2. Impact of top management awareness about knowledge and its importance, 3.Team participation of employees, 4.Organizational commitment, 5.Employee acceptance, 6. Change management, 7. Proper environmental evaluation, 8.Suitable database and management information systems. It is evident that importance and influence level of these factors is different.

Following specifying final factors for description, MADM model, AHP, was formulated. The reason for using AHP is solving multivariate decision making problems with hierarchical structure. Then, data needed for implementation of the model should be collected. This stage is the most important stage after model formulation, since all inferences, conclusions, recommendations, and suggestions will be made based on results of calculation of these data. To this end, necessary data were collected by developing, distributing and collecting questionnaires.

Nasrin Heshmati Safa and Saeed Hakami Nasab

Findings

Q1: What are factors affecting strategic planning success?

Following gathering ideas and recommendations of the experts, 8 factors were determined as the main affecting factors in the current situation as follows:

1. Participation of top management
2. Top management awareness about knowledge and its importance
3. Team participation of employees
4. Organizational commitment
5. Employee acceptance
6. Change management
7. Proper environmental evaluation
8. Suitable database and management information systems

Q2: How is priority of factors affecting strategic planning success?

AHP Model Design

Modeling in AHP is based in hierarchy tree which represents the problem under study. Its level 1 is the goal and last level is competing alternatives and intermediary levels are decision making criteria. In the problem modeling of the current research, the goal is determining and prioritizing factors affecting strategic planning success, which is summarized in the tree, and competing alternatives are final affecting factors, which are selected following statistical analysis. 8 factors including 1.Participation of top management, 2. Top management awareness about knowledge and its importance, 3. Team participation of employees, 4.Organizational commitment, 5.Employee acceptance, 6. Change management, 7. Proper environmental evaluation, 8. Suitable database and management information systems are considered as decision making criteria for evaluating the alternatives. That is, strategic planning success is affected by these 8 factors. According to the calculations (available in appendix), weight of 8 main factors affecting strategic planning success is given as Table 2.

Priority of the criteria is as follows:

Top management awareness about knowledge and its importance has highest impact and Proper environmental evaluation has least impact on strategic planning success.

DISCUSSION AND CONCLUSION

Findings regarding first research question, following studying theoretical and research literature, factors affecting strategic planning success were identified and classified. Initial classification included 8 factors: 1. Participation of top management, 2. Impact of top management awareness about knowledge and its importance, 3. Team participation of employees, 4. Organizational commitment, 5. Employee acceptance, 6. Change management, 7. Proper environmental evaluation, 8. Suitable database and management information systems.

Findings for second research question regarding prioritization of factors affecting strategic planning success in Tehran Province Customs showed priorities as follows: 1. top management awareness about knowledge and its

4118

Nasrin Heshmati Safa and Saeed Hakami Nasab

importance, 2. Participation of top management, 3. Team participation of employees, 4. Employee acceptance, 5. Organizational commitment, 6. Suitable database and management information systems, 7. Change management, 8. Proper environmental evaluation.

Research findings showed individuals who are responsible for part of strategic planning should participate in designing that part. Various studies investigate key role of top management of the organization and its participation in success of strategic planning. Inappropriate understanding of top managers about this process and lack of their support and commitment are factors for strategic planning process failure. Strategic awareness in strategic planning process refers to appropriateknowledge about competitors, customer resources, and regulations. Identification of strategic planning goals allows organization to align goals of the organization and provide better plans by better choices. Research findings indicate role and importance of team participation in various studies have been shown. Team participation plays basic role in strategic planning process and its success. Informing team of organizational changes is the main part of team participation. Research findings in this work are consistent with findings by Haghighi (2009). They found team participation as important in strategic planning success inNational Iranian Gas Company.

Research findings in this work are consistent with findings by Haghighi (2009). They found organizational commitment as important in strategic planning success inNational Iranian Gas Company. Environmentaluncertainty is one of the factors affecting success of the organization's planning. In an uncertain environment, organizations perform business strategic planning as an organizational learning process. Research findings in this work are consistent with findings by Haghighi (2009). They found proper environmental evaluation as important in strategic planning success inNational Iranian Gas Company.

REFERENCES

1. Abarghooei, S. (2010).Fuzzy approach to strategic planning in agriculture, Agricultural Economics and Development, No. 71.
2. Ahmadi, H. (2001).Strategic planning and its application, Saye Nama Cultural Center, Tehran.
3. Bello A., Maes, J., Egoh, B., Willemen, L., Liquete, C., Vihervaara, P., Schägner, J. P., Bidoglio, G. (2008).Mapping ecosystem services for policy support and decision making in the European Union.Ecosystem Services, 1: 31-39.
4. Bryson, J. M. (2011). Strategic planning for public and nonprofit organizations: A guide to strengthening and sustaining organizational achievement, John Wiley and Sons.
5. Gholipour, H. (1384). Strategic planning for SMBs, Business Journal, 9:35.
6. Haghighi, M. (2009).Factors affecting strategic planning process in National Iranian Gas Company, Business Management, 1: 3-4.
7. Kouri,M., Ko‹A.S.O. and Lee‹S.F.(2000)‹"Implementing the strategic formulation framework for the banking industry of Hong Kong"‹ Managerial Auditing Journal‹Vol. 15‹pp. 46-77.
8. Rahimnia, F. (2011).Elements of strategic planning for providing conceptual and practical model for small industrial companies, Industrial Management Studies, 9:23.
9. Sadeghi, M. (2011).Analysis of marketing information systems effect on strategic planning effectivenss (Case study: Banks), Beyond Management, Productivity Management, 5: 25- 51.
10. Samadi, M. (2009).(Ahwaz Pipe Co.), Journal of Behavior, Specific for Management Papers, 7: 12.
11. Umbi, R. M. (2003). Strategic planning in a turbulent environment: evidence from the oil majors. Strategic management journal, 24: 491-517.
12. ZareiMatin, H. (1992).Strategic planning for strategic resources, Knowledge Management Journal, Tehran University Press, 17: 66.

Nasrin Heshmati Safa and Saeed Hakami Nasab

Table 1: Summary of research background

No.	Author	Year	Title	Method	Finding
1	Samadi	2009	marketing strategic planning and appropriate strategy selection using AHP	AHP technique	Three extracted strategies include product development, horizontal integration and homogenous diversification, in terms of priority
2	Abarghooei	2010	Fuzzy approach to strategic planning in agriculture	Brainstorming	Results for fuzzy analysis show threatening and harmful effect of external factors as internal weaknesses is stronger than opportunities and strengths which are present for achieving optimal outlook. In strategy setting, internal weaknesses should be more considered than external threats.
3	Sadeghi	2011	Analysis of marketing information systems effect on strategic planning effectiveness (Case study: Banks)	Descriptive	Findings show external output of the marketing information systems has strong impact on effectiveness of marketing strategic planning process. Other findings suggest variables of information content and form have highest and lowest explanatory power for changes in elements of strategic planning process.
4	Gholipour	2005	Strategic planning for SMBs	Descriptive	Results of data analysis show in the view of statistical sample, there is significant difference between strategic planning in large sized companies and this type of planning in small sized companies in various cases, and the model proposed in this research is suitable for strategic planning in small sized companies.
5	Ahmadi	2001	Investigating a mathematical optimization model for strategic planning of technology transfer in developing countries	Descriptive	The model includes two phases: phase 1: determining optimality of strategies, policies and plans under study using qualitative, quantitative, an critical criteria, phase 2: optimization of alternatives considering budget, HR, time, etc. limitations. Developed mathematical model was used for achieving technology needs by one of manufacturing units in Iran and its effectiveness was tested.
6	Haghighi	2009	factors affecting strategic	Ground finding	Impact of five factors including senior management participation in the

4120

Nasrin Heshmati Safa and Saeed Hakami Nasab

			planning process in National Iranian Gas Company		strategic planning process, senior management awareness of knowledge and importance of strategic planning, team participation of employees in the strategic planning process, change management in the strategic planning process and accurate environmental assessment in success of strategic planning in National Iranian Gas Company was supported
7	Rahimnia	2011	elements of strategic planning for providing conceptual and practical model for small industrial companies	Ground finding	Findings showed 70 percent of the companies under study had coherent plans. Unlike previous studies, this study found no significant linear relationship between strength of strategic planning and environmental change.
8	Umbi	2010	Factors affecting implementation of strategic plans in technical training institutes in public centers	Ground finding	According to the findings, management support helps enhancingimplementation of strategic planning in Department of Veterinary.
9	Kouri et al.	2009	Factors for success of strategic planning: reconstruction of digital library scientific plan	Survey	Results for poll along with local experience of the authors show there are several potential factors including employee skill and budget which affect strategic planning.

NasrinHeshmati Safa and Saeed Hakami Nasab
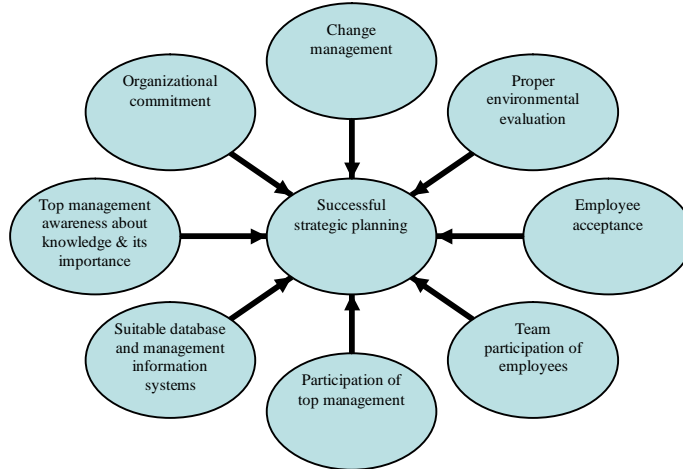
Fig1: Haghighi's model (2009)

Table 2: Weights of main criteria

No.	Main Criterion	Weigh of Main Criterion
1	Participation of top management	0.181
2	Impact of top management awareness about knowledge and its importance	0.328
3	Team participation of employees	0.145
4	Organizational commitment	0.103
5	Employee acceptance	0.105
6	Change management	0.037
7	Proper environmental evaluation	0.036
8	Suitable database and management information systems	0.065

Table 3: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Participation of managers in formulating strategic planning		1	0.181
2	Participation of managers in implementing strategic planning	0.181	1	0.181
3	Participation of managers in monitoring strategic planning		1	0.181

Nasrin Heshmati Safa and Saeed Hakami Nasab

Table 4: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Awareness of managers about strategic planning knowledge	0.328	0.643	0.211
2	Awareness of managers about implementation of strategic planning		0.255	0.083
3	Participation of managers in training courses for strategic planning		0.101	0.033

Table 5: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Implementation of strategic planning as team	0.145	0.385	0.055
2	Cooperation of employees as team in strategic planning		0.504	0.073
3	Creating specific groups for strategic planning in different units		0.111	0.016

Table 6: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Continuous commitment of employees to strategic planning	0.103	0.231	0.024
2	Normative commitment of employees to strategic planning		0.218	0.022
3	Affective commitment of employees to strategic planning		0.551	0.056

Table 7: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Extent of acceptance of strategic planning importance	0.105	0.643	0.067
2	Lack of resistance toward strategic planning		0.255	0.027
3	Positive attitude of employees toward strategic planning		0.102	0.011

Nasrin Heshmati Safa and Saeed Hakami Nasab

Table 8: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Familiarization of employees with the change which is created in the organization's planning	0.037	0.665	0.024
2	Acceptance of planning change by employees		0.145	0.000
3	Managing changes which are as a result of strategic planning		0.190	0.007

Table 9: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Preparing ground for entrance of strategic planning	0.036	0.325	0.011
2	Creating suitableenvironmental ground for strategic planning acceptance		0.426	0.012
3	Proper environmental evaluation		0.248	0.008

Table 10: Weights of sub-criteria

No.	Sub-criterion	Weight of main criterion	Weight of sub-criterion	Final weight
1	Availability of database	0.065	0.643	0.042
2	Availability of adequate information in organization		0.255	0.017
3	Access to organizational information		0.102	0.006

Table 11: Final prioritization

Factor	Weight of main criterion	Weight of sub-criterion	Final weight
Participation of managers in formulating strategic planning	0.181	1	0.181
Participation of managers in implementing strategic planning	0.181	1	0.181
Participation of managers in monitoring strategic planning	0.181	1	0.181
Awareness of managers about strategic planning knowledge	0.328	0.643	0.211
Awareness of managers about implementation of strategic planning	0.328	0.255	0.083
Participation of managers in training courses for strategic planning	0.328	0.101	0.033
Implementation of strategic planning as	0.145	0.385	0.055
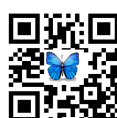
Nasrin Heshmati Safa and Saeed Hakami Nasab

team			
Cooperation of employees as team in strategic planning	0.145	0.504	0.073
Creating specific groups for strategic planning in different units	0.145	0.111	0.016
Continuous commitment of employees to strategic planning	0.103	0.231	0.024
Normative commitment of employees to strategic planning	0.103	0.218	0.022
Affective commitment of employees to strategic planning	0.103	0.551	0.056
Extent of acceptance of strategic planning importance	0.105	0.643	0.067
Lack of resistance toward strategic planning	0.105	0.255	0.027
Positive attitude of employees toward strategic planning	0.105	0.102	0.011
Familiarization of employees with the change which is created in the organization's planning	0.037	0.665	0.024
Acceptance of planning change by employees		0.145	0.000
Managing changes which are as a result of strategic planning		0.190	0.007
Proper environmental evaluation	0.036	0.325	0.011
Preparing ground for entrance of strategic planning	0.036	0.426	0.012
Creating suitable environmental ground for strategic planning acceptance	0.036	0.248	0.008
Availability of database	0.065	0.643	0.042
Availability of adequate information in organization	0.065	0.255	0.017
Access to organizational information	0.065	0.102	0.006

Nasrin Heshmati Safa and Saeed Hakami Nasab

Participation in formulating strategic planning1

Participation in implementing strategic planning1

Participation in monitoring strategic planning 1

Participation of top management 0.181

Awareness about strategic planning knowledge 0.643

Awareness about implementation of strategic planning 0.255

Participation in training courses for strategic planning 0.101

Top management awareness 0.328

Implementation of strategic planning as team 0.385

Cooperation of employees as team in strategic planning 0.504

Creating groups for strategic planning in different units0.111

Team participation of employees 0.145

Continuous commitment of employees to strategic planning 0.231

Normative commitment of employees to strategic planning 0.218

Affective commitment of employees to strategic planning 0.551

Organizational commitment 0.103

Extent of acceptance of strategic planning importance 0.643

Lack of resistance toward strategic planning 0.255

Positive attitude of employees toward strategic planning 0.102

Employee acceptance 0.105

Familiarization with the change in the organization's planning 0.665

Acceptance of planning change by employees 0.145

Managing strategic planning change 0.190

Change management 0.037

Proper environmental evaluation 0.325

Preparing ground for entrance of strategic planning 0.426

Creating suitable environmental ground for strategic planning acceptance 0.248

Proper environmental evaluation 0.036

Availability of database 0.643

Availability of adequate information in organization 0.255

Access to organizational information 0.102

Suitable database and management information systems 0.065

Strategic planning success

Fig 1. Research conceptual model

RESEARCH ARTICLE

Association of Body Composition and Socio-economic factors among University Staff

Mansour Rezaei[1]* and Mahdi Faramoushi[2]

[1]Department of Industrial Design, Tabriz Islamic Art University, Tabriz, Iran
[2]Department of Physical Education, Tabriz Islamic Art University, Tabriz, Iran

*Address for correspondence
Mansour Rezaei
Department of Industrial Design,
Tabriz Islamic Art University,
Tabriz, Iran
E-mail: rezaie.m.art@gmail.com

ABSTRACT

Body composition is affected by several factors such as age, sex, genes, diet, and exercise. It may also be influenced by some socioeconomic factors. The objective of the present study was to evaluate the association between socioeconomic factors and body composition among university staff.
This cross-sectional study was conducted at Tabriz Islamic Art University. 102 male staff-faculty and employees- were invited to participate in this study. Body composition was measured by body composition analyzer (Boca X, Germany) and fat-free mass (FFM), fat mass (FM), total body fat percentage (TBF) were obtained. The skin folds were obtained using Harpenden skin fold caliper on the right side of the body at the following sites: chest, abdominal, and thigh. Socioeconomic factors including education status and income were determined using questionnaires. The data were analyzed using SPSS software version 22. Spearman's correlation test was used to analyze the data. Statistical significance was set at $P < 0.05$.The data analysis revealed that there was no significant relationship between socio-economic factors and body composition measurements except a negative correlation between body fat and income ($P > 0.05$). Income was significantly correlated with fat mass ($r=-0.38$, $p=0.032$) and fat percentage ($r=-0.45$, $p=0.02$). Staff from with low income are at higher risk of having excessive fat. It may be in part due to obligation for working overtime and then less physical activity during leisure time.

Key Words: Body composition, Monthly income, Educational status, Fat mass
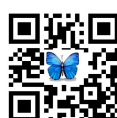
Mansour Rezaei and Mahdi Faramoushi

INTRODUCTION

Nowadays, there is broad agreement among clinicians, exercise scientists, and public health experts that body composition influence vulnerability and resistance to disease (1). Body composition is influenced by age, sex, genes, and several environmental and behavioral factors such as exercise, diet, smoking and alcohol(2). It is speculated that there is an association between these factors and longevity which may be caused by redundant fat mass. Obesity poses one of the leading public health challenges for the 21st century all around the world(3). Developed and developing societies are now facing an epidemic of obesity(3). Rapid increases in the prevalence of obesity have also been noted in developing countries which have been resulted from lifestyle changes(3). It is related adversely to metabolic biomarkers and to poor health outcomes as it is an important risk factor for premature death (4-6) and diseases like diabetes, cardiovascular disease, high cholesterol, hypertension and asthma (7-9). Excess weight also reduces the quality of life, raises medical expenditures, stresses the health care system and decreases productivity(10, 11).

A number of studies have shown that there might be a relationship between obesity and socioeconomic factors but the reports are controversial (12-15). In the developed world there has been shown a consistently inverse relationship between socioeconomic status (SES) and obesity or being overweight for women, and no relationship in men or children (16). In contrast, there is a positive relationship between SES and obesity in both sexes in the developing world. National data from poorer countries in Latin America, such as Guatemala and Honduras, for example, showed higher levels of SES associated with a greater prevalence of obesity; however, in the richer countries, like Mexico, there was an entirely negative association between SES and obesity (17). Seminal review of 144 studies by Sobal and Stunkard (1989) conducted 15 years ago demonstrated a direct relationship between SES and obesity in developing societies. In other words, men, women and children of higher SES had a higher likelihood of being obese than those of lower SES(16). In developed societies, an inverse relationship was found for women, while relationships for men and children were inconsistent (12, 13). People with low SES are already at high risk of poorer health from a range of chronic conditions and diseases. Regarding the literature, the reports about the association between body composition and socioeconomic factors are controversial. The objective of the present study was to evaluate the potential association between socioeconomic factors and body composition in university staff.

MATERIALS AND METHODS

Subjects:

All staff members of Tabriz Islamic Art University were invited through e-mail to participate in this cross-sectional study; 102 male staff- faculty and employees- accepted the invitation. An orientation session was held to provide a detailed study overview to the subjects. Volunteers filled out the consent form and general health questionnaire during the orientation session. Participants suffering from serious disease such as serious heart, lung, kidney or liver failure, neurological disorders, diabetes and cancer were excluded from the study.

Anthropometric measures:

Participants were asked to attend the laboratory to be measured for body composition. Total body mass and height were measured in the laboratory with the subjects dressed in light clothing. Body mass index was calculated as body mass in kilograms divided by height in meters squared (kg/m^2). The skin folds were obtained using Harpenden skin fold caliper on the right side of the body at the following sites: chest, abdominal, and thigh. Whole-body composition was measured by body composition analyzer (Boca X, Germany) and fat-free mass (FFM), fat mass (FM), total body fat percentage (TBF) were obtained. Participants were asked to avoid any kind of exercise 24 hours prior to measurements. They were also required to avoid eating and drinking 4 hours before measurements.

Mansour Rezaei and Mahdi Faramoushi

Socioeconomic factors:

The socioeconomic factors being studied were education and income, based on self-reported information. All respondents educational attainment were assessed using a 4-category questionaire: 1- High-school or less, 2- Some college degree, 3-graduate and 4-postgradute.
Income was measured as monthly salary plus income from all sources of the respondent and his or her spouse and also was grouped into 4 categories: 1) less than 10 million Rials, 2) 10-15 million Rials, 3) 15-20 million Rials and 4) 20 million Rials or more.

Statistical analyses:

All analyses were performed by SPSS-18 statistical software. Mean and standard deviations were calculated for all variables. Distribution of data was assessed for normality using Shapiro-Wilk test. Relationships between the parameters were examined using the Spearman's correlation test (r). Statistical significance was set at a level of $P < 0.05$.

RESULTS

Table 1 shows the mean values and standard deviations of anthropometric measurements in the study population. Socioeconomic status including monthly income and educational level is shown in table 2.
The data were analyzed for the relationship between socioeconomic factors and weight, fat percent, fat mass, and fat free mass.

There were no significant relationship between educational status and body composition variables including BMI, weight, fat percentage, fat mass, and fat free mass (r=0.087, p>0.05, r=0.138, p>0.05, r=0.029, p>0.05, r=0.045, p>0.05, r=0.145, p>0.05, respectively). Moreover, We observed no significant correlation between income and BMI, weight, fat percentage, fat mass, and fat free mass (r=0.095, p>0.05, r=0.088, p>0.5, r=-0.45, p=0.02, r=-0.38, p=0.032, r=0.103, p>0.05, respectively). The relationship between income and fat percentage (r=-0.45, p=0.02) and also between income and fat mass (r=-0.38, p=0.032) was statistically significant showing that staff with lower income had more fat.

DISCUSSION

In this study of university staff, socio-economic factors were examined in relation to the anthropometric measurements of BMI, weight, fat percentage, fat mass, and fat free mass. Our findings showed that there was no significant relationship between socio-economic factors and body composition measurements except a negative correlation between income and body fat.

The association between income and the BMI has been investigated in several studies. It is a controversial issue, some authors reported a connection, while others have not found any relationship (15, 18, 19). We observed no significant relationship between socio-economic factors and BMI, weight and fat free mass which is inconsistent with Rosmond et al (1999). They reported a significant positive relationship between low level of education and BMI (15). They claimed that educational level and employment showed significant, independent predictive power to the BMI. The results were also inconsistent with Fernald (2007) who reported a positive correlation between BMI and socio-economic factors(14). They concluded that some factors related to habitual diet such as the increased consumption of high calorie beverages and foods may explain some of the positive relationship between socio-economic factors and body mass index as it was reported previously(20, 21). On the contrary, our results are consistent with Cawley and Schmeiser(22, 23). Schmeiser et al (2008) found that family income has no appreciable effect on BMI among men. However, they provided an evidence of a positive causal link between income and weight for men(23).

4129

Mansour Rezaei and Mahdi Faramoushi

One of the main findings of the present study was the negative relationship between body fat and income. Some authors have reported a connection between socioeconomic factors and obesity. It has shown in some studies that the poor are leaner and the more affluent are more frequently obese(24). On the contrary, some reported that obesity is more common in those of lower socioeconomic status, and less frequent in the highest socioeconomic class which is to some extent consistent with our result (24, 25). We speculate that the lifestyle may be a contributing factor in the negative relationship between income and body fat percentage. Estabrooks et al (2003) reported that people in high socioeconomic status were more active than people in low socioeconomic status (26). Brownson et al (2000) also reported that people with higher incomes were more likely to participate in leisure time physical activities than those with lower incomes(27). Hence, socioeconomic status may influence life-style and fatness as well. Low income may obligate staff to work overtime. Therefore, they might lack the time to do exercise during leisure time which can result in fatness. Gran et al, reported that fatness increases with income level in the adult male, which is contradictory with ours, yet decreases with increasing income in the adult female (28, 29). Among men higher education or higher income was associated with greater fatness (24). Ogend et al (2010) reported that among men, obesity prevalence was generally similar at all income levels, with a tendency to be slightly higher at higher income levels, but there was no significant trend between education level and obesity prevalence(12).

It seems that the differences between our results and those reported previously may be related to sum factors such as the small sample size, gender distribution or underreporting in questionnaires by the participant which can be the limitations of present study. The relationship between obesity and socioeconomic status differs by sex and race and ethnicity group(12). It is reported that women, for instance, are more stigmatized by obesity than men (15, 30, 31). It shows that they are more concerned about their weight and shape than men. It may provide an incentive for women to have an active life style.

CONCLUSION

The results of the present study showed that educational status was not correlated with body composition measurements,   yet, there was a negative relationship between income and fat percentage showing that Staff with low income is at higher risk for having excessive fat. We speculate that it may be in part due to obligation for working overtime and then less physical activity during leisure time.

ACKNOWLEDGEMENTS

REFERENCES

1. Cesari M, Penninx BW, Newman AB, Kritchevsky SB, Nicklas BJ, Sutton-Tyrrell K, et al. Inflammatory markers and cardiovascular disease (the health, aging and body composition [health ABC] study). The American journal of cardiology. 2003;92(5):522-8.
2. Roche AF, Heymsfield SB, Lohman TG. Human body composition: Human Kinetics Publishers; 199
3. Yoon K-H, Lee J-H, Kim J-W, Cho JH, Choi Y-H, Ko S-H, et al. Epidemic obesity and type 2 diabetes in Asia. The Lancet. 2006;368(9548):1681-8.
4. Allison DB, Fontaine KR, Manson JE, Stevens J, VanItallie TB. Annual deaths attributable to obesity in the United States. Jama. 1999;282(16):1530-8.
5. Fontaine KR, Redden DT, Wang C, Westfall AO, Allison DB. Years of life lost due to obesity. Jama. 2003;289(2):187-93.

6. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. Jama. 2005;293(15):1861-7.

7. Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. Jama. 1999;282(16):1523-9.

8. Mokdad AH, Bowman BA, Ford ES, Vinicor F, Marks JS, Koplan JP. The continuing epidemics of obesity and diabetes in the United States. Jama. 2001;286(10):1195-200.

9. McTigue K, Larson JC, Valoski A, Burke G, Kotchen J, Lewis CE, et al. Mortality and cardiac and vascular outcomes in extremely obese women. Jama. 2006;296(1):79-86.

10. Andreyeva T, Sturm R, Ringel JS. Moderate and severe obesity have large differences in health care costs. Obesity Research. 2004;12(12):1936-43.

11. Finkelstein EA, Fiebelkorn IC, Wang G. National medical spending attributable to overweight and obesity: how much, and who's paying? HEALTH AFFAIRS-MILLWOOD VA THEN BETHESDA MA-. 2003;22(3; SUPP):W3-219.

12. Ogden CL, Statistics NCfH. Obesity and socioeconomic status in adults: United States, 2005-2008: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2010.

13. Ball K, Crawford D. Socioeconomic status and weight change in adults: a review. Social science & medicine. 2005;60(9):1987-2010.

14. Fernald LC. Socio-economic status and body mass index in low-income Mexican adults. Social science & medicine. 2007;64(10):2030-42.

15. Rosmond R, Björntorp P. Psychosocial and socio-economic factors in women and their relationship to obesity and regional body fat distribution. International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity. 1999;23(2):138-45.

16. Sobal J, Stunkard AJ. Socioeconomic status and obesity: a review of the literature. Psychological bulletin. 1989;105(2):260.

17. Barquera S, Rivera JA, Espinosa-Montero J, Safdie M, Campirano F, Monterrubio EA. Energy and nutrient consumption in Mexican women 12-49 years of age: analysis of the National Nutrition Survey 1999. salud pública de méxico. 2003;45:530-9.

18. Troisi R, Weiss S, Segal M, Cassano P, Vokonas P, Landsberg L. The relationship of body fat distribution to blood pressure in normotensive men: the normative aging study. International journal of obesity. 1990;14(6):515-25.

19. Van Barneveld T, Seidell J, Traag N, Hautvast J. Fat distribution and gamma-glutamyl transferase in relation to serum lipids and blood pressure in 38-year old Dutch males. European journal of clinical nutrition. 1989;43(12):809-18.

20. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. The American journal of clinical nutrition. 2006;84(2):274-88.

21. Wannamethee SG, Shaper AG. Alcohol, body weight, and weight gain in middle-aged men. The American journal of clinical nutrition. 2003;77(5):1312-7.

22. Cawley J, Moran J, Simon K. The impact of income on the weight of elderly Americans. Health Economics. 2010;19(8):979-93.

23. Schmeiser MD. Expanding wallets and waistlines: the impact of family income on the BMI of women and men eligible for the earned income tax credit. Health economics. 2009;18(11):1277-94.

24. Garn SM, Bailey SM, Cole PE, Higgins I. Level of education, level of income, and level of fatness in adults. The American journal of clinical nutrition. 1977;30(5):721-5.

25. Silverstone JT. Obesity and social class. Psychotherapy and psychosomatics. 1970;18(1-6):226-30.

26. Estabrooks PA, Lee RE, Gyurcsik NC. Resources for physical activity participation: does availability and accessibility differ by neighborhood socioeconomic status? Annals of Behavioral Medicine. 2003;25(2):100-4.

27. Brownson RC, Housemann RA, Brown DR, Jackson-Thompson J, King AC, Malone BR, et al. Promoting physical activity in rural communities: walking trail access, use, and effects. American journal of preventive medicine. 2000;18(3):235-41.

28. Garn SM, Clark DC. Economics and fatness. Ecology of Food and Nutrition. 1974;3(1):19-20.

29. McLaren L. Socioeconomic status and obesity. Epidemiologic reviews. 2007;29(1):29-48.
30. Björntorp P. Visceral obesity: a "civilization syndrome". Obesity Research. 1993;1(3):206-22.
31. Drapeau V, Therrien F, Richard D, Tremblay A. Is visceral obesity a physiological adaptation to stress? Panminerva medica. 2003;45(3):189-96.

Table 1. Anthropometric characteristics of the participants

Age(year)	33.87±6.54
Weight(kg)	77.97±10.95
Height(cm)	175.08±6.36
BMI(kg/m²)	25.40±3.60
Fat percentage	21.81±6.49
Fat mass	7.59±6.89
Fat free mass	57.35±5.67

Table 2. Socioeconomic status of the participants

characteristic	No (102)	%
Educational level		
High school or less	18	17.64
Some college degree	9	8.82
Graduate	39	38.23
Post graduate	36	35.29
Monthly income		
Less than 10 million R	71	69.60
10-15 million R	13	12.74
15-20 million R	13	12.74
20 million R or more	5	4.90

RESEARCH ARTICLE

Security Risks Assessment by Customer in Cloud Computing

Lotfiserveh[1]* and Fakhri parvin[2]

[1]Faculty member of computer engineering department, islamicazaduniversity, marivanbranch, marivan, Iran
[2]Candidate of computer engineering, islamicazaduniversity, science and research branch, tehran, Iran

*Address for correspondence
Lotfiserveh
Faculty member of computer engineering department,
Islamicazaduniversity,
Marivan branch, marivan, Iran
Email: serveh_lotfi2002@yahoo.com

ABSTRACT

Cloud computing with its appealing promises such as decreased costs and facilitation of complicated IT management, has been widely welcomed by many customers. Notwithstanding, its advantages are also accompanied with some challenges and concerns about its security risks for cloud customers**.** The present paper deals with quantitative assessment of security risks mentioned by customer as follows: first, a customer identifies the security risks and subsequently, performs its quantitative assessments. At the next stage, security risksare sent by the customer to different providers who have the intended service and after the quantitative assessment performed by the providers and sending them to customer, a cloud customer while comparing its quantitative assessment with providers' assessment, selects a provider who has the least possible risk.

Key words: Cloud Computing, Security Risk, Customer, Provider, Risk Assessment.

INTRODUCTION

Cloud computing is continuously being adopted by a wide range of users and organizations but the security issues and challenges existing in it has led many people to feel suspicious about adopting them. For instance, even computer giants such as Google, Microsoft, Amazon, and Salesforce.com have had security problems in cloud computing[1]. For example, on February 24th in 2009, Gmail service was disconnected for four hours and it was disabled. Also, according to the survey conducted on 244 IT executives by IDC about cloud services in 2009, it was revealed that security was at the top of the cloud-related concerns[2].Now, despite the improvements in cloud technology and increased number of employees, cloud computing, as a new technology, introduces more security

4133

Lotfiserveh and Fakhri parvin

risks[3].Therefore, it is necessary that a cloud customer evaluates the security risks before placing its sensitive data in the cloud and thereby by being aware of the existing risks and vulnerability in cloud computing cloud customers can select the cloud provider with the lowest possible risk. Consequently, the customer would put its data in a cloud with the highest level of confidence.

This paper provides a framework for quantitative assessment of security risks mentioned by the customer and has been organized as follows: The second section discusses the relevant and significant works on security risk assessment. Section 3 includes the basic concepts about cloud computing and assessment of security risks. In the fourth section, the approach to assess security risks in the present study will be investigated. The paper is concluded in the fifth section.

Related work

Recently, some works have been performed on the issues related to security risk management in cloud computing environment which can be divided into two groups based on risk analysis methods: Quantitative and qualitative risk analysis methods[4].

For instance, in QUIRC, a quantitative assessment framework for security risks is displayed in six key classes of security objectives including confidentiality, integrity, availability, multi-party trust, mutual auditability, and usability in cloud computing framework[5].

In[6], an analytical approach from user's perspective has been provided and it deals with security risk analysis of cloud data before including sensitive information in a cloud environment. The main objective of this work is to assist the cloud provider. In order that a customer feels confident before placing its data in a cloud, this approach is based on a trust matrix and considered as a qualitative analysis method.

National Institute of Standards and Technology(NIST)provides a risk management framework for IT systems for reducing the risks and also for better protection of sensitive information which includes the suggested steps for security risk management[7].

In [1], risk management framework includes 5 components including user requirement self-assessment, cloud service providers desktop assessment, risk assessment, third-party agencies review, and continuous monitoring. Through this framework cloud providers can better perceive users' demands and as a result, some trust will be created between users and providers.

Being different with the above mentioned works and other works where security risks have been typically raised by the service provider, the present paper focuses on the assessment of security risks mentioned by the cloud customer and thereby, the customer would engage in protection of its organization's assets and have control over its security issues.

Basic concepts
This section includes the concepts related to cloud computing and the concepts of security risks assessments.

Cloud computing:

There are abundant definitions about cloud computing in various publications. In every technological journal or almost every IT website or weblog, cloud computing has been discussed. However, in the definition provided by National Institute of Standard and Technology (NIST), cloud computing has been formally and comprehensively described [3] as follows, "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool

4134

of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."
For better understanding of security issues in cloud computing, the main technological concepts associated with it should be discussed.

Development models:

There are several development models in cloud computing including private, community, public, and hybrid models. In private model, cloud infrastructure is used by an organization. The community model is applied by customers of several organizations who have common concerns. Infrastructure of the public model is used for all organizations. The hybrid model is a combination of two or more distinct cloud infrastructures (private, community, or public)[3, 8].

Services provided by cloud computing can be classified into three main categories: software as a service (Saas), platform as a service (Paas), and infrastructure as a service (Iaas) InSaaSmodel, a service is provided for customers by a cloud provider using a cloud infrastructure. In this model, the customer has no management or control over basic infrastructures including the network, servers, operating systems, storage and or even unique software capabilities, unless some settings are performed by users in special cases[3];for example, in Salesforce.com company, CRM is one of the management applications for relationship of cloud computing customers[8].

Using PaaS model, customers can create their own applications applying cloud infrastructure and platforms provided by providers including programming languages, services, libraries, and tools[8].For instance, the Google Corporation hasprovidedGoogle AppEngine platform[9].

In IaaS model , You would use the basic computing resources and cloud infrastructure to run the cloud software; S3 service of Amazon, can be mentioned as an example of IaaS[10].''It is a simple web service interface that can be used to store and retrieve any amount of data at anytime from anywhere on the web".

Concepts of security risk assessment:

Risk management is a process that allows IT mangers to protect important and sensitive assets in their organizations and includes three processes of risk assessment, risk mitigation, and evaluation and assessment [7].Therefore, risk assessment is one of the key steps in risk management.

Organizations perform risk assessment to identify potential threats and risks related to the IT section. Using risk assessment, one can have an appropriate control to omit and reduce the risks[4].
In order to assess the risks, vulnerability, threat, and risk conceptualizations should be explained and the relationship among them should be clarified.

Vulnerability:

Occasionally, there is a weakness in a system that causes the existing resources in the environment to be used through unauthorized access by a malicious. This weakness may exist in hardware, software, or procedural. As an example, a weakness in insecure physical entries or a weakness in a service which is run on a server can be mentioned here [11].

Threats:

Everything which leads to a failure or interruption in the cloud service or causes the loss of valuable assets of cloud services and cloud customers through an attempt to identify the existing vulnerabilities, is called a threat. In risk assessment, threat analysis and the kind of effects they would have on the cloud customer's provider in the cloud environment are among the crucial issues which must be considered[1].

For example, the hacking attack to EC2 of Amazon in 2008 due to control weaknesses led into the disablement of the service for users. So that the attacker could execute his desired commands as an authorized cloud user[12].

Risk:

Risk is defined as the probability that a threatening factor runs a specific vulnerability. To measure the risk value, threat probability and threat impact level must be specified. Threat level is obtained by the results gained of successful run of a threat in vulnerability; and prioritization of impact level is based on the impact it has on the organization's assets. Also, the more sensitive and critical the assets, the higher is the impact level. Impact level assessment can be performed either quantitatively or qualitatively [7].

Threats and risks in cloud computing:

One of the best attempts to detect security risks has been performed by the European Network Information Systems Agency (ENISA)that has carried out a comprehensive study in this field.ENISA has categorized the cloud computing risks into three classes: organizational, technical, and legal which will be briefly described[13].

organizationalrisks**:** They include all the risks which are likely to affect a structure, an organization, or a business; for example, every change occurring in the organization providing the cloud, including a provider's failure is considered among the organizational risks.

technicalrisks**:** They include the problems and failures related to the service provided by the provider and/or technologies used by cloud providers such as attacks which cause the penetration into the cloud provider's data. legalrisks**:** This kind of risk is mostly related to data issues and encompasses data exchange between several countries having different rules about data protection and privacy policy. For example, a potential change in providers' commitments in various countries may lead in your data loss.

Risk assessment approach

Risk assessment approach mentioned in this paper includes the following sections: risk assessment by a cloud customer, risk assessment by the cloud provider and selection of providers with the lowest risk by customer.

 Risk assessment by a cloud customer:

A cloud customer who uses cloud service for different reasons prefers to perform the security risks before putting its sensitive data in the cloud. In the present paper, security risk assessment by the customer is consisted of these three stages:
1-   Identification of security risks
2-   Quantitative assessment of security risks
3-   Sending the security risks for the intended cloud provider

Lotfiserveh and Fakhri parvin

At the first stage of identifying security risks, a customer should consider various choices. At first, the customer is faced with different security risks given the selection of the type of service delivery model (one of the IaaS, PaaS or SaaS cases). For example, in SaaS delivery model, the security risks, briefly posed in[14], can be mentioned.

- Data Security: In the traditional model, security of data is provided by the customer but in SaaS model, since the data are maintained in another place by the provider, additional security controls must be created to enhance the data security and preventing security vulnerabilities.
- Network Security: in SaaS model, all data transfers between the cloud customer and the provider are performed via network. Therefore, a secure network which prevents penetration of sensitive information is required.
- Data Locality: When a customer's data are put in a cloud, it is not clear in which country and under which rules and regulations the customer's data are located.
- Data Integrity: One of the most important issues in each system is data integrity. This can be easily done by a system with a database through database limitation and transactions. However, in a distributed system holding several databases and applications (data integrity), this would be very difficult and complicated and it should be properly managed.
- Authentication and authorization: This means SaaS customers must remember to remove/disable accounts as employees leave the company and create/enable accounts as come onboard.
- Data Confidentiality: Data confidentiality is one of the significant issues in cloud computing. Cloud computing services include data storage locations, video locations, people's health and other issue. This information is stored by the provider. Maintaining a customer's privacy confidential information by the provider has a particular importance.
- Web Application Security: SaaS is a kind of software which is located on the internet. The existing challenges on the security of SaaS are not apart from other web applications. Security holes existing in web application create vulnerability for SaaS application.
- Data Breaches: When data of various customers are placed together in a cloud environment, the potential of the users' data being attacked would be increased and would lead the cloud environment to have the highest risk of being attacked.
- Virtualization Vulnerability: One of the main components of cloud is virtualization. It means that various samples are run on a physical machine. In currently available VMMs, it is not completely separated and there are numerous problems in all VMMs.
- Availability: A customer should be assured that SaaS software is available every time and everywhere.
- Backup: A customer should make sure that if an incident occurs to the data, how the cloud provider would retrieve the data and how much time is needed to do this.
- Identity Management and Sign-on Process: ID management is the investigation of the individuals' identity and identification and controlling the access to system resources by placing restrictions for identity sign-on in a system and usually, all the information related to user accounts, passwords, and other cases are maintained in SaaS.

Another option affecting the identification of security risks is selection of development models where the customer specifies one of the development models (Private, Public, Hybrid, or Community) according to cost and required security level. Each model contains different security risks. For example, if the development model is a private one, the security level would be higher and consequently, the cost would become higher too; and if the model is public, security level would be lower and similarly, cost would be lower. Now, the customer after choosing the above-mentioned options must engage in data collection to specify the security risks. This will be performed by experts having expertise on security risks and they can collect the data through the following ways:

1- IT experts of managers who are in direct contact with the cloud could be asked through a questionnaire to specify the security risks.
2- Investigation of the organizations that have applied cloud services and have encountered with security risks.

Lotfiserveh and Fakhri parvin

3- Investigation of the documents containing risk assessment reports, system testing results, system security planning, and security policies.

For instance, Gartner has identified seven customer-specific security risks in cloud computing before placing the data in a cloud which are briefly explained in the following[15].

1- Privileged User Access: Since customers' data are maintained outside the organization, a customer should ask the providers to have precise monitoring and control about employing administers managers with privileged licenses.
2- Regulatory Compliance: Every customer is responsible for maintaining integrity and security of one's own data even if they are maintained by the provider.
3- Data Location: Data location has significant importance since when the customer's data are placed in the cloud it is not clear in which country or under which rules and regulations these data will be located.
4- Data Segregation: Multi-tenancy is one of the important features of cloud computing. In such situations, a customer's data are typically placed in a shared environment together with other customers' data.
5- Recovery: A customer should ask the provider to see how the data would be retrieved if they are encountered with an incident and how much time is needed to do this.
6- Investigative Support: Maybe investigation of illegal and inappropriate activities would be impossible in cloud computing because handling would be very difficult since several customers enter into cloud computing simultaneously and data are hosted in numerous centers.
7- Long-term Viability: Customer's confidence in data availability, even if an unexpected incident occurs.

Since different choices are selected by a cloud customer, it is not possible to provide a common list for all customers and also the lists of security risks are different given the customer's various demands. The customer specifies *m* security risks according to the selected options; this is presented as the following vector $(R_1 \ldots \ldots R_m)$.

The second stage is quantitative assessment of security risks. In the present study, a quantitative analysis method is used. In this section, the value of acceptable risk in various security risks is specified by the customer. The acceptable risk is a risk that the customer wants to live with (can be tolerated by the customer) and the customer believes that no serious problem would occur with that amount of risk as risks cannot be completely omitted.

This assessment is performed with respect to the impact that a risk can have on the customer's organization and risks can be classified into three state: low (0-2), moderate (3-5), and high (6-8). However, these amounts are relative and they can be changed according to the problem requirements. Typically, a customer tends to have the lowest possible risk in every security objective. In order to evaluate each security risk, a customer can use the views of n number of experts and calculate them according to formula 1. R_c value can be between 0 and 8.

$$R_c = \frac{1}{n}\sum_1^m R_i \qquad i = 1 \ldots n \qquad (1)$$

For example, if three experts suggest three values of {.23,.30,.55}for data segregation, the value of acceptable risk would be 0.36.
For *m* number of security risks, table 1 is created by the customer. In this table, the risks column includes: the security risks identified by the customer and the column for risks' value identifies the values that can be tolerated for each risk by the customer. After assessing the risks by the customer and completion of table 1, at the third stage, the customer can send the $(R_1 \ldots \ldots R_m)$ vector for the intended provider and ask the cloud provider to perform the quantitative assessment.

Lotfiserveh and Fakhri parvin

Risk assessment by cloud provider:

Usually, in previous works, risk assessment was performed by the provider according to the security risks raised by the provider. But in the present study, the customer sends the security risks (R_1……R_m) for the provider and asks the provider to perform the quantitative assessment of the security risks. For this quantitative evaluation in the present paper, previous works have been used[5][16].

A provider should perform the following stages:
1- Identification of threats affecting the security risks and calculating the probability of their occurrence.
2- Calculating the impact of threats on security risks
3- The quantitative assessment of security risks

In order to perform the quantitative risks assessment associated with a threat, a provider should identify the probability of threat occurrence and its impact for each security risk, i.e. the provider should obtain R_e for *m* security risks and specify what kind of impact the threat would have on them.
$R_e = P_e.I_e$ (2)

In the above formula R_e is the risk, *e* is the threat, P_e is the probability of the threat, and I_e is the impact. P_e value is usually less than 1. In order to obtain the probability of P_e of a threat, the provider can assume a specific time range and calculate the probability according to the attacks taken place in that time range. Then, to calculate the probability, one needs to investigate the threats history on the provider's cloud services. This is performed by cloud provider's experts of security issues. For example, assume that during a period of 10 months, a provider's service is run 530,000,000 times, and that service is attacked 230,000 times by a particular threat, then the probability of that threat for the service would be 0.00043.

In addition to the probability, the impact that the threat has on the security risks should be identified by the provider. It might that a threat has no impact on a security risk but it may have a high impact on another risk; and I_e is obtained according to the impact the threat creates in the security risk; and as you can see in Table 2, it is classified in three groups of low (0-2), moderate (3-5), and high (6-8). However, these values are relative. Therefore, R_e value would be between 0 and 8.

For example, if one of the security risks is data segregation and a threat occurs, whose impact on data segregation is 4 and threat probability is 0.01, then R_e value for data segregation is 0.04. Regarding the threats existing in the cloud environment, Intercepting data in Transit, Management Interface Compromise, Cloud Provider Malicious Insider, and Loss of Encryption Keys can be mentioned .

To determine the final value for quantitative assessment of every security risk related to the cloud service, previous works can be applied [5]. If there are n threats, then for each security risk, R_p can be calculated as follow:

$$R_p = \frac{1}{n}\sum_{1}^{n} Pe.Ie \qquad i = 1 \ldots n \qquad (3)$$

For example, in the formula 3, if there are four threats with impacts of {1,3,5,2 } and probabilities of {0.01, 0.1, 0.04, 0.002 } on data segregation, their R_p will be 0.1(3)+0.04(5)+0.002(2)+ 0.01(1)=0.714.

The provider obtains an R_p value for each security risk. The provider creates Table 3 for quantitative risks assessment. In this table, the risks column includes the risks sent by the customer and the risks value column includes the quantitative risk assessment by the cloud provider. This table is sent by the provider to the customer.

Selection of cloud service provider by the customer:

There may be providers who provide a similar service and the customer wants them to perform the quantitative assessment of security risks. Meanwhile, the customer by investigating the assessments performed by its selects a provider which has the lowest possible risks and the customer can use the following formula 4 for assessment:

$i = 1 \ldots \ldots m$

$D_i = R_{pi} - R_{ci} \quad (4)$

If $D_i < 0$ then, its value will be assumed to be zero. The following vector is designated to specify the distances between the risks performed by cloud provider and the customer.

$i = 1 \ldots \ldots m$

$(D_1 \ldots \ldots D_m)$

The cloud customer selects a provider with the shortest possible distance. In addition to the above-mentioned criterion, a cloud customer can use the choices such as the provider's cost and reputation as the assessment criteria.

After choosing the provider, the customer asks the provider to add the risk assessment performed by itself on the service agreement level SLA since SLA should include the mutual understanding and must be accepted by both the cloud provider and the customer [17].

CONCLUSIONS

Undoubtedly, security issues in cloud computing are among the most important concerns for customers and providers. The present paper investigated the quantitative assessment for security risks raised by the cloud customer. A customer after doing its quantitative risk assessment asks the providers who presents the intended service to perform the risk assessment. After announcing the results, a provider who has the lowest possible risk will be selected. This type of assessment has the following advantages compared to other assessments: 1- It is done by the customer and the customer can pose its wishes and put its data on the cloud confidently. 2- This assessment is quantitatively expressed and can be easily applied. 3- It is a comprehensive method that encompasses various choices.

REFERENCES

1. Xie, F., et al. A risk management framework for cloud computing. in Cloud Computing and Intelligent Systems (CCIS), 2012 IEEE 2nd International Conference on. 2012. IEEE.
2. Corporation, I.D., 2009.
3. Mell, P. and T. Grance, The NIST definition of cloud computing. 2011.
4. Drissi, S., H. Houmani, and H. Medromi, Survey: Risk Assessment for Cloud Computing. International Journal of Advanced Computer Science and Applications, 2013. **4**: p. 143-148.
5. Saripalli, P. and B. Walters. Quirc: A quantitative impact and risk assessment framework for cloud security. in Cloud Computing (CLOUD), 2010 IEEE 3rd International Conference on. 2010. IEEE.
6. Sangroya, A., et al., Towards analyzing data security risks in cloud computing environments, in Information Systems, Technology and Management. 2010, Springer. p. 255-265.
7. Stoneburner, G., A. Goguen, and A. Feringa, Risk management guide for information technology systems. Nist special publication, 2002. **800**(30): p. 800-30.
8. Velte, T., A. Velte, and R. Elsenpeter, Cloud computing, a practical approach. 2009: McGraw-Hill, Inc.
9. https://developers.google.com/appengine.
10. https://aws.amazon.com/s3/.
11. Kumar, B.S., et al., Cloud Specific Issues and Vulnerabilities Solutions.
12. Gruschka, N. and M. Jensen. Attack surfaces: A taxonomy for attacks on cloud services. in Cloud Computing (CLOUD), 2010 IEEE 3rd International Conference on. 2010. IEEE.

13. Catteddu, D., Cloud Computing: benefits, risks and recommendations for information security. 2010: Springer.
14. Subashini, S. and V. Kavitha, A survey on security issues in service delivery models of cloud computing. Journal of Network and Computer Applications, 2011. **34**(1): p. 1-11.
15. Brodkin, J., Gartner: Seven cloud-computing security risks. 2008.
16. Saripalli, K., N. Mahasenan, and E. Cook. Risk and hazard assessment for projects involving the geological sequestration of CO2. in Proceedings of the 6th International Conference on Greenhouse Gas Control Technologies (GHGT-6), J. Gale and Y. Kaya (eds.). 2002
17. Hale, M.L. and R. Gamble. Secagreement: advancing security risk calculations in cloud services. in Services (SERVICES), 2012 IEEE Eighth World Congress on. 2012. IEEE.

Table 1: Quantitative Assessment by the Customer

Risks/Threats	Risks value
R1	Rc1
.	.
.	.
.	.
Rm	Rcm

Table 2. Impact Level of a Threat

Impact Level	Descriptions
High	If an incident occurs, it is highly likely to have adverse impacts
Moderate	If an incident occurs, it is somewhat likely to have adverse impacts.
low	If an incident occurs, it is unlikely to have adverse impacts.

Table 3. Quantitative Risk Assessment by the Provider

Risks/Threats	Risks value
R_1	R_{p1}
.	.
.	.
.	.
R_m	R_{pm}

RESEARCH ARTICLE

Mineral Potential Modeling of Gold and Base Metals in Mahneshan Using Geographic Information System

Behnam Gojan Samani[1], S. Ali Almodaresi[2]* and Reza Molkaraei[3]

[1] MSc in Remote Sensing and Geospatial Information System, Civil Engineering College, Yazd Branch, Islamic Azad University, Iran. Behnam_Samani@Yahoo.com

[2] S.Ali Almodaresi, PhD Geomorphology, Assistant Professor, Civil Engineering college, GIS&RS Department, Yazd Branch, Islamic Azad University, Hesabi Blv, Safaieh, Yazd, Iran, Almodaresi@iauyazd.ac.ir

[3] MSc in Remote Sensing and Geospatial Information System, Civil Engineering College, Yazd Branch, Islamic Azad University, Iran RezaMolkara128@gmail.com

*Address for correspondence
S. Ali Almodaresi
PhD Geomorphology, Assistant Professor,
Civil Engineering college, GIS&RS Department,
Yazd Branch, Islamic Azad University,
Hesabi Blv, Safaieh, Yazd, Iran,
E mail: almodaresi@iauyazd.ac.ir

ABSTRACT

Mahneshan region is located in Zanjan province and in the northwestern of Iran. The purpose of this study was to mineral potential mapping in this region using geographic information system. One of the methods of preparing mineral potential maps with the help of geographic information system is using weight of evidence method. In this method, similar points can be searched according to characteristics and features of known points. In the studied area, the 02 known mining index and also data related to aerial geophysical studies, satellite imagery, geology, economic geology and stream sediment geochemical surveys were used. All maps were combined and integrated after the calculation of the weight of evidence and obtaining binary maps for initial data and a mineral potential forecast map has been prepared in which, possibility of mineralization in all its parts is specified. Finally, high-priority areas for copper, lead, zinc and gold were introduced according to the latest conducted surveys and their compliance with the geology. According to the geological situation and indices and also, considering the weight of evidence, the rifts in the region were introduced as the area with the most probability of

mineralization (70 percent). This region is prioritized in order to explore elements such as lead, zinc, copper and gold.

Key words: mineral potential modeling, geographic information system, weight of evidence.

INTRODUCTION

Overview

The area which is investigated in this study is Mahneshan geological sheet 1/100000 in Mahneshan region in Zanjan province and in the northwestern of Iran. This sheet is located in 30' 36° to 37° north latitude and 30' 47° to 48° eastern longitude. The region's area is approximately 2,472 square kilometers. In this region, different exploration surveys were done by different groups of geological and mineral exploration in the country and during these studied, some indices of different elements in the form of mineralization or abandoned mines except active mines have been observed. The purpose of this study was to specify the forecast model of potential areas and introduce suitable areas for tracking copper, lead, zinc, gold and prioritizing them in the region. The information of Geological and Mineral Exploration organization was used in order to reach this goal. After collecting all the information and preparation, different data were integrated using Geographic Information System and weight of evidence method. Then, promising areas have been introduced to be in the priorities of exploration in the next steps.

GIS which is stand for Geographic information system will be used in the following. It is a computer system for spatial data management. This system consists of different computer programs that makes possible to achieve a series of special operations, including collecting, organizing, processing and analysis, modification, combination, question and answer and search, predict and display the spatial data. GIS provides tools to answer two basic questions: 1. What are the characteristics of a particular situation? 2. Where there are these features? GIS is designed to gather the spatial data collected from various sources in a database and specify their relation while processing and analysis of data. For example, the discovery of a mineral deposit requires consideration of multiple types of spatial data (various studies), such as geology, structural geology, geochemical and geophysical properties, exploration works which are done in the past, and etc. GIS provide this possibility to predict the favorable areas of mineral potential maps and then make better decisions for future exploration priorities while combination of different data and consider multiple parameters involved in the exploration [1]. Also, modeling with GIS in mineral potential fields is done through calculation of capability or suitability of a point with the help of data from different exploration methods. Mineral potential is calculated by assigning weights to different data. Maps or by assigning weights to the analysis of evidence and the parameters of the known mineral indexes are done or will be done using expert subjective judgment. Generally, a GIS model can be assumed in the form of integrating a series of maps as input for the preparation of an output plan. Predicting the location of mineral aggregates should be based on empirical relationships and with the help of descriptive models of the known reserves. Descriptive model which is a kind of mineral reserve and tracked based on the characteristics of similar reserves, is considered as a guide to find new reserves of the same type. This type of modeling is called data-based models. In the data-based models, various input maps are integrated using models such as logistic regression, weight of evidence or neural network analysis [1]. In the present study, weight of evidence method was used which is described below.

MATERIALS AND METHODS

Probability of discovery of a mineral index (mineral deposit) as D in the presence of witnesses, such as B (geophysical or geochemical anomalies, etc.) can be provided with a probability of (1):

Ali Almodaresi *et al.*

$$P\{D|B\} = \frac{P\{D \cap B\}}{P\{B\}} \tag{1}$$

In which, $P\{D|B\}$ is the possibility of a mineral deposit in the case of a binary pattern (B) (binary pattern here is a map which composed of two colors and each occasion is appropriate or not appropriate). But P{D ∩ B} is the total area of D and B or P{D ∩ B} = N{D ∩ B}/ N{T}. Also, P{B} is the probability and area (number of unit cells of binary pattern B) and he number of unit cells in the total area. In general, in the above {N} is the number of unit cells and {P} is the probability. By substituting these expressions in equation (1), equation (2) will be achieved as follows.

$$P\{D|B\} = \frac{N\{D \cap B\}}{N\{B\}} \tag{2}$$

Conditional probability of P{D|B} is equal to the ratio of the binary pattern that is covered with reserves. Since, this relationship uses intersection, it is concluded that if there is a witness, the detection area decreases and as a result, probability of discovering increases. Now, the conditional probability of the binary map is defined by the presence of a store such as D in Equation 3:

$$P\{B|D\} = \frac{P\{B \cap D\}}{P\{D\}} \tag{3}$$

Since P{B ∩ D} is similar with P{D ∩ B}, Equations (1) and (3) can be combined to Equation 4 for solving.

$$P\{D|B\} = P\{D\}\frac{P\{B|D\}}{P\{B\}} \tag{4}$$

As Chang et al. (1992) have pointed that information about the numerator is obtained often from statistical study resources and information about the denominator of exploration studies on the existence of reserves that their properties are desired. Also, the similar expression for the probability of potential anomalies with the absence of control can be determined by Equation 5.
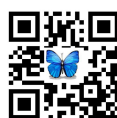
$$P\{D|\bar{B}\} = P\{D\}\frac{P\{\bar{B}|D\}}{P\{\bar{B}\}} \tag{5}$$

It is clear that the chance of finding a resource in which, there is no anomaly control is significantly lower than the case of presenting anomaly [1]. Given that N(T) is the total number of unit cells and N(D) is the number of desired points in the study area (N(D) is an integer number), if we show a class with the value of 1 binary map (where there is anomaly) with B and the number of cells N(B) and we show the number of cells which are covered with a class with the value of zero (where there is not anomaly), we will have Equation 6:

N(B) + N($\bar{\bar{B}}$) = N(T)   (6)

Given that the weights can be calculated as W^+ and W^- that they can be the criteria for accompanying or not accompanying between points (known indexes) and see different parts of the pattern. These weights are calculated for all the classes map. W^+ introduces accompaniment of the positive points of each class and W^- introduces absence or negative correlation with the location of the particular class of map control. The difference between the two weights (C) is the contrast of the parameters that reflects the overall situation of the accompaniment or not accompaniment the desired points with specific classes of maps and whatever be greater, it is more reflector [1]. Generally, overall weight of a map of the binary classes 7 and 8 are expressed by the ratio of the probabilities conditional relationships, in which P{} represents the probability.

$$W^+ = Ln\frac{P\{B|D\}}{P\{B|\bar{D}\}} = Ln\frac{\{B \cap D\}/D}{\{B \cap \bar{D}\}/\bar{D}} \tag{7}$$

Ali Almodaresi *et al.*

$$W^- = Ln\frac{P\{\bar{b}|D\}}{P\{\bar{b}|\bar{D}\}} = Ln\frac{\{\bar{B}\cap D\}/D}{\{\bar{B}\cap\bar{D}\}/\bar{D}} \qquad (8)$$

In which, $B \cap D$ is subscribe of the two sets of B (parts covered with a special class of binary map) and D (representative set of points of view). Thus, equation 9 can be written as follows:

$$W^+ = Ln\frac{N(B\cap D)/N(D)}{[N(B)-N(B\cap D]/[N(T)-N(D)]} \qquad (9)$$

Similarly, the relation for W⁻ can be rewrite, if the area of the unit cell decreases. Thus, equation 9 can be written as a simple equation like equation 10.

$$W^+ = Ln\frac{N(B\cap D)/N(D)}{N(B)/N(T)} \qquad (10)$$

After the calculation of analyzing weight of evidence and the highest contrast, a binary map is prepared for each map. Then, these maps are integrated and the value of P(D|B) are calculated for all unit cells and finally, a map is produced that shows the empirical probability distribution of a mining index per unit of area (each cell) of the studied region [1, 2].

Study Area

In Mahneshan's 1/100000 sheet of geology, types of igneous, sedimentary and metamorphic stones can be seen. Of course, a large part of it is covered sedimentary stones and development of igneous and metamorphic stones in parts of East and South-East and West are visible on the map. The age of stone units in this area is variable since Precambrian period until the present are. Figure 1 shows Mahneshan geological map units. In continue, the most important region units are explained in terms of exploration [3]:

PCgn: This unit is made of high grade metamorphic rocks and consists of a series of gneiss associated with micaschist and amphibolite.

PCa: The transformation unit includes micaschist - quartz - feldspar Gerona with lepidoblastic and porfiroblastic texture associate with layers of amphibolites and marbles bars. The marble shows a metamorphic facies with Parazhnzodiopside - Quartz – titanite.

PC^{MS}, PC^{SM}, PC^{M} units: These units generally consist of a layered medium Moscovite roll marbles, calc-schist quartz and micaceous, schist mica-quartz Geronaous, calc schist tremolite colinozeosite. PCM unit is created of lepidoblastic schists to gray uniform porfiroblastic with weak weathering. In cases where a lot of calc-schists and marbles roll over gray schist unit PCM audio tape increases, PC^{MS} and PC^{SM} subsidiaries are formed, respectively.

PC^{12}: Medium to thick marble unit from white to light gray and includes compressed and overlapping grains of calcite contains fiber scales of white mica (Moscovite) and rarely contains chert nodules form a band.
PC^{K}: Shale – phyllite and slit from green to grayish with the layers of tuff, meta-andesite and thin layers of dolomite which is rarely associated with acidic lavas.

K1, K2, K2^{M}: Cretaceous outcrops in the southeast corner of the area including shale and sandstone severely crushed and partially transformed with color of dark green (K1) which is followed by a series of sandstone and limestone marl gray (K2m) and fossiliferous limestones with a layered medium and light gray (K2).
Gd: Anataxi granite with an alkali composition, hypidiomorphic tissue, white to light gray.
Gd^{p}: Coarse-grained pegmatites consist of biotite-moscovite and Gerona.

Alt: Intermediate to advanced argillic alterations around the granite.

Economic Geology of the Mahneshan Area

1/100000 sheet of Mahneshan is mostly covered of the sediment and observed intrusions and transformation masses with potential mineralization in this area can be classified as follows:
There is an intrusive granitic mass in the East of the region that pegmatites and then, limes surrounded it. There is also intrusive granitic and metamorphic gneisses masses in the west of the area which is younger than limestone and dolomites and numerous quartz veins have cut it. Lead and zinc sulphide mineralization with the type of galena and sphalerite and in the grid with cutter veins of marble-dolomite with quartz veins are evident in this area. In some area, pale yellow quartz veins have cut dolomitic units that in samples case there is gold. Several old works have been done in these dolomites in the form of holes along the mineralized veins. Samples of ore containing mineralization along the pores show 0.11 to 11.79% zinc [4]. There is a granitoid pluton g2 mass with a granular texture and macroscopic appearance, white to pink. This intrusive mass becomes more fine-grained in the border and the percentage of its dark minerals (mafic) is reduced, while its potassic feldspar becomes richer. The mineralogical changes can be a sign of magmatic differentiation [3]. Microspariti units (fossiliferous limestones with a layering of medium and light gray) K2 and sandstone K2^m gray marly limestones and shale and highly crushed sandstone in dark green K1 in this area caused by thermal flux and hydrothermal fluids by intrusive masses g2 were transformed by contact method and created skarn–hornfels zones. In this regard, magnetite, various grona of andradite and hydrogrossular, hedenbergite, diopside and etc. are the set of minerals which are associated with copper sulfide ores of chalcopyrite and copper hydrocarbons (Malachite). In such a region in which, piro metasomatism is governed, ion transfer context has been provided by mineralizing fluid and by physical and chemical changes, mineralization occurs and for this reason, copper mineralized skarn incident took place near the minerals [3]. According to the conducted economic geology studies in the area, most mineral deposits and signs include lead, zinc, copper and sometimes gold. Given that in this area, intrusive masses are in the vicinity of limes and dolomites and there is also a fracture system in the area mineralization in the region can be predicted hydrothermal skarn-type. Generally, there are 20 known indices of copper, lead, zinc and gold mineralization in this area. These indices are shown in Figure 1.

Used Data

In Mahneshan area, geological studies, aerial geophysics (magnetometers), fluvial geochemical survey, remote sensing (satellite image processing) and signs of economic geology and mineral deposits have been done and the data are as follows:

1. The geology digitized map of 1/100000 in Mahneshan area is shown in Figure 1.
2. A digitized map indicates the location of indices and mineral sign of the area that the position of 20 known indices of copper, lead, zinc, gold and antimony is separated from it and has been used. The indices position is shown in Figure 1.
3. Map showing areas of alteration (alteration) obtained from the satellite image that this map is converted into binary after digitization and shown in Figure 2.
4. The first derivative of the magnetic field intensity map which is prepared from the intensity map of the magnetic field and using aerial magnetometers. In order to be usable in GIS and weighting functions can be performed, the maps were re-classified (more details are given in the next sections). Figure 3 shows the re-classified map.
5. Geochemical anomaly maps of copper, lead, zinc, silver, arsenic, antimony, barium and mercury were overlapped after digitization in GIS and a binary map was obtained from them. This map is shown in Figure 4 and as can be seen anomaly in this area has the value of 1 and non-anomaly has the value of 0.

Ali Almodaresi *et al.*

DISCUSSION AND CONCLUSIONS

Weight of evidence analyze was used in order to determine the spatial dependence between the known mineral indices as a criterion to identify new. These calculations were done for 3 maps, geological map (geological units as host stone lithology), the first derivative of the magnetic field map and the map of rifts in the region. But, weight of evidence analyze was not done for alteration zone mapping and geochemical anomaly maps. These maps were prepared to be combined with the other binary maps after converting into binary maps for regions 1 and consider the code alteration and geochemical anomalies and coded 0 for non-altered zones and non-anomalies (Figure 2 and 4).

Analyze of weight of evidence on the geological map

Weighting operation for various units of the geological map of the area was conducted according to the indices in the region. Table 1 shows the parameters related to analyze of weight of evidence for each unit of the geological map in which there is a known index. These parameters include the covered area, the number of indices, W^+ and W^- weights and the calculated contrasts. There is no data (mineral index) for many units that are mostly sedimentary. Consequently, weighted and contrast values have not been determined for these units. Therefore, they are not in the table. As can be seen K2, K1, Pcgn, Pc12 and Pcsm units have the contrast higher than 2. Thus, these units were selected as the best units and binary map showing the appropriate areas (code 1) and poor areas (with code 0) is provided according to them. This map is a promising geological map which is shown in Figure 5 [5].

The analysis of weights of evidence on the first derivative of the magnetic field intensity map

The first derivative of the magnetic field map is used to reduce the uncertainties and making local and regional anomalies clearer, since the total intensity map of the magnetic field has its own complexity. Initially, changes of field intensity in the map were divided into 20 domains in order to calculate the analysis of the weights of evidence. The map was re-classified and each domain got a specific code (Figure 3). Then, weights of evidence parameters were calculated for the re-classified map. Table 2 indicates the parameters for calculating the weights of evidence for the classes having index. It can be seen in the table that classes 13, 12, 8, and 14 have contrast more than 2. Therefore, the first derivative of the magnetic field was created based on this table in which, the value of 1 has been given to the classes with contrast more than 2 and the value of 0 has been given to the classes with contrast less than 2. Figure 6 shows the map.

Analysis of the weights of evidence and conducted operations of rifts

Initially, all specified rifts on the geological map were digitized separately and they were overlapped with rifts derived from the satellite image, so that a combined map be created. Then, the region within 1000 meters of rifts in this map were divided into 100 m to 100 m intervals. Figure 7 shows the rifts segmentation map. Then, weighting operation was conducted at different distances through weights of evidence calculation. Table 3 shows the calculated parameters (at distances that there is a known index). According to this table, it can be seen that the 100 meters distance of rifts has the highest contrast and binary map of the region's studied rift were prepared based on that in which, the value of 1 has been given to the first 100 meters distance of rifts and the value of 0 has been given to the other area. This map is shown in Figure 8 [5].

Combination of binary maps and obtaining promising regions

After the calculation of the analysis of the weights of evidence and obtaining the binary maps for geological units (host stone lithology), the first derivative of the total intensity of the aerial magnetic field and the rifts, these three maps were combined along with alteration and geochemical anomalies binary maps that each one includes appropriate and inappropriate as a map (values 1 and 0) for tracking oredeposite points Figures (2, 4, 5, 6 and 8) in order to specify the region with the most probability of mineralization. Figure 9 shows the combined map. This map

specifies the empirical probability of having a mineral index in each unit cell of the region and it can be seen that the highest probability is related to the region PC12 and K1 and K2 in parts of West and South-East of the region and especially, the region's rifts which were identified as the two regions 1 and 2.

DISCUSSION

According to the conducted evaluation and also with respect to the map (9), two regions 1 and 2 are introduced as the best regions for the further exploration. Region 1 is located in the dolomite and limestone which is prioritized for tracking lead, zinc, copper and gold according to geological situation and observed indices and also considering that the method of weights of evidence of rifts in the region are introduced as the regions with the highest probability of mineralization. Region 2 also has the highest probability and it is suitable for tracking lead, zinc, and copper according to the geological situation and it is the second priority. Thus, mineral indices in the region can be predicted in the form of lead, zinc and copper mineralization in dolomites and limestones and probably in the form of vein and skarn and also the existence of gold in dolomites with lead and zinc or silica veins.

REFERENCES

1. Bonhan-Carter, G, F (1994), "Geographic Information System for Geoscientists", modeling with GIS, geological survey of Canada.
2. Bonhan-Carter, G, F (1995), "Geographic Applications of GIS mineral mapping" CRCAMET, Department if exploration Geophysics: Curtin University of Technology, Western Australia.
3. Alavi, M (1991), sedimentary & structural characteristics of the Paleo-Tethys remnants in northeastern Iran, Geological Society of America Bulletin,
4. Bertin, J, (1983), Semiology of Graphics, the University of Wisconsin press, Translated by W.J.Berg
5. Fisher, Dr. Peter (1996), Project Argus (interactive computer visualization of spatially distributed data)
6. Lotfi, M., (1379), "Evaluation of the geology and mineral deposits in 1:100,000 quadrangle geological map of Mahneshan, Geological and Mineral Exploration Organization
7. Sadeghi, M., Fanoudi, m. (1379), "tracking plan of lead and zinc mineralization in the area of 4000 square kilometers", Iran Zinc Mines Development Company, in consultation with the Geological and Mineral Exploration Organization, Report of Geological and Mineral Exploration
8. Yousefi, M. (1381), "Mineral potential modeling of Mahneshan area using GIS and stream sediment geochemical survey", Mahneshan area using GIS and stream sediment geochemical survey
9. Aghanabati, A, (1383), Iran Geology, Geological and Mineral Exploration Organization of the country
10. Darvishzadeh, A, (1376), Metamorphic petrology, Payam Noor University
11. Fatemi, S. A., Maghsoudi, S., Nourozi, Gh. (1390), Evaluation of potential mineral exploration for copper and iron in 1:100,000 sheet of Mahneshan using image processing of remote sensing data, Tehran, Tarbiat Moallem University
12. Karimi, H. (1391), "Evaluation of the spectral analysis techniques of remote sensing data in determining changes and future goals for metallic mineral resources", M.Sc. Thesis, Tarbiat Modarres University
13. Mobasheri, M. R. (1389), "Physics foundations in remote sensing and principles of satellite", second edition, publication of Khajeh Nasir University
14. Mehrmanesh, A. (1389), "Detection of mineral potential using remote sensing and GIS", M.Sc. Thesis, Khajeh Nasir University
15. Daneshvar Saein, L. Iraj, R. (1388), "Evaluation and integration of geological, geochemical and remote sensing data in order to detect promising areas in a 1:50,000 sheet of Mahneshan", Journal of the Earth
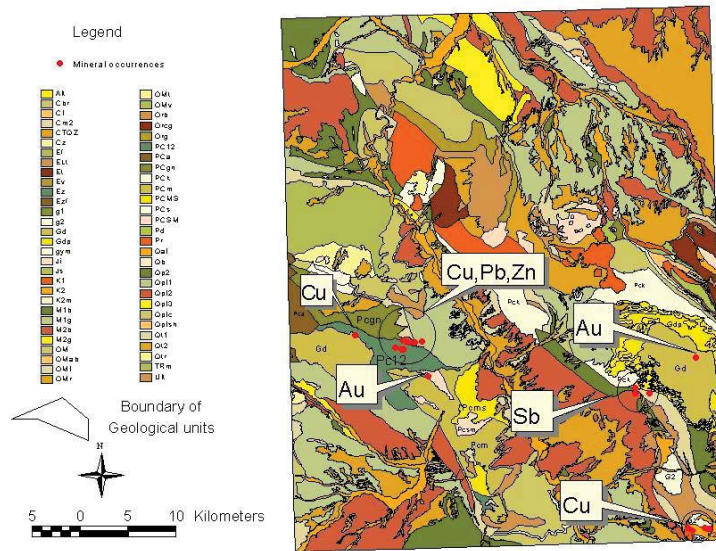
Ali Almodaresi *et al.*

Figure 1. Geological map of Mahneshan and location of the known indices

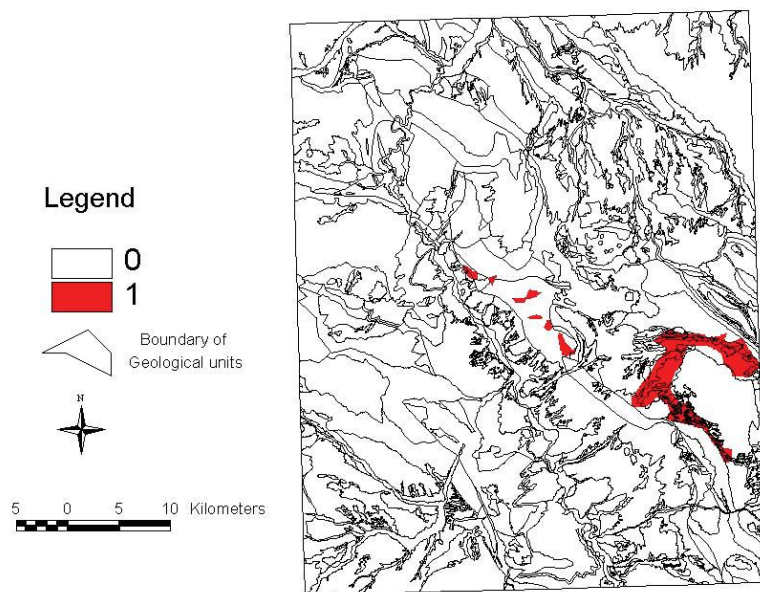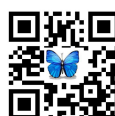**Figure 2. Binary map representing the alteration zones [5]**
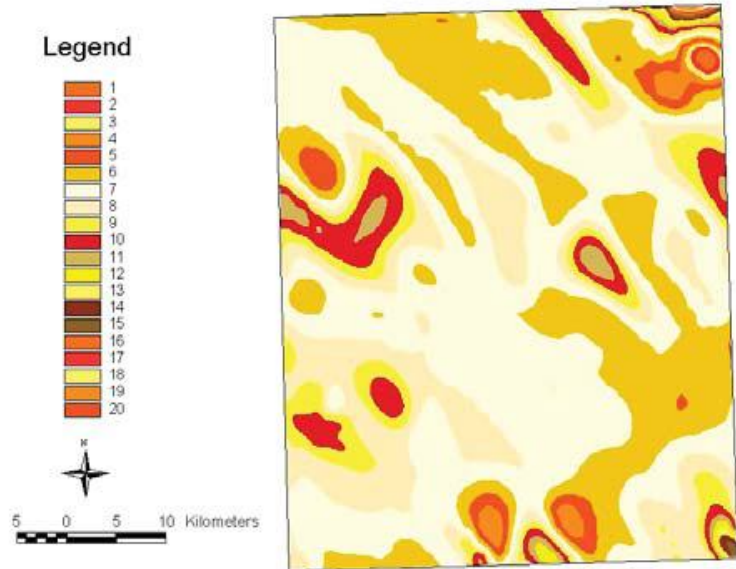
Figure 3. Re-classified map of the first derivative of the magnetic field intensity [5]
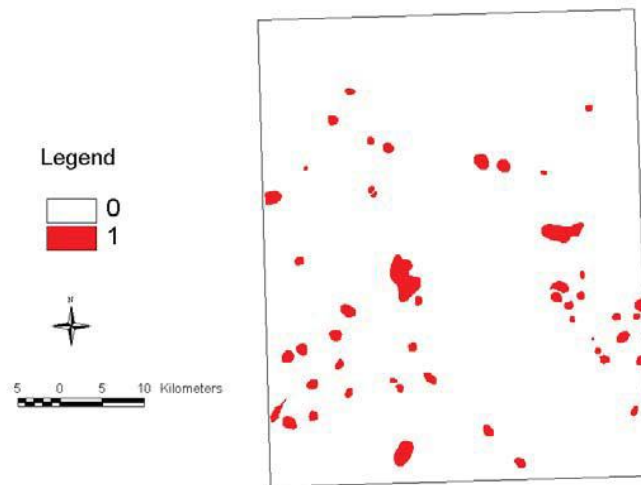
Figure 4. Binary map representing the geochemical anomalies of the discovered elements [5]

Ali Almodaresi *et al.*

Table 1 - Analysis of the weights of evidence for the geological map [5]

Contrast	W⁻	W⁺	Number of available indices	Area in square kilometers	Geological units
6.5231	-0.0512	6.4719	1	1.1900	K_1
4.5430	-0.2205	4.3226	4	10.5200	K_2
3.2193	-0.2744	2.9449	5	37.3200	Pc_{12}
2.7586	-0.0480	2.7101	1	9.1700	pcsm
2.4573	-0.0959	2.3614	2	25.1700	pcgn
1.7693	-0.0424	0.7269	1	22.8500	Ait
1.2117	-0.0728	1.1389	2	80.6800	OMI
0.4448	-0.0366	0.4082	2	165.3800	Qpl_1
0.3019	-0.0131	0.2888	1	93.0500	Gd
-0.8533	0.0625	-0.7881	1	271.2200	Qpl_2
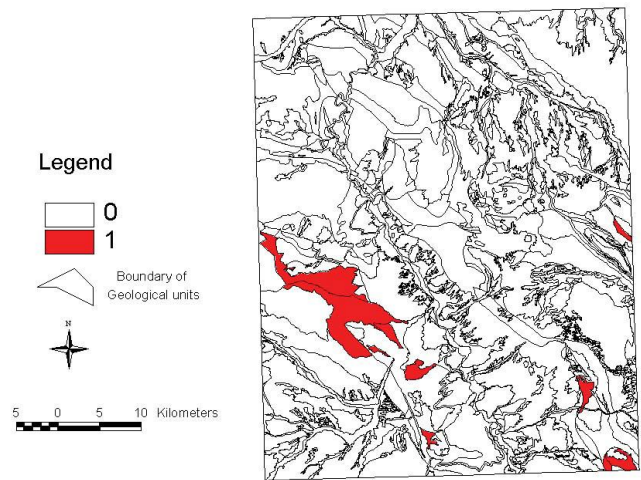
Figure 5. Binary map of geological units [5]

Table 2. Analysis of the weights of evidence for the first derivative of the magnetic field intensity map

Contrast	W⁻	W⁺	Number of available indices	Area in square kilometers	code
3.8641	-0.0502	3.8140	1	3.7100	14
3.7040	-0.0500	3.6540	1	4.1800	13
2.9559	-0.0486	2.9073	1	7.7100	12
2.1670	-0.8570	1.3100	13	443.8900	8
-0.1374	0.0290	-0.1084	4	551.6300	6

Ali Almodaresi *et al.*
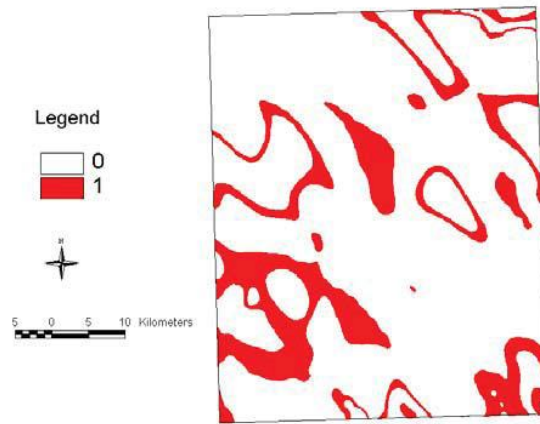
Figure 6. Binary map of the first derivative of the magnetic field intensity
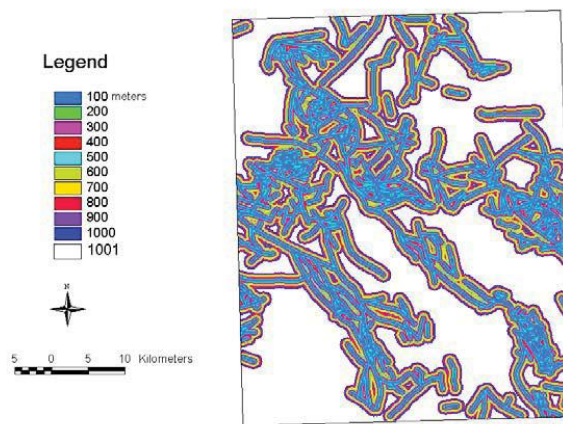
Figure 7. Segmentation map of the studied rifts [5]
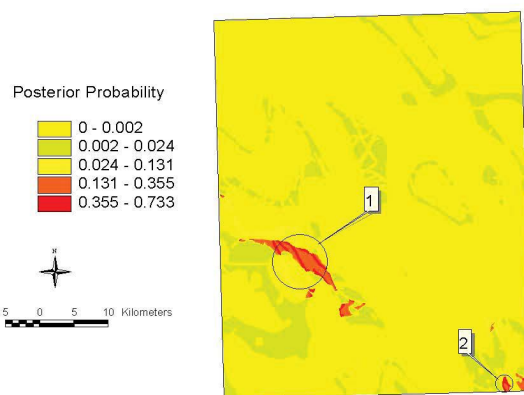
Figure 9. The map showing the empirical probability of mineralization in the region [5]

4152

The Analysis of Urban Heat Islands Using Geographic Information Systems and Remote Sensing (Case Study: Yazd City, Iran, 2002 to 2013)

S.Mohsen MirHoseini[1], Mohamad Ghasemi [2], S.Ali Almodaresi[3]* and Reza Molkaraei[4]

[1] MSc in Remote Sensing and Geospatial Information System, Civil Engineering College, Yazd Branch, Islamic Azad University, Iran. Mirhosseini_Mohsen@Yahoo.com

[2] MSc in Remote Sensing and Geospatial Information System, Civil Engineering College, Yazd Branch, Islamic Azad University, Iran. Mohamad_gh62@Yahoo.com

[3] S.Ali Almodaresi, PhD Geomorphology, Assistant Professor, Civil Engineering college, GIS&RS Department, Yazd Branch, Islamic Azad University, Hesabi Blv, Safaieh, Yazd, Iran, Almodaresi@iauyazd.ac.ir

[4] MSc in Remote Sensing and Geospatial Information System, Civil Engineering College, Yazd Branch, Islamic Azad University, Iran RezaMolkara128@gmail.com

*Address for correspondence
S.Ali Almodaresi
Assistant Professor, Civil Engineering college,
GIS&RS Department, Yazd Branch, Islamic Azad University,
Hesabi Blv, Safaieh, Yazd, Iran,
E-mail: almodaresi@iauyazd.ac.ir

ABSTRACT

The temperature is among the factors that affect the environment and it is considered as one of the environment quality indicators. Many scientists have focused their studies on the environmental indicators to assess the sustainability of cities. With the development of urbanization extended areas of agricultural and forest areas have been replaces by houses, industrial areas and other infrastructures. Urban areas have a different balance of energy and water than the rural areas. These differences and changes in these concepts lead to the loss of energy balance and runoff in urban environments which is followed by serious environmental problems for the residents. Thus, in the urban areas depending on the land cover some regions with different temperature than the rest of the areas are created and this phenomenon is called the urban heat island. In this research the urban heat islands of Yazd _ one of the most important population and industrial areas of Iran and had experienced rapid urban development in recent decades _are studied.

The main objective of this study was to evaluate the Landsat 7 and 8 in extracting the heat islands and the role of vegetation in the heat adjustment. To achieve this goal the Landsat data for the period 2002 to 2013

Ali Almodaresi *et al.*

obtained from two images was used. With the analysis of the land use map and the prepared thermal analysis map the temperature statistics of each urban areas, the temperature pattern and NDVI satellite image were obtained. On the one hand the results present the ability of remote sensing data in the study of environmental parameters in urban areas and on the other hand it represents the effectiveness of vegetation and land type on the emergence of current thermal conditions of Yazd.

Key words: Geographic system and remote sensing information, Landsat satellite, heat islands, Yazd City.

INTRODUCTION

Overview

Population growth and industrial development have led to reduced vegetation area around the cities and the land cover change in these areas. Due to the same transformations in the natural cover the increased temperature of the atmosphere and the surface have become one of the most important problems in urban areas. In urban areas the hard surfaces such as asphalt, bitumen and etc. are replaced by vegetation. Since these modifications have been wider in the cities than the marginal areas there temperature difference between cities and the margins has increased during the time. One of the major effects of the   heat island phenomenon is the increased energy consumption in urban areas is warm months. On the other hand, heat island phenomenon represents a severe shortage of plants. The shortage of vegetation causes other problems such as increased levels of various pollutants in the air, the contamination, waste and finally loss of rainfall, increased noise, increased mental health problems and… . So the measurement of this phenomenon is very important. During the past two decades the remote sensing of the Earth's surface temperature has become one of the most important issues due to increased require to land surface temperature data for environmental studies and land resource management activities (Sobrino et al., 2004). Gallo et al (1993) compared the vegetation index and land surface temperature obtained from AVHRR with the minimum air temperature observed in urban and rural areas. Wang et al (2007) suggested a successful approach to determine the relationship between land surface temperature (LST), use pattern and land cover data using the remote sensing and Landscape ecological methods. The results suggested that the extracted images seriously represent urban morphology that are reasonably related to the biophysical properties of the cities. There is a positive correlation with temperature and impermeable surfaces and a negative correlation with green vegetation.

Therefore based on the previous discussion we analyze the thermal data of Landsat 7 and 8 satellite to extract heat islands and the role of vegetation is analyzed.

In order to evaluate the results of the sensors and the effect of vegetation and other parameters on the surface temperature we need to use the quantitative indicators of temperature. LST (Land Surface Tem perature) i.e. the surface temperature in the dry lands is among the main parameters measured by remote sensing sensors and it is basically one of the outputs of thermal remote sensing and LST mapping of the dry lands. This index presents the effect of various objects in electromagnetic energy emitted and it can be widely used in the climate management along with SST (Sea Surface Temperature).

There are different algorithms to calculate LST:

a)   Single band method (Sobrino et al., 1991)
b)   Separate window method (Becker, 1990)

Ali Almodaresi *et al.*

c)   Temperature and radiation power method (Zhilpsie, 1999) and multi-angular method (Sobrino et al., 1996)

Among studies conducted in recent years the ones that are performed by using multitemporal temperature images are more important, because in these types of studies it is possible to explore the spatial and temporal variations. An important part of studies have used the classical statistical methods to identify spatial and temporal variations of the Heat Islands. Since no study has had addressed the temporal and spatial variations of the Yazd thermal environment comprehensively and systematically, this study is dedicated to spatial and temporal variations of the Heat Islands of Yazd. The results of this study can be useful for environmental planners, regional and municipal environmental protection organizations and scientists, agriculture and economy and help the managers and urban planners to use infrastructure measures to reduce the heat islands of Yazd.

Case study

Yazd area under study includes the city of Yazd, Zarach and Ashkzar and most commercial and industrial centers are placed within this area that includes a high percentage of the population of the province. In this project 2 Landsat 7 images and the new Landsat 8 satellite are used these images cover the time period 2002-2013 and they are related to warm period of the year (July).

In order to produce the NDVI images the ENVI software was used and in order to integrate different rasters GIS Software was devised.

MATERIALS AND METHODS

Measuring the urban area temperature using the temperature data

Based on the Stefan Boltzmann law the land surface and the atmosphere emit energy in the form of waves. The waves spread within the range of 4 to 100 microns long wavelength and they are known as the ground or the thermal radiations. The wavelength of the land's severest radiation is between 300 and 240 K in tropical regions and -33 C in polar areas. So, given the range of thermal band 10.44 -. 12.42 This band can be used to recognize the temperature level in different areas of the city (Alijani, 1998, p. 91).

The main stages of calculating the temperature are as follows:

Temperature estimation equations:

For the Landsat 7 satellite the transfer of digital numbers into the Spectral Radiance based on the presented spectral irradiance reference in the sensor guide and using the metadata of the image is as follows: (Sadeghi Nia 2012)

Transferring band 6 DN into radiance

$$Radiance = \frac{LMAX - LMIN}{QCALMAX - QCALMIN} \times (QCAL - QCALMIN) + LMIN$$

Where:
LMIN: 0-1 DN optical reflection

LMAX: DN optical reflection
QCAL: DN
QCALMIN: Maximum DN (0)
QCALMAX: Maximum DN (255)

And for the Landsat 8 it is obtained based on the following equation in which we extract the M_L and A_L values from the metadata image.

Lλ = ML Qcal + AL
Lλ = TOA spectral radiance (Watts/ (m2 * srad * μm))
ML = Band-specific multiplicative rescaling factor from the metadata
(RADIANCE_ MULT_ BAND_ x, where x is the band number)
AL = Band-specific additive rescaling factor from the metadata
(RADIANCE_ ADD_ BAND_ x, where x is the band number)

Qcal = DN (Quantized and calibrated standard product pixel values)

Spectral Radiance convert to temperature

For spectral radiance convert into the blackbody temperature the Planck realtion (TB) is used to convert the spectral radiance values into the blackbody temperature: (Qihao Weng, 2003)

$$T_B = \frac{K_2}{\ln\left(\frac{K_1}{L_\lambda} + 1\right)}$$

Where: Tb is the Effective temperature sensors (light sensor temperature) is based on Kelvin, K1 and K2 are the first and second correction constant in the Landsat 7 and 8 as follows:

Landsat 7 for Band 1-6(low gain) K1 = 666.09, K2 = 1287.71
Landsat 8 for Band 11: K1 = 774.89, K2 = 1321.08

Temperature correlation released from the land (LST)

Surface temperature is calculated according to the following relationship:

$$S_t = \frac{T_B}{1 + (\lambda \times T_B/\rho)\ln\varepsilon}$$

Where S_t is the land surface temperature in Kelvin degrees, λ is the band wavelength r (mean), ρ is calculated from the following relation:

$$\rho = h * c/\sigma$$

σ is the Boltzmann constant equal with $1/38 \times 10^{-23}$ J / K. h is the Planck's constant equal with $6/626 \times 10^{-34}$ JS.

ε Emissivity

In the final phase of data conversion the Kelvin to Celsius degrees conversion was performed:

Celsius = Kelvin − 273.15

Emissivity is the ratio of the radiation power emitted by an object in a constant temperature to the radiation power emitted by a blackbody at the same temperature, emissivity depends on the object temperature, sensor's viewpoint and the wavelength (Mobasheri, 2006) Emissivity is obtained by various methods including:

- TISI(Becker and Li, 1990; Dash et al, 2005)
- TES(Gillespie et al, 1988)
- A methods based on plant index (Sobrino and Raissouni; 2000; Griend and Owe, 1993; Valor and Caselles, 1996) (Momeni and Serajian, 2006).

Calculating emissivity using

In this method $NDVI$ threshold is used.

A. $NDVI < 0.2$ in this case the pixel related to the dry soil and its mean emissivity is based on the library analysis of the soil samples for thermal 0.978 Landsat

B. $NDVI > 0.5$: the pixels with NDVI value greater than 0.5 are the areas with full vegetation and the constant value is estimated for 0.985 emissivity

C. $0.2 < NDVI < 0.5$: This case is a combination of different phenomena and the emissivity value is calculated based on the following relation.

$$\varepsilon = \varepsilon_V P_V + \varepsilon_S(1 - P_V) + d\varepsilon$$

ε_v: Vegetation

ε_s: Soil emissivity

P_v: Vegetation percentage

The vegetation percentage is calculated using the following equation:

$$P_v = \left[\frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}} \right]^a$$

In which the value of 'a' is between 0.6-1.25 and in this study the value of 0.6 is used.

$d\varepsilon$ Indicates the effect of geometric distribution of normal surfaces and their internal reflection. This part is negligible for smooth surfaces but for the heterogeneous and uneven surfaces it is approximated by the following equation:

$$d\varepsilon = (1 - \varepsilon_s)(1 - P_V)F\varepsilon_V$$

F is the image coefficient the average value of which considering the variable geometric distribution of the surfaces is 0.55.

DISCUSSION AND CONCLUSIONS

Obtaining the thermal classification map and determination of heat islands

At this stage using the above mentioned relations, the thermal images of Yazd are extracted and after conducting the classification the thermal image is divided into 7 classes the thermal map of which is obtained and presented in Figures (2) and (3).

Discussion

Based on the observation of the land use map and the study of the thermal map of the area the points of the heat areas are determined. Figure (4) represents the arid lands that have high radiation power as a heat island (temperatures above 40 ° C) due to the presence of elements such as calcium, sodium, magnesium in the soil.

According to Yazd temperature class map Yazd city heat islands coincides with commercial centers, industrial and dusty and arid areas.

The factors involved in the relative warmth of the cities compared to their countryside are as follows:
- During the day time the solar energy evaporates water from the soil in arid areas and increases its thermal energy. Therefore in the cities with vegetation buildings, streets and sidewalks absorb a major part of the radiated energy.
- The amount of runoff increases in the cities due to impermeable paved sidewalks and asphalt streets thus the cities with less water evaporation less results in cooling and this increases the temperature.
- Wasted heat from buildings, cars and trains are other factor involved urban warming and the generated warmth is transferred in to the atmosphere.
- Thermal properties of buildings can transfer heat by conduction to the air. Bitumen, asphalt, brick and concrete are better heat conductors than vegetation.
- Meteorological data indicate a minimum temperature of 25 degrees and the maximum temperature of 38 degrees for the 10th of July 2002 and the minimum and maximum temperature of 28 and 41 degrees for the 16th of July 2013 in Yazd which indicates an increase in temperature of Yazd.
- Interestingly, the heat-island of Yazd compared to its surroundings desert, has a cooler weather. Deserts are warmer due to their soil and vegetation.
- Yazd industrial town has the higher temperature of 44 degrees due to the presence of high activity in the factory area. The temperatures of 46-48 degrees in this area in 2013 compared to the temperatures 23-42 and 42-43 indicated the same fact. Planting trees, lake water and vegetation caused by sewage, distinguished the area from the surrounding wilderness and the temperature of 32-42 degrees indicates this area being cooler than the urban areas.
- Ali Abad region (Yazd Meybod Road) that used to be cooler than its surroundings in 2002 now has the same temperature of its surrounding wilderness due to the construction of the furnace Brickyard and enhanced activity of the furnaces.

REFERENCES

1- Shakiba, A. et al (2009) analyzing the relationship between land use and land cover and heat islands.
2- Sadeghinia, A. (2012), the application of spatial analysis techniques solidarity on heat island analysis of Tehran.

3- Mokhtari, A., (2000), Comparison of remote sensing in the study of green space in the city, the second regional conference on green space, Ahwaz.

4- Alavi panah, K., (2008), Thermal remote sensing and its application in geology Statistical Yearbook of Iran - Tehran (2011).

5- Alijani, B, Kaviani, M., (1998), An introduction to climate, SAMT publisher, p. 91

6- Becker, F. and A. L. Li. 1990, Towards a local split window method over land surfaces, International Journal of Remote Sensing. 11:369-393.

7- Bastiaanssen, W.G.M. Menentia, R.A. Feddes, A.A.M. Holtslag, (1998). A remote sensing surface.

8- Cracknell, A.P. (1997). The advanced very high resolution radiometer (AVHRR). Taylor &Francis energy balance algorithm for land (SEBAL). Journal of Hydrology, 212–213 (1998), p. 198–212.

9- Gallo et al, (1993), The Use of the Urban Heat Island Effect, Journal of Applied Meteorology, 32(5):899-908.

10- Gillespie, A., J.S. Cothern, S. Rokugawa, T. Matsunaga, S.J. Hook and A.B. Kahle. (1998). A temperature and emissivity separation algorithm for Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) images. IEEE Transactions on Geoscience and Remote Sensing, 36(4): 1113-1126.

11- Lu, D., and Weng, Q., (2004), Spectral mixture analysis of the urban landscape in Indianapolis city with LANDSAT-7 ETM+ imagery: Photogrammetry Engineering and Remote Sensing, 70(9), p.1053-106.

12- Sobrino,J. A., Cool, C., and Caselles, V,. (1991). Atmospheric correction for land surface temperature using NOAA-LL AVHRR channels 4 and 5. Remote Sensing of Environment, 38, 19-34.

13- Sobrino, J. A., Li, Z-L., Stoll, M. and Becker, F., (1996). Multi –channel and multiangle algorithms for estimating sea and land surface temperature with ATSR data. International Journal of Remote Sensing, 17, 2089-2114.

14- Sobrino,et al,(2004),Land Surface Temperature Retrieval from LANDSAT TM 5,REMOTE Sensing of Environment,90:434-440.

15- Weng,Q, et al,(2007),Assessing the effects of land use and land cover patterns on thermal conditions using landscape metrics in city of Indianapolis, United States, Urban Ecosyst,10:203-219 Ltd., London, U.K., 534 pp.

16- Weng,Q, Dengsheng Lu, Jacquelyn Schubring, (2003) , Estimation of land surface temperature–vegetation abundance relationship.

17- Becker, F. and A. L. Li. (1990), "Towards a local split window method over land surfaces, International Journal of Remote Sensing. 11:369-393.

18- Bastiaanssen, W.G.M. Menentia, R.A. Feddes, A.A.M. Holtslag, (1998). A remote sensing surface energy balance algorithm for land (SEBAL) 1. Formulation. Journal of Hydrology 212–213, 198–212.

19- Cracknell, A.P. (1998). The advanced very high resolution radiometer (AVHRR). Taylor &Francis energy balance algorithm for land (SEBAL). Journal of Hydrology, 212– 213, p. 198–212.

20- Gallo et al, (1993), The Use of the Urban Heat Island Effect, Journal of Applied Meteorology, 32(5):899-908.

21- Lu, D., Weng, Q., (2004), Spectral mixture analysis of the urban landscape in Indianapolis city with LANDSAT-7 ETM+ imagery: Photogrammetry Engineering and Remote Sensing, 70(9),p.1053-106 .

22- Sobrino,J. A., Cool, C., and Caselles, V,. (1991). Atmospheric correction for land surface temperature using NOAA-LL AVHRR channels ٤ and ٥. Remote Sensing of Environment, 38, 19-34.

23- Sobrino, J. A, Li, Z-L., Stoll, M. and Becker, F., (1996). Multi –channel and multiangle algorithms for estimating sea and land surface temperature with ATSR data. International Journal of Remote Sensing ,17,2089-2114

24- Sobrino,et al, (2004), Land Surface Temperature Retrieval from LANDSAT TM 5,REMOTE Sensing of Environment,90:434-440.

25- Weng,Q, et al, (2007), Assessing the effects of land use and land cover patterns on thermal conditions using landscape metrics in city of Indianapolis,United States,Urban Ecosyst,10:203-219 a.Ltd., London, U.K., 534 pp.

Weng,Q, Dengsheng Lu, Jacquelyn Schubring (2003) , Estimation of land surface temperature–vegetation abundance relationship.

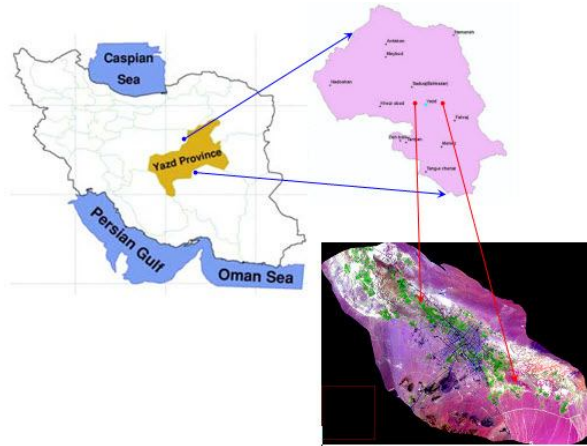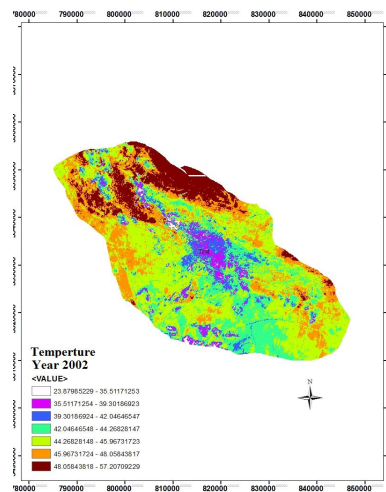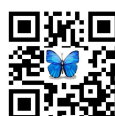**Ali Almodaresi** *et al.*

Figure 1- The area under study

Map No. (2) Surface Temperature Map of Yazd 2002
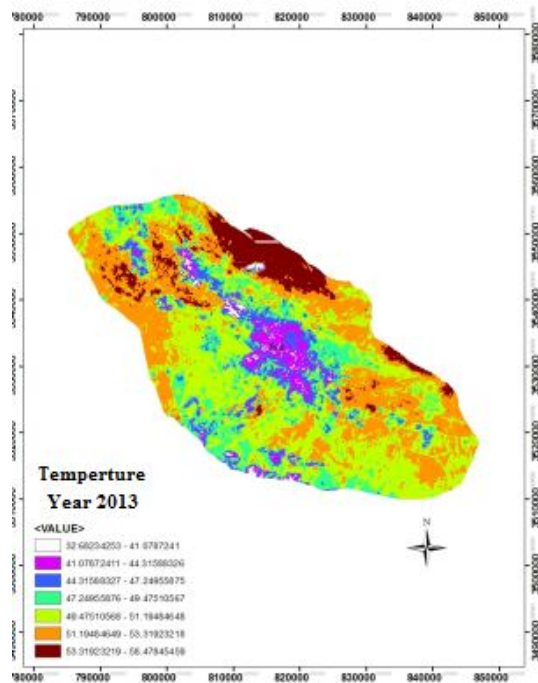
Map No. (3) Surface Temperature Map of Yazd 2013
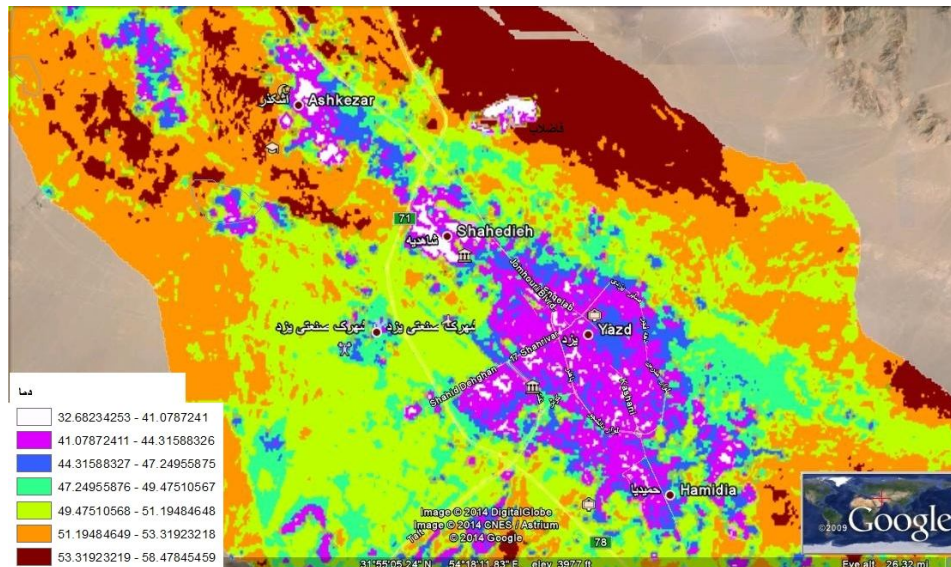
Map (4) surface –temperature of Yazd 2013 with urban centers location

RESEARCH ARTICLE
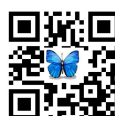
Detecting Changes in Land Usethrough Satellite Image Classification Worldview-2 Method and Artificial Neural Network Algorithms

Hamid Ghanbarzade[1], Ali Sarkaregar Ardakani[2]* and Ali Mohammad Latif[3]

[1]M.A Student, RS&GIS Department .Yazd Branch, Islamic Azad University, Yazd, Iran.hamid.kartography@gmail.com
[2]Assistant Professor, RS & GIS Department .Yazd Branch, Islamic Azad University, Yazd, Iran.aliardakani@yahoo.com
[3]Assistant Professor, Electrical and Computer Engineering Department, Yazd University, Yazd, Iran.alatif@yazduni.ac.ir

*Address for correspondence
Ali Sarkaregar Ardakani
Assistant Professor,
RS&GIS Department .Yazd Branch,
Islamic Azad University,
Yazd, Iran.
E-mail: aliardakani@yahoo.com

ABSTRACT

Generally one of the most interesting problems in image processing is to have a key function in detecting land use changes. Environmental protection and management has led to increasing interest in remote sensing society. Detecting land-cover changes leads to remote sensing analysis of multi-spectral images obtained from the same geographical area at two different times. Artificial neural networks are created as an important tool for addressing many of the problems related to image processing which includes both methods of supervised and unsupervised classifications. In this study we addressed the methods recognized by both supervised and unsupervised classification for detecting changes in multitemporal changes in high resolution and multi-spectral satellite images resulting in the best algorithm for classifying high resolution and multi-spectral satellite images for the multi-layer perceptron algorithm (MLP) with an overall accuracy and kappa coefficient of 91.28% and 0.89 respectively. Also the radial basis function (RBF) with an overall accuracy of 77.75% and a kappa coefficient of 0.72 and finally the self organizing map (SOM) with the least accuracy rate of 74.09% for the overall accuracy and kappa coefficient of 0.67 was obtained. Finally, the analysis of changes in this area includes the highest class of land use changes is associated with the class of no use (arid) and the vegetation class with 8450 square

meters of arid land changed into vegetation class. Also 482 square meters of vegetation class is changed to buildings.

Key words: classification, change detection, MLP, RBF and SOM neural networks

INTRODUCTION

Classification is one of the most important methods to extract information from remote sensing images that allows users to generate various data types such as cover maps, user maps and changes map. The classification algorithms are divided into supervised and unsupervised methods. In supervised classification algorithms the training data that are prepared based on real terrain maps and field operations are used. There is no training phase in the unsupervised method, and the algorithm performs classification based on the statistical characteristics of remote sensing data. Unsupervised classification methods are commonly known as clustering methods. In this case, the image is classified into several classes with unknown labels; therefore the user has to specify the classes' label based on other sources of information. The accuracy of supervised classification algorithms is higher than unsupervised algorithms [1].

In this paper the Multi Layer Perceptron algorithm (MLP) and radial basis function algorithm (RBF) which are supervised neural networks and the unsupervised neural network Self Organizing Map algorithm (SOM) are used to classify the Worldview-2 satellite images.

Victor-Emil Neagoe et al (2012) using the algorithms of neural networks and statistical methods and supervised and unsupervised classification and Landsat 7 ETM + satellite images related to Markaryd in Sweden in 2002 and 2006, in which the total number of pixels were 400 × 400 pixels and only 2000 pixels were used for network training and the rest of 158,000 pixels are used for testing. The best experimental results were obtained using supervised multi-layer perceptron neural network (MLP) with an accuracy of 88.24% while among the unsupervised methods using all the pixels, the best results were related to the absolute difference of pixels (ADIP) method with an accuracy of 78.22%. The experimental results in this study demonstrate that the methods of detecting changes in neural networks have a better performance of fuzzy statistical methods [2].

In the present research in addition to providing the classification of the images of the area using supervised and unsupervised neural networks methods, the accuracy analysis and comparison of the results are performed. The main objective is to select the best algorithm for detecting changes in the land forms. The results obtained from the accuracy of the classification algorithms being used suggest that the multilayer perceptron algorithm the best accuracy.

The areaunderstudy

The study area is the El-Obeid AirPort. This airport is located in the area 13º 09' 35"N and 30º 13' 44"E in the south east of El-Obeid -Sudan. In this area given the data provided by the images remarkable land use changes have occurred. The images used in this research are the worldview-2 satellite images with 1 year interval. The first picture was taken on October 22, 2010 and the second one is taken in November 13, 2011. These images have 4 bands with 2m pixel size and 1 panchromatic band with the pixel size of 0.6m. These images are sourced in UTM image system in 36N zone. The ellipsoid base in WGS84.
The satellite images are the most data being used shown in Figures 4 and 5.

MATERIALS AND METHODS

Artificial neural network is made of simple computational elements called neurons simulated based on the human biological neural neurons. The main task of the neurons is to receive information from neighboring neurons as input, to assign a weight parameter to each input, impact the existing inputs through the neurons inner performance function in order to calculate the response of neurons to input data and ultimately sending the calculated response to other neurons in the network as a new input [3]. The two important steps in the neural network include: network training and network refresh. In this study the multilayer perceptron network, radial basis function and self organizing map algorithms are used.

Multilayer Perceptron Neural Network

The input layer has neurons equal with the number of classification of input data and each neuron has the task of entering an information band into the network.

As can be seen in Figure 1, the output layer has one neuron that specifies the output class of each pixel and the middle layers as input and output interface layer, makes the network performance nonlinear and flexible. Training MLP neural networks consists of two steps. In the first phase the direction of which is from the input to the output, the error value is calculated using equation (1);

$$(1) \quad E = \frac{1}{2}\sum_{j=1}^{L}(d_j - o_j^m)^2$$

Where d_j and o_j represent the expected output and the result of the neural network in the j-th neuron in the output layer and L is the number of neurons designed in the final layer. In the second phase the direction of which is from the output into the input the weight vectors are moderated. The equation (2) presents these calculations:

$$(2) \quad \begin{cases} \Delta W_{i,j}^{k-1,k} = -\eta(t)\frac{\partial E}{\partial W_{i,j}^{k-2,k}} \\ \Delta W_{i,j}(t+1) = -\Delta W_{i,j} + \alpha\Delta W_{i,j}(t) \end{cases}$$

Where $W_{i,j}$ is the weight associated with the j-th neuron response which is sent to the i-th neuron in the next layer. H is the numerical constant that controls the process and the corrections applied to the weights and it is called learning rate. A is known as the momentum parameter takes values between zero and one, and stabilizes the learning process so that the corrections at each stage are influenced by the previous step. t presents the number of repetition of learning step. The value of η must be between zero and 1. The use of large amounts such as 0.8 cause rapid convergence but in the next repetitions, the solution of algorithm fluctuates around the minimum point of the algorithm and the low value leads the algorithm to be time consuming, but the algorithm achieves higher stability [7].

Neural networks of radial basis functions:

Radial basis neural networks due to fast and inclusive training are interesting and helpful and they have attracted attention. In 1990 Gyrus, Poggi and Hartman and Copper proved that the networks with radial basis functions are very string structural estimations and through having enough neurons in the hidden layer are capable of estimating any continuous function with any degree of accuracy. Fig 2 presents a radial basis function network.

Since the curve of radial basis functions is symmetric the neurons inthehidden layer are calledradial basis function neurons. There are various radial basis functions and in this study the radialnetworks are the same as theGaussianorexponentialfunction represented in equation 3:

$$(3) \quad \phi\left(\|\ x - u_j\ \|\right) = e^{\frac{\left(\|x-u_j\|\right)}{\sigma_j}}$$

Where, σ_j is the j-th width Cornell factor. The reason for selectingexponentialGaussianfunction as the neuron response function in the radial basis function networks is that Gyrus and Poggi (1990) showed that the exponentialfunction is a member of the group of functions that have the best properties in approximation. This fact guaratees that there are set of functions that approximate the relationship betweeninputandtargetvectors better thananyother set and this property does not exist in sigmoidfunction being used in propagationnetworks [7].

Self-organizing map neural network

As you can see in Figure 2 Self-organizing map network algorithm is composed of two layers, the input layer in which each neuron usually equivalent to one band of the image and the output layer is called the competitive layer [4] [5]. The output layer of SOM is a set with m neurons and these neurons are placed next to each other in a particular topology. Each neuron obtains the (x_i, y_i) coordinates in the topology space and the $w_i = (w_i^1, w_i^2, \dots, w_i^n)^T \in R^n$ weight vector in which n represents the size of the input data .

TheSOM algorithm is trained in a two-step process. Firstly, the winner neuron in the SOM algorithm is selected based on the similarity criteria which is usually the Euclidean or Manhattan distance. Secondly, the update of the neurons vector weight is done in the learning phase which is a recursive action. Equation (4) represents the update of the weights.

$$(4) \quad W_i(t+1) = W_i(t) + \eta(t)h_{si}(t)[X - W_i(t)]$$

Where the parameter h_{si} is the neighbor function around the winner neuron (s), $\eta \in [0,1]$ is the update rate of the weight vector, W is theweight vector, t indicates repetition and $i \in [1,m]$ is the number of neuron being analyzed. The function h_{si} can be a bubble with a constant value for the winner neuron within a neighboring radius and the value of zero is considered for other neurons or Gaussian function. These parameters are based on the nature of the input data and are determined by trial and error [6]. Also the dead unit created due to non-participation in the competition affects the results of SOM algorithm [7].

RESULTS

In order to implement the algorithm used in this paper the Matlab program was used. For this purpose the functions of the program were specified based on the research requirements. Also the image preparation and extracting educational and data check were performed by ENVI program. The implementation process and the results of each part including implementation of MLP, RBF and SOM algorithms are discussed below.

The results of classification using multi-layer neural network

In this study, a multi-layer perceptron neural network with a 4 neuron input layer including 1-4 bands of the normalized image and a hidden layer with 10 neurons, and an output layer (being used as the training layer) are used for both images.

Ali Sarkaregar Ardakani *et al.*

In order to achieve a better zoning and obtain an accurate output a different structure of neural network through the variation in the number of neurons and other parameters was tested. According to Tables 1 and 2 the best architecture and network topology for the classification process is repeated for each satellite image with an optimal repetition of 85 and learning rate of .1 and the neuron numbers of 10 and the momentum factor of 0.5 and the MSE error 0.128 were selected for image Time2-2011. During the training process of the input data 15% was selected for the test data, 15% for validation and 70% for training the network.After the classification the land cover and the land use maps were obtained in 6 classes: , airports, roads, buildings, water zones, areas of no use (arid) and the vegetation and the land cover and land use maps of multi layer perceptron are presented in Figures 6 and 7.

The results of classification using Neural networks of radial basis functions

First we set the learning error rate or the average resulr for the training samples with a variable called Goal (The default valueof this variableisequal tozero and the same value is used in the designed network). The increase value of the number of radial basis functions (Step) in each step was set as 2. Regarding the implementation of the model in the two images being studied using the empirical method the optimal network typology is selected and finally the following architecture network was chosen.

for Time1-2010 : Spread=3, Number of RBF functions=10, Number of data set=4 , Goad = 0
for Time2-2011: Spread=1,Number of RBF functions=10,Number of data set=1 Goal= 0

As a result, the image Time1-2010 is trained with R = 0.81% and Time2-2011 image is trained with R = 0.83%. The figures 8 and 9 show the output of the classification.

The results of classification using Self-organizing map neural network

Determines the number of nerves in the input and output layers of an SOM network. The number of input nerves is equal to number of input widths. However, there is no explicit rule about the number of output nerves. In this study after introducing the inputs and outputs to the networks the training was performed. The classified maps are presented in Figure 10 and 11.

Evaluating the overall accuracy of the classified maps

The final step in the process of classification is estimating the accuracy. By estimating the accuracy the rate of reliability is determined on the results. The most common way to express the classification accuracy is to use error matrix. According to the error matrix several parameters are extracted to express accuracy including overall accuracy, Kappa coefficient, User's accuracy and Producer's accuracy [1]. The closer the percentage of overall test accuracy and Kappa coefficient is to 100 the better performance appears by the classification algorithms. To assess the performed classifications some training samples were used and the error matrix was formed to evaluate both classifications (Tables 3 to 8 show the matrix). In the table the values on the main diagonal represent pixels that are correctly classified and other non-diagonal numbers represent the wrongly classified pixels.

DISCUSSION

The comparison of the separation method of land cover obtained from the maps and the error matrix of the two methods shows that the multi-layer perceptron neural network algorithm has more accuracy and capability to classify the satellite images compared to the other two methods. Therefore in order to analyze the land use changes and the change of each classified classes two output images of the MLP model are used due to its high capability in classification.

We obtained the map of the changes in each class using function (XOR) by MATLAB and programming presented in figures 12-17. Finally in order to show the class to class changes the CROSSTAB tool (tools for detecting changes) in IDRISI program are used which is presented in Table9.

According to the above map the change of land use and the conversion into other uses is shown. For example the green areas indicate the areas that have not been used as the vegetation area but they are changes into the vegetation areas in image 2. Table 9 indicate the map of the area (square meters) of each of these classes.

REFERENCES

1. Richards J. A., Jia X., 2006, Remote SensingDigital Image Analysis an Introduction,4th Edition, Chapter 1, Springer, Germany, Berlin, Heidelberg.
2. Neagoe V E, Neghina M, Datcu M. 2012. Neural network techniques for automated land-cover change detection in multispectral satellite time series imagery. International Journal of Mathematical Models and Methods in Applied Sciences, 6:130-139
3. Atkinson P.M., Tatnall, A.R.L., 1997, Neural Networks in Remote Sensing, Int. J. Remote Sensing, Vol. 18, No. 4, pp. 699-709.
4. Kohonen T., 1995, Self-Organizing Maps, Springer, Berlin, Heidelberg, New-York: Springer, Berlin.
5. Kohonen T., Kaski S., Lagus K., Salojarvi J., Honkela J., Paatero V., Saarela A., 2000, Self Organization of a Massive Document Collection, IEEE Trans. ON NEURAL NETWORKS, Vol. 11, No. 3, pp. 574–585.
6. Su M.C., Chang H.T., 2000, Fast Self-Organizing Feature Map Algorithm, IEEETRANS. ON NEURAL NETWORKS, Vol. 11, No. 3, pp. 721-733.
7. Menhaj M.B., 2002, Introduction to Artificial Neural Network, the publication center of AmirKabir University.
8. Haykin S., 1999, Neural Network aComprehensive Foundation, 2th edition,Pearson prentice hall .
9. Worlview-2 Imagery Products: Product Guide, DigitalGlobe, Longmont, CO, Feb. 2006. [Online]. vailable: http://digitalglobe.com
10. Kalami Harris SM. 2012. ANN training set, the fourth and fifth sections: theoretical foundations and practical implementation of neural networks RBF. Www.faradars.org.
11. Kalami Harris SM. 2012. ANN training set, the eleventh and twelfth: competitive neural networks and SOM (a) and (b). Www.faradars.org.
12. Kalami Harris cm. 2012. Training Artificial Neural Networks, Part I, II and III: Fundamentals of Theory and design of multi-layer neural networks or MLP. Www.faradars.org.
13. Hosseini Asl A. 2012. Land cover change detection in remote sensing data based on artificial neural networks. Master's thesis, Department of Earth Sciences of Shahid Beheshti University.

Ali Sarkaregar Ardakani *et al.*

Figure 4. The image of the study area on October 22nd, 2010 RGB Bands (1, 2, 3) Time1 image

Figure 5. The image of the study area on November 13th, 2011 the combined RGB color bands (1, 2, 3) Time 2 image
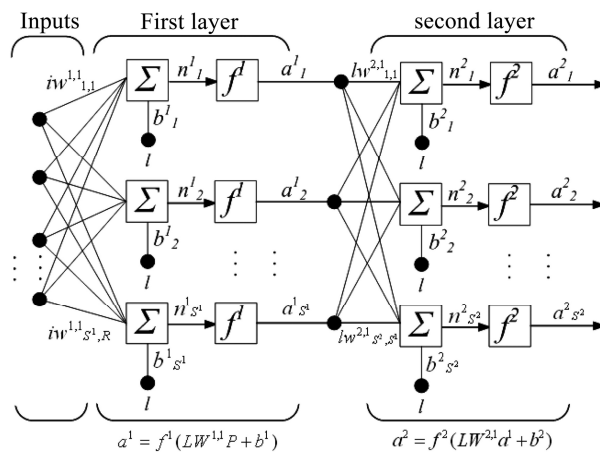
Figure 1: Two-layer neural network
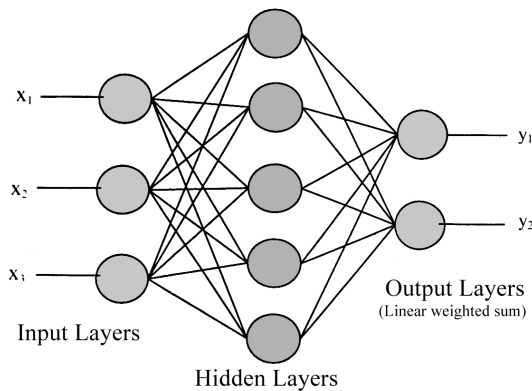
Figure 2. A radial basis function network

Ali Sarkaregar Ardakani *et al.*
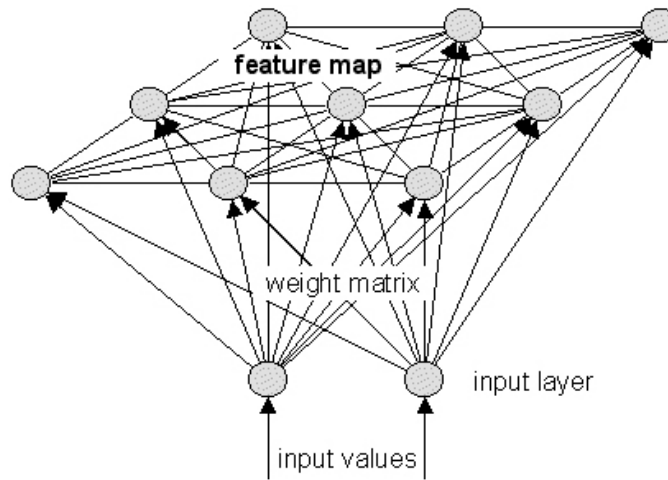
Figure 3. Self-organizing map network

Table 1. The value obtained from the optimal repeated values of the parameters extracted from the image Time1-2010

Row	Repeat	Training coefficient	Momentum factor	Number of neurons	MSEerror
1	85	0.1	0.5	10	0.182
2	60	0.15	0.6	9	0.546
3	87	0.01	0.8	12	0.179
4	33	0.2	0.9	11	0.373
5	66	0.5	0.7	14	0.425

Table 2. The value obtained from the optimal repeated values of the parameters extracted from the image Time2-2011

Row	Repeat	Learn coefficient	Momentum factor	Number of neurons	MSEerror
1	85	0.1	0.5	10	0.128
2	21	0.015	0.6	8	0.564
3	13	0.01	0.8	16	0.354
4	46	0.2	0.9	14	0.373
5	20	0.21	0.5	9	0.325
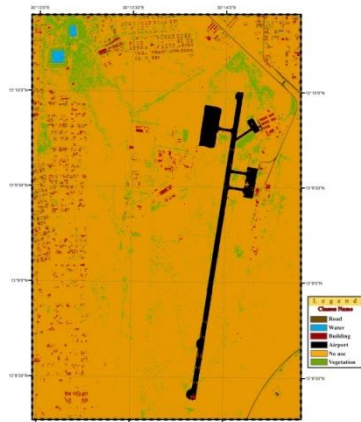
Figure 6. Multilayer Perceptron algorithm map for classification of satellite image Time1-2010
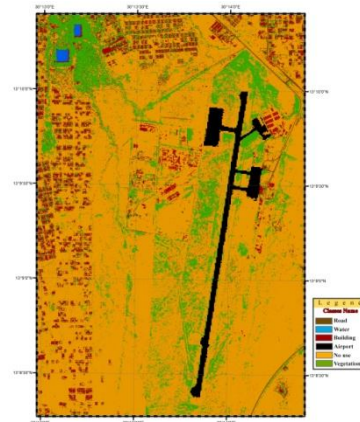
Figure 7. Multilayer Perceptron algorithm map for classification of satellite image Time2-2011
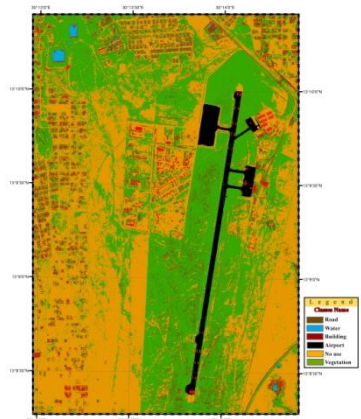
Figure 8. Map of classification based on radial basis functions algorithm (RBF) for satellite image Time1-2010
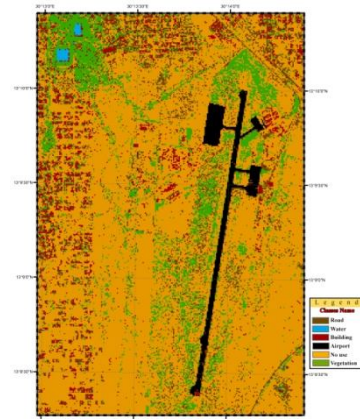
Figure 9. Map of classification based on radial basis functions algorithm (RBF) for satellite image Time2-2011
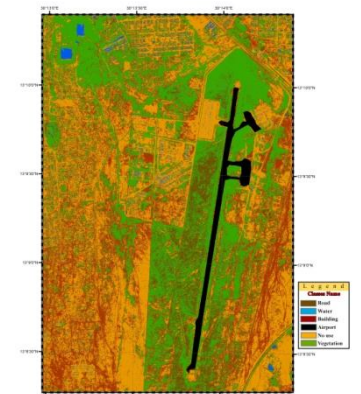
Figure 10. Map of classification based on Self-organizing map algorithm (SOM) for satellite
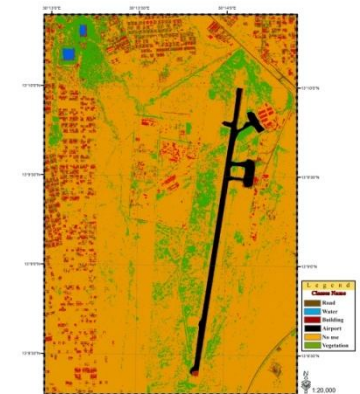
Figure 11. Map of classification based on Self-organizing map algorithm (SOM) for satellite image

4170
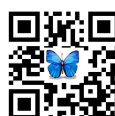
Ali Sarkaregar Ardakani *et al.*

Table 3. The classification error matrix of land cover algorithm (MLP) for satellite image Time1-2010

Classes	Water	Building	Road	Airport	No use	Vegetation	Total	User's accuracy
Water	67	0	0	0	0	3	70	95.71428571
Building	2	263	4	2	14	7	292	90.06849315
Road	0	6	212	2	0	5	225	94.22222222
Airport	0	6	4	109	7	10	136	80.14705882
No use	1	7	9	2	280	8	307	91.20521173
Vegetation	3	7	1	0	2	231	244	94.67213115
Total	73	289	229	115	303	264	1273	
Producer's accuracy	91.78082	91.00346	92.57642	94.78261	92.40924	87.5		
accuracy	91.28044							
Kappa	0.89184							

Table 4. The classification error matrix of land cover algorithm (MLP) for satellite image Time2-2011

Classes	Water	Building	Road	Airport	No use	Vegetation	Total	User's accuracy
Water	65	2	0	0	3	3	73	89.04109589
Building	2	268	14	3	5	7	299	89.63210702
Road	0	11	198	4	3	2	218	90.82568807
Airport	0	2	2	104	8	2	118	88.13559322
No use	2	4	5	4	282	14	311	90.67524116
Vegetation	4	2	0	0	2	236	244	96.72131148
Total	73	289	219	115	303	264	1263	
Producer's accuracy	89.04109	92.73356	90.41095	90.43478	93.06930	89.39393		
accuracy	91.29057							
Kappa	0.891754							

Ali Sarkaregar Ardakani *et al.*

Table 5. The classification error matrix of land cover algorithm (RBF) for satellite image Time1-2010

Classes	Water	Building	Road	Airport	No use	Vegetation	Total	User's accuracy
Water	65	9	0	0	2	1	77	84.41558442
Building	8	241	5	5	12	11	282	85.46099291
Road	0	12	154	13	4	12	195	78.97435897
Airport	0	3	31	83	7	7	131	63.35877863
No use	0	9	21	6	246	39	321	76.63551402
Vegetation	0	15	8	8	32	194	257	75.48638132
Total	73	289	219	115	303	264	1263	
Producer's accuracy	89.0411	83.3912	70.3196	72.1739	81.1881	73.4848		
accuracy	77.83056							
Kappa	0.72483							

Table 6. The classification error matrix of land cover algorithm (RBF) for satellite image Time2-2011

Classes	Water	Building	Road	Airport	No use	Vegetation	Total	User's accuracy
Water	67	10	0	0	12	0	89	75.28089888
Building	4	237	3	6	5	21	276	85.86956522
Road	0	19	147	7	7	12	192	76.56252252
Airport	0	3	32	88	7	6	136	64.70588235
No use	0	12	20	9	265	48	354	74.85875706
Vegetation	2	8	17	5	7	177	216	81.94444444
Total	73	289	219	115	303	264	1263	
Producer's accuracy	91.78082	82.00692	67.12329	76.52174	87.45875	67.04545		
accuracy	77.67221							
Kappa	0.723245							

Ali Sarkaregar Ardakani *et al.*

Table 7. The classification error matrix of land cover algorithm (SOM) for satellite image Time1-2010

Classes	Water	Building	Road	Airport	No use	Vegetation	Total	User's accuracy
Water	68	31	3	0	8	4	114	59.64912281
Building	1	186	5	6	29	34	261	71.26436782
Road	0	38	175	9	6	30	258	67.82945736
Airport	0	3	17	87	12	5	124	70.16129032
No use	1	16	8	8	234	24	291	80.41237113
Vegetation	3	15	11	5	14	167	215	77.67441865
Total	73	289	219	115	303	264	1263	
Producer's accuracy	93.15068	64.35986	79.90868	75.65217	77.22772	63.25758		
accuracy	72.60491							
Kappa	0.662738							

Table 8. The classification error matrix of land cover algorithm (SOM) for satellite image Time2-2011

Classes	Water	Building	Road	Airport	No use	Vegetation	Total	User's accuracy
Water	60	11	0	0	8	8	87	68.96551724
Building	8	223	7	9	23	33	303	73.59735974
Road	0	11	153	8	12	18	202	75.74257426
Airport	0	6	31	77	7	6	127	60.62992126
No use	1	16	28	12	246	4	307	80.13029316
Vegetation	4	22	0	9	7	195	237	82.27848101
Total	73	289	219	115	303	264	1263	
Producer's accuracy	82.19178	77.16263	69.86301	66.95652	81.18812	73.86364		
accuracy	75.53444							
Kappa	0.69672							

Ali Sarkaregar Ardakani *et al.*

Figure 12. Water class changes map
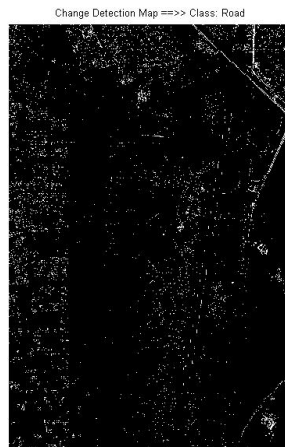
Figure 13. Road class changes map
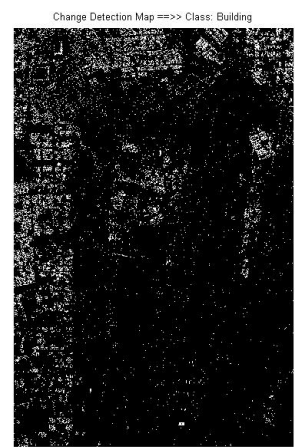
Figure 14. Building class changes map
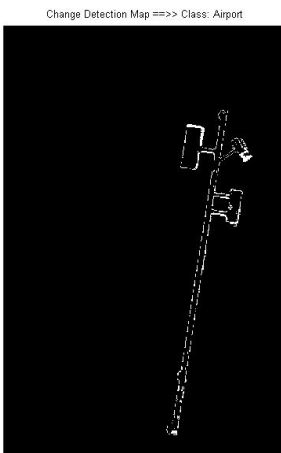
Figure 15. Airport class changes map

Figure 16. Vegetation class changes map

Figure 17. No use class changes map

Table 9. The changes surface are of each class into another class in image Time1-2010 And the Time2-2011

Table change (m)	No Use	Building	Road	Vegetation	Water	Airport
No Use	73459.764	0	0	1606.2696	7.956	205.9956
Building	0	1642.2804	0	482.3568	0	0
Road	0	0	170.7408	140.6016	0	0
Vegetation	8449.9272	107.9424	11.376	5631.9912	4.5756	64.1376
Water	2.2176	0	0	1.5552	189.414	0
Airport	361.4976	0	0	13.1004	0	2385.738

RESEARCH ARTICLE

Identification and Ordering Critical Success Factors In Implementation of Knowledge Management in Oil and Gas Karoon Company

Iraj Akbarifar[1]*, Karim Hamdi[3] and Mohammad Hossein Pour[2]

[1]Departmet of Management, Khouzestan Science and Research Branch, Islamic Azad University, Ahvaz, Iran
[2]Departmet of Management, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran
[3]Department of Managementand Economics, Tehran Science and Research Branch, Islamic Azad University, Tehran, Iran

*Address for correspondence
Iraj Akbarifar
Departmet of Management,
Khouzestan Science and Research Branch,
 Islamic Azad University,
Ahvaz, Iran.

ABSTRACT

In the wisdom era in which knowledge is the most important asset of any organization many organizations have implemented knowledge management. Current work aims at investigating necessary infrastructures for knowledge management system establishment. Descriptive research method was used and it is a survey type since it investigates current status and describesdemographiccharacteristics. Lee and Choi model's questionnaire was used for investigating infrastructural factors including culture, structure, information technology, and human resources, and Lawson model was used for studying knowledge management processes including creation, acquisition, organization, storage, dissemination and application of knowledge. Validity of the questionnaire was confirmed by the experts and validity and reliability was obtained as 0.95 and 0.96, respectively using Cronbach alpha which is acceptable. Stratified sampling design was used and data were collected from a population of 541 employees of Oil Company. Sample size was specified as 226 using Krejcie and Morgan Table. To this end, 320 questionnaires were distributed and respective sample was collected for analysis. Results were obtained at descriptive statistics (mean, SD) and inferential statistics (t-student test and Friedman) levels using SPSS software following verifying normality by Kolmogorov-Smirnov test. Findings indicate only information technology is in suitable status for successful establishment of knowledge management system, and this factor has highest priority in infrastructural factors and knowledge acquisition has

4175

highest priority in KM processes. Investigating status of infrastructural factors and processes is the primary action which can provide strong foundation for subsequent actions in this regards.

Key words: Knowledge Management, Infrastructure, Organizational Culture, Organizational Structure, Information Technology, Human Resources.

INTRODUCTION

Knowledge is the main asset of the organization for creating sustainable competitive value and advantage (Chen, 2011). Organizations have also been influenced by knowledge accumulation so that increased volume of information in the organizations and necessity for using knowledge in organizational decision making over two last decades has led to emergence of a phenomenon known as knowledge management. It indicates necessity for planning, organization, leadership, and monitoring organizational knowledge as well as management of knowledge access process so that it is effective and efficient (Kelly, 2004). Vatnabi and Snow (2008), knowledge management can be defined as process of acquiring, storing, sharing, dissemination and application of tacit and explicit knowledge beyond the organizational boundaries (Bakhshizadeh, 2011). Knowledge management is regarded as an organizational strategy and asset for management of organizational knowledge and it utilizes processes of creation and acquisition, storage, sharing and dissemination, retrieval and use of tacit and explicit knowledge. Knowledge management approaches means that companies and organizations seek for creating competitive advantages through continuous learning which is obtained as a result of formulating various types of knowledge (Ignasio, 2008).

Lawson (2003) proposed a model by combining processes from three knowledge models from three groups of authors including Wig (1997), Parieh (2001) and Horwith and Armascost (2003). According to this model, knowledge management cycle model is classified with six different processes: 1. Knowledge creation, 2. knowledge acquisition, 3. knowledge storage, 4. knowledge organization, 5. knowledge application, 6. knowledge dissemination. Knowledge management infrastructures are enablers for increasing the efficiency of knowledge management activities. Among the enablers of knowledge management, technology, organizational structure and culture are the most powerful enabling factors (Gold, 2001).Focus and formalization aspects are determinants of organizational structure (Tata and Prased, 2004). Organizational culture includes cooperation, trust, and motivation for knowledge sharing and transfer in the organization (Detinne et al., 2004). Since imposing changes in the organizations is not possible without involvement of the individuals (Gaffor, 2008), human factor should be especially considered for evaluation of readiness and thus successful implementation of knowledge management.

Looking at organization's nature it can be found great part of employees will be retired over few years in the future. Acquiring, sharing and using knowledge of retired employees before leaving organization is one of the risks and problems of public organizations. To this end, human resource management is considered as an important strategy in public organizations and knowledge management as one of management tools plays significant role in human resource management strategy.

The main research question in the current work originates from the fact that Karoon Oil and Gas Production Company intends to implement knowledge management system in its organization, and it wants to be aware of status of existing knowledge management processes. Current level of knowledge management on the oil company is specified by measuring level and extent of establishment of infrastructural processes and factors, and the gap can be found by comparing between current and optimal status. Identifying presuppositions and necessary grounds for implementing knowledge management helps better implementation.

Thus, considering importance of knowledge management establishment in Karoon Oil and Gas Production Company, current research aim at providing answers for following questions: what are necessary infrastructures for

knowledge management system implementation in the company? How is current status and readiness of knowledge management infrastructures and processes? Does it provide possibility for establishment of knowledge management system? What are priorities of infrastructural factors for providing suitable solutions? Infrastructures (enablers) and their readiness level will be investigated in the following. Answers of these questions can be helpful and guiding for managers and decision makers in Karoon Oil and Gas Production Company for successful establishment of knowledge management system.

THEORETICAL FOUNDATIONS

In recent years, knowledge management has been regarded as one of the most attractive and challenging issues in business management area and its application scope is extending along with other issues of management area. According to Zirax, knowledge management is processes of absorption, application and re-application of individual and organizational knowledge (Hadizadeh et al., 2010). Knowledge management is a complex process of aligning organizational mission with the best methods which enables the organization to be competitive and profitable in its sector. Snowden (2002) classifies knowledge management literature which has been developed over 15 last years. It is classified into three different phases or generations which can be summarized as follows: 1. efficient use of knowledge, 2. knowledge learning and transfer, and 3. creation of new knowledge (Snowden, 2002).

The authors have identified different processes for knowledge management including creation, transfer and use (Spender, 1996), acquisition, transfer and use (Delong, 1997), identifying, acquiring, developing, sharing, dissemination, use and maintenance (Probest et al., 2000). Alavi (2001) claimed that knowledge creation alone does not suffice and other mechanisms are needed for knowledge storage and retrieval. The key point in knowledge management is ensuring that provided knowledge is usefully utilized (Probst, Rub and Rumhardt, 2000). Effective knowledge application helps companies to increase their effectiveness and reduce the costs (Davenport and Klahr,1998). Knowledge application includes knowledge application for supporting decision making, action taking and problem solving and it ultimately leads to knowledge creation.

Organizational culture includes a collection of values, beliefs, and norms of procedures which are shared by the organization's individuals (Roobin, 2004). Organizational structure is one of the factors which affect organizational behavior and it is effective in the way and evolution of behavior of individuals and groups. In fact, managers can divide, organize, and control organizational activities with the help of organizational structure and they are able to provide a stable framework for achieving organizational goals.

Information technology as the responsible factor for maintaining knowledge management attempts is one of the major knowledge management enablers in the organization (Gaffoor, 2008; Yeh et al, 2006).

With studying knowledge management literature it can be found human resource and knowledge management are closely related and many knowledge management plans failed because of negligence to human factor. Employees are the main elements in every organization, and the organization with more empowered and productive employees is more successful (Arabi, 2012).

Human capital represents the knowledge inventory of an organization's individuals (Bontis and Girardi, 2000, p.85). According to Chen and Huang (2007), competency of employees is the hard part of human resource which includes knowledge, skills, and talents. Attitude of employees is the soft part of human resource which includes motivation and job satisfaction. Attitude is regarded as a requisite which causes that employees express their competency freely (Chen and Huang, 2007).

Iraj Akbarifar *et al.*

REVIEW OF LITERATURE

Chang (2011) in his work entitledKnowledge Management Implementation Pattern Using Fuzzy Performance Development, Case Study: Health Organization, studied knowledge management infrastructures and provided a model of knowledge management processes and enablers for using nursing knowledge assets. Results of fuzzy quality performance development indicate during implementation of knowledge management in this hospital, strengthening enablers is necessary for promoting these elements in knowledge management process. Matrix of interaction between knowledge management enablers and knowledge management process elements indicates this hospital should attempt to improve employee satisfaction and reduce gap between important and satisfaction level of elements in knowledge management process. Enablers include evaluation, leadership, information technology and organizational culture, and knowledge management processes and enablers were evaluated averagely suggesting readiness of the organization for knowledge management implementation.

Ghafoor (2009) in his research from Faculty of Economics and Management, Stellenbosch University, entitled Evaluation of Readiness for Knowledge Management Application in Local Governments Studied by Stellenbosch Municipality stated knowledge management can considerably promotes organizational productivity and it requires long term commitments and commitment of all organizational members. Prior to knowledge management implementation, it is necessary to ensure knowledge management enablers are ready and adequately developed in the organization. Evaluation of knowledge management enablers is necessary for achieving organizational success and effectiveness of knowledge management processes. Considering reviewed literature, enablers include "Organizational culture", "structure", "human resources", "information technology", "strategy and leadership" which are not unique and they are interrelated. Thus, in order to successful implementation of knowledge management, the organization should develop these variables adequately and support them.

Yeh et al. (2006) in their work entitled Knowledge Management Enablers: Case Study aiming at analyzing basic role of enablers for knowledge management implementation in the organization stated knowledge management enablers in the organization cause knowledge development and stimulation of knowledge creation leading to improvement and effectiveness of knowledge management activities which enables simple implementation processes and higher knowledge management productivity speed. According to them, strategy and leadership is the most important part of top management support. For organizational culture, the main part id sharing culture which actually needs information technology. For empowerment and enabling, educational courses and learning channels and motivational programs for employees are key factors.

Also, for information technology, digitizing documents and speed of knowledge search for reuse are the main factors. They also identified establishment of a dedicated unit as a key factor for developing and extending knowledge management and communication and coordination between different units. Their model was practically confirmed in the industry and it can be a reference for business and academic environments,

Research model and hypotheses

Two main dimensions of this research are knowledge management processes and infrastructures and Lawson's model was used for measuring knowledge management processes. According to this model, knowledge management cycle is classified with six different processes: 1. Knowledge creation, 2. knowledge acquisition, 3. knowledge storage, 4. knowledge organization, 5. knowledge application, 6. knowledge dissemination. In this research, knowledge management infrastructures are extracted based on Lee and Choi's model (2003) which includes: Information Technology (Technology), organizational structure, organizational culture and human resources. Research model is proposed as Fig 1.
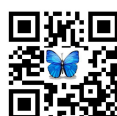
Iraj Akbarifar *et al.*

This model includes following hypotheses:

H1: The organization has suitable information technology for successful establishment of knowledge management.
H2: The organization has suitable organizational structure for successful establishment of knowledge management.
H3: The organization has suitable organizational culture for successful establishment of knowledge management.
H4: The organization has suitable human resource for successful establishment of knowledge management.
H5: The organization has suitable organizational processes for successful establishment of knowledge management.

H5-1: The organization has suitable knowledge creation process for successful establishment of knowledge management.
H5-2: The organization has suitable knowledge acquisition process for successful establishment of knowledge management.
H5-3: The organization has suitable knowledge organization process for successful establishment of knowledge management.
H5-4: The organization has suitable knowledge storage process for successful establishment of knowledge management.
H5-5: The organization has suitable knowledge dissemination process for successful establishment of knowledge management.
H5-6: The organization has suitable knowledge application process for successful establishment of knowledge management.

METHODOLOGY

Current research is applied research and proposed factors for effective knowledge management can be used for organizations which intend to implement knowledge management. In terms of data collection method and due to using questionnaire for data collection, it is a descriptive survey. Since current research studies ideas of managers and employees in identification and investigation of key success factors for knowledge management system establishment in Karoon Oil and Gas Production Company, and evaluates current status of factors for implementation of knowledge management system, it is descriptive research.

Data analysis

Descriptive statistics (frequency, percent, mean, and SD) and inferential statistics (one-sample t-student test and Friedman test and Cronbach alpha for calculating reliability coefficients) were used for data analysis. SPSS software version 21 was used for analysis of collected data.

Statistical population, sample and sampling method

Statistical population includes all employees (male and female) with high school degree and above in Karoon Oil and Gas Production Company, which were working in Karoon Industrial Zone. According to figures by Human Resource Supply and Allocation Unit the number was 541 at 2014 (time of conducting research).
In order to specify sample size, Krejcie and Morgan Table was used and it was specified as 226. To this end, 320 questionnaires were distributed and finally 226 questionnaires were collected and evaluated.

Data collection method and tool

In order to collect data, an author made questionnaire with 58 items was used. The questions were designed in to parts for measuring g knowledge management processes and knowledge management infrastructures. The part

Iraj Akbarifar *et al.*

designed for knowledge management processes was developed based on Lawson's standard questionnaire (2003) including items 1–24. This questionnaire was designed based on Likert scale. 24 items in this part are divided into 6 parts with 4 items and each level of activity was assigned to each of six processes. In the part dedicated for measurement of knowledge management infrastructures, view of employees toward knowledge management in the company under study was measured. This part was measured by standard questionnaire of Lee and Choi (2003) and Rampersod (2002) which covers human resource dimension. This part of the questionnaire includes five-point Likert scale covering items 25 to 58 in relation with technology, structure, culture, and human resource components. Five first items are related to technology, 10 items are related to organizational structure, 12 items are related to organizational culture and 7 items are related to human resources. Organizational structure includes decentralization and formalization dimensions in the organization. Out of 10 related items, 5 first items measure focus in the organization and next 5 items measure formalization in the organization.

Validity and reliability

In order to ensure if questionnaire items provide suitable questions for investigating respective indexes, standard questionnaire was used following consultation with professors and obtaining ideas of experts.

Reliability of the questionnaire was verified using Cronbach alpha. Reliability coefficients of knowledge management processes and knowledge management infrastructures questionnaires were reported as 0.96 and 0.95, respectively denoting optimal rehabilitee coefficients for the questionnaire.

RESEARCH FINDINGS

Information wasanalyzed by SPSS software. The results are provided in this section and they are examined.
In order to investigate adequacy of the sample size and variance of t5he variables, sample size adequacy test is used. Kolmogorov-Smirnov index is a measure of sampling adequacy. Sig value greater than 5% shows the sample has a normal distribution. The test results are given in Table 1 below.

Demographic variables including gender, age, education, and working experience are studied. Male employees included about 96.0 percent and female employees included about 4.0 percent of the sample. Age group 30 – 40 years had highest frequency (45.01%) and age group 20 – 29 years had lowest frequency (9.3%). Employees with high school diploma had highest frequency (407.0%) and employees with MA degree and above had lowest frequency (4.04%). Employees with working experience of 21 to 30 years had highest frequency and employees with working experience of 31 years and above had lowest frequency.

In order to examine status of each component, one sample t-test was used. The main point in using one sample t-test is selecting the test value, that is, the middle point should be chosen. Given the considered scale in items, test value was set as 3. If mean of answers in each component of variables is above 3, its status is regarded as optimal, and otherwise the variable is not in the optimal status in the view of the population under study. In this test, H_0 and H_1 are stated as follows for investigating mean status of the population idea.

$H_0: \mu x \leq \mu_0$
$H_1: \mu x > \mu_0$
Considering above mentioned facts, $\mu_0 = 3$.
Decision is made considering p-value index. If it is smaller than test level (α) and limits of the confidence interval, "mean difference with test value" is positive, H0 is rejected. Test level is considered as 0.05. Researchhypotheses with results obtained from the analysis will be given in the following.

H1:

H_0: In the view of employees, information technology infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, information technology infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 2, mean score of items related to IT status in the view of employees is larger than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is positive, thus null hypothesis is supported and alternative hypothesis is rejected. Hence, H1 is supported.

H2:

H_0: In the view of employees, organizational structure infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, organizational structure infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 3, mean score of items related to organizational structure status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. Hence, H2 is rejected.

H3:

H_0: In the view of employees, organizational culture infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, organizational culture infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 4, mean score of items related to organizational culture status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H3 is rejected.

H4:

H_0: In the view of employees, human resource infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, human resource infrastructure for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 5, mean score of items related to human resource status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H4 is rejected.

H5:

H_0: In the view of employees, organizational processes for successful establishment of knowledge management in Karoon Oil and Gas Production Company are suitable.

H_1: In the view of employees, organizational processes for successful establishment of knowledge management in Karoon Oil and Gas Production Company are not suitable.

Considering Table 6, mean score of items related to organizational processes status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5 is rejected.

H5 -1:

H_0: In the view of employees, knowledge creation process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, knowledge creation process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 7, mean score of items related to knowledge creation process knowledge creation process status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5-1 is rejected.

H5 -2:

H_0: In the view of employees, knowledge acquisition process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, knowledge acquisition process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 8, mean score of items related to knowledge acquisition process status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5-2 is rejected.

H5 -3:

H_0: In the view of employees, knowledge organization process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, knowledge organization process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 9, mean score of items related to knowledge organization process status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5-3 is rejected.

H5 -4:

H_0: In the view of employees, knowledge storage process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, knowledge storage process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Iraj Akbarifar *et al.*

Considering Table 10, mean score of items related to knowledge storage process knowledge creation process status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5-4 is rejected.

H5 -5:

H_0: In the view of employees, knowledge dissemination process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, knowledge dissemination process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 11, mean score of items related to knowledge dissemination process knowledge creation process status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5-5 is rejected.

H5 -6:

H_0: In the view of employees, knowledge application process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is suitable.

H_1: In the view of employees, knowledge application process for successful establishment of knowledge management in Karoon Oil and Gas Production Company is not suitable.

Considering Table 12, mean score of items related to knowledge application process knowledge creation process status in the view of employees is smaller than theoretical mean value (3) and there is statistical significant difference. Test result indicates sig level is smaller than 0.005 and t is negative, thus null hypothesis is rejected and alternative hypothesis is supported. That is, H5-6 is rejected.

Friedman Test for Ranking Key Infrastructural Factors in Successful Establishment of Knowledge Management

As observed in Table 13, X^2 is 0.2450 which is significant at level p = 0.000 and it denotes different level of importance for factors. IT factor with mean rank of 0.334 is in the first rank and most important factor, and organizational culture factor with mean rank of 0.179 is in the last place of importance.

Infrastructural factors were evaluated at four parts including IT, organizational structure, organizational structure, organizational culture and human resource. The diagram indicates current status and optimal status for each component. IT, organizational structure, human resource, and organizational culture are identified as the most important infrastructural factors respectively in Karoon Oil and Gas Production Company. Having suitable IT has highest importance of the employees and its status is more suitable than other variables in the company. Special attention is necessary for organizational culture which has no suitable status for successful implementation of knowledge management in the company and is in the lowest rank of importance, and appropriate culture should be created by training and necessary incentives for successful knowledge management establishment.

Friedman Test for Ranking KM Key Processes in Successful Establishment of Knowledge Management

As observed in Table 14, X^2 is 0.9648 which is significant at level p = 0.000 and it denotes different level of importance for KM processes. Knowledge acquisition with mean rank of 0.193 is in the first rank and most important process, and knowledge dissemination process with mean rank of 0.288 is in the last place of importance.

Diagram 10-4. Comparison of mean ranking of KM processes

Investigating Impact of KM Processes on Success of KM Establishment in Karoon Oil and Gas Production Company

Following diagram indicates current and optimal status and importance of KM processes.
Knowledge management processes were measured and evaluated at three parts including creation, acquisition, storage, organization, dissemination and application, and their current status ad optimal status and importance level can be seen in the diagram. Knowledgeacquisition, organization, creation and storage are the main process factors for knowledge management in Karoon Oil and Gas Production Company. Knowledgeacquisitionprocess has highest importance and knowledgedissemination process has lowest importance and has no suitable condition for successful establishment of knowledge management, reason of which may be negligence to teaching, learning and empowering employees for acquiring necessary knowledge.

DISCUSSION AND CONCLUSION

Today knowledge is regarded as a key and valuable competitive asset which is seen as the basis for sustainable growth and preserving stable competitive advantage. The society attention and demand for information is increasing in the new century. Thus, the society inevitably needs enhancement of information and knowledge management. Organizations have also been influenced by knowledge accumulation so that increased volume of information in the organizations and necessity for using knowledge in organizational decision making over two last decades has led to emergence of a phenomenon known as knowledge management. It indicates necessity for planning, organization, leadership, and monitoring organizational knowledge as well as management of knowledge access process so that it is effective and efficient. Given various proposed models in knowledge management field, current research uses a model including six processes: knowledge creation, acquisition, organization, storage, dissemination, and application. Successful implementation of knowledge management requires availability of necessary infrastructures for its implementation in the organization; otherwise, knowledge management strategy would fail. These infrastructures which are known as enablers include information technology, organizational structure, organizational culture, and human resource.

Results of t-test indicate organization has suitable information technology for successful establishment of knowledge management. However, the organization does not have suitable organizational structure, organizational culture, human resource, and organizational processes, knowledge creation, acquisition, storage, dissemination and application process for successful establishment of knowledge management. Friedman test was used for ranking infrastructural factors and processes of knowledge management among employees of Karoon Oil and Gas Production Company. Information technology and organizational structure were in top ranks and human resource and organizational culture were in the lowest ranks. Among knowledge management processes, knowledge acquisition, organization and creation components had highest rank and knowledge application, storage and dissemination components had lowest ranks.

Findings are consistent with findings by Chang (2011) in information technology dimension. In organizational culture dimension, it is consistent with findings by Sadeghi (2011). In terms of organizational structure component, it is consistent with findings by Ghafoor (2010). In terms of human resource dimension, it is consistent with findings by Ghafoor (2009) and Yeh (2006). Also, findings in knowledge management processes are consistent with findings by Chang (2011).

Iraj Akbarifar *et al.*

REFERENCES

1. Alavi, M., &Leidner, D. E. (2001). Knowledge management and knowledge management system: Conceptual foundations and research issues. MIS Quartely, 25 (1), 107-13 6.
2. Bakhshizadeh, A. (2011). Relationship between social capital and knowledge management activities in Khuzestan Water and Power Authority, the Fourth International Conference on Knowledge Management, Tehran.
3. Bontis, N., &Girardi, J. (2000). Teaching knowledge management and intellectual capital lessons: an empirical examination of the TANGO simulation. International Journal of Technology Management, 20(5), 545-555.
4. Chang, T.C., & Chuang, S.H. (2011). Performance Implications Of Knowledge Management Processes: Examining The Role Of Infrastructure Capalibity And Business Strategy, Expert System With Application, Vol.3 8,PP .6170.6178.
5. Chen, C.J., & Huang, J.W. (2007). How Organizational Climate And Structure Affect Knowledge Management-The Social Interction Perspective, International Journal Of Information Management. Vol. 27, PP.1 04.118.
6. Chen, C.W. (2011). Modeling And Initiating Knowledge management Program Using FQFD: A Case Study Involving a Healthcare Institute.Springer.Science, Business Media B.V.
7. Davenport, T. H. &Prusak, L. (1998). Working Knowledge: How Organization Manage What They Know, Boston: Harvard Business School Press.
8. Detinne, K.B., Dyer, G., Hoopes, C., &Harris, S. (2004). Toward a model of effective knowledge management and direction for future research: Culture, Leadership, and CKOs. Journal of Leadership &Organizational Studies, 10(4), 26-43.
9. Gaffoor, S. (2008).Assessing readiness for the implementation of knowledge management in local governments: The case of Stellenbosch Municipality. Thesis for the degree of Master of Commerce at Stellenbosch University, School of Public Management and Planning Faculty of Economic and Management Sciences, Decmber 2008.
10. Gaffoor, S. (2008).Assessing readiness for the implementation of knowledge management in local governments: The case of Stellenbosch Municipality. Thesis for the degree of Master of Commerce at Stellenbosch University, School of Public Management and Planning Faculty of Economic and Management Sciences, Decmber 2008.
11. Gold, A. H., Malhotra, A, &Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. Journal of Manangment Information system, 18(1), 185-214.
12. HadizadehMoghadam, A., Raminmehr, H. &Heydari, H. (2010).A model of knowledge management success, public management outlook, No. 4, pp. 83-100.
13. Ignacio, J, Rodriquez, Ruir, A. (2008). EFQM Model: knowledge Govermance and Competitive Advantage, Journal Of Intellectual Capital, Vol.9, No.1, PP.133.156.
14. Kelly, C. (2003). Electronic Government strategies.Ameta group, Advisory service.
15. Laupas, R. (2003). The Process Of ReatrithingConcoltants Tacit Knowledge In Organization Explicit Knowledge : Case Studies In Management Consulting Firms London. IBM Press.
16. Lee, H., &Choi, B. (2003). Knowledge management enablers, Processes, and Organizational Performance: An integrative view and empirical examination Journal of Management Information System .20(1).179-228.
17. Parikh, M. (2001).knowledgemanangement frame work for high research and development, Inginerring Management Journal, 13(3). 27- 33.
18. Robbin, S. P. (2004). Organizational Behavior (11 III ed). Upper Saddle River, NJ: Prentice-Hall.
19. Snowden, D. (2002). Complex acts of knowing: paradox and descriptive self-awareness. Journal of knowledge management, 6(2), 100-111.
20. Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. Strategic Management, 17(Winter), 45-62.Delong, D. (1997). Building the knowlage-based organization: How culture drives knowlage behaviors. Center for business innovation.
21. Stewart, G. &Uberbrwon, K.J. (2012). Human resource management, strategy and action links (Tr. By M. Arabi and M. Fayyazi), Tehran: Mahkameh Publication, Third Edition.

22. Tata, J. &Prasad, S. (2004). Team Self-management, Organizational Structure, and Judgments of team effectivenss. Journal of Manangement Issues, 16(2),248-265.
23. Tata, J. &Prasad, S. (2004). Team Self-management, Organizational Structure, and Judgments of team effectiveness. Journal of Manangement Issues, 16(2),248-265.
24. Wig, K.M. (1997). Knowledge Management: Whets did it come from and whers will it go? Export Systems with Applications, 14
25. Yeh, Y. 1., Lai, S.Q., & Ho, C. T. (2006). Knowledge management enablers: a case study. Industrial Management &Data System, 106 (6), pp. 793-810.
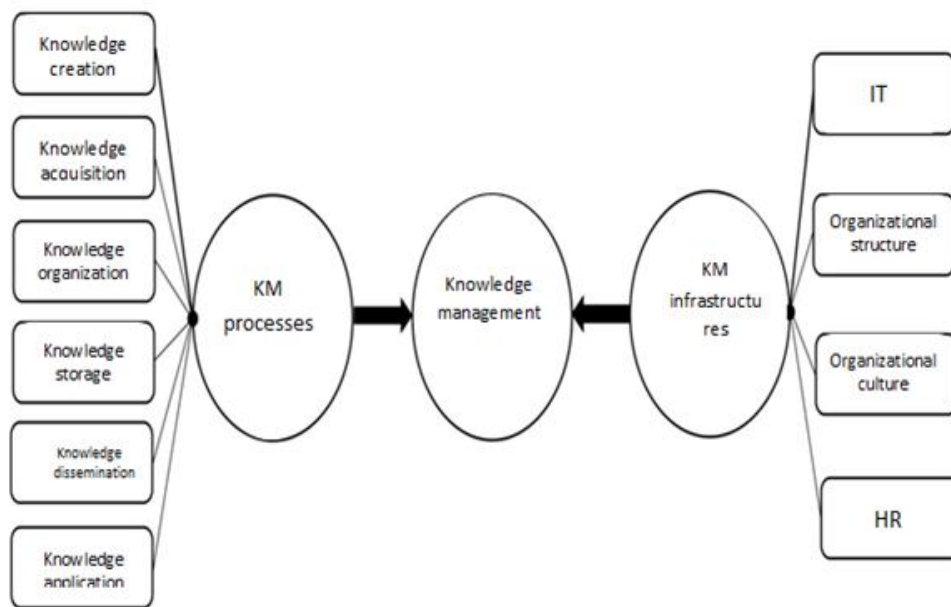
Fig 1. Research model

Table 1: Results of the Kolmogorov-Smirnov test

statistic	0.031
Df	225
Sig.	0.200

Table 2: Results of one sample t-test analysis for comparison of mean status score of information technology infrastructure in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
IT	0.334	0.0825	3	225	0.612	0.00001	H1 is supported
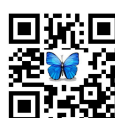
Table 3: Results of one sample t-test analysis for comparison of mean status score of organizational structure infrastructure in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
organizational structure	0.220	0.0590	3	225	-6.38	0.00001	H1 is rejected

Table 4: Results of one sample t-test analysis for comparison of mean status score of organizational culture infrastructure in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
Organizational culture	0.179	0.0742	3	225	-0.552	0.00001	H1 is rejected

Table 5: Results of one sample t-test analysis for comparison of mean status score of human resource infrastructure in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
human resource	0.193	0.0740	3	225	-0.974	0.0151	H1 is rejected

Table 6: Results of one sample t-test analysis for comparison of mean status score of organizational processes in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
Organizational processes	0.175	0.0742	3	225	-0.833	0.00001	H1 is rejected

Table 7: Results of one sample t-test analysis for comparison of mean status score of knowledge creation process in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
knowledge creation	0.182	0.0863	3	225	-0.1156	0.0002	H1 is rejected

Iraj Akbarifar *et al.*

Table 8: Results of one sample t-test analysis for comparison of mean status score of knowledge acquisition process in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
knowledge acquisition	0.193	0.0897	3	225	-0.993	0.0225	H1 is rejected

Table 9: Results of one sample t-test analysis for comparison of mean status score of knowledge organization process in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
knowledge organization	0.186	0.0823	3	225	-0.782	0.0009	H1 is rejected

Table 10: Results of one sample t-test analysis for comparison of mean status score of knowledge storage process in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
knowledge storage	0.168	0.0830	3	225	-0.691	0.00001	H1 is rejected

Table 11: Results of one sample t-test analysis for comparison of mean status score of knowledge dissemination process in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
knowledge dissemination	0.148	0.0762	3	225	-0.598	0.00001	H1 is rejected

Table 12: Results of one sample t-test analysis for comparison of mean status score of knowledge application process in the view of employees with mean criterion score (3)

Variable	Mean	SD	Test value	Df	T statistics	Sig level	Test result
knowledge application	0.173	0.0870	3	225	-0.695	0.00001	H1 is rejected

Iraj Akbarifar *et al.*

Table 13: Friedman test results ranking infrastructural factors

Factor	Mean rank	Rank	(X^2)	Df	P Sig level
IT Infrastructure	0.334	1	0.2450	3	0.00001
Organizational Structure Infrastructure	0.220	2			
organizational culture Infrastructure	0.179	4			
human resources Infrastructure	0.193	3			
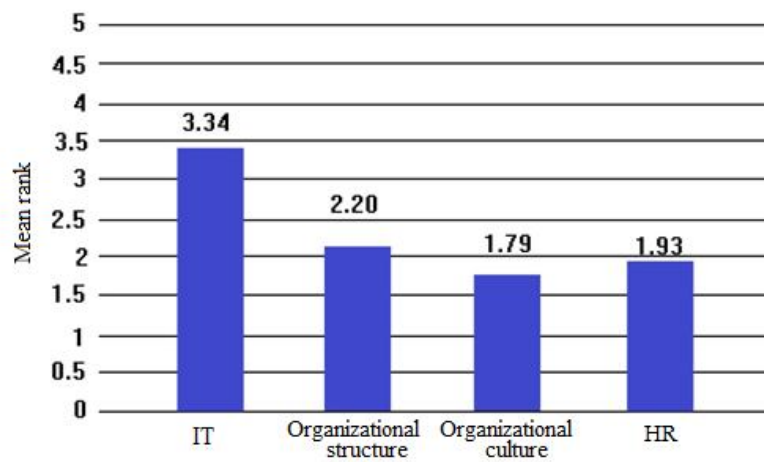
Fig 2. Comparison of mean ranking of KM infrastructures
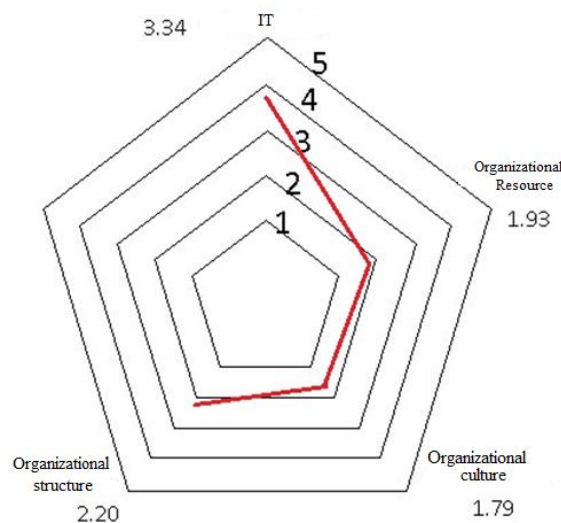
Fig 3. Status of KM infrastructures
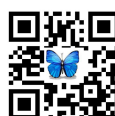
Iraj Akbarifar *et al.*

Table 14: Friedman test results ranking KM processes

Factor	Mean rank	Rank	(X²)	Df	P Sig level
knowledge creation process	0.182	3	0.9648	5	0.00001
Knowledge acquisition process	0.193	1			
Knowledge organization process	0.186	2			
Knowledge storage process	0.168	5			
Knowledge dissemination process	0.148	6			
Knowledge application process	0.173	4			
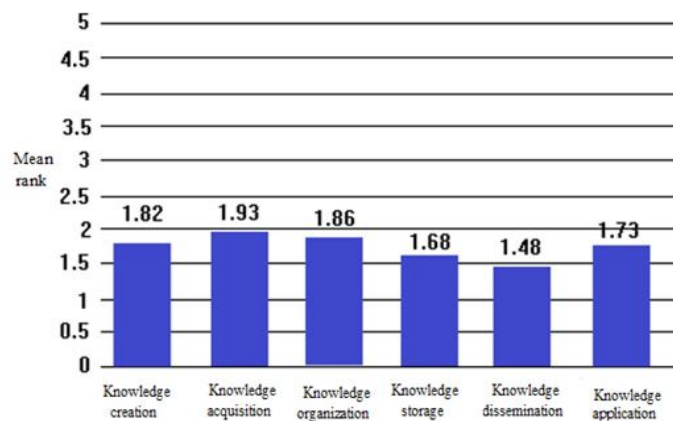
Fig 4. Comparison of mean ranking of KM processes
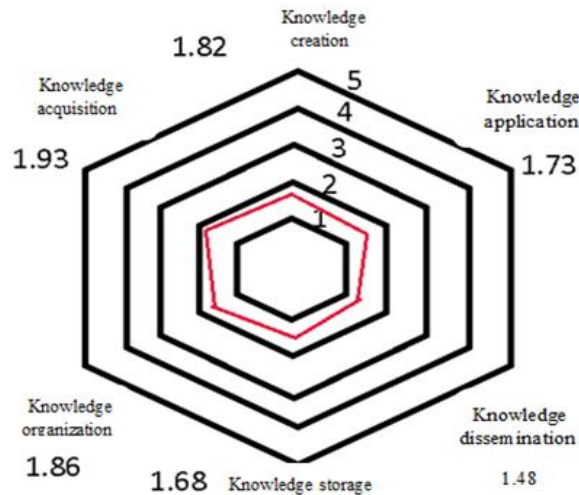
Fig 5. Status of KM processes

RESEARCH ARTICLE

Determination of Composition and Anti Microbial Activity of Helichrysum arenarium Essential Oil.

Farzane Jahantiq, Ali Mohamadi Sani* and Azade Khiabani

Department of Food Science and Technology, Quchan Branch, Islamic Azad University, Quchan Iran.

*Address for correspondence
Ali Mohamadi Sani
Department of Food Science and Technology,
Quchan Branch,
Islamic Azad University,
Quchan Iran
Email: mohamadisani@yahoo.com

ABSTRACT

The aim of this study was to investigate the chemical composition and antimicrobial effect of Helichrysum arenarium L. essential oil in "in-vitro" condition. For this purpose the essential oil was obtained by hydro-distillation and analyzed by GC/MS. The antimicrobial effect was studied on the growth of seven microbial species including Bacillus cereus**,** Pseudomonas aeruginosa, Proteus vulgaris, Saccharomyces cereviciae, Candida utilis, Penicillium digitatum and Aspergillus niger using micro-dilution method. The minimum inhibitory concentration (MIC) and minimum bactericidal or fungicidal concentration (MBC, MFC) were determined for the essential oil at ten concentrations. Results showed that a total of 38 compounds of the essential oil were identified and the main components were a-pinene (32%), 1,8-cineole (16%), α-humulene (15%), β-caryophyllene (8%). Results of antimicrobial analysis showed that B. cereus (MIC=1625 and MBC=7500 µg/ml) was more resistance than two other bacterial species. Among the tested yeasts, S. cereviciae (MIC=406 and MFC=3250 µg/ml) was more sensitive than C. utilis (MIC=1625 and MFC=7500 µg/ml) while among the fungal species, growth of P.digitatum inhibited at lower concentration of oil (MIC=3250 and MFC=7500 µg/ml) than the A.niger. The results of the present study indicated that H.arenarium L essential oil had antimicrobial activity; therefore, it can be used as a natural preservation to increase the shelf life of food products.

Key words: Helichrysum arenarium, Antimicrobial activity, Essential oil composition, Minimum inhibitory concentration

Ali Mohamadi Sani *et al*.

INTRODUCTION

Food borne disease mediated by pathogenic microorganisms or microbial toxins is an important global public health problem because they take a huge toll on human health and mortality. It has been estimated that as many as 30% of people in the industrialized countries suffer from food borne diseases each year caused by microbes [1]. Food additives have been used for centuries in the food processing practices for several purposes including the prevention of microbial growth and increase in the food shelf lives [2]. Due to the excessive use of food preservatives which some of them are doubtful to be carcinogenic and teratogenic and also increasing consumer demand to natural foods with a long shelf life and without chemical preservatives, food producers trend to replace chemical preservatives with natural forms such as oils and herbal extracts as antibacterial additives [3]. In the recent years, efforts have been devoted to find new antimicrobial materials from natural resources for food preservation [3]. Reports indicated that many extracts and essential oils of edible plants had properties to prevent against a wide range of fungal contamination of foods [4].

Helichrysum arenarium L. (popularly known as everlasting, immortal flower or fadeless flower) belongs to asteraceae family [5]. It is a perennial herbaceous plant of height 15–40 cm that flowers in June- August with yellow to reddish-orange or even brown inflorescences of various colour intensity [6] and broadly distributed in Europe, western Siberia, and central Asia [7]. Helichrysum arenarium are used for the treatment of kidney stones, uro-genital disorders, stomach pain, jaundice, diarrhea, asthma [5], gall-bladder and gastric disorders, cystitis, and arthritis [6]. For coughs and colds, a tea is prepared or the leaves are boiled in milk. For pain relief, leaves are burned and the smoke is inhaled. Leaves are widely used on wounds to prevent infection [7]. The aims of the present study were to evaluate the composition and potential antimicrobial activities of essential oil of Helichrysum arenarium L collected from Iran on the growth of some bacteria, yeasts and fungi.

MATERIALS AND METHODS

Plant material and Extraction of essential oil

Aerial parts of the Helichrysum arenarium L. plant were collected in 2012 from Khorasan Razavi Province (the northeast of Iran), Iran. The essential oil of aerial parts of the H.arenarium L. was extracted with water steam distillation using a clevenger apparatus according to the method of British Pharmacopoeia. The distilled essential oils were dried with anhydrous sodium sulfate and stored in the sterilized vial at 4°C until use.

Analysis of the essential oil

The chemical composition of the essential oil was analyzed using GC–MS technique. The mass spectrometer was Agilent 6890 N GC/5973MSD-SCAN (Agilent Technologies, Palo Alto, CA, USA) in the electron impact (EI) ionization mode (70ev) and HP- 5MS (bonded and cross-linked 5% phenyl-methylpolysiloxane,30 mm-0.25 mm, coating thickness 0.25 µm) capillary column (Restek, Bellefonte, PA). Injector and detector temperatures were set at 220°C. The oven temperature was held at 50°C for 30 min, then programmed to 240°C at rate of 3°C/min. Helium (99.99%) was the carrier gas at a flow rate of 1 ml/min. Diluted samples (1/100 in hexane, v/v) of 1.0 were injected manually. The identification of the components was based on the comparison of their retention times and mass spectra with the data given in the literature, National Institute of Standard and Technology (NIST), Wiley and our own created library [8].

Organisms and Inoculation Conditions

The test organisms used in this study included Bacillus cereus PTCC1023, Pseudomonas aeruginosa PTCC1310, Proteus vulgaris PTCC1449, two yeasts (Saccharomyces cereviciae PTCC24860, Candida utilis PTCC5052) and two fungi

species (Penicilllium digitatum ATCC201167 and Aspergillus niger PTCC5011) which were obtained from Persian Type Culture Collection (PTCC), Iran and American Type Culture Collection (ATCC).

To prepare microbial suspension, bacterial species were cultivated on nutrient agar (Merck, Germany) slant at 37°C for 24 h while yeasts and fungal species were cultivated on PDA (Merck, Germany) slants and incubated at 25°C for 48 h. Finally, suspensions were adjusted to 0.5 McFarland standard turbidity. The yeasts and fungal suspensions were adjusted to make a conidial or spores concentrations of 10^6 cell or spore/ml via counting with a hemacytometer. Bacterial suspensions were standardized to concentrations of $1.5×10^8$ CFU/ml.

Minimum Inhibitory Concentration (MIC) Test

 H.arenarium essential oil dissolved at 5% dimethyl sulfoxide (Aplichem, Germany) and Then, it diluted to the highest concentration (60000 µg/ml), and then serial twofold dilutions were made in a concentration range from 50.75 to 30000 µg/ml.

MIC values of essential oil against microbial strains were determined based on a microwell dilution method. Ninety five µl of Mullerhinton broth (Merck, Germany) was dispended in to each 96 wells. 100 µl of stock solution of H.arenarium essential oil was added in to the first wells. Then 100 µl from their serial dilutions was transferred in to other consecutive wells except the well number 11 as positive control. Then 5 µl of the microbial suspension was added to each well except well number 12 as negative control. Contents of each well were mixed on a plate shaker at 300 rpm for 20 s and then incubated at 25°c for 48 h for yeasts and fungi and 37°c for 24 h for bacterial strains. Microbial growth was determined by detecting the absorbance at 630 nm using the ELX808 Elisa reader (Biotek Instrument Inc, USA). The MIC of essential oil was taken as the lowest concentration that showed no growth.

Minimum Fungicidal Concentration (MFC) Test

The minimum fungicidal or bactericidal concentrations (MFC and MBC) were determined with sub-culturing 10µl aliquot from all MIC wells showing no visible growth on the mullerhinton agar plates.

Statistical analysis

All data obtained from the trial were analyzed by Excell software.

RESULTS

Chemical composition of H.arenarium essential oil

Chemical composition analysis of the essential oil identified a total of 38 compounds. The main components of essential oil were a-pinene (32%), 1,8-cineole (16%), α-humulene (15%), β-caryophyllene (8%). Other separated components accounted for less than 29% of the oil.

Effect of essential oil of Helichrysum arenarium L on microbial species

The antimicrobial effect of essential oil against the microorganisms is shown in Table 1. Results obtained from the microdilution method, followed by measurements of MIC and MBC indicated that essential oil of H.arenarium L. exhibited significant antibacterial activity against tested bacteria and the sensitivity was as follows: P. vulgaris> P.aeroginosa> B.cereus. Among the tested yeasts and fungi, the most sensitive yeast was S.cereviciae while resistant of Aniger and p.digitatum. was more than C.utilis (Figure1).

DISCUSSION

Chemical composition of H.arenarium essential oil

Different studies have been done in other regions on chemical composition of the essential oil of different species of Helichrysum such as analysed Helichrysum bracteiferum oil of fresh leaves collected in Madagascar Island that 1, 8-cineole (18%), α-humulene (11.6%) and β-caryophyllene (9.6%) were the main components [9] also investigate chemical composition of four commercially available Helichrysum oils obtained from, H. bracteiferum (DC.) Humbert, H. cordifolium DC. H. hypnoides (DC.) R. Vig et Humbert and H. rusillonii Hochr., of Madagascar origin showed that Helichrysum bracteiferum oil to be rich in β-pinene (10.3%), 1,8-cineole (24.8%) and α-humulene (10.1%), whereas H. cordifolium oil contained β-caryophyllene (46.4%) and α-humulene (10.9%), Helichrysum hypnoides oil contained 1,8-cineole (51.5%) and H. rusillonii oil was rich in 1,8-cineole (11.7%) and β-caryophyllene (29.5%) [10]. EI-Olemy studied on aerial parts of Helichrysum forsskahlii, indemic to southern Saudi Arabia, and reported selina-5,11-diene (45.3%), δ-3-carene (7.8%), 1,8-cineole (4.2%) and β-caryophyllene (4.9%) as main constituents [11]. The essential oil of aerial parts of Helichrysum Aucheri collected from Iran mainly contained a-pinene (39.6 %), 1,8-cineole (19.7 %) and β-caryophyllene (7.3 %) [12]. However found that composition of Helichrysum arenarium (L.) Moench. of natural populations from eastern Lithuania were: β-caryophyllene), δ-cadinene, octadecane and heneicosane. Monoterpenes and oxygenated monoterpenes made up 4.0–13.9%, aliphatic hydrocarbons 0.4–35.3%, and sesquiterpenes 24.7–71.2% of the oils [13]. The major components of essential oil of the flowers of Helichrysum odoratissimum (L.) Less growing wild in Kenya were α-pinene (43.4%), (E, E)-farnesol (16.8%) and α-humulene (14.6%) [14]

Effect of essential oil of Helichrysum arenarium L on microbial species

The antimicrobial activities of different Helichrysum species have been studied but there is not enough data about the antimicrobial activity of essential oil of the Helichrysum arenarium.

In a studied showed that methanolic extract of H.arenarium inhibited growth of E.coli and S.aureus while they did not find a significant influence on B.subtilis [15] also methanolic extract of two subspecies of H.arenarium on B.cereus and S.aureus was any antibacterial activity was specificated for B.subtilis [16]. In another reported showed that petroleum ether and ethanol extracts of H.arenarium have antibacterial activity on S.aureus but have no effect on E.coli [17]

According to Table1, essential oil of H.arenarium was effective on reducing yeasts with higher effect on S.cereviciae than C.utilis. Antifungal activities of extracts of Helichrysum compactum and Helichrysum chasmolycicum have been reported [18,19]. Results of this study are different from aslan research on ethanolic extract of two subspecies of H.arenarium [17] they reported that ethanolic extract of this plant had no antifungal effect on S.cereviciae and C.albicans.

We found that essential oil of H.arenarium was effective on growth and activity of selected molds and yeasts and the effect on yeast species was more than molds. Many researchers have been proved antibacterial and antifungal effect of essential oil and extract of different species of Helichrysum [16,18,19]. The differences observed in activity of essential oil or extraction products in other research [17].may be due to their different quality and quantity of active compounds in essential oil and extract. It is clear that essential oil of plant is more active than its extract.furthermore, the extraction product can vary in quality, quantity and in composition according to climate, soil composition, plant organ, age and vegetative cycle stage [20].

According to chemical composition of the essential oil found in the current study and by others, isoprenoids (mono-, sesqui-, di-, and triterpenoids) and phenolic compounds are the main active compounds [21] with antimicrobial properties.

CONCLUSION

The results of the present study indicateed that Helichrysum arenarium L essential oil had antimicrobial activity; therefore, it can be used as a natural preservation to increase the shelf life of food products.

ACKNOWLEDGEMENTS

REFERENCES

1. Johnson EA. Bacterial pathogens and toxins in foodborne disease, Food Safety: Contaminants and Toxins In D'Mello, JPF.Oxford; Cabi publisher,2003.
2. Ditschun TL, Winter CK. Food Additives. In: Food Toxicology. Edites, W. Helferich, and C. K. Winter. CRC Press, Boca Raton, FL. PP 2000;187-202
3. Mahzooni-Kachapi SS, Mahdavi M, Roozbeh-Nasira'ei L., Akbarzadeh M, Rezazadeh F. Investigation of Compositions and Anti-bacterial Effects of the Essential Oils in Stachys lavandulifolia.vahl Collected from Baladeh Region. Food industrial conferences 2011.Quachan, Iran.
4. Karbin S, Baradaran Rad A, Arouiee H, Jafarnia S. Antifungal activities of the essential oil on post-harvest disease agent Aspergilus Flavus. Adv Environ Biol 2009; 3(3): 219-225.
5. Eroglu HE, Hamzaoglu E, Aksoy A, Budak U, Albayrak S. Cytogenetic effects of Helichrysum arenarium in human lymphocytes cultures. Turk J Biol 2010; 34: 253-259.
6. Eshbakova KA, Aisa HA. Components of Helichrysum arenarium. Chem Nat Comp 2009;(45)6-12
7. Radusiene J, Judzentiene A. Volatile composition of Helichrysum arenarium field accessions with differently colored inflorescences. Biologija 2008; 54(2):116–120.
8. Stein SE. National Institute of Standards and Technology (NIST) Mass Spectral Database and Software, Version 1990; 3.02, USA
9. Ramanoelina PAR, Bianchini JP, Gaydou EM. Chemical composition of essential oil of Helichrysum bracteiferum. J Essen Oil Res 1992;4(5):531-532.
10. Baser KHC, Demirci B, Kirimer N. Compositions of the essential oils of foue Helichryum species from Madagascar. J Essen Oil Res 2002;14(1):53-55
11. El-Olemy MM, Al-Rehaily AJ, Albishi OA, Mossa JS, Demiircj B, Husnu Can Baser K. Composition of essential oil of Helichrysum forsskahlii (Gmel) Hilliard et Burt. J Essen Oil Res 2005;17 (1): 112-116.
12. Torabbeigi M, Abrooman Azar P, Aghaei Meibodi Z. Chemical composition of essential oils of aerial parts of Helichrysum aucheri from Iran. Anal Chem Let 2011; 1(5-6):393-396.
13. Jidzentiene A, Butkiene R. Chemical composition of the essential oils of wild Helichrysum arenarium (L.) with differently colored inflorescences from eastern Lithuania. J Essen Oil Res 2006;18(1): 80-83.
14. Lwande W, Hassanali A, Wanyama OB, Ngola, S, Mwangi, JW. Constituents of the essential oil of Helichrysum odoratissimum (L.) less. J Essen Oil Res 1993; 5(1):93-95
15. Albayrak S, Aksoy A, Sagdic O, Budak U. Phenolic compounds and antioxidant and antimicrobial properties of Helichrysum species collected from eastern Anatolia, Turkey. Turk J Biol 2010; 34: 463-473.

16. Albayrak S, Aksoy A, Sagdic O, Hamzaoglu E. Compositions, antioxidant and antimicrobial activities of Helichrysum (Asteraceae) species collected from Turkey. Food Chem 2010; 119: 114–122.

17. Aslan M, Ozcelik B, Orhan I, Karaoglu T, Sezik E. Screening of antibacterial,antifungal and antiviral properties of the selected Turkish Helichrysum species. Planta Med 2006; 72: 997-997.

18. Suzgec-Selçuk S, Birteksoz AS. Flavonoids of Helichrysum chasmolycicum and its   antioxidant and antimicrobial activities. S. Afr. J. Bot 2011; 77: 170-174.

19. Suzgeç S, Mericli AH, Houghton PJ, Çubukcu B. Flavonoids of Helichrysum compactum and their antioxidant and antibacterial activity. Fitoterapia2005; 76:269-272.

20. Mastelic J, Politeo O, Jerkovic I, Radosevic N. Composition and antimicrobial activity of Helichrysum italicum essential oil and its terpene and terpenoid fractions. Chem Nat Compd 2005; 41(1):35-40.

21. Faleiro ML. The mode of antibacterial action of essential oils. In: Science against microbial pathogens: communicating current research and technological advances. Microbiology book series-2011 Edition. A. Mendez-Vilas (Editor). 2: 1143-1156.

Table1: Minimum inhibitory concentration (μg/ml) and minimum fungicidal or bactericidal concentration (μg/ml) of essential oil of Helichrysum arenarium

Microorganisms	MIC (μg/ml)	MBC or MFC (μg/ml)
Bacillus cereus	1625	7500
Pseudomonas aeruginosa	812.5	3250
Proteus vulgaris	406	3250
Saccharomyces cereviciae	406	3250
Candida utilis	1625	7500
Penicillium digitatum	3250	7500
Aspergillus niger	3250	15000

- The values in the table are an average of 3 experiments.

Ali Mohamadi Sani *et al.*
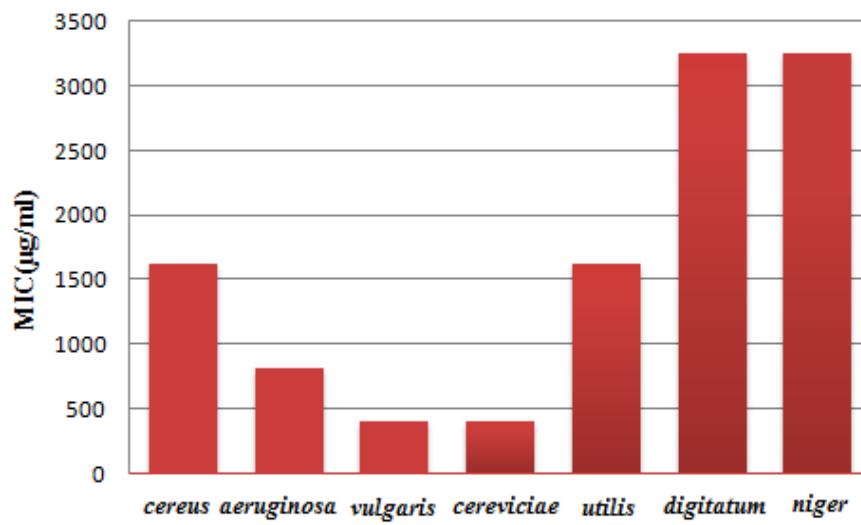
Figure 1. The minimum inhibitory concentration (MIC) essential oil of Helichrysumarenarium against B.cereus, P. aeruginosa ,P. vulgaris, S.cereviciae, C.utilis, P.digitatum, A.niger.

RESEARCH ARTICLE

Investigating the Effect of Educational Intervention on self-care Behaviors of Women with Hypertension Referred to Urban Health Centers

Nilowfar Salighehdar Iran[1], Firoozeh Mostafavi[2*], Alireza Didarloo[3] , Akbar Hassanzadeh[4].

[1]MSc Student , Department of Health Education and Promotion,School of Health, Isfahan University of Medical Sciences,Isfahan, Iran. Email : salighehdarnilowfar5@gmil.com
[2]Assistant Professor, Department of Health Education and Promotion,School of Health, Isfahan University of Medical Sciences,Isfahan, Iran. Email : f_mostafavi@yahoo.com
[3]Assistant Professor, Department of Social Medicine ,School of Medicine , Urmia University of Medical Sciences,Isfahan, Iran. Email: didarloo_a@yahoo.com
[4]Instructor in Biostatistics, School of Health, Isfahan University of Medical Sciences,Isfahan, Iran. Email : hassanzade_2000@yahoo.com

***Address for correspondence**
Dr Firoozeh Mostafavi
Assistant Professor,
Department of Health Education and Promotion,School of Health,
Isfahan University of Medical Sciences,
Isfahan, Iran.
E-mail : f_mostafavi@yahoo.com

ABSTRACT

Introduction: Hypertension, as a silent killer, is a non-communicable disease that is prevalent throughout the world and can be controlled by self-care behaviors. Women are more vulnerable to hypertension disease. Teaching self-care behaviors to women, including proper nutrition, physical activity, stress management, regular drug use and regular use of sphygmomanometer, help them managing their blood pressure.
Objective: In the present study the effect of education on self-care behaviors of women with high blood pressure has been measured.

Materials and Methods: The study was conducted as a randomized clinical trial on 64 patients with hypertension who had referred to urban health centers; they were divided randomly into control and test
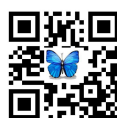
Firoozeh Mostafavi *et al.*

groups . Researcher designed questionnaire of self-care behaviors in hypertension, whose validity and reliability had been measured, was provided to the control and test group both before and after education intervention. The Data obtained was analyzed by statistical software SPSS version 21 and t-test.

Results: The mean score of self-care behaviors before intervention in the test and control groups had no significant difference. But in the post-test significant differences between was observed the means of two groups (0/05> p). Educational intervention resulted in a significant increase in the mean score of self-care behaviors of hypertension in test group from 50/9 ±14/2 to 58/8± 15/0. But, in the control group, no significant difference was observed in the mean score of self-care behaviors in pretest and posttest.

Conclusion: Educational intervention was effective in increasing self-care behaviors associated with hypertension. Therefore, one way to manage non-communicable disease of hypertension is teaching self-care behaviors in the areas of nutrition, physical activity, stress management, regular drug use and regular use of a sphygmomanometer.

Key words: Educational intervention, Self-care behaviors, Women, Hypertension, Health centers.

INTRODUCTION

According to updated statistics of America, cardiovascular diseases is known as the first cause of death in the world and America (1). Hypertension is considered as an important risk factor for cardiovascular diseases (2). Blood pressure is the force exerted by the blood on the arterial wall, which has a range of natural and unnatural and its unnatural range is called hypertension. Since hypertension has no apparent and detectable signs and has unpleasant cardiovascular side effects, it is introduced as "silent killer" . Because of importance of this disease, slogan of the World Health Organization in 2013   was that take high blood pressure serious.

Most of the times the disease is detected after damaging organs (3).

Many people around the world are suffering from hypertension; the incidence rate is one in every ten people in the second and third decades of life. And this rate gets 5 out of 10 cases in the fifth decade of life. Global prevalence of hypertension about one billion people that is estimated to get to 1/56 billion people in 2025. About 7/1 million deaths annually can be attributed to hypertension (4). Its prevalence rate is increasing due to rapid growth of population, and social changes such as urbanization . About 50 million people in America are affected by this disease and almost 30% of adults are not aware of their disease (5). Prevalence of hypertension is about 20% in Iran and it is the second leading cause of mortality. World ranking of Iran in the number of deaths due to hypertension is 67 and its prevalence of in cities Tehran, central regions of Iran and Bushehr has been reported respectively 22, 18.9 and 24.5% (6). The prevalence of hypertension among women due to pregnancy and menopause is higher (7). Many deaths are attributed to hypertension among women, many of which could be prevented by educational intervention (8).

Hypertension has spectrum of clinical manifestations   and lack of control over it and its progress leads to disorder in function of organs. Complications of this disease include neurological damages (nervous), adverse cardiovascular outcomes such as brain stroke and heart attack, eye diseases and sight disorders as a result of bleeding of vessels in the retina of eye, kidney failure and symptoms such as headaches, chest pains and shortness of breath (9) . Global economic cost of hypertension is   370 billion dollars and includes 10% of total cost of health care   (10). Self- care behaviors are a range of health behaviors that are posed by individuals to take responsibility for their health (11). Self-care behaviors are one of the main determinants of controlling hypertension . Self- care is a Processes defined

Firoozeh Mostafavi *et al.*

for maintenance and management of health   disease and feeling of illness .   Key role of self- care behaviors for management of hypertension   include diet rich in fruits and vegetables, giving up smoking, enough physical activity, timely use of antihypertensive drugs, weight loss, reduced intake of saturated fat, reduced consumption of foods containing sodium and stopping alcohol consumption , stress management and regular use of Sphygmomanometer (12). Joe and colleagues in a study entitled "The impact of the Internet on knowledge, self-efficacy and self-care behavior in hypertensive workers" conducted in 2003, found that Internet training and using email and is effective in improving self-care behaviors in personnel (13). In a study by Lee et al., Entitled "Correlation between self-care behaviors and management of hypertension among   Koreans of America" conducted in 2012, it was found that people with high self-efficacy management have better self-care behaviors in hypertension (14).In the study performed by Ghohar and colleagues entitled "Self-care and pharmaceutical tracking: a study in hypertensive patients outside clinic" in 2009,it was found that there are alternative methods of self-care in patients with hypertension, including complementary and alternative therapies of CAM, self-monitoring and tracking blood pressure medication   prescribed. This study showed that complementary therapies are used most in the considered population (15). In a study conducted by Warren Findlou et al., entitled "Prevalence of self-care activities among African - Americans with hypertension" in 2011, it was found that there are still challenges in self-care behaviors associated with hypertension such as physical activity, consumption of salt alcohol and smoking among these people (16). Investigation by Jabalameli and colleagues on "the effectiveness of cognitive-behavioral stress management intervention on quality of life and blood pressure in female patients with hypertension" showed that this intervention improves quality of life and reduce blood pressure in test group compared to the control group. By teaching different techniques of stress management, improvement in the quality of life and reduction of the blood pressure is observed (17). Gelyn et al did a research entitled "interventions used to improve blood pressure control in patients with hypertension," in 2010. This study was a randomized controlled clinical trial of and provided educational intervention in both groups presented. Results showed that the share of patients engaging in self-monitoring of blood pressure increased compared to controls (18).

In the study by Magadza et al   entitled "the Effect of educational intervention on patients awareness on patients with hypertension , beliefs about medicines and medical follow-up. "in South Africa 2009 , patients were monthly educated on hypertension and medical follow-up . The results showed that after intervention, the proper use of anti-hypertensive pills, self-report and punctuality in   drug use was significantly increased And drug beliefs of individuals were significantly improved (19).

In the study conducted by Park et al entitles " Effects of health education integrated with sport programs in older adults with hypertension in the elderly: a randomized control clinical trial " in South Korea in 2011, the experimental group received health education, individual counseling, and sport program regularly for 12 weeks. After the intervention, significantly there was decrease in blood pressure of the intervention group compared to the control group in which no intervention had been applied, and the score of quality of life in the intervention group increased (20).

This study aims at investigating the effect of educational intervention on self-care behaviors of women with hypertension.

MATERIALS AND METHODS

The present study was a randomized controlled clinical trial   conducted in the city of Urmia. The study population were women with hypertension who referred to urban health centers . Sample size was obtained by the formula $n = \frac{(z_1 + z_2)^2 2 s^2}{d^2}$ as at least 32 people. Z1 is confidence coefficient of 0/95, that is 1/96   . Z2 is test power coefficient of 0/80, that is 0/84 . S estimate standard deviation self-care behaviors in the two groups. d minimum score difference between self-care behaviors of two groups that indicates a significant difference which is considered as 0/7.

4200

Firoozeh Mostafavi *et al.*

For sampling 2 Urban Health Centers were randomly selected among 26 health centers and 32 samples were randomly selected from each. Inclusion criteria were definitive diagnosis of hypertension, ability to read and write and exclusion criteria were unwillingness to continue to participate in the study, having acute complications of hypertension, and absence in one training session. For experimental group ,4 sessions of 90 minutes was provided by a graduate student in health education and one health communicators, including: proper nutrition associated with hypertension, physical activity, stress management, using a sphygmomanometer and regular drug use. In order to improve effectiveness , teaching methods including lectures, booklets, brochures, CD, were used. Data collection tool was demographic questionnaire including age, education, occupation, income, source of getting information about hypertension and questionnaire of self-Care Behaviors in hypertension , which had been validated   by 6 members of the faculty of Medicine universities of Urmia and Isfahan and after modifying   the content was approved. Also, the reliability of self-care behaviors associated with hypertension in a pilot study on 20 cases were confirmed by Cronbach test score of 0/75. The questionnaire of hypertension self-care behaviors consists of 20 questions, each question had 100 score and divisible to 6 parts of   0 , 20, 40, 60, 80, 100. After summing the scores, the resulting number was divided by 20, and a score up to 100 is obtained; the more it closer to 100 , it indicates a high level of self-care behaviors in people with high blood pressure. Pre-test and post-test were conducted in test group and control group and were analyzed using spss software version 21 , independent t t-test and dependent t test.

FINDINGS

Based on the descriptive statistics and Table 1, the maximum frequency percent in test group was in age range 41-50 and in control group in age   51 years. According to Table 2, the maximum frequency percent   in both test and control groups had diploma and below that. According to Table 3, the most frequency percent in both test and control groups were housewives. According to Table 4, the most frequency percent in both test and control groups were earning between 200-430 $. According to Table 5 the most frequency percent in both experimental and control groups source of gaining information was radio and television. According to Table 6, the mean score of self-care behaviors before the intervention in test group was 50/91±14/27 and in the control group was 50/28±15/50 ; and after the intervention   in test group was 58/8±15/00 , and in the control group as 49/7±14/00. According to statistical analysis, Table 8 and 7 show that there was no significant difference between self-care behavior score before intervention in control group and test group since significance level   for the related test is (0/854) and it is greater than 0/05, but according to the tables 14 and 13 after the intervention the difference between self-care behaviors in two groups was significant (0.000) and smaller than 0/05.

Table 10 and 9 show that there was significant differences (0.000)between self-care behavior scores in the test group before and after the intervention ; and it was smaller than 0/05. But according to Table 12 and 11 there was no significant difference between   self-care behavior in the control group before and after the intervention, (0/329) and it was is greater than 0/05.

DISCUSSION

Educational interventions on self-care behaviors to chronic disease such as hypertension help them to manage and control the disease in a better way. The importance of care in these patients is such that that reduces the need for regular visits to hospitals and treatment centers and decreases health care costs . Educational interventions in this regard should be targeted and provided in different educational methods by including various care components. In the study by Joe et al   also internet education provided on   knowledge, self-efficacy and self-care behavior in workers with hypertension showed the effectiveness of this approach in increasing self-care behaviors (13). In the
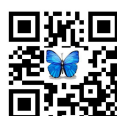
study by Lee et al Correlation between self-care behaviors and management of hypertension among Koreans of America was demonstrated (14). The study by Ghohar et al also self-care behaviors like complementary therapies in the management of hypertension was demonstrated (15). Warren and colleagues in showed the prevalence of self-care activities among African - Americans with hypertension in their study (16).

In the study by Jabalameli and colleagues the effectiveness of cognitive-behavioral stress management intervention on blood pressure was assessed as positive (17). In the research by Galin et al educational interventions on improving blood pressure control in patients with hypertension were associated with an increase in their self- care (18). In the study by Magadza et al after educational intervention, proper use of anti-hypertensive pills, self-report and punctuality in the field of drug use was significantly increased and drug beliefs of individuals significantly improved (19).

In the research by Park et al on the effects of health education combined with the sport program in older adults with hypertension, after intervention decrease in blood pressure was observed significantly in the test group compared to the control group (20).

In the present study, using different educational methods such as manuals, brochures, CD, lectures and group discussions, self-care behaviors associated with hypertension in the intervention group increased compared to control group, which suggests that the findings of this research is consistent with results of other studies.

CONCLUSION

Although in this study, educational intervention in test group resulted in change in self-care behaviors in women with hypertension refereeing to Health Center, for their full capabilities and increasing their self-efficacy for self-care behaviors, some periodical meetings to continue this training is essential.

ACKNOWLEDGMENTS

REFERENCES

1-Santulli G. "Epidemiology of cardiovascular disease in the 21st century: updated numbers and updated facts." Journal of Cardiovascular Disease.2013: 1-2.

2-Bromfield S, Paul M. "High blood pressure: the leading global burden of disease risk factor and the need for worldwide prevention programs." Current hypertension reports 2013: 1-3.

3-Seyedmazaheri m. Pharmacological and non-pharmacological treatment of hypertension : a review article.ARYA Athrosclerosis Journal.2012:8;217-221.

4-Chaman R,Yonesian M,Haji Mohammadi A,Gholami Taromsari M. Servey prevalence of hypertension and risk factors affect on it in rural population.The Journal of science and health.2007:3(3,4):39-42.

5-Sotoodeh Asl N,Neshat Doost H T,Kalantari M,Talebi H, Khosravi A.Compare with drug-therapy and expectance-therapy on quality of life dimentions.The Journal of Clinic Psycology.2009:2(1):27-34.

6-Ezzati E,Anusheh M,Mohammadi I.The effect of Group debate on high-school boys parents.The Journal of research and health.2010 :16(6): 445-456.

7-Pimenta E. "Hypertension in women." Hypertension Research.2011: 35(2); 148-152.

8-Forman J P., Meir J. S, Gary C. C. "Diet and lifestyle risk factors associated with incident hypertension in women." JAMA: the journal of the American Medical Association.2009: 302(4); 401-411.

9- Seyedmazaheri M. Pharmacological and non-pharmacological treatment of hypertension : a review article.ARYA Athrosclerosis Journal.2012:8;217-221.

10-Joffres M,Falaschetti E,Gillespie C,Robitaille C,Loustalot F,Poulter N,McAlister FA,Johansen H,Baclic O,Campbell N. "Hypertension prevalence, awareness, treatment and control in national surveys from England, the USA and Canada, and correlation with stroke and ischaemic heart disease mortality: a cross-sectional study." BMJ open 2013:3(8) : e003423.

11-Gallant M P, Glenna S, Joshua G. G. "Chronic illness self-care and the family lives of older adults: A synthetic review across four ethnic groups." Journal of cross-cultural gerontology .2010: 25(1);21-43.

12-Lee JE, Han HR,Song H,Kim J,Kim KB,RyuJP,Kim MT. "Correlates of self-care behaviors for managing hypertension among Korean Americans: A questionnaire survey." International journal of nursing studies 2010:47(4); 411-417.

13- Jo Y, YB C. "The effect of on internet Commutyon knowledge, self-efficacy and self-cars behavior in workers with hypertension". Medline 2003.

14- Lee JE, Han HR,Song H,Kim J,Kim KB,RyuJP,Kim MT ."Correlates of self-care behaviors for managing hypertension amony Korean Americans". Journal of community Health 2012; 37(1): 15 – 24.

15- Gohar F.,Greenfield SM,Beevers DG,YH Lip G,Jolly K. "self-care and adherence to medication: a survey in the hypertension outpatient clinic." BMC Complementary and Alternative Meidcine 2008: 18:4.

16- Warren – Findlow J.,Seymour RB. "prevalence ratges of hypertension self-care activities amony African Americans". Journal Natl Med Assoc: 2011: 103(6): 503-512.

17- Jabalameli S, Neshatdoost HT,Molavi H. The effect of entervention strees manaments in behaveral cognitive methods on quality of life and hypertension in women. The journal of kordestan university of medical sciences. 2007:15(2):88-97.

18-Glynn, LG,Murphy AW,Smith SM,Schroeder K,Faheg T. "Interventions used to improve control of blood pressure in patients with hypertension." Cochrane database syst Rev. 2010:3(3).

19-Magadza, C., Radloff S E,Srinivas , S C. "The effect of an educational intervention on patients' knowledge about hypertension, beliefs about medicines, and adherence." Research in Social and Administrative Pharmacy.2009: 5(4) :363-375.

20-Park YH,Song M,Cho B,Lim J,Song W,Kim SH. "The effects of an integrated health education and exercise program in community-dwelling older adults with hypertension: A randomized controlled trial." Patient Education and Counseling.2011: 82(1) ;133-137.

Table 1: The age of patients

Age	Control Group		Case Group	
	Percent	Frequency	Percent	Frequency
	6.3	2	9.4	3
30>	34.4	11	12.5	4
30-40	21.9	7	40.6	13
41-50	37.5	12	37.5	12
50<	100	32	100	32

Firoozeh Mostafavi *et al*.

Table 2: Level of Education

Level of Education	Control Group		Case Group	
	Percent	Frequency	Percent	Frequency
Lower of Diploma	78.1	25	100	32
Ultra diploma	6.3	2	**0**	**0**
Bachelor	15.6	5	**0**	**0**
Total	100	32	100	32

Table 3: Job

Job	Control Group		Case Group	
	Percent	Frequency	Percent	Frequency
Employee	12.5	4	3.1	1
Housekeeper	87.5	28	96.9	31
Total	100	32	100	32

Table 4: Level of income

Level of income	Control Group		Case Group	
	Percent	Frequency	Percent	Frequency
200>$	37.5	12	31.3	10
200-430 $	43.8	14	65.6	21
$ 430 <	18.8	6	3.1	1
Total	100	32	100	32

Table 5: The Source of Information

The Source of Information	Control Group		Case Group	
	Percent	Frequency	Percent	Frequency

Firoozeh Mostafavi *et al.*

Health personnel	25.0	8	18.8	6
Friends and Family	18.8	6	25.0	8
TV & Radio	43.8	14	56.3	18
Other mass media	12.5	4	0	0
Total	100	32	100	32

Table 6: Mean and standard deviation for score of self- behaviors in case and control groups , before and next educational intervention

		Control Group	Case Group
Before of educational intervention	**Mean**	**50.2**	**50.9**
	Standard deviation	**15.5**	**14.2**
	Variance	240.4	203.7
	Minimum	24	15
	Maximum	79	73
		Control Group	Case Group
next of educational intervention	**Mean**	**49.7**	**58.8**
	Standard deviation	14.0	15.0
	Variance	197.2	225.1
	Minimum	24	5
	Maximum	76	79

Table 7: Mean and standard deviation for score of self- behaviors in case and control groups , before educational intervention

	Standard deviation	Mean	Count
Case Group	14/27	50/97	32
Control Group	15/50	50/28	32
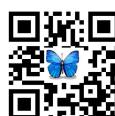
Table 8 : Two-Sample t-test

Kind of Test	Significance Level	Degree of Freedom	t	Diffrence of Mean
Two-Sample Test	0/854	62	0/185	+ 0/69

Table 9: Mean and standard deviation for score of self- behaviors in case group , before and next educational intervention

	Standard deviation	Mean	Count
Pre-test	14/27	50/97	32
Post-test	15/00	58/81	32

Table 10: Paired t-test

Kind of Test	Significance Level	Degree of Freedom	t	Diffrence of Mean
Paired t-test	0/000	31	4/80-	+ 7/84

Table 11: Mean and standard deviation for score of self- behaviors in control group , before and next educational intervention

	Standard deviation	Mean	Count
Pre-test	15/50	50/28	32
Pre-test	14/04	49/78	32

Table 12 : Paired t-test

Kind of Test	Significance Level	Degree of Freedom	t	Diffrence of Mean
Paired t-test	0/329	31	0/992	0/50
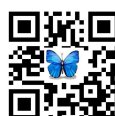
Firoozeh Mostafavi *et al.*

Table 13 : Mean and standard deviation for score of self- behaviors in case and control groups , next educational intervention

	standard deviation	Mean	Count
Case Group	15/00	58/81	32
Control Group	14/04	49/78	32

Table 14 : Two-Sample t-test

Kind of Test	Significance Level	Degree of Freedom	t	Diffrence of Mean
Two-Sample t-test	0/016	62	2/486	9/03

RESEARCH ARTICLE

Landslide Analysis to Estimate Probability Occurrence of Earth Quakes by Software Arcgis in South West of Iran.

Mostafaghasemi[1] and Hamid Reza Samadi[2*]

[1]Geology Department, tarbiatmodaresUniversity,Tehran, IRAN

[2]Teacherof Sama technical and vocational training college, Islamicazaduniversity,Najafabadbranch, Najafabad, Iran

*Address for correspondence

Hamid reza samadi
Teacherof Sama technical and vocational training college
Islamicazaduniversity,
Najafabadbranch,
Najafabad, Iran.
Email: h_samadi379@yahoo.com

ABSTRACT

Thepresent studyarea is located in the high mountains of zagros, where is The highest point of Iran. The region is a small part of the Iran extent, but more than 14% of rainfall volume is allocated. Due to many faults and heavily rainfall in there, the landslide surveying is very important. In this study, geological maps of the area were digitized by ARC GIS software and FISHNET pattern, which the scale of them is 1/100000. Also, the alluvial outcrops were separated from the rocky outcrops. After that these outcrops were separated based on the stratigraphic column and were weighted according to the age. Also, the Digital Elevation Model (DEM) of the area was provided by the topographic map which its scale was 1/25000. After that zoning of slope was performed, too. The slope interval is between 20° to 40°. Based on the geometric terms, the occurrence of landside is high in there. The fault map of area was extracted digitally from the geological map. According to meteorological data, rainfall precipitation statistics of the study area, precipitation zonation map was prepared. As for the slope, material, precipitation, fault data and weight composition, the induced landslide (based on the occurrence of earthquake) was zoned via FISHNET pattern.

Key words: landslide, zoning, DEM

Mostafaghasemi and Hamid reza samadi

INTRODUCTION

Landslide as one of the natural disasters in mountainous, rainy andseismic areamakes many social and economic losses every year. After the earthquake, the oscillatory motion, and in particular landslide is as the most damaging natural disasters. In the last two decades, these damages increasingly have accelerated by human manipulation in natural oscillatory systems{1}. Identify factors affecting landslide and the zoning of the hazard, is the basic tool to investigate potential areas of risk and help planners for planning and necessary actions. To prevent damage, losses or reduce the extent of slope failure, the identifying of unstable areas and predicting the probability of their occurrence are essential. Fastest method to predict in the regional scale is the determination relatively potential of slip{2}. The zoning of land slip contains: surface divided into separate areas and ranking of these areas according to the actual degree or potential risks due to the occurrence of landslides on the slope{3}.

The purpose of zoning is the division of land into homogeneous areas is classified according to the degree of actual or potential landslide hazard. In other words, earth's surface is divided into specific and virtual areas of the potential risk degrees based on effective factors of creative the landslide. The factors include the parameters related to geology, soils, vegetation, climate, hydrology, physiography, and human intervention. But the effects of these factors in different parts are different{4}.

Location and geographical features of the study area

The longitude of the study area is from 51° to 51° 30□ 31□ E and its latitude is from 31° 30□ to 32° N. There are different formations such as sedimentary, igneous and metamorphic rocks. Stratigraphical formations consist of sedimentary and alluvial formations from Precambrian to the Quaternary. The study area is located in the Zagros Thrust and Sanandaj – Sirjan zone. Zagros Main Thrust Fault, its strike is North West to south East, passes from North East part of the Borojen map. This fault separates Zagros from Sanandaj-Sirjan zone.

The effective factors on landslide and the maps related to the factors

The investigation and linking the different maps show that lithology, the distance from the fault and dip of layers are the main factors which effect on the occurrence of landslide. But the precipitation, the areas with same seismic acceleration, the height differences and dip direction are less important. The DEM and slope map was plotted by the digitized topographic map which its scale is 1/25000. Faults and the alluvial strata were extracted from the 1/100000 map of the region**.**

Lithology

In the study area, the lithology is various, and it has a significant effect on zoning. Since the old layers are as to the first and second geological era, due to the high density, they have little effect on the occurrence of landslides. In the study, young layer of Quaternary period has been studied. Fig. 1 shows the layers of the Quaternary which are weighted by age.

Distance from faults

The faults have various effects on the landslide. The crunching and shearing in the fault zone, the infiltration of water in there, discontinutiesoccures around of faults and the differences of erosion in the hillside are the effects of faults. The fault can be as start on the slopes Many landslides during an earthquake approved its role in the occurrence of landslides on the slopes and in fact, they cause to reach the thresholdin the hillsides. In Fig. 2, the digital fault of the area is visible.

Mostafaghasemi and Hamid reza samadi

Topographic slope

Landslide risk in areas which has slope between 20 to 45 degrees, is higher than others. In this paper, Digital Elevation Model (DEM) was derived by using topographic maps with 1:25000 scale.

Precipitation

Precipitation leads to the rising the groundwater table, that the rising of water table, in turn increasing the hydrostatic pressure and pore water pressure in the materials of hillsides. They plays an important role in landslide. The study area has a weather station that an average annual rainfall is 32 mm.

Earthquake

An aggravating factors of landslides is earthquake. In the investigation, the earthquakes' magnitude is greater than 5 richterwere selected in Brojen.

METHODOLOGY

In this study, the alluvial layers were separated from the rock layers and were digitized at first by ARC GIS software and the map which its scale is 1/100000. After that the faults are digitized tooIn the next stepFISH mapping of the classifiedand was divided to 58 boxes which its length is 6 and its width is 5.5 km. All the factors mentioned in occurrence of landslides were jointed to the boxes.In the each FISHNET, the effect of alluvial layer was examined on there. according to the wieght of layers, the younger alluvium has a greater impact on the landslide in the final calculation. Also, the topographic slope, the distance from faults, earthquake and precipitation rate were surveyd in every box. The calculation was done by following equation(mora-varson method)The calculation was shown in the Tab. 1. The linking landslide factor together illustrated No. 49 and No. 59 of SHIT had the greatest effect on the phenomenom. .

The zoning of landslide is shown in Fig. 4. According to the figure, the northwest and southwest of the study area have more potential landslides than other areas.

CONCLUSION

The main factors of landslide are lithology, topographic slope, precipitation and faults.
Geological structure, topography, climate, soils, hydrology and etc, can provide the fertile field for geomorphologic phenomenomsepecially landslide. According to the weighted maps and natural features, the final map was plotted (Fig. 4).

REFERENCES

1.BonabeauE., DorigoM., TheraulazG. ,SwarmIntelligence: From Natural to Artificial
Systems, Oxford UniversityPress, New York, (1999).
2. Mossop, A., Segall, P., Subsidence at The Geysers geothermal field, N., California from a comparison of GPS and leveling surveys. Geophys. Res. Lett. 24, 1839–1842(1997).
3.Teufel, L.W., Rhett, D.W., Farrell, H.E., Effect of reservoir depletion and pore pressure drawdown on in situ stress and deformation in the Ekofisk field, North Sea. In: Rogiers, J.-C. (Ed.), Rock Mechanics as a Multidisciplinary Science. Balkema, Rotterdam, pp. 63–72(1991).
4. Segall, P., Induced stresses due to fluid extraction from axisymmetric reservoirs. Pure Appl. Geophys. 139,

Mostafaghasemi and Hamid reza samadi
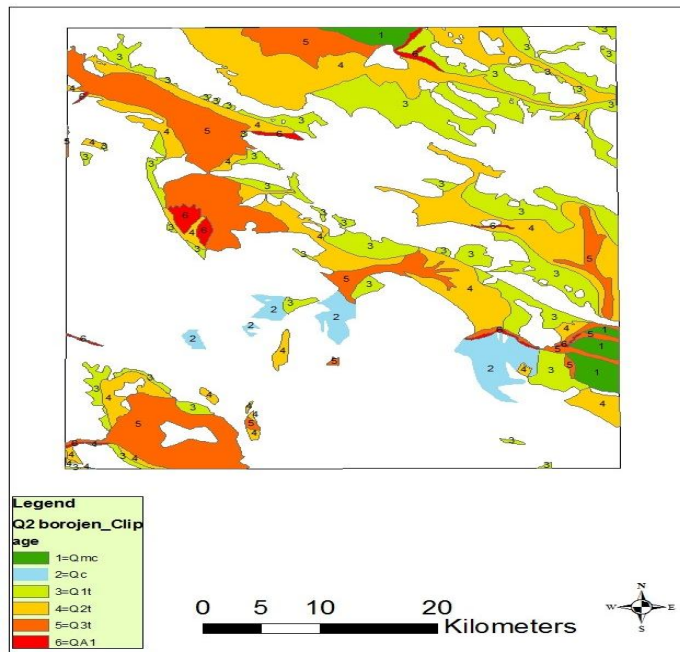
Fig. 1- the despersion of digital layer of Quaternary in the study area
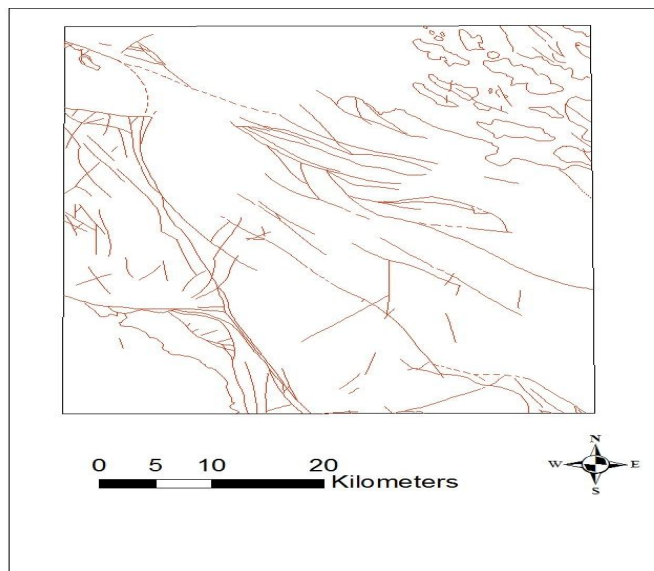
Fig. 2- the digital faults of area

4211
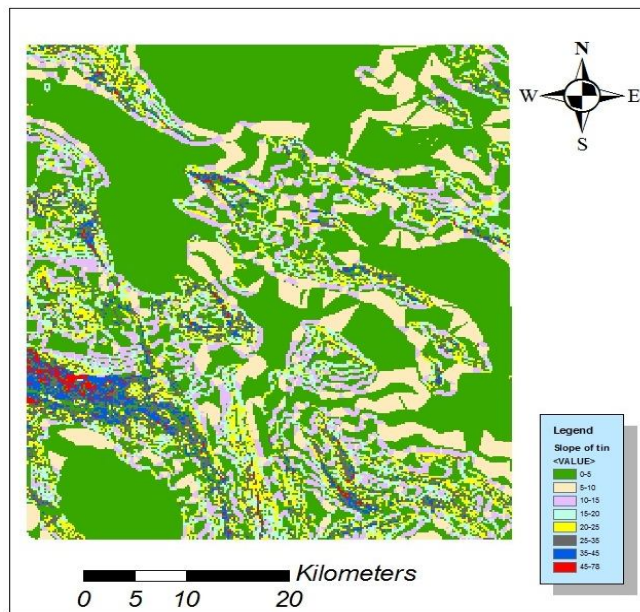
Fig. 3- the topographic slope by the 1:25000 map
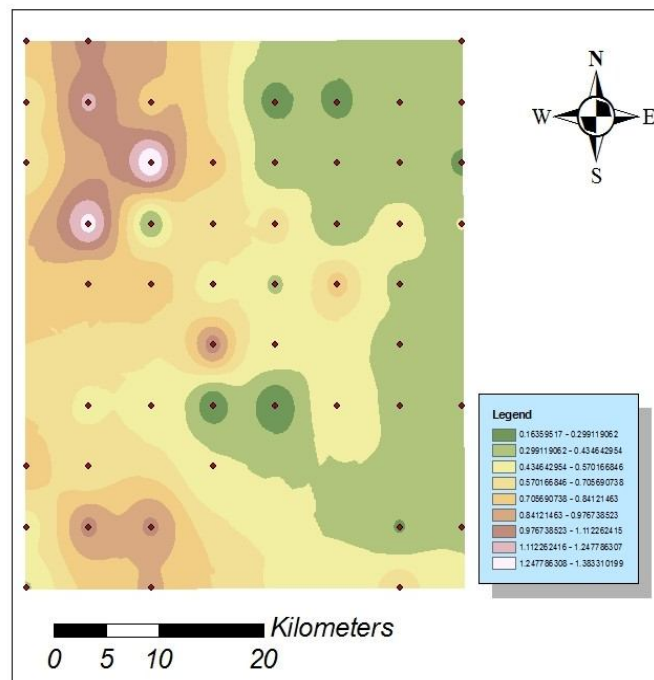
Fig. 4- the zoning of the landslide potential

Mostafaghasemi and Hamid reza samadi

Tab.1- Landslide index in every box

point	alluvium	Slope	fault	earthquack	Landslide index
0	.67	.33	0	.14	.78
2	.83	.45	.24	.33	.67
6	.5	.53	.14	.45	.45
8	.5	.78	.27	.44	.54
9	.83	.5	.67	.78	.35
10	.67	.5	.55	.67	.26
11	.33	.5	.78	.54	.98
12	.67	.66	.96	.34	.17
13	.5	.77	.33	.12	1.04
14	.33	.83	.24	.31	1.14
15	.87	.34	.46	.49	.33
16	.33	.97	.65	.65	.56
17	.44	.93	.76	.71	.62
18	.84	.55	.87	.26	.23
19	.93	.56	.34	.41	.51
20	.33	.34	.23	.95	.73
21	.43	.33	.54	.31	.67
22	.56	.56	.01	.49	.93
23	.32	.76	.42	.86	.61
24	.67	.89	.53	.46	.24
25	.5	.56	.54	.14	.59
28	.5	.45	.65	.37	.32
29	.83	.32	.76	.69	.67
30	.83	.78	.87	.08	.33
31	.66	.45	.67	.54	.56
32	.55	.5	.56	.34	.66
33	.95	.34	.34	.23	.79
34	.33	.54	.45	.67	.43
35	.78	.57	.53	.81	.62
36	.66	.83	.24	.28	.28
37	.56	.76	.56	.49	.89
38	.43	.96	.12	.78	.18
39	.44	.43	.18	.41	.22
40	.5	.32	.66	.55	.59
41	.5	.47	.77	.34	.68
42	.5	.33	.23	.22	.56
43	.5	.56	.66	.72	.67
44	.65	.44	.68	.69	.13
45	.77	.34	.66	.97	.61
46	.46	.89	.77	.23	.36
47	.35	.93	.33	.17	.72
48	.54	.35	.43	.33	.49
49	.84	.44	.95	.79	.44
50	.78	.5	.12	.65	.22
51	.5	.33	.23	.49	. 83

RESEARCH ARTICLE

Computational Architectural Algorithm to Design Typical Houses

Mohammadjavad Mahdavinejad[1]*, Ali Arabalizadeh Mahabadi[2] and MIlad Olfat[3]

[1]Assistant professor, Faculty of Art and Architecture, Tarbiat Modares University, Tehran, Iran
[2]Master student of Architecture, Faculty of Art and Architecture, Tarbiat Modares University, Tehran, Iran
[3]Master student of Architecture, Faculty of Architecture and Urban Design, Shahid Rajaei Teacher Training University, Tehran, Iran.

*Address for correspondence
Mohammadjavad Mahdavinejad
Assistant professor, Faculty of Art and Architecture,
Tarbiat Modares University,
Tehran, Iran.
E-mail: mahdavinejad@modares.ac.ir

ABSTRACT

In the field of the impact of new technology on architecture, it may be pointed to the role of computers and various software for designing of architectural and structural. Using the significant visual features of computers, many sketches (Etude) could be tested easily to study it on various aspects. It should be noted that some form and Surface which easily designed by computer can Not be designed by hand or traditional methods. Today, efforts are focused on using computers and artificial intelligence to produce the smart software for architectural design. The purpose of this research is production of a smart program for designing architectural plans with optimization capability based on user data. The research method in this study is modeling using Grasshopper plug-in in Rhinoceros software. The results show that a computational algorithm which is based on both "Simulated Annealing solver" and "Evolutionary solver" is very efficient to obtain the final solution.

Key words: Computational Architecture, Genetic Algorithm, Grasshopper, Rhinoceros, Simulation, Architectural Design

Mohammadjavad Mahdavinejad *et al.*

INTRODUCTION

Architectural design has a background of human life on earth. The first and the most important field of its appearance have been to make a residence, and architectures have had a special consideration to it. By passing time and necessity of constructing other buildings, considering decreasing construction expenses, increase of demand and increase of construction, role of constructors has become bolded and role of architects has become less. Therefore, architects have less considered to importance of architectural design of spaces and by Increasing of mass constructing process, design of these buildings has been neglected so that many modern houses don't have primary needs such as suitable light or etc. while considering to lack of land and high expense of house in modern societies, these space should be optimized.

Considering to modern construction policies, decrease of considering to its architecture and decrease of time for its design, the architects can't be expected to test new methods and create new and optimized spaces and only answer to primary needs is treated sufficiently. Of course, replication is in case that architect has selected a correct method and has not any error. But if architects can be provided an opportunity to pass first step, he/she will have an opportunity to create details and new modern spaces. But how create such an opportunity? Can computers provide this opportunity?

By invention of computer, flow of knowledge and sciences has advanced. By passing time, computer entered in all fields and caused to increase efficiency. Architecture as other sciences has been also affected by computer although, at first, it insisted against it. But during these years, it has been used as a tool for drawing, and it is mentioned as a space for designing. Finally, architecture uses partly its ability as a space for designing and presentation. At first of 80 decade, Nigel Cross questions "Can a Machine Design?" and knows its answer negative. Two decades later, not only he knows it positive but also he said it is necessary to study precisely.

Background of subject

In last years, field of computer and its applied programs has been considered in different parts of human life by developing sciences and increasing computer. Some researchers have been performed in architectural design by computer such as "exploring generative growth and evolutionary computations in architectural design" or "advantages of evolutionary computation used for exploration in the creative" and "architectural design by using evolutionary computations". This research and last researches which has advanced entrance of computer in the field of architectural design and using artificial intelligence for creating intelligence software in the field of architectural design.

Tools

There are many tools for doing this work from independent programming languages to programming languages dependent to other programs. Choose of every tools needs to master it and recognize its ability and limits. Considering to conditions, Grasshopper software selected for this work which is a Plug-in for Rhinoceros software.

Software Information
Rhinoceros: modeling tools for designers

The most powerful 3D software in the world development platform for modeling, rendering, analysis, and fabrication tools for a wide range of disciplines. The available software development tools: grasshopper, Python, RhinoScript, etc. Rhino is registered software and needs to have a license. But most of the Rhino development tools

including Python, RhinoCommon and 3DM viewer are open source. All development tools are available with a valid license and can be installed on rhino.

Grasshopper

Grasshopper is a licensed plug-in for rhino. This is a graphical algorithm editor tightly integrated with Rhino's 3-D modeling tools. Unlike RhinoScript, Grasshopper needs no knowledge of programming or scripting and allows designers to develop programs with genetic algorithm. For this research Rhinoceros v. 5.0 64-bit and Grasshopper v. 0.9.0006 was used.

Simulation

Defining Issue for computer

In defining issue for computer, it is necessary to provide it in computable language. At first step, it is not possible to consider all factors effective on flow of architectural design and we are inevitable to simplify design in primary form. But in flow of solving problem, this subject is considered that every part is able to gradation and increase factors effective on design until in future, it will be possible to develop research in other factors such as climate, materials, furniture, quality of space and etc. In premise, the problem was defined as a rectangular land with five internal spaces including bedroom, kitchen, bathroom and living room which its minimum spaces is determined by user. Also, 4 directions was selected and defined for this land as having light and desirability of light and view which was selected by user. In answer to the problem, in addition to the best arrangement, we follow the best dimensions of space with the least amount of useless space, the most amount of light and minimum interference of places.

Explaining problem

All spaces were introduced (with one base point, length and width) as some rectangular. As length and width of these rectangular is considered positive, by being constant of base point in Cartesian coordinates, they can be in one mode and the rectangular will be displaced by moving their base point. Also, ability of rotating 90 degree was considered for every space in order to have ability of Rotation. This relocation of spaces should not be so that exit from borders of the land or have interference. For preventing this action and leading computer for repairing this error, a penalty has been considered which is evaluated according to amount of interference and whatever interference is more, the penalty will be more and vice versa. Of course, as in reality, exit of spaces from land cause the plan to be unacceptable, the penalty has been considered so that it causes to fail the plan and prevent spaces to exit from land.

At next step, adjacency of spaces is defined and penalty is considered according to desirability or undesirability of adjacency, distance and having or not having direct relation. Then one of main factors, light of spaces was designed. For this purpose, value of light and reward of it use is determined for sides of land in directions that user determines. If spaces hang to one of sides of holding light, they will be given maximum reward and if they recede from them, they will be given reward according to their distance. In case of existing good view in a special direction, user can allow importance ratio for that in order to give more reward for that part. And at last step, remained and vacant spaces was analyzed in order to have a desirable space. The most desirable space was considered as the biggest rectangular space to have minimum vacant space and reward is considered according to it.

The results of program were different considering to change of inputs (direction of light and enter and dimensions of the land) which is evaluated desirably.

Figure 2: Dimensions of the land were determined as 6*6 m and light side were determined as northern and southern sides and place of entrance were determined as northern or southern side.

Figure 3: Dimensions of the land were determined as 6*6.5 m and light side were determined as northern and southern sides and place of entrance were determined as northern or southern side.

Figure 4: Dimensions of the land were determined as 6.5*6 m and light side were determined as northern and eastern sides and place of entrance were determined as northern side.

CONCLUSION

Evolutionary computation method converges after some times (depends on number of variances, their dependence to each other and determined limits) and it is prevented to test different and new modes or creating mutation. This is why that most answers become uniformed and don't change very much and answers become similar with slight difference which are sometimes more undesirable than first answer.

Although, totality of answer is suitable in evolutionary computation but necessarily it is not a good and executable answer because it has some problems such as interference and or being vacant spaces between them and external wall.

This time, using Annealing computation method is a solution and improves found answer so that at most times, it has no technical and architectural problems and is capable to being constructed. However, it may have some problems in feature of beauty and art because there wasn't opportunity to pay attention to artistic features of architecture and climate factors.

Considering to possibility of using programming language and scripting in grasshopper, the solution is to produce and use computational algorithm which is a combination of above two methods until final answer is gained more easily and faster.

Advantage of grasshopper is lack of need to know programming language while, being limited to use available orders cause user to use many orders for providing simple orders.

Also at the time of computation, different software problems were produced which was solved by using different ploys and it was more effective but some of these errors cause some problems for reaching correct results and some of them is seen as follows which it seems that it is related to computational errors of grasshopper software

Figure 7: should be computed in definition of vacant spaces and is shown in red color which is in left hand. In middle figure, some of it has been computed and some has not. In right figure, all spaces have been computed as vacant spaces. Because of being little spaces, little variety is seen in plans. But it is predicted that more variation is seen in plan by adding other spaces and more variations.

In this project, design was done in two dimension space while, architecture is done in three dimensions. This is why that it is proposed using floors and entering altitudinal levels.

Only one house has been designed in this research. But according to the results, this project is able to generalize residential units and towns. Also, by designing software in this field, programs can be imagined for designing different spaces such as administrative, schools and etc.

Mohammadjavad Mahdavinejad *et al.*

In this research, holding light was studied and factors affected on it such as dimensions of patio, its height, and depth of room and … were withdrawn. Their affect and other climate such as wind, rain, humidity and etc. can effect on desirability of spaces.

Also, putting cases such as furniture, material, color and light in future research will be desirable for richening and more applying design.

Following figures show trend of finding one of answers from beginning to end.
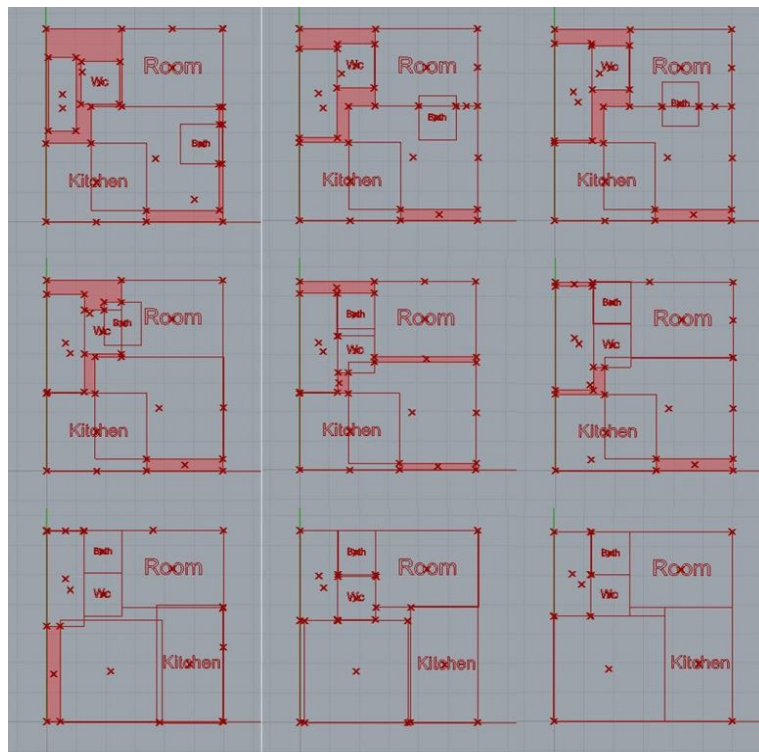
Fig.1: Trend of finding one of answers
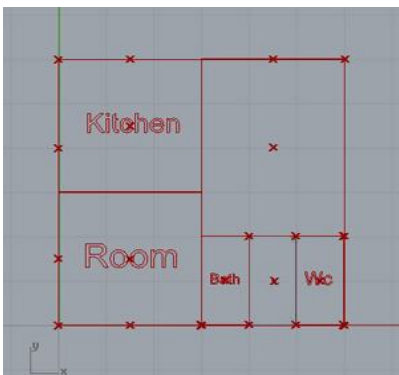
Fig.2: First plan   **Fig.3: Second plan**   **Fig.4: Third plan**

4218
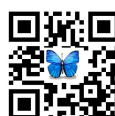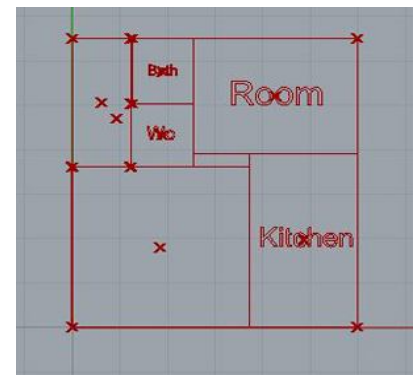
Mohammadjavad Mahdavinejad *et al.*

There is a sample of computations for finding answers.
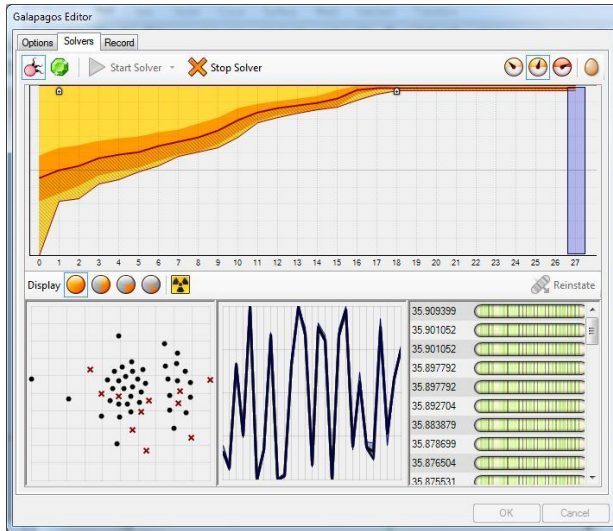
| **Fig.5: Evolutionary solver** | **Fig.6: Simulated Annealing solver** |
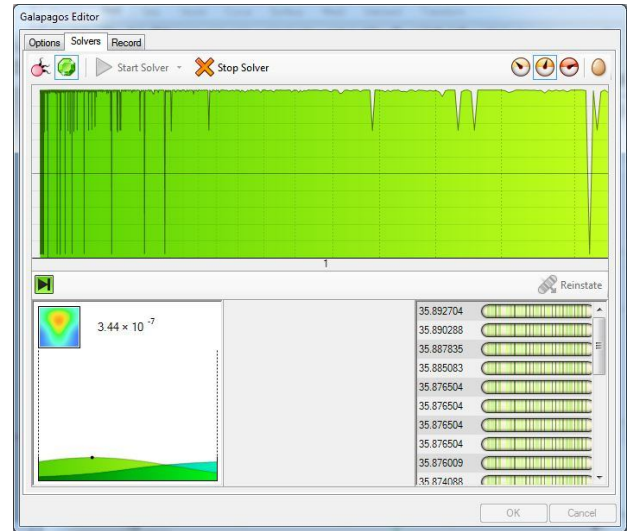
Fig.7: computational errors

RESEARCH ARTICLE
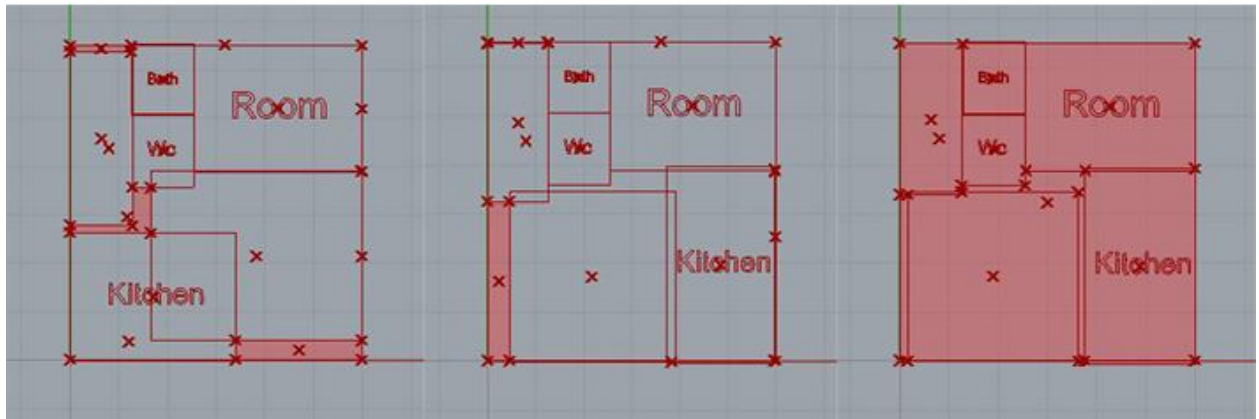
Designing Expert Systems Based on Neural - Fuzzy Methods for Modeling and Decision Making in Crisis Management Cycle

Mohammad Nemati Goodarzi[1]*, Ahmad Farmahini Farahani[2], Seyed Emad Hosseini[3] and Seyed Emad Hosseini[4]

[1]Planning manager of institute for International Energy Studies (IIES), Tehran, Iran.
[2]Director of Research, Institute for International Energy Studies (IIES).
[3]Research deputy of institute for International Energy Studies (IIES), Tehran, Iran.
[4]Mehdi Tavakoli HSE, NIOC,National Oil Company, Tavakolimehdi@yahoo.com.

*Address for correspondence
Mohammad Nemati Goodarzi
Planning manager of institute for International Energy Studies (IIES),
Tehran, Iran.

ABSTRACT

Crisis management involves a series of scientific and administrative activities for the prevention, rescue, reducing waste and damage during the accidents. Planning, foresight, ability to predict crises and decision making before and during the crisis and risk management are among those activities that arise in crisis management.

Expert systems are one of the useful tools that can be used widely in crisis management. Expert systems are automatic consulting systems which provide interferences on the areas in which they are specialized. An expert system is a computer program that covers a wide range of information in the knowledge base that provides integration, judgment, intuition for the conclusion of a particular subject. Among these we can refer to Neural - Fuzzy system.

This paper attempts to examine the capacity of Neural - Fuzzy systems for designing expert system which can be utilized in crisis management and to provide suggestions for the use of these systems in the crisis management field.

Key words: Crisis management, Expert Systems, Neural - Fuzzy systems, Forecasting, Decision-making.

INTRODUCTION

Crisis management involves a series of scientific and administrative activities for the prevention, rescue, reducing waste and damage during the accidents which is based on the four basic principles of forecasting and disaster preparedness, reduction of waste and damage caused by the crisis, and getting out of the crisis and restoring normalcy and ultimately reconstruction and retrofitting toward crisis.

In other words it should be said: crisis management is a practical science that by the systematic observation and analysis of past crises tries to find the means by which it can prevent the occurrence of disasters and be prepared to deal with them on the one hand in the case of crisis it tries to relief and recover the situation. The extent of the concepts and application areas in this knowledge have led to exercise of science and various fields in crisis management is such a way that it has covered broad range of science and knowledge including engineering to medicine and the humanities. Also several activities are proposed in crisis management including: planning, foresight, ability to predict crisis and decision making before and during the crisis and risk management. One of the tools that can be widely used in crisis management is expert system. Such systems are, in fact, primitive and simple examples of advanced technology which are based on knowledge. This paper examines the expert systems based on Neural - Fuzzy methods and its application in crisis management by mentioning an example.

Problem Statement

Systems or expert systems refer to a specific category of computer software that attempt to help professionals and human experts or partial replacement of them in limited areas of specialization. Expert systems usually store data in the form of facts and rules in the knowledge base in a structured way and then by using special techniques they derived from these data, the required results. In fact due to modeling these systems of human logic and reasoning, and the sameness of knowledge resources which they used, the result of expert system can be decisions which can be used in different fields and areas and it also would be reliable and influential. Expert systems are very diverse in their application. Some of these areas include: medicine, accounting, process control, human resources, financial services and GIS that in any of these fields different types of works like guidance, analysis, classification, consulting, design, assessment, probing, prediction, creating concepts, identification, justification, learning, management, control, planning, scheduling and testing can be performed faster and more easily by the help of experimental systems.

Every expert system is made up of two distinct parts: a knowledge base and inference engine or decision making. Figure 1 shows the general structure of an expert system.

The knowledge base of an expert system uses two types of knowledge which are based on facts as well as inconsistent knowledge. Actual or certain knowledge is a kind of knowledge that can be shared and extended in different domains, since correctness is certain. On the other hand, uncertain knowledge is more uncertain and it is based on personal impressions. When the guess or uncertain knowledge of an expert system is better, the level of expertise will be greater and in special circumstances, it will take better decisions. This kind of knowledge can help speed up the process of solving a problem.

With the advent of artificial intelligence and evolutionary concepts in the 80s and the recognition of capacity of system in creating expert systems, the use of artificial intelligence techniques in creating such system was increased day by day. One type of such systems is expert systems which are based on Neural-fuzzy methods. In the fuzzy method input information of the system are fuzzy and in form of rules if ... then they enter in the knowledge base and the inference engine draw conclusions about the inputs. The purpose of fuzziness of is to follow fuzzy logic which is suggested against classical logic. Fuzziness shows the uncertainty in a particular phenomenon. For example, if you want to comment on the existence of crisis, on the basis of classical logic whether crises exist or not exist.

However, based on fuzzy logic, the crisis can be classified at different levels such as: lack of crisis, low crisis moderate crisis and high crisis. By this classification and based on the rules if ... then, we can provide a knowledge base for developing model crisis with previous experience (certain knowledge) and expert opinion (uncertain knowledge). In general we can say that fuzzy systems are based on a set of input data upon which they perform forecasting and modeling. Input data source can be in two ways: 1- of human knowledge 2- the measurement and mathematical models. In Figure 1 the general structure of a fuzzy system is shown.

In the neural network technique for a number of inputs, one or more output is gained that these outputs are thee subordinate of the weight activity levels of the outputs. The main function of this model is its ability to model different phenomena, as well as capability is the other feature of this technique. In the Figure 2 a single-layer neural network structure of single neurons is shown.

Neural - Fuzzy networks (ANFIS) combine the ability of the two neural - fuzzy systems in the best way. These networks consider the fuzzy inputs and also have the ability to learn. The neural network gets the fuzzy inputs and outputs then provides new classification and input and output connections and finally produces new rules. In neural- fuzzy networks, fuzzy logic is considered for Inference and providing a deterministic or fuzzy output and the neural network is used for learning, classifying abilities and modifying models. In figure 3 the structure of the nervous-fuzzy system is shown.

If we define crisis management as planning for the crisis then the four-step for planning crisis control should be carried out. First predictable unpleasant phenomena, then contingency plans should be set, then disaster management teams are organized and finally to complete the program, they should perform them by tests and practical exercises. Expert System which is based on Neural – Fuzzy methods due to the complex nature of crises that limit the ability of mathematical modeling, can be applied greatly in the prediction, modeling and decision-making in crisis management. The strength of such systems is to take advantage of events and past experiences (certain knowledge) and expert opinion (uncertain knowledge) for modeling different phenomena simultaneously which in the field of crisis management can establish relationship between different variables for modeling in the best way due to several factors affecting the occurrence of a crisis and its effects. In following part we are going to provide a hypothetical example of applying this approach to modeling losses due to the earthquake crisis in cities.

METHODS

Casualties from earthquake are affected by various factors and variables that limit its classification and modeling to predict loss rate in an area. Modeling casualties enables crisis managers to forecast the effects and to determine factors that enhance weight loss as well as its impact. After this stage, crisis managers with knowledge of different areas of weaknesses can provide corrective solutions. Factors influencing the losses caused by the earthquake, based on Japanese International Cooperation Agency (JICA) are divided into three general categories: 1 - the distinctive of architecture and urbanism 2 - preparedness and resistance indicators 3- risk related indicators, that according to the requirement of each category of other variables are added to them. Each of these variables is themselves influenced by other variables. A table of these indicators and variables affecting them are named. Procedure is as follows that for each of the input variables fuzzy values is defined, for example, for the variable of oldness of structure according to the age of the building the degree of oldness is defined in the fuzziness form: low, medium and large oldness that this scale can be defined for security of the power lines in form of very poor, poor, acceptable and good. Each category will represent a numeric value.

By defining the fuzzy values for the variables we design a neural network. Four neural networks will be designed for this purpose. In Figure 4 formed network is shown.

Mohammad Nemati goodarzi *et al.*

By determining inputs and outputs the data associated with this model must be collected that this matter by developing a knowledge base and using fuzzy rules if.... will be done. For this issue a group of experts (specialists), using their own experiences (Heuristic knowledge), as well as the scientific study of past events attempt to develop fuzzy rules and knowledge base. The number of these rules may be developed as follows:

- If the population density is high, and width of the passages is low, then the loss is very high.
- If the population density is high and force organizing is weak or the amount of equipment and temporary housing aid is the loss is very high.
- If the level of earthquake intensity is high and focal depth or distance from the epicenter of the earthquake is very high, then loss rate is low.
- If the population density is high and width passages are high then the loss is high.
- If the population density is low and width passages is low or organizing forces is weak then the death rate is low.
- If the level of earthquake intensity is high and the oldness of structure is low then loss rate is about average.
- If the number of rescue group is low and level of earthquake intensity is moderate or distance from the epicenter of the earthquake is small, then loss rate is low.

After the development of the knowledge base, the network attempts to connect the input and loss rate and in this process input affecting weight is determined in loss rate. One of the unique features of this network is the possibility of upgrading and expanding the knowledge base as soon as new data is received from scientific studies as well as the new quake which results in an increase in accuracy over time. This network is designed in the form of computer software as a reliable tool for decision making regarding earthquake preparedness and also to reduce potential loss of earthquake and it has the capability to provide for crisis managers the possibility of identifying strengths and weakness of hardware and software to deal with earthquakes and it helps in making informed decisions and allocate resources properly to prevent the loss.

DISCUSSION

The results of the theoretical model will be used to predict the loss rate which will be sensitive to the distinctive of architecture and urbanism(Y)preparedness and resistance indicators (Z) risk related indicators (X)in such a way that with any change in these subgroups: (Y1-Y10 , Z1 - Z5 and X1-X5) the loss rate will also change. With the production of this model and by using a comprehensive map of the city the loss rate in each region is characterized due to earthquake intensity. Thus the urban areas are studied according to discussed factors in the model and the responses that are related to the loss in each region are included in the model, according to the previous communication model attempts to produce output losses that are related to the specific area and loss rate and its main are reflected on the map. Using this model, a comprehensive map of losses due to earthquakes in different parts of the city can be obtained under the different scenarios and since the weight of the impact of each factor is determined in the specific model, we can identify the most effective factor in causing losses in each region that this results help crisis managers effectively in the prevention phase in order to focus the most costs on the most effective factor in creating the loss caused by the earthquake. For instance, if the loss rate predicted to be very high in the area of city, we should determine the main cause of loss rate increase by considering the weight impact on factors. This loss may be caused from the excessive oldness of structures or high density of buildings near the epicenter of the earthquake while the indicators of readiness and resistance may not have much impact on this increase. In these circumstances, despite the high level of awareness and adequate facilities and rescue groups and durable groups, due to high population density and the age of structures the losses will be very high. Therefore, dealing with improvement of readiness and resistance indicators will not have much impact on reduction of losses in this area, yet architecture and urbanism changes with distancing from the epicenter of the earthquake can be an effective practice. In general, what can be said about the results of using neural - fuzzy models in predicting the losses is that these results are durable and viable and while reducing risk of decision-making it increases the reliability of distributed knowledge in crisis management.

Mohammad Nemati goodarzi *et al.*

However, the results of this model in case of unexpected events will lead to improper judgment. Also the knowledge of causation is not usually available for obtaining these results.

CONCLUSION

Prediction, prevention and reducing the impact of the crisis require a consideration of all the factors of a crisis and its consequences. Yet the complexity of crisis controls challenges multiple factors that influence decision making in a crisis. Using experimental and statistical methods to evaluate crisis have their own advantages and disadvantages, however, considering all the effective variables and factors in a crisis in the form of a model is an activity that is not achievable with conventional tools. Expert System based on Neural - Fuzzy methods is a way that by modeling of these phenomena can enable crisis managers to be prepared against crisis by making right decisions. Modeling using Neural - Fuzzy methods makes it possible for crisis manager to examine a variety of factors could be involved in a crisis by concurrent adoption of certain knowledge from scientific studies and previous crises and heuristic knowledge derived from expert opinion in the form of an expert system. One of the main advantages of this method of producing computer software based on neural- Fuzzy system is that this software can be used for the decision-making process, or any activity that can be used in modeling. It is also possible to easily upgrade the network and its application, with the passage of time and changes in crisis management and if the knowledge base of the network is higher the reliability and accuracy of conclusions will also increase. It appears that this method has the ability to be used for various crisis modeling. Among these crises we can point to the earthquake in Tehran. By using this method, the effective variables on earthquake effects are identified and we can specify the connections between these variables and the required actions can be carried out. The output of this model will be a reliable tool due to the simultaneous use of academic studies and experts' knowledge that easily will allow the crisis managers to identify the earthquake vulnerabilities in different parts of the city and they will be enabled to easily use the designed model for decision making and allocation resources to prevent damage caused by the earthquake.

REFERENCES

1-   Technical information about underground storage reservoirs for natural gas, porner gruupe
2-   Study on Underground Gas Storage in Europe and Central Asia, Working Party on Gas, Geneva, January 2010
3-   TAM Underground Gas Storage, TAM international, Inflatable and Swellable Packers, 2008
4-   1st Russia & CIS Gas Technology Conference RGTC 2004 - Moscow 28 & 29 September
5-   Pipeline & gas (October 2011).
6-   The Correlation between Factor of Safety and Twist Angle in Axial Fan Blade Zare Ali, Najafzadeh Ali, E. Ahmadi Naeim and Shahizare Behzad, Res. J. Recent Sci., 3(1),50-56(2014)
7-   LNG Today, Fully Update and Expanded, Andy Flower, June (2004)
8-   Asian LNG Market Outlook, FACT INC, October (2005)
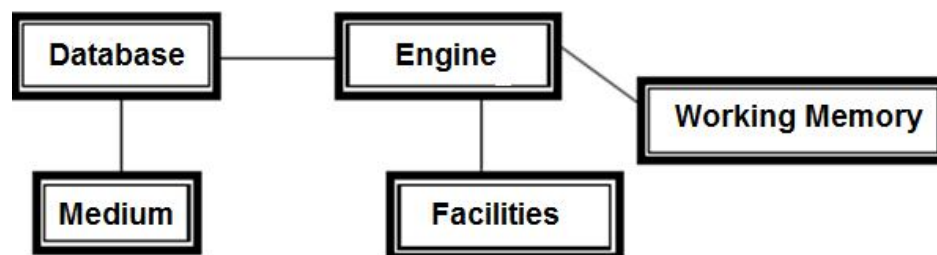
Figure 1: Structure of an Expert System

Mohammad Nemati goodarzi *et al.*
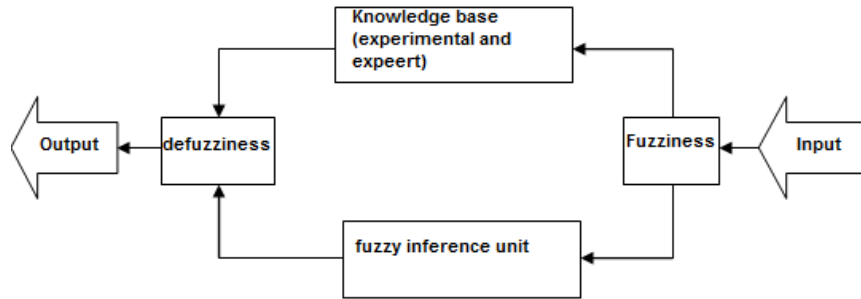
Figure 1: the functioning process of a fuzzy system
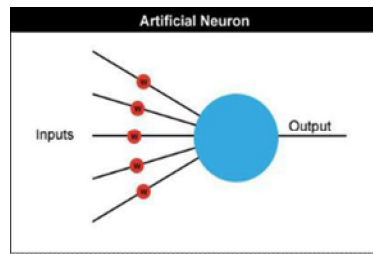
Figure 2: Neural Network Systems
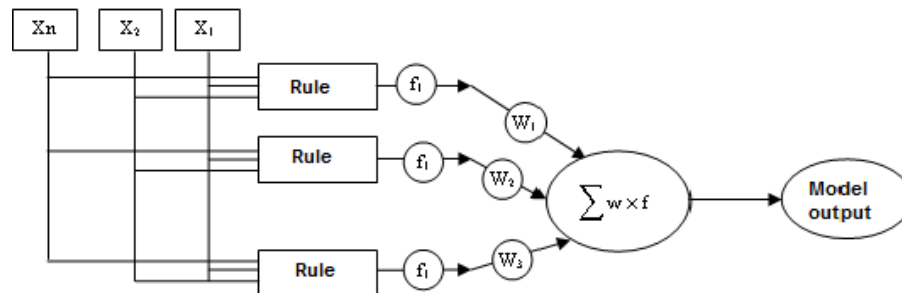
Figure 3: General structure of a neural-fuzzy network

Mohammad Nemati goodarzi *et al.*

Table 1: factors affecting the losses caused by the earthquake

X	Risk related indicators	Z	Indicators of readiness and resistance	Y	Architecture and Urban Planning features	Row
X_1	Time of event	Z_1	Training and public awareness	Y_1	Population density	1
X_2	Far and near the epicenter of the earthquake	Z_2	the situation of durability groups	Y_2	Passages width	2
X_3	The severity of the earthquake	Z_3	Number of bases of search and rescue and relief	Y_3	Oldness of structure	3
X_4	Focal depth	Z_4	The amount of the temporary resettlement and relief equipment	Y_4	Distance to open space	4
X_5	Duration of earthquake	Z_5	Status of Organizing Forces	Y_5	Distance from hospitals and rescue centers	5
				Y_6	The distance from the bases of fire department	6
				Y_7	Building Density	7
				Y_8	Accumulation of hazardous substances	٨
				Y_9	The relative strength of buildings	٩
				Y_{10}	Gas line safety	١٠
				Y_{11}	Power line safety	١١
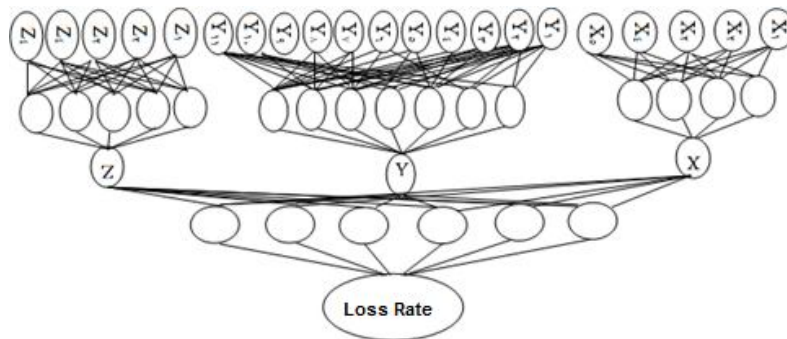
Figure 4: Established Neural - Fuzzy networks to forecast earthquake loss rate

RESEARCH ARTICLE
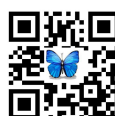
Impact of Gamma irradiation on Pellet Production Characteristics of Brewers Spent Grains

Senthil Murugan. S

Department of Animal Nutrition, College of Veterinary and Animal Sciences,Kerala Veterinary and Animal Sciences University, Pookode 673 576, India

*Address for correspondence
Senthil Murugan. S
Department of Animal Nutrition,
College of Veterinary and Animal Sciences
Kerala Veterinary and Animal Sciences University,
Pookode 673 576, India
Tel: +91-9446233030,
E-mail: s_senthilmurugan@hotmail.com

ABSTRACT

A3x4 randomized completely block design (RCBD) with the control (0 per cent BSG) and 0, 7, 14 kGy gamma irradiated Brewers Spent Grain (BSG) added at 5, 10, 15 and 20 per cent replacing de-oiled rice branwas designed with unbalanced runs to evaluate the effects of gamma irradiation (γ-irradiation)on pellet production rate (kg/hr), Pellet durability Index (PDI) of cattle feed.BSG incattle feed preparations reduces production rate significantly ($p<0.05$) as per cent increases in the feed formulations. Gamma irradiation had direct effect and there was increase in production rate by 5 and 10 per cent if 7 and 14 kGyγ-irradiated BSG respectively, included at 10 per cent level in pellet formulations compared against un-treated BSG. Meanwhile, the increase in production rate was not proportion as gamma irradiation dose increases. Gamma irradiation had no direct significant ($p<0.05$) effect to improve PDI value except that there was increase of 2.5 to 3.0 per cent compared against 14 kGy γ-irradiated BSG included at 15 per cent level.

Key words: Brewers spent grains, Gamma irradiation, Pellet production rate (kg/hour), Pellet Durability Index

Senthil Murugan

INTRODUCTION

Brewers spent grain (BSG) is one of the waste products from beer production and accounts approximately 20 kg/100 L of beer produced; amounts to 30 million metric tons per year (Mussattoet al., 2006). Thesematerials are either used in un-dried or dried form (WBG or BSG respectively) for feeding the dairy animals as it contains high energy relatively high protein with rumen bypass potential.Animals whichreceive pelleted feeds generally have higher performances in terms of average daily gain and higher feedconversion compared with mash feeds.The compounded animal feed manufacturing involves the use of a variety of raw materials in varying ratios; to produce with certain nutritive composition, hygienic andphysical quality with least cost. Apart from the formulation cost, operating the pelletizing system at themaximum production rate will reduce the cost of production (Briggs et al., 1999).

Food irradiation is a process of exposing food to ionizing radiations, such as gamma rays emitted from radioisotopes [60] Co and [137] Cs, or high energy electrons and X-rays produced by machine sources (Diehl,2002). The irradiation dose applied to a food product is measured in terms of kilo Grays (kGy). One kilo Gray is equivalent to 1000 grays (Gy), 0.1 megarad (Mrad), or 100,000 rads. Gamma irradiation has been recognized as a reliable and safe method for improving the nutritional value and inactivation or removal of certain anti-nutritional factors in foods and feeds (Farkas, 2006; Gharghani et al., 2008; Taghinejad et al., 2009).During 1981, the US Food and Drug Administration (FDA) concluded that food irradiated at 50 kGy or less can be considered safe for human consumption (FDA, 1981).

Pelletized feed improve feed efficiencies by reducing segregation of ingredients, minimizing spoilage and enabling the feed ingredients to be gelatinized with a combination of moisture, heat, and pressure (Thomas, 2005), improves starch degradability by 15 per cent in ruminants (Tamminga and Goelema, 1995) and rateof passage of feed materials (van der Poe1 et al., 1995); allowing for better utilization by animals (Thomas, 2005), the raw materials used for cattle feed production are having different frictional behaviors(Garrison, 2005), varying mechanical energy requirements (Israelsen et al., 1981), thereby varying in cost of production and different pellet quality. Apart from that, the chemical composition of individual raw materials also decides the pellet production rate and quality. The aim of this study was to reduce cost of production by operating pelletizing system at maximum production rate to improve energy efficiency by reducing kilowatt- hours per ton (kWh/ton) with desirable physical quality. As far as we know, there is no detailed information in the literature about the effects of γ-irradiation on chemical composition and graded inclusion of BSG in cattle pellet production parameters. Therefore we conducted this study in order to explicate effects of various doses of γ-irradiation on chemical and pellet-ability characteristics.

MATERIALS AND METHODS

Sample collection and preparation

The Brewers Spent Grain (BSG) in fresh, wet form was collected from local brewery companies (Malabar Brewers Ltd and United Breweries Ltd, Kerala State, India). About 3000 kg of wet brewer's grain collectedwas sun dried and preserved for gamma irradiation, pellet production and feeding trial studies.

Gamma Irradiation treatments

The sun dried BSG was gamma irradiated at Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala Veterinary and Animal Sciences Universityfor chemical composition studies. About 2000 kg dried BSG required for pellet production and feeding trial was gamma irradiated at commercial facilities available in Board of Radiation and Isotope Technology, Department of Atomic Energy, Navi Mumbai, India for pellet production studies.

Senthil Murugan

Pellet Production and Pellet Durability studies

Experiments were conducted at the Feed Analytical Lab, Kerala Feeds Ltd pilot feed mill. The cattle feed raw material were ground through 4 mm hammer mill screen. Then, the ground raw material was mixed in 250 Kg Y blender for 5 minutes. The mash was conditioned to a temperature near 70° C in Pellet Mill (Replica Model 200 kg per hour of local manufacturer). The conditioner mixing paddles were set at about a 45 degree forward angle (Brigss et al., 1999). The die used in this pellet mill is having internal diameter of 205 mm, die width of 80 mm, die area is 380 cm² and the motor power of 5.0 -9.0 KW. The 8 mm pelletproduced in this mill was cooled in manually operated vertical cooler of 100 Kg capacity. All experimental runs were performed using a warm die. The production rate (kg per hour) was measured at feed rate of 70 by monitoring the maximum motor ampere of 12.5, where the motor trip off. Then the collected pellets were sieved to remove fines and weight was considered as production rate for the run. The average weight of ten runs was considered as production rate for the particular production experiment.The hot pellet was cooled in cooler before measuring the pellet durability index by tumbling box method presented in FeedManufacturing Technology-IV proceedings released American Feed Industry Association by Robert (1994).

Statistical Analyses

The unbalanced experimental block design for compounded cattle feed pellet production experiments were summarized in Table 1 due to frequent trip off of pellet mill because of high motor load with the control (0per cent BSG) and 0, 7, 14 kGy gamma irradiated BSG added at 5, 10, 15 and 20 per cent replacing DORB white. Statistical analysis for Pellet production experiment results were studied by using the general linear model procedure for multivariate analysis in SPSS (v.16.0).The effect of gamma irradiation on pellet production rate and PDI results were studied for its statistical significance by Least Squares Means and Duncan descriptive post hoc methods describe in the software package.

RESULTS AND DISCUSSION

Effects of Gamma irradiation on Pellet Production Rate (kg/hour)

The average pellet production rate (kg/hour) for untreated and γ-irradiated BSG replacing De-oiled Rice Bran (DORB) at 0,5,10,15 and 20 per cent level in compounded cattle feed formulation are summarized in Table-2. BSG in cattle feed preparations reduces production rate significantly ($p<0.05$) as per cent increases in the feed formulations.Gamma irradiation had direct effect and there was increase in production rate by 5 per cent if 7 kGy γ-irradiated BSG and 10 per cent if 14 kGy γ-irradiated BSG, included at 10 per cent level in pellet formulations compared against un-treated BSG.Meanwhile, the increase in production rate was not proportion as gamma irradiation dose increases.

Effects of Gamma irradiation on Pellet Durability Index

The measured Pellet Durability Index (PDI) in the present study was found to be 95.02 per cent where pellets produced without BSG and compared against pellets produced with untreated and γ-irradiated BSG replacing De-oiled Rice Bran (DORB) at 0,5,10,15 and 20 per cent level in compounded cattle feed formulation are summarized in Table-2. Gamma irradiation had no direct significant ($p<0.05$) effect to improve PDI value except that there was increase of 2.5 to 3.0 per cent compared against 14 kGy γ-irradiated BSG included at 15 per cent level. The PDI values recorded in other production trials are well within the accepted range.

Senthil Murugan

Effects of Gamma irradiation on Pellet Production rate (kg/hour) and Pellet Durability Index

Thevariables which affect the pellet production rate and pellet quality includes ratio of different ingredients, levels of protein, fat, minerals,fibre, starch, density, texture, moisture content of individual feed ingredients.The fibre content of individual raw material having more insoluble fiber is generally assumed to reduce pellet durability because of its resilient and rigid properties (Thomas et al., 1998), which in turn allows less interaction with other feed-borne nutrients and water.Protein also influences pellet durability, and in a study by Briggs et al. (1999), the authors concluded that increased amounts of intact protein had a positive effect on pellet durability. Inclusion rate of un-treated BSG in cattle feed formulations increases replacing de-oiled rice bran decrease pellet production rate and PDI.Meanwhile, inclusion of gamma irradiated BSG increases production rate and pellet quality significantly up to 10 per cent. The reasons attributed for decreases in production rate and

PDI may be due to presence of more insoluble fiber, cellulose and lignin in untreated BSG (Denstadli et al.,2010) and decrease in cellulose and ADL content due to effect of gamma irradiation recorded in the present study. Moreover, crude protein and fat also influences pellet durability (Briggs et al., 1999); in this study the crude fat content was decreased and there was no changes in crude protein. Process such as malting and mashing induce protein denaturation (Jones,2005) and have affected pellet durability negatively, that's why the decrease in cellulose and ADL content not have positive effect; when BSG was included more than 10 per cent compared against untreated BSG.

Pellet quality is generally measured as Pellet Durability Index (PDI).Durability is the ability of pellet to withstand fragmentation and abrasion during mechanical and pneumatic handling (bagging, storage and transport) without breaking up and to reach farmers without generating a high proportion of fines (Thomas and Vander poel., 1996, Cramer et al., 2003; Amerah et al., 2007).

The intention of the commercial feed manufacturers would be increase the feed production rate by reducingproduction cost with increased pellet quality. But, the researcher Shipeet al. (2011) reported that increased pellet quality could be achieved by a lower feed production (0.5 tonne/h vs 0.8 tonne/h).In the present study, inclusion of gamma irradiated BSG attained increase in production rate and without reduction in PDIresulting in an increased thermo-mechanical nutrient interaction and feed particle adhesion (Moritz and Lilly, 2010).

CONCLUSION

It could be concluded that, gamma irradiation causes decrease in cellulose and lignin to certain extent by that improving increase in pellet production and improved PDI. The changes in BSG due to gammairradiation may make things easier, rumen microorganisms can effectively utilize cellulose and other plant carbohydrates as their source of carbon and energy as it de-lignified or depolymerized or degraded. Further study is needed to determine economic benefits of gamma irradiation processing in comparison with other processing methods.

REFERENCES

1. Amerah, A.M., Ravindran, V., Lentle, R.G. 2007a. Feed particle size: Implications on the digestion andperformance in poultry. Worlds Poult. Sci. J. 63: 439 – 451.
2. American Society of Agricultural Engineers(ASAE), 1997. ASAE S269.4, Cubes, pellets and crumbles definitions and methods for determining density, durability and moisture. St. Joseph, MI.Briggs,J.L., Maier, D.E., Watkins, B.A., Behnke, K.C.1999. Effect of ingredients and processing parameterson pellet quality. Poult. Sci. 78: 1464–1471.

3. Cramer, K.R., Wilson, K.J., Moritz, J.S., Beyer, R.S.2003. Effect of sorghum-based diets subjected to various manufacturing procedures on broiler performance. J.Appl. Poult. Res. 12: 404 – 410.

4. Denstadli, S. Ballance , S. H. Knutsen, B. Westereng, and B. Svihus. 2010. Influence of graded levels

5. of brewers dried grains on pellet quality and performance in broiler chickens Poul. Sci. 89 :2640–2645.

6. Diehl, J. F. 2002. Food irradiation - past, present and future. Radiat. Phys. Chem. 63:211-215.

7. Farkas, J. 2006. Irradiation for better foods. Trends in Food Science and Technology.17:148-152.

8. Feed Manufacturing Technology-IV, American Feed Industry Association, pp 121-122, Robert R.Mc

9. Ellhiney.1994.

10. Food and Drug Administration.1981. Irradiation in the production, processing, and handling of food; final rule.

11. 21 CFR Part 179. Federal Register 51:13376-13399.

12. Garrison, R.2005. Pelleting. In. Feed Technology V. American Feed Industry Assn. pp 149-151.

13. Gharaghani, H., M. Zaghari, G. shahhoseini and H. Moravej. 2008. Effect of gamma irradiation on anti

14. nutritional factors and nutritional value of canola meal for broiler chickens. Asian-Aust. J. Anim. Sci. 21:1479-1485.

15. Israelsen, M., Busk, J. and Jensen, J.1981. Pelleting properties of dairy compounds with molasses,alkali-

16. treated straw and other by-products. Feedstuffs, 53: 26-28.

17. Jones B. L. 2005. The endogenous endoprotease inhibitors of barley and malt and their roles in malting and

18. brewing. J. Cereal Sci. 42:271–280.

19. 14.Moritz, J.S., Lilly, K.G.S 2010. Production strategies and feeding opportunities for pellets of high quality.

20. In: Proceedings of the 8th Annual Mid-Atlantic Nutrition Conference, University of Maryland,ollege Park,MD, pp. 85–90.

21. Mussatto, S.I .G. Dragone, J.A.Teixeiraand I.C. Roberto 2008.Total reuse of Brewer's Spent Grain in Chemical and Biotechnological Processes for the production of added-value compounds.

22. Bioenergy: Challenges and OpportunitiesInternational Conference and Exhibition on Bioenergy

23. April 6th – 9th Universidade do Minho, Guimarães, Portugal.

24. Shipe, K.J., Evans, A.M., Lilly, K.G.S., Shires, L.K., Swiger, B.N., Moritz, J.S .2011.Effects of feed

25. manufacture techniques that vary feed exposure to pellet die heat and pressure on pellet quality and subsequent broiler lysine utilization. Poult. Sci. 90 (Suppl. 1): 105.

26. SPSS. 2007. SPSS User's Guide, version 16.0, SPSS Inc., New York, USA.

27. Taghinejad, M., A. Nikkhah, A. A. Sadeghi, G. Raisali1 and M. Chamani .2009. Effects of Gamma Irradiation on Chemical Composition,Antinutritional Factors, Ruminal Degradation and In vitro Protein

28. Digestibility of Full-fat Soybean.Asian-Aust. J. Anim. Sci. 22, (4): 534 – 541.

29. Tamminga, S. and Goelema, J.O .1995. The significance of rate and site of starch digestion in ruminants.

30. Carbohydrates in feeds for ruminants. Proc. SCI, 28 February. London, UK.

31. Thomas, M., van der Poel, A.F.B. 1996.Physical quality of pelleted animal feed 1.Criteria for pellet quality.

32. Anim. Feed Sci. Technol. 61: 89-112.

33. Thomas, M., van Vliet, T., van der Poel, A.F.B 1998). Physical quality of pelleted animal feed: 3 Contribution of feedstuff components. Anim. Feed Sci. Technol.70: 59–78.

34. Van der Poel, A.F.B., Verstegen, M.W.A. and Tarnminga, S. 1995. Chemical, physical and nutritional effects of feed processing technology. In: 16th Western Nutrition Conference, 13- 14 September 1995, Saskatoon Sask., Canada. 266 pp.

TABLE 1

Unbalanced experimental block design (X represents repeated experiments)

Inclusion Level of BSG In Percent	Gamma Irradiation Dose		
	0 kGy	**7 kGy**	**14 kGy**
5	xx	xx	xx
10	xx	xx	xx
15	xxx	xxx	xxx
20	xxxx	xxx	xxx

Table 2
Effect of Inclusion level of Gamma Irradiated BSG on Pellet Production rate (Kg/hr)and Pellet Durability Index

Gamma Irradiation Dose	Inclusion Level (per cent)	Production Trial	Pellet Production Kg/Hr	Pellet Durability Index (per cent)
	0	T_0	156.04 ± 3.21	95.02 ± 0.248
0 kGy	5	T_1	$163.48^{cde}\pm3.23$	$95.94^{c}\pm0.248$
	10	T_2	$158.75^{bcd}\pm3.09$	$95.39^{c}\pm0.237$
	15	T_3	$138.02^{a}\pm3.09$	$94.50^{b}\pm0.237$
	20	T_4	$133.40^{a}\pm3.23$	$93.48^{a}\pm0.248$
7 kGy	5	T_9	$160.06^{bcd}\pm3.23$	$95.66^{c}\pm0.248$
	10	T_{10}	$167.93^{def}\pm3.09$	$95.81^{c}\pm0.237$
	15	T_{11}	$157.93^{bc}\pm3.09$	$93.95^{ab}\pm0.237$
	20	T_{12}	$155.25^{bc}\pm3.23$	$93.58^{a}\pm0.248$
14 kGy	5	T_{13}	$169.74^{ef}\pm3.23$	$95.84^{c}\pm0.248$
	10	T_{14}	$175.76^{f}\pm3.09$	$95.98^{c}\pm0.237$
	15	T_{15}	$154.46^{bc}\pm3.09$	$96.97^{d}\pm0.237$
	20	T_{16}	$151.93^{b}\pm3.23$	$94.594^{b}\pm0.237$

[a, b ,c, d, e, f] Mean values with different superscripts in a rows differ significantly ($P<0.05$)

RESEARCH ARTICLE

Structural Analysis of Weak Efficient Frontier in DEA

I.Roshdi, G.R. Jahanshahloo* and F. Hosseinzadeh Lotfi

Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran.

*Address for correspondence
Gholam Reza Jahanshahloo
Professor of Applied Mathematics, Department of Mathematics,
Science and Research Branch,
Islamic Azad University,
Tehran, Iran.
E-mail: jahanshahloo@khu.ac.ir

ABSTRACT

Identifying the frontier of the technology set in data envelopment analysis (DEA) provides a valuable explicit external representation of the technology and is highly useful in many areas of DEA.The frontier of the technology set consists of two types of full dimensional facets, efficient and weak. Although considerable research studies have been carried out on determiningefficient facets, there are many cases where knowledge of weak facets is required for a thorough analysis. In this study, we provide a comprehensive analysis of the full dimensional weak facets of the constant returns to scale based technology set. Furthermore, using this characterization, we then propose an algorithm to identify all of these facets. We elaborate our algorithm by an illustrative example.

Key words: Data envelopment analysis; Production possibility set; Weak frontier; Weights and multipliers; Mixed integer linear programming.

INTRODUCTION

DEA (Data Envelopment Analysis), introduced by Charnes et al. [1]is a powerful technique for assessing the relative efficiency of a set of homogeneous decision making units (DMUs) with multiple inputs and multiple outputs. Based onobserved data and a set of postulates, DEA constructs a reference technology set known as production possibility set (PPS), whose frontier identifies the relatively most efficient DMUs. Depending on the position of a DMU relative to the frontier of the PPS, it is classified as efficient or inefficient.

I.Roshdi *et al.*

One of the highly pertinent problems in the DEA literature is the issue of identifying the frontier of the PPS. The frontier of the PPS is composed of two different types of facets: full dimensional efficient facets (FDEFs) and full dimensional weak facets (FDWFs). While many research studies have been conducted on characterizing and finding FDEFs [2-7], the structures and identification of FDWFs, particularly for the constant returns to scale (CRS) based PPS, were not investigated in the literature.Moreover, there are many PPSs of DEA models in which the number of extreme efficient DMUs lying on each facet is less than the total number of inputs and outputs; and, consequently, all of the full dimensional facets are weak. Thus, identification all of these FDWFs provides a valuable explicit external representation of the technology and is highly useful in many areasof DEA such as identifying the reference set for an inefficient DMU [3], (ii) finding closest target for an inefficient DMU [8-9], grouping DMUs according to their frontiers [10] and using them for sensitivity and stability analysis [11-12].

So far, very few studies have been conducted on determining FDWFs and characterizing their structures. Recently, Jahanshahloo et al. [13-14] have proposed two different algorithms for finding the "weak defining hyperplanes" of the PPS under variable returns to scale (VRS) assumption [15]. There are, however, considerable structural differences between the VRS and CRS –based PPS. There is no research work that have directly and comprehensively discussed about the structures and fining FDWF of the CRS-PPS.

In this paper, using basic concepts of the theory of polyhedral sets, first, we establish a detailed characterization of the structure of the FDWFs within the CRS-based technology. Then, we propose a mixed integer linear programming (MILP) based algorithm for determining all FDWFs of the PPS. The computational advantages of our algorithm will be explained in Section 4. In addition, our algorithm's program is easily programmed as GAMS decks and solved using GAMS's interface to the MILP branch and bound solvers as BONMIN.

This remainder of the paper isorganized as follows. The primal descriptions of the PPS concentrating on the representation of the CRS-based technology are reported in Section 1. Sections 2 and 3 include the characteristics, structures, and identification of the FDWFs. In Section 4, we explain our proposed algorithm. An illustrative example is presented in Section 5, which intuitively describes our proposed algorithm for finding all FDWFs of the PPS. The conclusion and future directions for research are summarized in the last section.

Preliminaries

Throughout the paper, we are dealing with n observed DMUs; each uses m inputs to produce s outputs. To establish the notation for subsequent use, for every$j \in J = \{1, \ldots, n\}$we use $\mathbf{x}_j = (x_{1j}, \ldots, x_{mj})^T \in \mathbb{R}_{\geq 0}^m$ and

$\mathbf{y}_j = (y_{1j}, \ldots, y_{sj})^T \in \mathbb{R}_{\geq 0}^s$ to show the input and output vectors of DMU_j, respectively.Note that the vectors are in bold;$\mathbf{x}_j \neq \mathbf{0}_m$ and$\mathbf{y}_j \neq \mathbf{0}_s$, where $\mathbf{0}$ is a vector of an appropriate dimension with the value 0 in every entry.

Further, the superscript T stands for a vector transpose. We also use the subscript$o \in \{1, \ldots, n\}$as the index of the under evaluation DMU.

To facilitate our discussion, following Charnes et al. [16], we further assume that the data domain is in reduced form. A data domain is said to be in reduced form if for no pair$(j, k)$with$j \neq k$and the scalar$\alpha$is$\mathrm{DMU}_k = \alpha\mathrm{DMU}_j$.

The production possibility set (PPS) or the technology set, *T*, is defined as the set of all technologically feasible input–output combinations, i.e.,

I.Roshdi *et al.*

$$\{(x, y) \in \mathbb{R}_{\geq 0}^{m+s} \,|\, \mathbf{x} \text{ can produce } \mathbf{y}\}. \tag{1}$$

Under the standard assumptions of inclusion of observations, convexity, constant returns to scale (CRS) and free disposability of inputs and outputs, the unique non-empty PPS generated from the n observed DMUs, can be represented as the following algebraic form [1]:

$$= \left\{ (x, y) \in \mathbb{R}_{\geq 0}^{m+s} \,\Big|\, \sum_{j \in J} \lambda_j x_j \leq x, \, y \geq \sum_{j \in J} \lambda_j y_j, \, \lambda_j \geq 0, \forall j \in J \right\}. \tag{2}$$

Relative to T_c, Charnes et al. [1]introduced the initial DEA model for measuring the efficiency of DMU_o:

$$
\begin{aligned}
\min \quad & \theta \\
s.t. \quad & \sum_{j \in J} \lambda_j x_j \leq \theta x_o, \\
& \sum_{j \in J} \lambda_j y_j \geq y_o, \\
& \lambda_j \geq 0, \forall j.
\end{aligned}
\tag{3}
$$

This program is called the (input-oriented) envelopment form of the CCR model. DMU_o is *radial efficient* if $\theta^* = 1$; and is *CCR-efficient* if and only if it is radial efficient and all constraints (except the nonnegative ones) are binding at optimality. In other words, DMU_o is CCR-efficient if and only if it is radial efficient and the optimal value of the following model is equal to zero.

$$
\begin{aligned}
\max \quad & \sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+ \\
s.t. \quad & \sum_{j \in J} \lambda_j x_{ij} = \theta^* x_{io} + s_i^-, \quad i = 1, \ldots, m, \\
& \sum_{j \in J} \lambda_j y_{rj} = y_{ro} - s_r^+, \quad r = 1, \ldots, s, \\
& \lambda_j \geq 0, s_i^- \geq 0, s_r^+ \geq 0, \forall j, i, r.
\end{aligned}
\tag{4}
$$

The set of all DMUs corresponding to positive λ_j^*'s, denoted by R_o, is called the *reference set* to DMU_o, i.e.,

$$R_o = \left\{ \mathrm{DMU}_j \,\big|\, \lambda_j^* > 0 \text{ in some optimal solution to } (4) \right\}.$$

The dual of the model (4), called the *multiplier form*of the CCR model, is as follows:

$$\max \quad \mathbf{U}^T \mathbf{y}_o$$
$$s.t. \quad \mathbf{V}^T \mathbf{x}_o = 1,$$
$$\mathbf{U}^T \mathbf{y}_o - \mathbf{V}^T \mathbf{x}_o \leq 0, \qquad (5)$$
$$\mathbf{U} \geq 0, \mathbf{V} \geq 0.$$

DMU_o is CCR-efficient, if there exists at least one optimal solution $(\mathbf{U}^*, \mathbf{V}^*)$ tothe model(5), with $(\mathbf{U}^*, \mathbf{V}^*) > 0$

and $\mathbf{U}^{*T} \mathbf{y}_o = 1$; otherwise, DMU_o is CCR-inefficient.

Charnes et al. [16] introduced a detailed classification of the DMUs with reference tothe CCR model. They classified

the radial efficient DMUs into the categories E, E' and F. Following[16], we call elements of E, E' and F,

respectively *extreme* CCR-efficient, *non-extreme* CCR-efficientand *weak* CCR-efficient. DMU_o is extreme CCR-efficient

if and only if $R_o = \{\mathrm{DMU}_o\}$. To employ our algorithm that will be presented in Section 4, we need to determine

all the extreme CCR-efficient DMUs.Jahanshahloo et al. [6]proposed the following linear programming programto identify all the extreme CCR-efficient DMUs in one step:

$$\max \gamma_o = \sum_{j \in J - \{o\}} \lambda_j$$
$$s.t. \quad \sum_{j \in J} \lambda_j \mathbf{x}_j \leq \mathbf{x}_o,$$
$$\sum_{j \in J} \lambda_j \mathbf{y}_j \geq \mathbf{y}_o, \qquad (6)$$
$$\lambda_j \geq 0, \forall j.$$

Lemma 1. DMU_o is extreme CCR-efficient if and only if the optimal value of model (6) is zero, i.e. $\gamma_o^* = 0$.

Please see [1] for the proof.

I.Roshdi *et al.*

STRUCTURES OF THE FDWFS OF T_c

It is well-known that if $(\mathbf{U}^*$ be an optimal solution to the model(5), then $H: \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ is a *supporting hyperplane* of , i.e., the inequality $\mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ is satisfied for any $(\mathbf{x}, \mathbf{y})$. Thus, the set

$$F = T_c \cap \left\{ (\mathbf{x}, \mathbf{y}) \in \mathbb{R}^{m+s} : \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x} = 0 \right\} = H \text{ is a face of}$$

. If all the coordinates of $(\mathbf{U}^*$ is not positive, then is called *weak supporting* and the corresponding face, H^*, is called *weak face*. On the other hand, If $(\mathbf{U}^*, \mathbf{V}^*)$ then is called *strong supporting* and the corresponding face, H^*, is called *strong face*.

To illustrate the above defined concepts, consider $D1$ in Fig 1.As can be seen, there are an infinite number of hyperplanes passing through $D1$, of which only the two hyperplanes and are *defining*. While the former is a weak supporting hyperplane, the latter is a strong one. Hence, $F_1 = H_1$ and $F_2 = H_2$ are weak and strong facets of. We are going to examine the structure of the FDWF of and devise an algorithm for determining all of them. To comprehensively characterize the structure of an FDWF of , we need the following definitions and preliminaries:

Definition1.

Let $H: \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ be a supporting hyperplane of . Then, $F = H$ is called an FDEF of if (i) there exists at least one affine independent set with m elements of CCR-efficient DMUs lying on $F = H$, and (ii) all multipliers are strictly positive, i.e., $(\mathbf{U}^*, \mathbf{V}^*)$.

The hyperplane satisfying Definition 1 is called a Strong Defining Hyperplane (SDH) of.

Definition 2.

Let $H: \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ be a supporting hyperplane of . Then, $F = H$ is called a full dimensional weak facet (FDWF) of , if (i) there exists at least one affine independent set with m elements of CCR-efficient or radial efficient DMUs (observed or virtual) lying on $F = H$, and (ii) all multipliers are not strictly positive, i.e., $(\mathbf{U}^*$ have some zero components.

The hyperplane satisfying Definition 2 is called a *Weak Defining Hyperplane* (WDH) of .

Suppose that $H: \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ is a supporting hyperplane of . If the activities $($ and $($ belong to and lie on , then the activity $\mu(\bar{\mathbf{x}}, \bar{\mathbf{y}}) + \eta ($ belongs to and lies on H for any positive scalars and . Therefore, the intersection of each supporting hyperplane with , $F = H$, is a *convex polyhedral cone.* Each convex polyhedral cone is fully characterized by its extreme recession directions.

I.Roshdi *et al.*

The following theorem completely characterizes the extreme directions of the face $F = H$, where is a supporting hyperplane of .

Theorem 1. Suppose that $H: \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ is a supporting hyperplane of .

    (i)   If DI is an extreme CCR-efficient DMU lying on , then it is an *extreme direction* of the face, H.

    (ii)   If v_k^* for some $k \in \{1, ...,$ then the vector $\mathbf{d}_k = (\mathbf{e}$ is an extreme direction of the face H.

    (iii)   If u_q^* for some $q \in \{1, ...,$ then the vector $\mathbf{d}_q = (\mathbf{0}, -$ cannot be a feasible direction for the set H at DI (there does not any feasible direction corresponding this case).

Proof. See Appendix A.

Theorem 2 below demonstrates that at least one extreme direction of the facet H (is a WDH of) must be of type (i). In the other words, Theorem 2 emphasizes that all extreme directions of the facet H cannot be just of type (i), and it must have a direction as type (ii).

Theorem 2. Suppose that $H: \mathbf{U}^{*T}\mathbf{y} - \mathbf{V}^{*T}\mathbf{x}$ is a supporting hyperplane of . Then, there exists at least one extreme CCR-efficient DMU lying on .

Proof. See Appendix A.

Identification of the fdwfs

Suppose that $H: \mathbf{U}^T\mathbf{y} - \mathbf{V}^T\mathbf{x} = 0$ is a supporting hyperplane of T_c passing through DMU_o. As we mentioned above, $H \cap T_c$ is a convex polyhedral cone that is generated by its extreme recession directions. Let $D = \{\mathbf{d}_1, ..., \mathbf{d}_k\}$ be the set of all extreme recession directions of the facet $H \cap T_c$. Then,

$$F = H \cap T_c = pos(D) = \left\{ \mathbf{d} \mid \mathbf{d} = \sum_{j=1}^{k} \rho_j \mathbf{d}_j , \rho_j \geq 0, j = 1, ..., k \right\}.$$

If H is strong, then $D \subseteq E$. Otherwise the set D, in addition to extreme CCR-efficient elements, must have elements like $\mathbf{d}_h = (\mathbf{e}_h, \mathbf{0})$, where $\mathbf{d}_h$ is corresponding to the zero component $v_h = 0$ of the vector $\mathbf{V}$. Thus, to identify a WDH passing through DMU_o, we should determine a weak supporting hyperplane as $H: \mathbf{U}^T\mathbf{y} - \mathbf{V}^T\mathbf{x} = 0$ such that, first, the number of zero components of the vector $\mathbf{V}$ is maximal (equivalently, the hyperplane has the maximum number of extreme recession directions as type (ii) in Theorem 1) and, second, the hyperplane passes through the maximum number of extreme CCR-efficient DMUs. To achieve this, we formulate the following mixed integer linear programming (MILP) problem:

4238

I.Roshdi *et al.*

$$\min \phi_o = |E|\sum_{i=1}^{m} G_i + \sum_{j \in E} I_j$$

$$s.t. \quad \mathbf{U}^T \mathbf{y}_o = 1,$$

$$\mathbf{V}^T \mathbf{x}_o = 1,$$

$$\mathbf{U}^T \mathbf{y}_j - \mathbf{V}^T \mathbf{x}_j + t_j = 0, \quad j \in E, \tag{7}$$

$$t_j \le MI_j, \quad j \in E,$$

$$v_i \le MG_i, \quad i = 1,..,m,$$

$$U \ge 0, V \ge 0, G_i \in \{0,1\}\, I_j \in \{0,1\}, t_j \ge 0, \forall i,j,$$

where E is the set of all extreme CCR-efficient units and M is a sufficiently large positive quantity.

Note that $I_j = 0$ and $G_i = 0$ if and only if $t_j = 0$ and $v_i = 0$, respectively, i.e., DMU_j and $\mathbf{d}_i = (\mathbf{e}_i, \mathbf{0})$ belong to the recession directions of the face $H \cap T_c$ in which $H: \mathbf{U}^T \mathbf{y}_o - \mathbf{V}^T \mathbf{x}_o = 0$. Then, since we are minimizing $|E|(\sum_{i=1}^{m} G_i) + \sum_{j \in E} I_j$, and $I_j \in \{0,1\}$ and $G_i \in \{0,1\}$, the model (7) will be directed toward finding optimal solutions with as many $I_j = 0$ and $G_i = 0$ as possible, i.e., with as many possible $t_j = 0$ and $v_i = 0$. The coefficient $|E|$ in the objective function is to show priority of the maximum number of zero components in the vector $\mathbf{V}$ over the maximum number of extreme CCR-efficient DMUs lying on the corresponding hyperplane.

Theorem 3. Suppose that DMU_o is an extreme CCR-efficient DMU. If there exists at least one WDH passing through DMU_o and $(\mathbf{U}^*, \mathbf{V}^*)$ is an optimal solution to the model (7) in which $(\mathbf{U}^*, \mathbf{V}^*)$ is not positive, then $H^*: \mathbf{U}^{*T}\mathbf{y}_o - \mathbf{V}^{*T}\mathbf{x}_o == 0$ is a WDH of T_c.

Proof. See Appendix A.

Corollary 1. Assume that the conditions of Theorem 3 are fulfilled. Further, suppose that DMU_o is an extreme CCR-efficient DMU and the vector $(\mathbf{U}^*, \mathbf{V}^*)$ is an optimal solution of the model (7)which is not positive. Then $(\mathbf{U}^*, \mathbf{V}^*)$ is an extreme (basic) optimal solution of the model (7) obtained via the simplex method.

PROPOSED ALGORITHM FOR FINDING ALL THE WDHS OF T_c

In this section, by characterizing the structure of FDWFs established in Section 4, wepropose an algorithm for identifying all the FDWFs of T_c. Our algorithm performs the following procedure for each extreme CCR-efficient DMU at each stage.
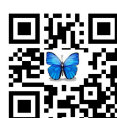
Main procedure. Consider the extreme CCR-efficient observed unit, DMU_o, evaluated by the model (7). By Theorem 3, if there exists at least one FDWF containing DMU_o, then the optimal solution of the model (7) is the gradient of a WDH passing through DMU_o and it is not *positive* for the vectors $\mathbf{U}$ and $\mathbf{V}$. If the vectors $\mathbf{U}$ and $\mathbf{V}$ associated with the optimal solution of the model (7) are positive, then the procedure will be terminated for DMU_o. The procedure implements the following step till the vectors $\mathbf{U}$ and $\mathbf{V}$ associated with the optimal solution of the model (7) are not positive.

Main step. Suppose that $\phi_o^* = |E| - k$ and $(\mathbf{U}^*, \mathbf{V}^*)$ are the optimal objective and optimal solution of the model (7), respectively. Let $H_o^*: \mathbf{U}^{*T}\mathbf{y}_o - \mathbf{V}^{*T}\mathbf{x}_o = 0$ and $F_o = H_o^* \cap T_c$. Take H_o^* as a WDH of T_c and let $J_o = \{j: I_j^* = 0\}$ and $G_o = \{i: G_i^* = 0\}$. The set J_o contains the indices of all the extreme CCR-efficient DMUs lying on H_o^* and the set G_o contains the indices of the components of the vector $\mathbf{V}^*$ that are zero. Next, we add the following constraint to the constraints of the model (7):

$$\sum_{j \in J_o} I_j + |E| \sum_{i \in G_o} I_i - \left(\sum_{j \in J_o} I_j + |E| \sum_{i \in G_o} I_i \right) \leq \phi_o^* - 1. \qquad (8)$$

; and evaluate DMU_o by the model (7) again. If, in addition to H_o^*, there exists another WDH passing through DMU_o, the model (7) with the newly added constraint (8) yields the gradient of another WDH passing through DMU_o as an alternative optimal solution. We save this WDH and construct the new sets J_o and G_o corresponding to the new WDH. If there does not exist another WDH except H_o^* passing through DMU_o, then the procedure is terminated for DMU_o.

Suppose that the implementation of the procedure is repeated *t* times for DMU_o. Then, *t* WDHs are determined.

Note that in the final step, the model (7) will have exactly *t* new added constraints corresponding to *t* WDHs. Finally, after the implementation of the main procedure for DMU_o, all WDHs of T_c passing through it and all the extreme CCR-efficient DMUs lying on these hyperplanes will be determined.

The Main procedure is performed for every extreme CCR-efficient DMU. To avoid obtaining the gradients of iterated WDHs determined in the implementation of the main procedure for DMU_o, we will add the constraint $I_o = 1$ to the constraints of the model (7) in all subsequent stages.

Note that, since the dimension of each FDWF of T_c is $m + s - 1$, if $|J_o \cup G_o| < m + s - 1$, then the procedure will be automatically terminated.

The algorithm in each step gives an extreme (basic) optimal solution of the model (5); equivalently in each step gives the gradient of a defining (weak or strong) hyperplane passing through DMU_o. Thus, the above algorithm by using

I.Roshdi *et al.*

the model (7), first gives the WDHs and then gives the SDHs of T_c, if there exist SDHs passing through DMU_o.

Theorem 4 below guarantees that the algorithm produces all the WDHs of T_c.

Theorem 4. The vectors $\mathbf{U}$ and $\mathbf{V}$ associated with the optimal solution of the model (7) are not positive as long as there exists a WDH passing through DMU_o.

Proof. See Appendix A.

Computational advantages of the algorithm:

➢ To identify all the FDWFs of T_c, we need only implement the algorithm for extreme CCR-efficient DMUs.

➢ Computational cost of the algorithm decreases progressively at every stage. In fact, the algorithm is designed in such a way that WDHs obtained in previous stages will not be repeated again. This is achieved by adding the constraints $I_j = 1, j = 1, \dots, k$, before moving to stage $k + 1$.

➢ As mentioned in Corollary 1, in the implementation of the procedure for DMU_o, in each step the procedure gives an extreme (basic) optimal solution of the model (5). Our algorithm is designed in such a way that it finds only all the non-positive extreme optimal solutions of the model (5) and the algorithm is automatically terminated as soon as there is no more non-positive optimal solution.

Summary of the algorithm for finding all WDHs:

Suppose that we have n observed DMUs, $\mathrm{DMU}_j, j \in J$. Evaluate these DMUs by the model (5).

Let $E = \left\{ \mathrm{DMU}_j : \mathrm{DMU}_j \text{ is extreme CCR-efficient} \right\}$.

Set $E_T = \emptyset$ and $S = \emptyset$.

Step1. Choose $\mathrm{DMU}_p \in E - E_T$ and set $E_p = \emptyset$ and $S_p = \emptyset$.

Step 2. Evaluate DMU_p using the model(7). If the optimal solution, $(\mathbf{U}^*, \mathbf{V}^*)$, is positive, then set $E_T = E_T \cup \left\{ \mathrm{DMU}_p \right\}$, and go to Step 5. Otherwise, go to Step 3.

Step 3. For $(\mathbf{U}^*, \mathbf{V}^*)$, set $J_p = \left\{ j \in E : I_j^* = 0 \right\}$ and $G_p = \left\{ i : G_i^* = 0 \right\}$. If $\left| J_p \cup G_p \right| < m + s - 1$, then set $E_T = E_T \cup \left\{ \mathrm{DMU}_p \right\}$ and go to Step 5; otherwise, put the hyperplane $H_p : \mathbf{U}^{*T} \mathbf{y} - \mathbf{V}^{*T} \mathbf{x} = 0$ into set S_p. Set, $E_p = E_p \cup J_p, S_p = S_p \cup \left\{ H_p \right\}$ and $S = S \cup \left\{ S_p \right\}$.

Step4. Add the constraint

$$\sum_{j \in J_p^c} I_j + |E| \sum_{j \in G_p^c} I_j - \left(\sum_{j \in J_p} I_j + |E| \sum_{j \in G_p} I_j \right) \le \phi_p^* - 1$$

to the constraints of the model (7) and go to Step 2.

Step 5. Add constraint $I_p = 1$ to the constraints of the model (7). If $E = E_T$,the algorithm is terminated; otherwise go to step 1.

ILLUSTRATION OF THE PROPOSED APPROACH

In this section we implement our proposed algorithm for the data listed in Table 1. Consider four DMUs are shown in Table 1, which use two inputs to produce one output. The PPS, T_c, constructed by these DMUs are depicted in Fig 3. For more explanations, the algorithm is presented stage by stage.

<INSERT Table 1 HERE>
<INSERT Fig. 3 HERE>

Clearly all the units are extreme CCR-efficient except D. Therefore,$E = \{A, B, C\}$.

Stage 1:

Let $E_T = \emptyset$ and $S = \emptyset$. Put $A \in E$.

Step 1-1. Evaluate A by the model (7). Then, the optimal solution$I_A^* = 5$, and $(v_1^*, v_2^*, u^*) = (1,0,1)$ is obtained. Since (v_1^*, v_2^*, u^*) is not positive, $H_{1A}: y - x_1 = 0$ is a WDH of T_c and we have $S = \{H_{1A}\}$. Furthermore,$t_A^* = 0$ and $v_2^* = 0$; hence, $J_A = \{A\}$, $G_A = \{2\}$,$J_A^c = \{B, C\}$ and $G_A^c = \{1\}$. Construct the following constraint:

$$\sum_{j \in J_A^c} I_j + 3\sum_{i \in G_A^c} G_i - \left(\sum_{j \in J_A} I_j + 3\sum_{i \in G_A} G_i\right) \leq I_A^* - 1 = 4.$$

Step 1-2. Add the above constraint to the constraints of the model (7) and again evaluate A by thismodel. Then, the optimal solution$I_A^* = 7$, and $(v_1^*, v_2^*, u^*) = (0.3, 0.6, 1)$ is obtained. Since $(v_1^*, v_2^*, u^*) > 0$, $H_{2A}: y - 0.3x_1 - 0.6x_2 = 0$ is a SDH of T_c, so the algorithm is terminated for A. Hence $E_T = \{A\}$ and the set S doesn't change.

Add the constraint $I_A = 1$ to the constraints of the model (7) and move to the next stage.

Stage 2:

Step 2-1. Put $B \in E - E_T$ and evaluate this unit by the model (7). Then, the optimal solution$I_B^* = 7$, and $(v_1^*, v_2^*, u^*) = (0.125, 0.375, 1)$ is obtained. Since $(v_1^*, v_2^*, u^*) > 0$, $H_B: y - 0.125x_1 - 0.375x_2 = 0$ is a SDH of T_c, so the algorithm is terminated for B. Hence,$E_T = \{A, B\}$ and the set S doesn't change.
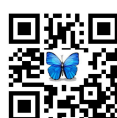
Add the constraint $I_B = 1$ to the constraints of the model (7) and move to the next stage.

Stage 3:

Step 3-1. Put $C \in E - E_T$ and evaluate this unit by the model (7). Then, the optimal solution $I_C^\varepsilon = 5$, and $(v_1^*, v_2^*, u^*) = (0, 1, 1)$ is obtained. Since (v_1^*, v_2^*, u^*) is not positive, $H_{1C}: y - x_2 = 0$ is a WDH of T_C and we have $S = \{H_{1C}\}$. Furthermore, $t_C^* = 0$ and $v_1^* = 0$; hence, $J_C = \{C\}, G_C = \{1\}, J_C^\varepsilon = \{A, B\}$ and $G_C^\varepsilon = \{2\}$. Construct the following constraint

$$\sum_{j \in J_C^\varepsilon} I_j + 3 \sum_{i \in G_C^\varepsilon} G_i - \left(\sum_{j \in J_C} I_j + 3 \sum_{i \in G_C} G_i \right) \le I_C^\varepsilon - 1 = 4.$$

Step 3-2. Add the above constraint to the constraints of the model (7) and again evaluate C by this model. Then, the optimal objective is $I_C^\varepsilon = 7$, and $(v_1^*, v_2^*, u^*) = (0.125, 0.375, 1)$ is obtained. Since $(v_1^*, v_2^*, u^*) > 0$, $H_{2C}: y - 0.125x_1 - 0.375x_2 = 0$ is a SDH of T_C, so the algorithm is terminated for C. Hence $E_T = \{A, B, C\}$ and the set S doesn't change.

Therefore, $S = \{H_{1A}, H_{1C}\}$ and since $E = E_T$, the algorithm is totally terminated.

CONCLUSION

In this paper, a detailed characterization of FDWFs of the CRS-based DEA technology set has been provided. We demonstrated that each FDWF of this PPS is a convex polyhedral cone;and provided a complete specification of its generators i.e. its extreme recession direction.In addition, we developed a binary MILP, the model (7), for finding all FDWFs passing through a specific extreme CCR-efficient DMU. Using this information, we proposed an algorithm for identifying all the FDWFs of T_C. Our algorithm has several computational advantages and can be easily

programmed as GAMS decks. Furthermore, via the implementation of this algorithm, all the extreme (basic) optimal solutions of model (5) will be automatically generated.

Appendix A

Proof of Theorem 1. (i).Let DMU_o be an extreme CCR-efficient DMU that lies on H. Since $H \cap T_C$ is a convex cone, the point $(\tilde{\mathbf{x}}, \tilde{\mathbf{y}}) + \lambda(\mathbf{x}_o, \mathbf{y}_o)$ lies on $H \cap T_C$ for any point $(\tilde{\mathbf{x}}, \tilde{\mathbf{y}})$ in $H \cap T_C$ and any non-negative scalar λ. Therefore, $(\mathbf{x}_o, \mathbf{y}_o)$ is a recession direction of $H \cap T_C$. By the way of contradiction, we claimthat this direction is also extreme. Otherwise, there exist two distinct recession directions of $H \cap T_C$ (i.e., two distinct points of $H \cap T_C$), namely $\bar{\mathbf{d}}$ and $\mathring{\mathbf{d}}$, and two positive scalars $\bar{\alpha}$ and $\tilde{\alpha}$ such that $(\mathbf{x}_o, \mathbf{y}_o) = \bar{\alpha}\bar{\mathbf{d}} + \tilde{\alpha}\mathring{\mathbf{d}}$. Since $\bar{\mathbf{d}}, \mathring{\mathbf{d}} \in H \cap T_C$, there exist two nonnegative vectors, namely $\bar{\boldsymbol{\lambda}}$ and $\mathring{\boldsymbol{\lambda}}$, such that

I.Roshdi *et al.*

$$\mathbf{\bar{d}} = \sum_{j=1}^{n} \bar{\lambda}_j (\mathbf{x}_j, \mathbf{y}_j) \text{ and } \mathbf{\mathring{d}} = \sum_{j=1}^{n} \mathring{\lambda}_j (\mathbf{x}_j, \mathbf{y}_j).$$

So, we have

$$(\mathbf{x}_o, \mathbf{y}_o) = \bar{\alpha} \sum_{j=1}^{n} \bar{\lambda}_j (\mathbf{x}_j, \mathbf{y}_j) + \tilde{\alpha} \sum_{j=1}^{n} \mathring{\lambda}_j (\mathbf{x}_j, \mathbf{y}_j).$$

Let us define $\hat{\lambda}_j = \bar{\alpha}\bar{\lambda}_j + \tilde{\alpha}\mathring{\lambda}_j, j = 1, \dots, n$. Then, $\mathbf{x}_o = \sum_{j=1}^{n} \hat{\lambda}_j \mathbf{x}_j$ and $y_o = \sum_{j=1}^{n} \hat{\lambda}_j \mathbf{y}_j$, indicating

that $(\theta = 1, \hat{\lambda}_1, \dots, \hat{\lambda}_n)$ is a feasible solution to the model (3) in evaluating DMU_o, for which $\hat{\lambda}_t > 0$ for some

index $t \neq o$. This is a contradiction and proves our claim.

(ii). Let $v_k^* = 0$ for some $k \in \{1, \dots, m\}$. Then, from the orthogonally of $\mathbf{d}_k = (\mathbf{e}_k, \mathbf{0})$ and the disposability

postulate of T_c, it is obvious that the point $(\tilde{\mathbf{x}}, \tilde{\mathbf{y}}) + \lambda(\mathbf{e}_k, \mathbf{0})$ lies on $H \cap T_c$ for any point $(\tilde{\mathbf{x}}, \tilde{\mathbf{y}})$ in $H \cap T_c$ and

any positive scalar λ. Therefore, $\mathbf{d}_k = (\mathbf{e}_k, \mathbf{0})$ is a recession direction of $H \cap T_c$. We claim that this direction is

also extreme. Assume, by the way of contradiction, that there exist two distinct recession directions of $H \cap T_c$,

namely $\mathbf{\bar{d}}$ and $\mathbf{\mathring{d}}$, and two positive scalars $\bar{\alpha}$ and $\tilde{\alpha}$ such that $(\mathbf{e}_k, \mathbf{0}) = \bar{\alpha}\mathbf{\bar{d}} + \tilde{\alpha}\mathbf{\mathring{d}}$.

Let $\mathbf{\bar{d}} = (\mathbf{\bar{d}}_x, \mathbf{\bar{d}}_y)$ and $\mathbf{\mathring{d}} = (\mathbf{\mathring{d}}_x, \mathbf{\mathring{d}}_y)$, where $\mathbf{\bar{d}}_x, \mathbf{\mathring{d}}_x \in \mathbb{R}_{\geq 0}^m$ and $\mathbf{\bar{d}}_y, \mathbf{\mathring{d}}_y \in \mathbb{R}_{\geq 0}^s$. Then, from the previous

relation follows that $\mathbf{\bar{d}}_y = \mathbf{\mathring{d}}_y = \mathbf{0}$, $\mathbf{\bar{d}}_x = \bar{\alpha}\mathbf{e}_k$ and $\mathbf{\mathring{d}}_x = \tilde{\alpha}\mathbf{e}_k$. This is a contradiction and proves our claim.

(iii). Since $u_q^* = 0$, the qth output axes, O_q, is parallel to H. Since the origin belongs to both O_q and H^*, we

have $O_q \subseteq H^*$. If $\mathbf{d}_q = (\mathbf{0}, \mathbf{e}_q)$ is a feasible direction for $H^* \cap T_c$ at DMU_o, then there exists some $\delta > 0$ such

that $(\mathbf{x}_o, \mathbf{y}_o) + \lambda(\mathbf{0}, \mathbf{e}_q) \in H^* \cap T_c$ for each $0 \leq \lambda < \delta$. This means that the activity

$(\mathbf{x}_o, \mathbf{y}_o + \lambda\mathbf{e}_q) \in H^* \cap T_c, 0 < \lambda < \delta$ dominates DMU_o. This is a contradiction. ∎

Proof of Theorem 2. Since H is a supporting hyperplane of T_c, it satisfies the following conditions:

(i) $\mathbf{U}^{*T}\mathbf{y}_j - \mathbf{V}^{*T}\mathbf{x}_j \leq 0, j \in J$.

(ii) There exists some radial efficient DMU of T_c, namely $(\bar{\mathbf{x}}, \bar{\mathbf{y}})$, where $\mathbf{U}^{*T}\bar{\mathbf{y}} - \mathbf{V}^{*T}\bar{\mathbf{x}} = 0$.

Without loss of generality, by normalizing $\mathbf{U}^{*T}\bar{\mathbf{y}} = \mathbf{V}^{*T}\bar{\mathbf{x}} \neq 0$, we assume that $(\mathbf{U}^*, \mathbf{V}^*)$ is an optimal solution

of the model (5) in evaluating $(\bar{\mathbf{x}}, \bar{\mathbf{y}})$. If $(\bar{\mathbf{x}}, \bar{\mathbf{y}})$ is an extreme CCR-efficient DMU, then we are done; otherwise, there

exists a linear combination as $(\bar{\mathbf{x}}, \bar{\mathbf{y}}) = \sum_{j \in J} \bar{\lambda}_j (\mathbf{x}_j, \mathbf{y}_j)$ in which $\bar{\lambda}_k > 0$ and DMU_k is an extreme CCR-

I.Roshdi *et al.*

efficient for some $k \in J$. Since H is passing through $(\bar{\mathbf{x}}, \bar{\mathbf{y}})$, it passes through all DMUs entered actively in the combination, particularly through DMU_k. ∎

Proof of Theorem 3. Consider DMU_o in Fig 1. Then, using the model (5), it can be seen that there are alternative optimal solutions which define an infinite number of hyperplanes passing through DMU_o, of which only the two hyperplanes H_1 and H_2 are defining. Suppose that N, N_1 and N_2 are the gradient vectors of H, H_1 and H_2, respectively. It is obvious that $N = \lambda N_1 + (1 - \lambda)N_2$ and the gradients of H_1 and H_2 are corresponding to two extreme (basic) optimal solutions when DMU_o is evaluated by the model (5). So it is sufficient to prove that the optimal solution of the model (7) is an extreme (basic feasible) optimal solution of the model (5). By contradiction, suppose that this is not true. Let $(\overline{\mathbf{U}}^1, \overline{\mathbf{V}}^1), \dots, (\overline{\mathbf{U}}^h, \overline{\mathbf{V}}^h)$ be all the extreme (basic) optimal solutions of the model (5) in evaluating DMU_o. Since $(\mathbf{U}^*, \mathbf{V}^*)$ is not an extreme optimal solution of the model (5), it can be represented as a linear convex combination of the vectors $(\overline{\mathbf{U}}^i, \overline{\mathbf{V}}^i)$, $i = 1, \dots, h$. Formally,

$$(\mathbf{U}^*, \mathbf{V}^*) = \sum_{i=1}^{h} \alpha_i (\overline{\mathbf{U}}^i, \overline{\mathbf{V}}^i), \sum_{i=1}^{h} \alpha_i = 1, \alpha_i \geq 0, i = 1, \dots, h. \tag{9}$$

There exists a combination as (9) in which for some $r \in \{1, \dots, h\} \bar{\lambda}_r \neq 0$ and $(\overline{\mathbf{U}}^r, \overline{\mathbf{V}}^r)$ is correspond to gradient vector of a WDH passing through DMU_o namely, $\bar{H}: \overline{\mathbf{U}}^{rT}\mathbf{y} - \overline{\mathbf{V}}^{rT}\mathbf{x} = 0$. From the optimality $(\mathbf{U}^*, \mathbf{V}^*)$ for the model (7), exactly all the constraints binding at $(\mathbf{U}^*, \mathbf{V}^*)$ are also binding at $(\overline{\mathbf{U}}^r, \overline{\mathbf{V}}^r)$ and any other constraint is not binding at $(\overline{\mathbf{U}}^r, \overline{\mathbf{V}}^r)$. Since $(\overline{\mathbf{U}}^r, \overline{\mathbf{V}}^r)$ is correspond to the gradient vector of a WDH passing through DMU_o, we have $\dim(\bar{H} \cap T_v) = \dim(H^* \cap T_v) = m + s - 1$. Therefore, $(\mathbf{U}^*, \mathbf{V}^*)$ is an extreme (basic) optimal solution of the model (5). This completes the proof. ∎

Proof of Theorem 4. By virtue of the type of the added constraints through the implementation of the algorithm, it suffices to prove that the optimal solution of the model (7) for variable $\mathbf{V}$ will not be positive. By the way of contradiction, suppose that the optimal solution of the model (7) for variable $\mathbf{V}^*$ is positive, and $\phi_o^* = (m + 1)|E| - k$. Suppose that $\bar{H}: \overline{\mathbf{U}}^T\mathbf{y}_o - \bar{V}^T\mathbf{x}_o = 0$ is a WDH of T_c that passes through DMU_o. Then $(\overline{\mathbf{U}}, \overline{\mathbf{V}})$ is a feasible solution of model (7) whose objective is $\bar{\phi}_o = (m - t + 1)|E| - l$, where $t \geq 1$ (according to Corollary 1) is the number of zero components of $\overline{\mathbf{V}}$ and l is the number of extreme CCR-efficinet DMUs lying on $\bar{H}$. Observing that k and l are both less than $|E|$, we have $\phi_o^* > \bar{\phi}_o$. This is a contradiction. ∎

REFERENCES

1. Charnes A, Cooper WW, Rhodes E. Measuring the Efficiency of Decision Making Units. Eur J Oper Res 1978;2: 429–444.
2. Yu G, Wei Q, Brockett P, Zhou L. Construction of all DEA Efficient Surfaces of the Production Possibility Set under the Generalized Data Envelopment Analysis Model. Eur J Oper Res 1996;9:, 491–510.
3. Olesen OB, Petersen NC. Identification and Use of Efficient Faces and Facets in DEA. J Prod Anal 2003;20: 323-360.
4. Jahanshahloo GR, Hosseinzadeh Lotfi F, Zhiani Rezai H, Rezai Balf F. Finding Strong Defining Hyperplanes of Production Possibility Set. Eur J Oper Res 2007;177: 42–54.
5. Jahanshahloo GR, Shirzadi A, Mirdehghan M. Finding Strong Defining Hyperplanes of PPS Using Multiplier Form. Eur J Oper Res 2009:194: 933–938.
6. Jahanshahloo GR, Roshdi I, Davtalab-Olyaie M. Characterizing and Finding Full Dimensional Efficient Facets of PPS with Constant Returns to Scale Technology. Inter J Ind Math 2013;5: 149–159.
7. Davtalab-Olyaie M, Roshdi I, Jahanshahloo GR, Asgharian M. Characterizing and Finding Full Dimensional Efficient Facets in DEA: A Variable Returns to Scale. J Oper Res Soc 2014;65: 1453-1464.
8. Silva MCA, Castro P, Thanassoulis E. Finding Closest Targets in Non-oriented DEA Models: The Case of Convex and Non-convex Technologies. J Prod Anal 2003;19: 251 –269.
9. Aparicio J, Ruiz JL, Sirvent I. Finding Closest Targets and Minimum Distance to the Pareto-Efficient Frontier in DEA. J Prod Anal 2007;28:209–218.
10. Chang KP, Guh YY. Linear Production Functions and the Data Envelopment Analysis. Eur J Oper Res 1991;52:215–223.
11. Jahanshahloo GR, Hosseinzadeh Lotfi F, Shoja N, Sanei M, Tohidi G. Sensitivity and Stability Analysis in Data Envelopment Analysis. J Oper Res Soc 2005;56:342–345.
12. Boljuncic V. Sensitivity Analysis of an Efficient DMU in DEA Model with Variable Returns to Scale (VRS). J Prod Anal 2006;25:173–192
13. Jahanshahloo GR, Hosseinzadeh Lotfi F, Akbarian D. Finding Weak Defining Hyperplanes of PPS of the BCC Model. App Math Model 2010;34: 3321–3332.
14. Davtalab-Olyaie M, Roshdi I, Partovi Nia V, Asgharian M. On Characterizing Full Dimensional Weak Facets in DEA with Variable Returns to Scale Technology. Optim 2014;1-21. http://dx.doi.org/10.1080/02331934.2014.917305
15. Banker RD, Charens A, Cooper WW. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. Manag Sci 1984;30: 1078 –1092.
16. Charnes A, Cooper WW, Thrall RM. A Structure for Classifying and Characterizing Efficiency and Inefficiency in Data Envelopment Analysis. J Prod Anal 1991:2: 197-237.

Table 1. Data of illustrative example

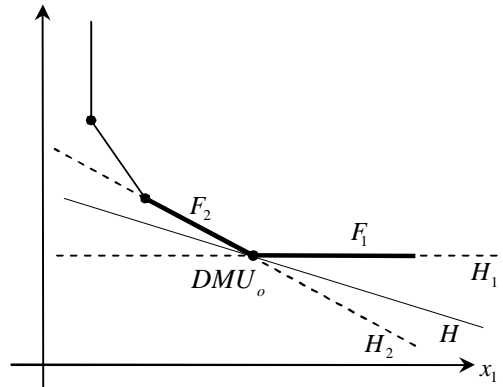|	A	B	C	D
x_1	1	2	5	6
x_2	4	2	1	5
y	1	1	1	1
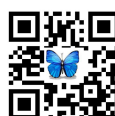
Fig 1. **and** **are weak and strong defining, respectively; and** **is supporting but not defining**.
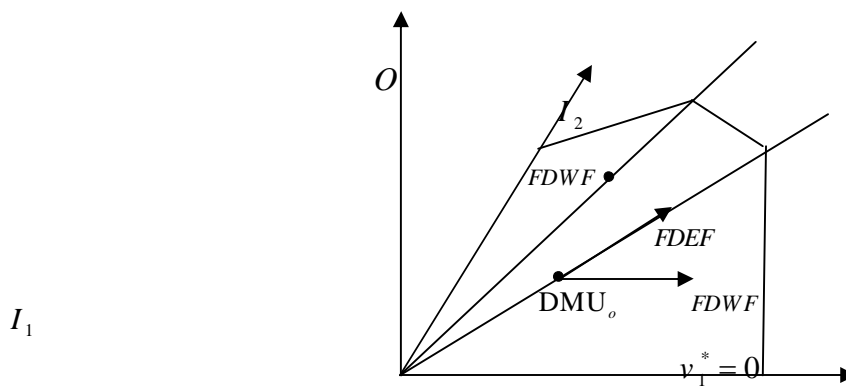
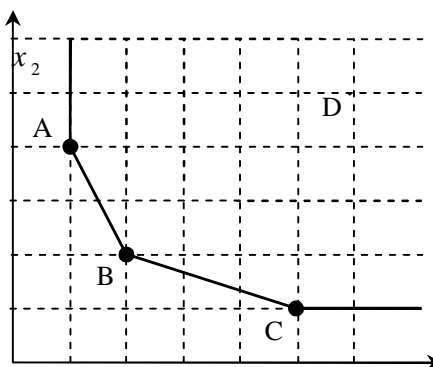**Fig 2. Various types of directions at point** **D for an FDWF of** .

Fig 3. The PPS of Illustrative example x_1

RESEARCH ARTICLE

N-SPECT Model and its Results Compare with Real Data in Estimation of Watershed Run off and Sediment Yield in Jafarabad Watershed, Bahabad, Yazd

Karimi M[1], Jamali AA[2]* and A Morovvati[2]

[1]MSc Student, Department of Watershed Management, Maybod Branch, Islamic Azad University, Maybod, Iran
[2]Assistant Professor, Department of Watershed Management, Maybod Branch, Islamic Azad University, Maybod, Iran.

*Address for correspondence
Jamali AA
Assistant Professor,
Department of Watershed Management,
Maybod Branch, Islamic Azad University,
Maybod, Iran.
Tel: +983532370963, Fax: +983532370969
E-mail: jamaliaa@maybodiau.ac.ir

ABSTRACT

Development of computer science in recent years has had a significant impact on all of Sciences. Since computerscan perform complex calculations in a possible shortest time, so it will play an important rolein the study ofnaturalsciences. A set ofmathematicalrelationshipsandtechniquesthatiseasily understood bycomputersis known as a model. Actually, Computer models are the understandable language for computers.Because many factors are involved in the management of water sheds so the importance of using such modelsis obvious. The various models designed andusedin this field. In this paper, a computer model named Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT) which is a suitable modelfor the estimation ofrunoffandsediment yield in catchmenthasbeenanalyzedandassessed inARC GIS medium. The study area, Jafar Abad, with a area of about 64,828hectares,is located in Bahabadbasinin Yazd, Iran. Predictionsof themodelare compared with measuring data. The measured amount ofannualprecipitationon thehydrology station and themodel prediction was 0.33 and 0.45 respectively. The amount of annual runoff measured at the station and model prediction was 5.34 and 6.41 cubicmetersper hectarerespectively.These values indicate that runoff and deposioverestimatedrstimated using this modelandthis issue shouldbe considered in the estimation.

According to the resultsif the necessary model parameters were collected and analyzed properly, we can use them odel for estimating the management of runoff and sediment yield in waters heds. One of the distinguishing features of this model is the ability to createmaps withthe capability of runoff and sediment yield estimation teaches point of the basin.

Key words: precipitation, runoff, erosionandsediment yieldmodels, ARC GIS, N-SPECT.

INTRODUCTION

A basin as a Hydrological unit has different elements and includes renewable natural resources, such as forest, grassland, soil and water. The quality of these elements and their interactions cause different reactions to the external factors, such as precipitation. The most fundamental problem in the management of catchments is the presence of sediment yield. The most obvious problem with them is sediment yield accumulation in behind of the structures, particularly dams. The accurate and scientific estimation of sediment yield rate could result in Savings administrative costs because structures will design according to the basin sediment yieldyield and in the event of flood, the possibility of damage will decrease. Runoff cancause erosion and finally it can produce sediment yield. Estimation of surface runoff is essential for explanation of water function in watershed and it is usefull for decreasing the flood risk and sediment yield rate. Application of models is the most common method in the management of watersheds. Model is the symbol of the fact that depicts the most important features of the real world into simple and general forms. However there are a lot of models for direct estimating of runoff but most of them requires a lot of parameteres and they can not be used because of the lack of proper data.

If the economic value of the soil and its importance in human life to be considered, it will be revealed that this precious gem is the source of all basic necessities of human nature and all living beings and human life depend on it. (Javadiet al., 2011).erosion, transport and sediment yield have an impact on water and nutrient circulation at a world scale. The global suspended sediment production is estimated to be 20×109 t y-1 of which over 25% is trapped in large dams constructed around the world (Gamvroudiset al., 2015). The mechanisms and rates associated with soil erosion, transport, and storage change with increasing spatial scale. As runoff and sediment move from relatively steep upland hillslopes and streams to lower gradient alluvial valleys, the balance between upland sediment production and sediment deposision over a decadal time scale is mediated by sediment yield along lowland streams and floodplains, typically producing yield that is smaller than upland supply (Smith and Wilcock, 2015).

Yesufet al., (2015) was studied sediment yield in Maybar gauged watershed using the Soil and Water Assessment Tool (SWAT). The model evaluation statistics suggested that SWAT extremely under-predicted peak sediment loads in both calibration and validation periods.

Nojavanet al., (2012) using two models, The Bureau of Land Management (BLM) and Fargas, estimate the rate of erosion in the Bandareh watershed in the Azerbaijan Qarbi province. Seven factors, including surface erosion, shallow rill erosion, sedimentation of streams and development of gully erosion were investigated and the results show the agreement between two models which used for erosion estimating. SunandCornish (2005) conducted a study about the discharge and Sediment yield rate of a river in the headwaters of Liverpool plains of Australia using SWAT model. The results showed that compared with other models, SWAT model has good predictive ability and better performance. Pandyet al., (2008) in a study used The Water Erosion Prediction Project (WEPP) model for predicting water erosion in a small catchment with hills in Karsu, India. After entering the required parameters and model analysis, it concluded that WEEP model is a good model for the region and It can easily be used in other areas.

To predict reliable quantity and rate of sediment transport from land surface into channels, rivers and water bodies, to identify erosion problem areas within a basin and to evaluate the effectiveness of management projects, models are

Jamali AA *et al.*

often used. Therefore, the selection and application of an appropriate model, which could give reasonable predictions, become essential for this purpose. Calibration and validation of these models are necessary before using them in research and/or real-world applications. No universally accepted procedures or guidelines for calibration and validation currently exist in the literature. (Yesuf et al., 2015).Because the watershed management is one of the most important components of any country's infrastructure planning, it is necessary to use advanced computer models.

Aim of this study was an examination of the N-SPECT computer model capabilities and accuracentral in centeral parts of Iran.

MATERIALS AND METHODS

The study area

The study was conducted in Jafarabad watershed, which is located in the western part of the Bahabad Basin, Asfij district, between longitudes 55 º43'1" to 56 º1'45" East and latitudes 31 º45'33" to 32 º06'21" north. It has an area of about 64,828 hectares. The highest point is 2780 meters and the highest and lowest point of pasture is 2780 and 1300 meters above sea level, respectively. According to the Pabo's flora classification, the study area is classified as Irano-Turanian Region, semi-steppe subregion. the region's topography includes high mountainous with steep slopes with Artemisia as a dominant vegetation. According to the gradient of rainfall between the years 1375 and 1390, the average annual rainfall is estimated about 130 mm (Fig. 3).

Methodology

N-SPECT is a comparative-computer base model which stimates the source of pollution and nonpoint erosion and runoff. It also investigates the relationship between land cover and other sources of pollution and erosion. N-SPECT is an extension in version 9.2 and 9.3 ArcGIS software and needs that Spatial Analyst extension to be installed. N-SPECT is designed for use in any situation in watersheds. However, if the user has access to the necessary information. One of the latest models has been proposed in the form of software named N-SPECT. This software is installed as plug-in effects in ARC GIS and then data processing can be performed. This software is provided by the National Oceanic and Atmospheric Administration of the United States of America. It mostly used to estimate the amount of runoff and sediment yield in catchments as well as metalic pollutants distributions in its water. In order to estimate the rate of runoff and sediment yields in jafarabad's catchment, the N-SPECT software was used and according to the results if the necessary parameters for this model was investigated properly, this model can be appliable for other catchments. However, due to various natural conditions in different parts of the region, the coefficients must be localized so the results would be closer to reality.The schematic diagram shown in (Fig. 1) describes the steps of this study.

In this model, we need to 6 factor:
1. watershed land cover or land use
2. The topography of the area (DEM map)
3. Parameters of the soil (hydrologic groups and K factor)
4. The amount of rainfall in different periods
5. The amount of rain erosion in different parts of the field
6-the area condition that should be considered in the model according to the certain standards using these factors, it will be possible to estimate watershed runoff and sediment yield. To enter the layers in model, all of them must be georeferenced and prepared according to the software classification, which is separately prepared and used (Fig. 2). After that, all layers will be imported in software medium and using them, the amount of annual runoff (in liter per

hectare) will be calculated and the map of sediment yield amount (in kilogeram per hectar) will be prepared. As mentioned above, this model can also be used to estimate the amount of water pollution.

RESULTS AND DISCUSSION

One of the main advantages of this model is the ability of preparing zoning map. It means that sediment yield map will be shown in form of different colors that show the volume of sediment yield in a different locationand also the runoff map has darker toneswhere the volume of runoff is more. Actually in the streams due to the runoff, the pixels density will be more (Fig. 3).

The output raster map created by this model, is considered as one of the outstanding characteristics of this model. Using such maps we can have a good analysis on the study area in accordance with managemnet needs. each pixel of Output raster map has a unique value that represents the amount of precipitation or runoff at that point.Using the Identify tool in ARCMAP software we can click on each pixel of the map to see the amount of runoff and deposion (Fig. 4 and 5).Finally, Comparison between actual data , collected from the station by the Regional Water office, and predictions by model was done andmodel validity was examined. In order to make this comparison, the Control station must be located in the outlet area of catchment,So what is observed in that point is suspended sediment yield which floats out of the area in times of flood.

Considering the output results of model, it can be concluded that the status of land cover, precipitation and nature of soil are independent variables and slope and hydrological conditions will be effective as dependent variables.

Soil erodibility (K) and land cover factors have the greatest impact on the model. The role of the rainfall erosivity factor (R) itself is controversial because in the other countries, especially in tropical areas and Gulf of Mexico, this factor has a significant impact. However, due to low rainfall in the central region of the Iran, this factor has a little impact. In Yazd province there are 25 hydrometric stations but because of climatic situation and lack of Permanent rivers most of them do not provide proper information for using in model, only jafarabad station Abad located in the northwest Bahabad is suitable for for check-in. To prepare erosivity maps, statistics gained from existing stations has been analyzed and erosivity map study area has been prepared according to the amount of rainfall with erosivity index of 14 to 20 which is more than the adjacent areas. land cover maps showed that the majority of the study area include poor pastures and outcrops especially in the southern part of the basin. Irrigated Agricultural lands and gardens there are only in villages in the study area.

Annual precipitation amount based on field measurements of hydrological stations was 0.33 tones per hectare and the estimated amount by model was0.45 tones per hectare. The amount of runoff measured on the station and predicted by model was 5.34 and 6.41 cubic meters per hectare per hectare respectively.

As mentioned above, this model has not been used in Iran watersheds so for conducting research studies in Iran, this model must be localized.

Estimations of this model for the study area are slightly higher than the actual values measured in the station, nevertheless, this model can be a useful tool for estimating runoff sediment yield in other interior basins of Iran.

The output raster map created by this model, which is considered as one of the outstanding characteristics of this model can be used according to the management needs. It is expected that in areas with adequaterainfall, continuous Showersandpermanent rivers, the obtained resultsare more acceptable.Similar to this study, performance statistics for sediment yield models could be seen as compared studies made by Setegnet al., (2010), Tolson and Shoemaker (2007), and Betrieet al., (2011) that sediment transport modeling has similar characteristics.

4251

In this study, runoff and sediment yield was estimated using N-SPECT model, however, this model also has the ability to estimate the pollution. Pollution of the river is particularly threatening to the health of society; therefore, if the parameters for the model are provided in the areas of environment it can also be used in environmental management. If the information required by this model has a good accuracy, it can be used for other parts of country, particularly in the areas leading to the rivers and lakes. Estimation of estuarine sediment at the confluence of the rivers and lakes is very important in the watershed planning issues.

REFERENCES

1.Javadi M, zehtabianGh, Ahmadi H,AyoobiSh, Jafari M.Comparison betweenestimations ofthe suspended sediment potential invarious unitsusing arainfall simulatorin Namehrood, the Natural ResourcesScienceand Technology, 2011;2,14-21.

2. Gamvroudis C, Nikolaidis N.P, Tzoraki O, Papadoulakis V, Karalemas N.Water and sediment transport modeling of a large temporary river basin in Greece. Science of the Total Environment 508 2015;354–365.

3.Smith S.M.C, Wilcock P.R. Upland sediment supply and its relation to watershed sediment delivery in the contemporary mid-Atlantic Piedmont (U.S.A.). Geomorphology 2015; 232,33–46.

4. Yesuf HM, Assen M, Alamirew T, Melesse AM. Modeling of sediment yield in Maybar gauged watershed using SWAT, northeast Ethiopia. Catena, 2015;127, 191-205.

5.NojavanM, MohammadiA, Gholami V.Determiningerosion ratesusing theBLM and Fargasmodels, case studyBandareh watershed, Journalof Geographyand Development, 2012;29, 130-119.

6.Sun H, Cornish PS. Estimating Shallow groundwater recharge in the Headwaters of the Liverpool Plains using a SWAT Hydrol process 2005;19 (3), 795-807.

7.Pandy A, Chowdary VM, Mal BC, Billib M. Runoff and sediment yield modeling from a small agricultural watershed in India using the WEPP model, Journal of Hydrology, 2008;348 (3), 305-319.

8.SetegnShimelis G, Dargahi B, Srinivasan R, MelesseAssefa M. Modeling of sediment yield from Anjeni gauged watershed, Ethiopia using SWAT model. JAWRA, 2010; 46 (3), 514–526.

9.Tolson BA, Shoemaker CA. Cannonsville reservoir watershed SWAT 2000 model development, calibration, and validation. J. Hydrol. 2007;337, 68–86.

10.Betrie GD, Mohamed YA, van Griensven A, Srinivasan R. Sediment management modeling in the Blue Nile Basin using SWAT model. Hydrol. Earth Syst. Sci. 2011;15, 807–818.
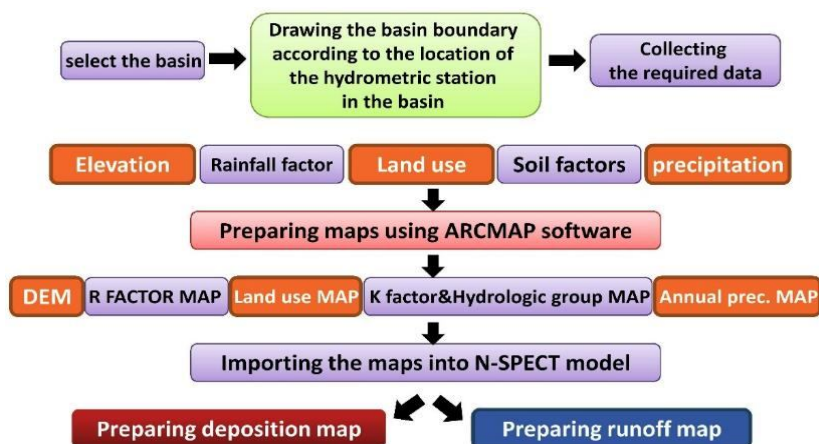
Figure 1: Schematic diagram of research stages
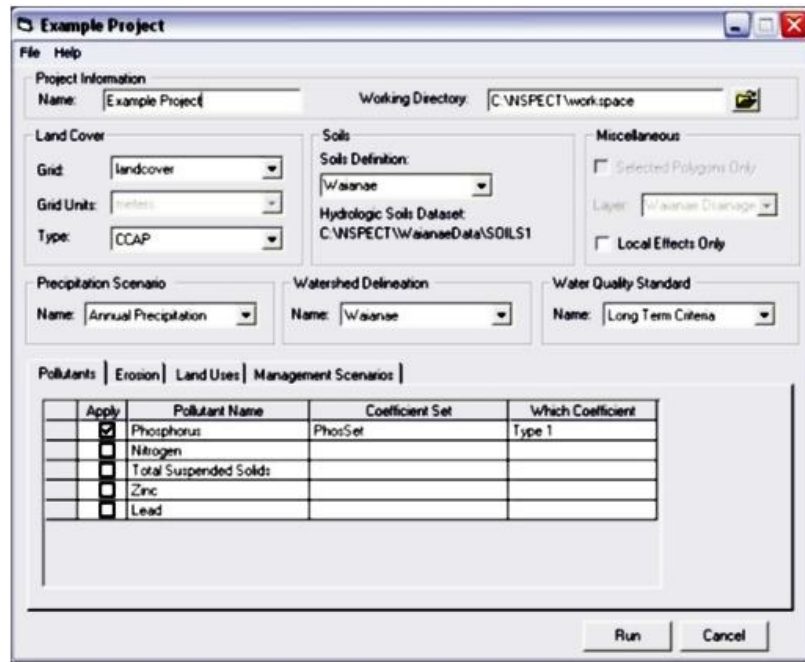
Figure 2: An image of the N-SPECT medium.
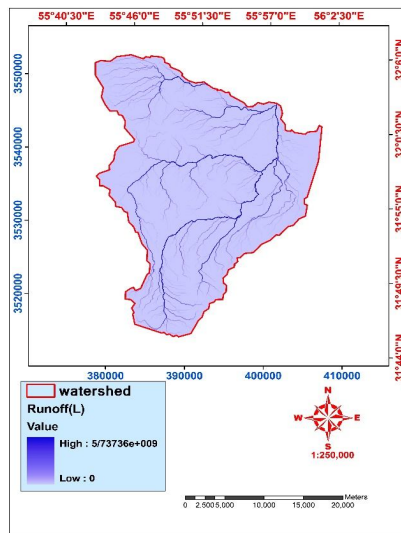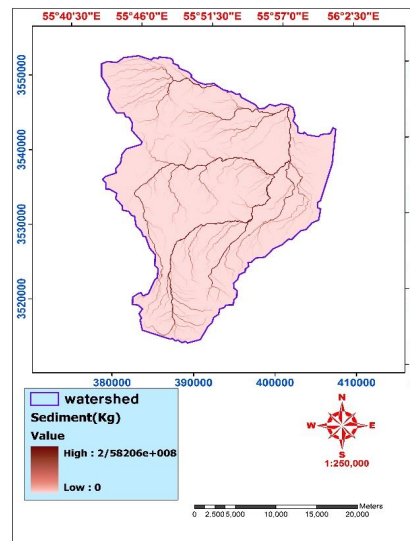
a   b

Figure 3: Sediment yield and runoff maps provided by the software,a=runoff map,b=sediment yield map
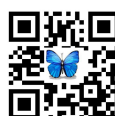
Jamali AA *et al.*
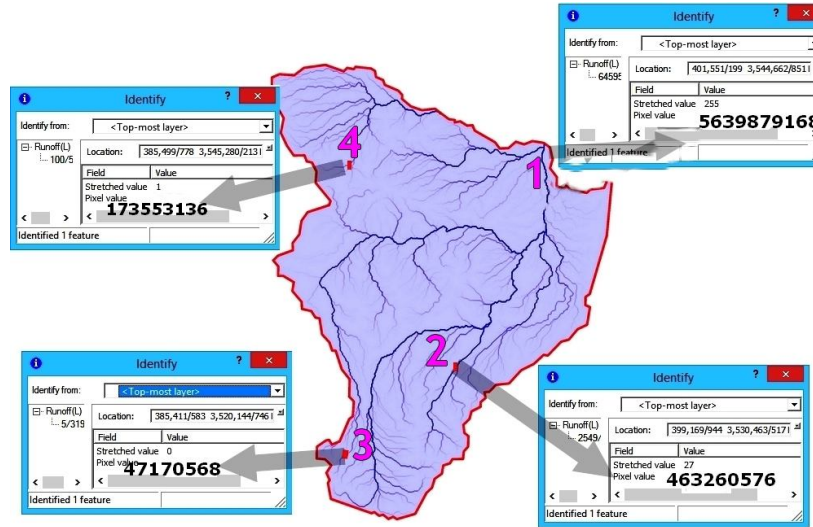
Figure 5: Point measurement capability in the runoff map of catchment by using the Identifytool in ArcGIS software
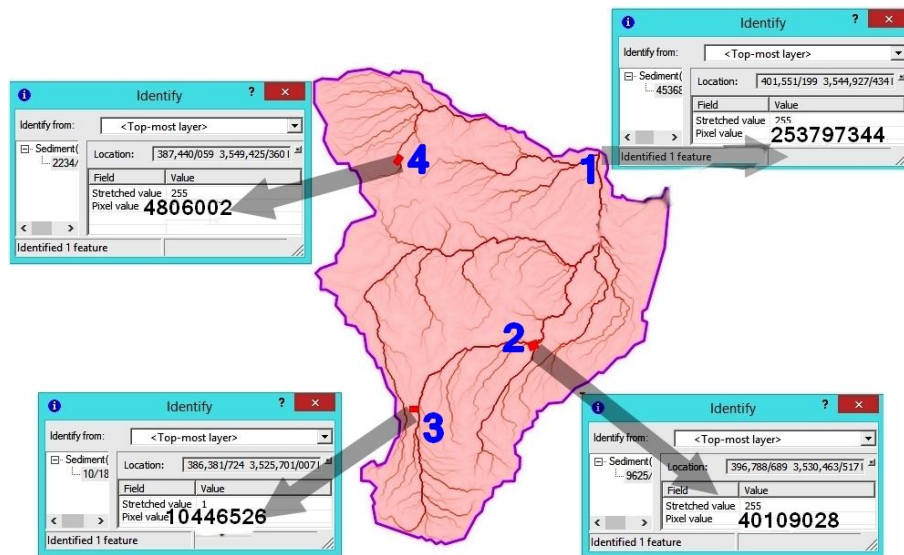
Figure 4: Point measurement capability in the sediment yield map of catchment using theIdentify tool in ArcGIS software

RESEARCH ARTICLE

Cashew Apple (Anacardium occidentale): Evaluation of Physical and Chemical Composition

Senthil Murugan. S[1]*, Sudish Kumar[2], Justus K. Rajan[2], L. Varshney[3] and Virendra Kumar[3]

[1]Department of Animal Nutrition, College of Veterinary and Animal Sciences, Pookode, Wayanad, Kerala,
[2]Plantation Corporation of Kerala,
[3]RTDD, BARC, Trombay, Mumbai - 400085.

*Address for correspondence
Senthil Murugan. S
Department of Animal Nutrition,
College of Veterinary and Animal Sciences,
Pookode, Wayanad, Kerala
Tel: +91-9446233030,
E-mail: s_senthilmurugan@hotmail.com

ABSTRACT

The present investigation was undertaken to exploit commercial value of cashew apple fruit waste obtained after extraction of juice as a feed stock for animal feed. Four fields in Kasargod estates of Plantation Corporation of Kerala (PCK) were selected for fruit yield prediction study and fruit nut yield study. The preliminary study on feeding value of Cashew apple waste obtained after juice extraction suggested that it could be used as feeding material. Cashew apple waste contains crude protein (13.03 per cent), crude fat (4.83 per cent), crude fibre (13.20 per cent), total ash (1.51 per cent) and Nitrogen free extract (67.31 per cent) on dry matter basis. The cyanogenetic glycosides content (in terms of HCN /100g sample) in different varieties of cashew apples varies between 20.65 mg to 26.61mg; and oxalic acid content in the cashew apples were found to be in the range 1.2 to 1.7 per cent. These values were found to be well within the acceptable limit and inclusion level and will not have any adverse effect on the animal feeding. The mineral analysis and vitamin analysis reveals this cashew apple waste can be used as a feed alternative for non ruminant animals. In continue to this study, effect of gamma radiation doses on the chemical composition and feeding value of cashew apple for cattle and rabbit are being investigated.

Key Words: Cashew Apple, Proximate composition, Physical quality

INTRODUCTION

Indian Livestock (2007) accounts 304.42 millions of dairy cattle and buffaloes, 648.88 million numbers of poultry and 0.42 million of rabbit. They are mainly dependent on residues from crops grown for human food, conventional forage crops and natural pastures. However, the demand and supply of the green and dry fodder projection in Year 2025 was estimated ~64.87 per cent deficit of greens and 24.92 per cent of dry fodder. In times of low reserve and high prices of feed, feed manufacturers often look for unconventional feeds to bridge the gap. "Waste" feeds may appear attractive due to lower price but there are issues to consider. The inclusion of alternative feedstuffs in animal diets might be interesting in some circumstances (relative price, feed quality), but it is limited because of the lack of information on their nutritive value.

Cashew apple (Anacardium occidentale L)-an important nut crop is grown in India on an area of 9,45,000 ha which produced 6,53,000 tones of raw nuts in 2010 -2011. Every year 65 lakh metric tons of fresh cashew apple fruits are wasted, after collecting nuts from the field without any commercial exploitation except few thousand tones in Goa. In Kerala, Plantation Corporation of Kerala (PCK) (A Kerala Government undertaking unit) owns 5738 Ha area under cashew cultivation in Kasargod and Kannur districts .The objective of this paper is to highlight the commercial value of cashew apple fruit waste obtained after extraction of juice as futuristic animal feed resource.

MATERIALS AND METHODS

Sample collection and preservation

Samples of cashew apple were collected from 5 trees of four fields in Kasargod estate of Plantation Corporation of Kerala (PCK) for fruit yield prediction study and fruit nut ratio study. The varieties selected for study purpose were Ullal, Anakkayam, Dharasri, Sulabha, Anagha, Priyanka, Madakathara I and II varieties were selected for prediction.The fallen fruits collected from the field was immediately washed with water to remove the impurities and kept in polythene cover before analyze for its chemical composition

Chemical analyses

The dry matter content was determined in sun dried BSG samples and cattle feed samples by 55°C for 48 h. The crude protein in BSG samples was determined according to AOAC (Method 984.13; AOAC, 1995). Ash was determined by burning duplicate 2 g samples at 600°C for 2 h in a muffle furnace (Method 942.05; AOAC, 1995). Standard methods were also used to determine ether extract (AOAC, 1995). The anti-nutritional factors like cyano-genetic glycosides content (in terms of HCN /100g sample) and oxalic acid were also analyzed as per Pathak(1996) .The fat soluble vitamins were analyzed as per Bureau of Indian Standard Method (1979)

RESULTS AND DISCUSSION

Quantification of availability of cashew apple

Four fields in Kasargod estate of Plantation Corporation of Kerala (PCK) was selected for fruit yield prediction study [2] and fruit nut ratio study. The 5 trees in each field of different varieties viz Ullal, Anakkayam, Dharasri, Sulabha, Anagha, Priyanka, Madakathara I and II varieties were selected for prediction.

Based on the flowering pattern study, the predicted nut yield and actual nut yield are presented in Table-1. The predicted nut yield against actual nut yield varies between fields significantly ($p < 0.05$). The rank correlation

between predicted and actual nut yield revealed significant and positive correlation (R^2=0.76) indicating that the effect of climatic factors on nut yield can be used for predicted efficiently.

The results could be practiced to estimate of cashew nut yield in the each cashew estates; which usually done by the open tender process followed by government. The contractors rather offering without any scientific study . However, the fruit/nut yield is variable due to variation in the climatic factors. Hence, the scientific prediction of fruit/nut is need of this hour in cashew industry.

The variety wise fruit weight, nut weight and fruit: nut ratio are given in Table -2. Out of eight cashew varieties, fruit weight, nut weight and fruit: nut ratio calculation reveals that Priyanka variety fruit (93.49 gms), nut (12.03 gms) weighs more than other varieties. The fruit: nut ratio ranges between 7.77:1 (Priyanka) to 12.01:1 (Anagha).
The linear regression prediction equation developed for fruit weight is given as

$$Y = 36.49 + 4.00\ X$$

where Y= Cashew fruit weight and X=Nut Weight.

The prediction equation can be used to estimate the cashew fruit weight by recording the nut weight collected from the fields.

There is total of 6300 ha of cashew plantation in PCK, in each ha there is approximately 200 trees planted per ha with average yield of 543 numbers of nuts and cashew fruits .The cashew nuts weighing 3.35 Kg and fruits weighing 33.123 Kg per tree respectively. There would be 41,734 tones of unutilized cashew apple in PCK every year, which can be used for animal feed purpose

Feeding Value of Cashew apple Waste

The cashew apple waste obtained after extraction of juice was studied for its proximate composition (Crude Protein (CP), Crude Fibre (CF), Ether Extract (EE), Total Ash, Sand and Silica (SS), Nitrogen Free Extract (NFE)) using standard method IS:7874 [3].The Proximate Composition of Cashew apple waste is summarized in Table-3.
The Fat soluble vitamins content in Cashew apple waste results are summarized in Table-4.The Beta Carotene content in Old senile variety was significantly more than other hybrid varieties. However the Vitamin E,D_2, C content in all varieties were not different significantly.

Anti Nutritional Factors

The cyano-genetic glycosides content (in terms of HCN /100g sample) in different varieties of cashew apples varies between 20.65mg to 26.61mg; and oxalic acid content in the cashew apples were found to be in the range 1.2 % to 1.7 % [4]. These values were found to be well within the acceptable limit and inclusion level and will not have any adverse effect on the animal feeding.

CONCLUSION

In Kerala, there is 4,97,000 tones of Cashew fruit is not utilized for any purpose. The preliminary study on feeding value of Cashew apple waste obtained after juice extraction suggested that it could be used as feeding material for animals. The mineral analysis and vitamin analysis reveals the Cashew apple waste can be used as a feed alternative for non ruminant also. The Plantation Corporation of Kerala (PCK) may promote collection of Cashew fruits among the cashew farmers and the same may be used by the feed manufacturing units as alternative feed raw material. In

continuation, the improvement of the nutritive value of cashew apple waste by using gamma radiation is under study.

REFERENCES

1.Livestock Census (2007), Directorate of Economics & Statistics, and Animal Husbandry Statistics Division, Department of Animal Husbandry, Dairying & Fisheries, M/O Agriculture.

2.Sapkal, B.B, Hulamani, N.C and Nalwadi .U.G (1994).Flowering and sex ratio in some cashew (Anacardium occidentale) selections. The Cashew (Jan-Mar):7-9.

3.IS :7874 Methods of tests for animal feeds and feeding stuffs: Part 1 General methods, Bureau of Indian Standards, New Delhi.

4. Pathak.N.N., Kamra,D.N.; Agarwal,N and Jakhmola, R.C(1996). Analytical techniques in Animal Nutrition Research, 1st ed. P. 58-59.

Table-1 .Predicted Vs Actual Nut Yield

Fields	Predicted Nut Yield (Numbers)	Actual Nut Yield (Numbers)	Predicted Nut Yield (Kg per Tree)	Actual Nut Yield (Kg per Tree)
Nenjamparamba	522.80[ab]	306.00[a]	3.23[ab]	1.89[a]
Kakkiyod	815.60[b]	821.00[c]	5.03[b]	5.07[c]
Kotoor II	485.60[a]	464.00[ab]	3.00[a]	2.87[ab]
Kotoor I	634.60[ab]	581.80[b]	3.92[ab]	3.59[b]

Means in columns with same superscript are not significant ($p < 0.05$)

Table -2: Cashew Fruit weight, Nut Weight and Fruit: Nut Ratio

Sl.No	Variety	n	Fruit Weight (Gms)	Nut Weight (Gms)	Fruit: Nut ratio
1	Ullal-3	11	46.98[a]	5.33[a]	8.82:1
2	Anakayam	11	53.76[ab]	5.87[ab]	9.16:1
3	Dharasri	11	63.05[cd]	5.90[b]	10.69:1
4	Madakathara I	103	61.82[bc]	6.06[bc]	10.20:1
5	Madakathara II	108	58.94[bc]	6.00[bc]	9.82:1
6	Sulabha	108	70.99[de]	7.89[d]	9.00:1
7	Anagha	71	78.56[e]	6.54[e]	12.01:1
8	Priyanka	11	93.49[f]	12.03[f]	7.77:1

Means in columns with same superscript are not significant ($p < 0.05$)

Table-3. Proximate Composition of Cashew Apple Waste (In Percent)

Sample	Moisture	CP*	EE*	CF*	Total Ash*	SS*	NFE*
Akshaya	7.51	13.51	5.51	13.47	1.67	0.13	65.83
Dharasri	6.7	12.84	4.16	12.41	1.74	0.05	68.86
Ullal	9.26	12.10	4.02	10.62	1.34	0.09	71.91
Madakkathara II	8.4	12.78	4.10	12.14	1.43	0.04	69.54
Madakkathara I	6.645	14.71	5.05	14.36	1.04	ND	64.85
Priyanka	7.925	13.11	5.35	14.09	1.39	0.03	66.07
Sulabha	7.94	14.22	5.67	12.86	1.99	0.12	65.26
Anagha	9.24	9.81	4.45	13.52	1.30	0.09	70.91
Anakkayam	8.09	13.53	4.30	14.61	1.35	ND	66.21
Dhana	7.35	14.88	5.30	14.82	1.42	ND	63.57
Senile & old (R)	7.69	13.06	4.85	12.10	1.80	0.07	66.83
Senile & old (Y)	7.21	11.69	5.14	13.35	1.74	0.05	68.10

*Results on Dry Matter Basis

Table -4. Fat Soluble Vitamins composition of Cashew Apple Waste

VARIETY	Beta Carotene as precursor of Vitamin A (mg/Kg) Mean+ SE	Vitamin E as Tocopherol (mg/gm) Mean+ SE	Vitamin D2 (as Ergocalciferol) (mg/Kg) Mean+ SE	Vitamin C (mg/100gm) Mean+ SE
Madakkathara I	$33.460^a \pm 6.544$	$37.440^a \pm 0.940$	$1.839^a \pm 0.594$	$59.953^a \pm 1.141$
Dharasri	$46.953^a \pm 2.685$	$27.965^a \pm 5.095$	$1.931^a \pm 0.605$	$56.183^a \pm 1.849$
Anakkayam	$39.727^a \pm 6.724$	$37.090^a \pm 3.680$	$1.097^a \pm 0.399$	$58.047^a \pm 1.177$
Madakkathara II	$58.003^{ab} \pm 8.444$	$37.910^a \pm 0.470$	$1.483^a \pm 0.554$	$56.626^a \pm 0.922$
Priyanka	$67.983^{ab} \pm 9.393$	$29.190^a \pm 2.060$	$1.708^a \pm 0.536$	$59.536^a \pm 0.787$
Old Senile (Yellow)	$93.410^{bc} \pm 17.653$	$34.665^a \pm 3.765$	$2.204^a \pm 0.579$	$59.4000^a \pm 1.695$
Dhana	$103.89^{bc} \pm 11.652$	$30.335^a \pm 7.415$	$2.045^a \pm 0.549$	$58.560^a \pm 0.340$
Old Senile (Red)	$126.51^c \pm 30.399$	$41.865^a \pm 2.975$	$1.615^a \pm 0.430$	$57.253^a \pm 2.251$

Means+ SE in columns with same superscript are not significant ($p < 0.05$)

RESEARCH ARTICLE

Relationship between Religious Orientation and Parenting Styles of Parents and Vandalistic Behaviors of High School Students in Gonbad Kavos City

Nasrin Barsalani*, Hasan Qnadzadgan and Yarali Dousti

[1]Department of Psychology, Faculty of Humanities, Islamic Azad University, Sari, Iran

*Address for correspondence
Nasrin Barsalani
Department of Psychology,
Faculty of Humanities,
Islamic Azad University,
Sari, Iran.

ABSTRACT

Current work aims at investigating relationship between religious orientation and parenting styles of parents and vandalistic behaviors of high school students in GonbandKavos. To this end, 300 high school students in GonbadKavos were selected using cluster sampling and they completeddemographic information list, Baumrindparenting style inventory (1972) and Allport's Religious Orientation Scale (1950) and results were analyzed using SPSS software. Research results indicate there is no significant relationship between vandalistic behaviors and religious orientation. Vandalistic behaviors and permissive and authoritarian parenting style are significantly related, but there is no significant relationship between vandalistic behaviors and authoritative parenting style. There is significant relationship between internal religious orientation and parenting style, but there is no significant relationship between external religious orientation and parenting style. Regression analysis results indicate internal and external religious orientation of parents play no significant role in predicting vandalistic behaviors of children. Also, parenting styles of parents do not play significant role in predicting vandalistic behaviors of children. Thus, vandalistic behaviors can be reduced by training parenting styles.

Key words: Religious orientation, parenting styles, vandalistic behaviors, GonbadKavos

INTRODUCTION

Vandalism is said to those crimes that their main purpose is self-conscious destruction of public property (Wise, 1982). Vandalism in its new form has been emerged in modern communities (MohseniTabrizi, 2004). Vandalism is among delinquencies and crimes which emerging in modern community. Thus, it should be noted that in all historical eras, specific forms and types of social disorders have been emerged in the society due to nature of structures, organizations, institutions and social relations. Hence, some behaviors have been defined asdejected or deviant behaviors in some historical eras. Also new deviant behaviors have been rose which are specific to the new community. In other words, with interpretation of social structures and relations, not only new forms and types of disorders have been developed, but also prevalence rate and their meanings have also changed. In sociological texts and social pathology, vandalism is frequently used as meaning having dejected spirit which represents tendency to self-chosen, intentional and voluntarily destruction of public facilities and assets. Since it incurs many harmsannually to national and public asset, it seems considerable part of harms are done by students, so that it goes beyond educational environment. That is, students not only destruct such assets as door, wall, desks and benches, but also they damage assets out of the educational environment such as green space, busses, and etc. thus, it is necessary to identify reasons and factors causing for emergence of such behaviors and scientific soutions should be applied for directing adolescents toward blossoming their talents and abilities to optimal use of public assets for public welfare. Current work attempts to investigate vandalism phenomenon. Since rare studies are available on vandalism, and this behavior is one of crime types, current research attempts to investigate relationship between religious orientation and parenting styles and vandalistic behaviors in high school students in GonbadKavos.

Theoretical Foundations

Vandalism means having dejected spirit which represents tendency to self-chosen, intentional and voluntarily destruction of public facilities and assets (Meirerand Clinard, 1975), or it means voluntary destruction of public property and belongings continuously and repeatedly. Thus, vandalism is a kind of voluntary destruction of assets in a continuous and repeated manner with specific motivations (Clinard, 1975). In terminology, vandalism means anarchistic anti-urban behavior and tendency for destruction of public property. Vandalism can be classified into two general types: A. vandalism with specific plan or goal which is often in group, B. vandalism with no planning and predetermined goals which is often individual. Although the firsttype is more observed in the society and it seems stronger, it should be noted second type incurs more damage to the society and it is less considered only because of intangibility. Gender, age, and environmental conditions are factors affecting vandalism, which will be descried in the following. Gender impact: experimental studies have shown gender differences in vandalistic behaviors among men and women. According to research findings, most vandals are in male group. In other words, boys perform vandalism, which is accompanied by violence, more than girls. According to a psychological theory, grisl are more successful in coping with anger than boys (NohseniTabrizi, 2004). Age group impact: vandalism is specific to a certain age group. According to studies, children, adolescents and youths at ages 10 to 25 perform vandalistic behaviors more than other age groups. Environmental conditions impact: prevalence of vandalism in urban areas is more than rural areas. Psychological and educational studies indicate vandalism has acquisitive origin and it results from environmental conditions (Bahrami, 1983). An interrelated collection of factors including unemployment, non-useful free times and not emptying adolescent mental emotions are main causes of vandalism. Role of media and educational and cultural centers such as universities, schools, and etc. in socialization of youths and prevention of vandalism is very effective (MohseniTabrizi, 2004). Parenting styles are styles which are used by parents for nurturing children and represent their attitudes toward their children. One of the main and effective factors which plays basic role in human evolution and growth is the family. Family environment is the first and most stable factor influencing development of the personality (Shariatmadari, 1988; quoted in Ahadi and Mohseni, 1999). In fact, family is the first founder of one's personality, values and intellectual criteria which has significant role in one's destiny and style and policy of living in the future, and one's ethics and mental health is considerably dependent on this factor.

Child's reaction to his surrounding environment is affected by social group regulations. Since family is also a social unit and social values and criteria are transferred to the child through the family, it is highly important as a medium in terms of influence of socialenvironment on the child (Ahadi and Mohseni, 1999). In most communities, family relations have been more discussed than other aspects of adolescent development. Family is regarded as the identityorigin of the adolescent. One's convergence and integration, which is considered as the main achievement of adolescence by Ericson, is mainly dependent on the experiences in the family. Authors have found that family relations are important social and emotional source in the adolescent life (Shahraray, 2005). Family experiences have outcomes and implications for the adolescent life out of family boundaries, and they influence relationships with peers, teachers, and other adults as well as emotional relations, academic performance and selection of job and success in job. Family's emotional sphere, the way of nurturingchildren used by parents, and opportunities and expectations which family life provides for normal development are present since the beginning of the life and they continue their influence in adolescents and shape future path in the adolescent's life (Shahraray, 2005). Religious orientation can be defined as follows: it is the overall approach adopted by the individual toward the religion. That is, the individual has a collection of beliefs, practices, and special rituals in his life in relation with a superior entity (sacred). Religious orientation can be equivalent to religiosity. Religious orientation term is a descriptive compound composed of terms orientation and religious. Thus, both terms should be defined for clarity so that meaning of the compound is specified (Golcheshmeh, 2013). Orientation is composed of two parts. The term Orient means "direction" (Dehkhoda, 1994) and the term Tion is a suffix which makes the term as an infinitive. Thus, orientation means taking direction toward something. Orientation also means "overall approach, ideology or view (Worldview)." The term Religion means method and procedure, proceeding, a branch of faith, faith and cult, and every of philosophical ideologies. Religion also means cult and way. Kersini (1999) defines religion as "an organized set of values and beliefs which are used as social and moral role models." Thus, religious orientation can be defined as follows: "one's overall approach toward religion; that is, he has a collection of beliefs, practices and special rituals in his life in relation with a sacred superior entity." It often specifies personal characteristics as ability or relent (Azarbayijani, 2003).

REVIEW OF LITERATURE

Bahrami (2002) showed there is inverse relationship between religious orientation and anxiety and positive direct relationship between religious orientation and self-esteem. Janbozorgi (2007) in his work on 140 male and female students in Tehran universities found direct relationship between religion and religiosity and mental health. Ghaemifar (2007) in his work entitled Factors Affecting Vandalism with Emphasis on Jahrom Urban Community found girls tend vandalistic behaviors more than boys, while committing vandalistic actions is more in boys than girls, because boys have higher freedom of action. Kahoe (2007) in his work in relation with personality and its correlation to internal and external religious orientation found internal orientation has high correlation with internal motivations and academic achievements and external orientation has low correlation with internal expectations.Mc.corry (2005) in a qualitative research entitled Personal Control, Gender, and Crime in Patriarchal Families stated interpretations of adolescents about their parents' control and their reactions to controls and adolescence crime are related. Jils (2004) in his research entitled Crime with Emphasis on Violence, Theft, and Vandalism among Alberta High School Students with a sample of 182 adolescents found there is significant relationship between violence and vandalism unity and motivational control. But no significant relationship was observed between social commitments and three crimes under study.

Methodology and Research Hypotheses

Current research is a descriptive research of correlation type. It investigates relationship between religious orientation and parenting styles of parents and vandalisticbehaviors. Accordingly, research hypotheses include as follows:

1.   There is relationship between religious orientation of parents and vandalistic behaviors.

Nasrin Barsalani *et al.*

2. There is relationship between parenting styles of parents and vandalistic behaviors.
3. There is relationship between religious orientation of parents and parenting styles.
4. Religious orientation of parents predicts vandalistic behaviors.
5. Parenting styles of parents predicts vandalistic behaviors.

Statistical Population and Sample and Sampling Method

The population includes all high school students in GonbadKavos including 61 high schools, 50 public schools; 28 female schools and 22 male schools with total of 2,000 students. Sample size was specified as almost 300 students based on Krejcie and Morgan formula considering sampling error 05% and confidence level 95% correlated with chi square statistics. Cluster sampling method was used. 4 public schools and 4 non-public schools were selected among high schools of GonbadKavos city. Then, two classes from each school and 25 students from each class were selected.

Data Collection Tool

Demographic Information Questionnaire: This questionnaire includes demographic variables such as age, gender, and etc. as well as birth order.

Parenting Style Inventory: This inventory was developed by Marrel and McLone based on behavioral definitions of three parenting styles and it was prepared by Baumrind parenting style inventory. This inventory is a simple form of closed answer tests which includes three groups of six items for identification of each of three parenting styles (authoritative, authoritarian, permissive) in three separate sections.

Religious Orientation Scalewas developed based on Allport's theory. According to Allport's theory, internal religion is common religion with organized and internalized principles, while external religion is something external and a tool for fulfilling personal needs such as status and security. Allport's intention by internal religious orientation is a common motivational commitment which is the goal and ultimate rather than a means for achieving personal goals (Janbozorgi, 1999). Options of this test include one to twelve which measure religious orientation (from totally agree to totally disagree). This scale is scored based on Likertscales ranging from totally agree to totally disagree, and items take scores from 1 to 5. That is, option A has score 1, option B has score 2, option C has score 3, option D has score 4, and option E has score 5.

Data Analysis

Descriptive and inferential statistics were used for data analysis. In descriptive statistics, frequency distribution table and diagrams were used for description of data and indexes of central tendency and dispersion were used in terms of groups. In inferential statistics, Pearson correlation coefficient was used for determining relationship between variables and variance analysis and multivariate regression were used for determining contribution of components.

Data Descriptive Analysis

Firstly frequency and percentage of subjects in terms of age is given. In terms of age, 41.7 percent of respondents were males and 58.3 percent of them were males. In terms of residential place, 69 percent lived in city and 31 percent lived in villages. In terms of academic field, 32.3 percent studied mathematics – physics, 38.7 percent studied sciences, and 28 percent studied humanities. In terms of income, 35.3 percent had income below 500,000 Toman, 39.3 percent has income between 500,000 to 1,000,000 Toman and 5.3 percent had income above 1 million Toman. Income of 20 percent of the families was not specified. In terms of participation in religious rituals, 34.3 percent always participated, 44.3 percentoften participated, and 21.4 percent rarely participated in religious rituals. Table 1 gives mean and SD for variables under study.

Nasrin Barsalani *et al.*

Data Inferential Analysis (Testing Hypotheses)

Following descriptive analysis of data, research hypotheses are tested. Research hypotheses are tested in Table 9-2.

Above table indicates there is no significant relationship between vandalisticbehaviors and internal religious orientation ($p = 0.29$, $r = 0.062$) and external religious orientation ($p = 0.13$, $r = 0.088$). Thus, H1 is rejected. In the literature, no study was found which directly addressed relationship between religious orientation of parents and vandalistic behaviors of children. But findings in this work are indirectly consistent with findings by Jils (2004) and inconsistent with findings by Bahrami (2002), Janbozorgi (2007), Taghiyareh et al. (2004), Idler (1987), Kahoe (2007), Cupple et al. (2005), Klamins (1998) and Crider (1988). In these studies it is shown there is significant relationship between religious orientation and mental health. Such conclusion can be made due to several reasons. First, it can be attributed to accurate completion of questionnaires and understanding the statements by the students. If students do not completequestionnaires accurately for such reasons as low motivation or lack of time or etc., the questionnaires may not be adequately reliable and such conclusion can be made. However, it is less probable. Second, there may be many influential and confounding variables which influence relationship between religious orientation and vandalistic and may adjust their interaction. Third, religious orientation of parents may not mean that adolescents have also the same religious orientation. Thus, the adolescent may be not much committed to the religion and commit vandalistic behaviors.

Above table indicates there is significant relationship between vandalistic behaviors and permissive style ($p = 0.023$, $r = 0.13$) and authoritarian style ($p = 0.018$, $r = 0.14$), but there is no significant relationship between vandalistic behaviors and authoritative style ($p = 0.66$, $r = -0.03$). Thus, H2 is supported. It is indirectly inconsistent with findings by Shiri (1996), Nabavi et al. (2010), Bergin (1980) and Mc.corry (2005). These studies found there is relationship between parental behaviors and vandalistic behaviors in children. It can be said that permissive and authoritarian parenting styles are related to vandalistic behaviors, but there is no relationship between authoritative style and vandalistic behaviors. It denotes that permissive and authoritarian styles both may threaten mental health and direct adolescents to abnormal behaviors including vandalism. Of course, low correlation coefficients in this regards may suggest that many variables man intervene in relationship between parenting style and vandalistic behaviors including lack of answeringquestionnaires or presence of confounding variables. However, it can be said also perhaps children at high school level also are influenced by other sources such as peers, media, internet, etc. and they are less influenced by authoritative parenting style.

Above table indicates there is significant relationship between internal religious orientation and permissive style ($p = 0.0001$, $r = 0.34$), authoritarian style ($p = 0.0001$, $r = 0.31$), and authoritative style ($p = 0.019$, $r = 0.14$). There is no significant relationship between external religious orientation and permissive style ($p = 0.55$, $r = 0.55$), authoritarian style ($p = 0.31$, $r = 0.06$), and authoritative style ($p = 0.55$, $r = 0.03$). Thus, H3 is supported. Findings in this research are indirectly consistent with findings by Sadeghi and Mazaheri (2005), GholamiJaliseh (2007), Sadeghi and Mazaheri (2007), Taghiyareh et al. (2007) and Allport et al. (1968). These studies found there is relationship between religious orientation and behavior of parents and children behaviors. This finding seems logical, since when religious orientation is internal it influences all aspects of life including parenting style, but when orientation is external, actually one wants religion for achieving his goals and it may not be related to many aspects including parenting style. In order to test H4 and H5, multivariate regression analysis was used. Tables 5 – 7 show results for H4 and Tables 8 – 10 show results for H5.

Above table shows about 1 percent of variance of vandalistic behaviors can be predicted based on religious orientation of parents.
Above table indicates F is not significant, thus data are not fitted to model.

Indian Journal Of Natural Sciences *www.tnsroindia.org. © IJONS*

Vol.5 / Issue 29/ April 2015 *International Bimonthly* *ISSN: 0976 – 0997*

Nasrin Barsalani *et al.*

Above table indicates internal and external religious orientation play no significant role in predicting vandalistic behaviors. Thus, H4 is rejected. It is indirectly inconsistent with findings by Bahrami (2002), Janbozorgi (2007), Taghiyareh et al. (2004), Idler (1987), Kahoe (2007), Cupple et al. (2005), Klamins (1998) and Crider (1988), while it is consistent with findings by Jils (2004).

Above table shows about 3 percent of variance of vandalistic behaviors can be predicted based on parenting styles of parents. Above table indicates F is not significant, thus data are not fitted to model.

Above table indicates parenting styles play no significant role in predicting vandalistic behaviors. Thus, H5 is rejected. It is indirectly consistent with findings by Shiri (1996), Nabavi et al. (2010), Bergin (1980) and Mc.corry (2005) and with result of H1.

CONCLUSION

It can be concluded that educational, cultural, religious institutions, media and, more importantly, the family and urban management should be all convergent for reduction of vandalistic behaviors. City prosperity and happiness is in direct contact with the health and prosperity of its citizens. With awareness of urban services costs and the way of dealing with vandals, citizens can prevent from progress of this unpleasant phenomenon. On the other hand, urban management and beautification authorities in the cities should also gain a new definition of urban beautification concept, and considering causes and underlying factors of vandalistic behaviors, they should attempt to design facilities, spaces, equipment, and tools used by the public in such a way that they are in high strength and usability and motivation for destruction by vandals is reduced. Inferential statistics show there is no significant relationship between vandalistic behaviors and religious orientation. There is significant relationship between vandalistic behaviors and permissive and authoritarian parenting styles, but there is no significant relationship between vandalistic behaviors and authoritative parenting style. There is significant relationship between internal religious orientation of parents and parenting styles, but there is no significant relationship between external religious orientation of parents and parenting styles. Regression analysis results indicate internal and external religious orientation of parents does not play significant role in predicting vandalistic behaviors. Also, parenting styles of parents do not paly significant role in predicting vandalisticbehaviors.

RECOMMENDATIONS

1. Conducting research on confounding variables between religious orientation and parenting style of parents and vandalistic behaviors of children
2. Conducting research regarding other variables related to vandalistic behaviors
3. Conducting research regarding other variables related to religious orientation
4. Conducting research regarding other variables related to parenting style
5. Conducting interventional research for reducing vandalistic behaviors
6. Conducting similar research in students of other educational levels
7. Conducting research at higher education students

REFERENCES

1. Ahadi, H., Mohseni, Nikchehreh. (1999). Developmental psychology: basic concepts in adolescence and youth psychology, Tehran, Foundation Press
2. Azarbayijani, M. (2007). Testing religious orientation relying on Islam, ShahidBeheshti University, Faculty of Psychology, MA in Clinical Psychology.

Nasrin Barsalani *et al.*

3. Bahrami, E. (2003). Relationship between religious orientation, anxiety and self-repair, Journal of Psychology, 24, Sixth Year, No. 4.
4. Big John, M. (2008) religious orientation and mental health.Faculty of Medicine, ShahidBeheshti University of Medical Sciences, Vol. 31, No. 4.
5. Clinard, M. &Meirer, R. (1986).Sociology of Deviant Behovior. N. y: Holt Rinenart and Winston.
6. Janbozorgi, M. (1998).Effectiveness of psychotherapy without Islamic religious orientation on stress and tension, Journal of Psychology, Third Year, No. 8.
7. Kahoe, Richard, D. (2007). Personality and achievement correlates of in trinsic and entrinsic religious orientation. Journal of personality and social psychology.Volume 29, Issue. 6.
8. MohseniTabrizi (2000). Vandalism theoretical and experimental principles, review of the findings of a social science study, 16.
9. Shahraray, M. (2005). Developmental psychology, Adolescents (evolutional view), Tehran: Elm Publications.
10. Wise, J. (1982). A jentle deterrent to vandalism psychology today, September 31-35.

Table 1: Mean and SD for research variables

Variable		No	Mean	SD
Parenting Style	Permissive	300	21.8367	6.28610
	Authoritarian	300	21.3933	6.72627
	Authoritative	300	24.4133	6.58079
Religious Orientation	Internal	300	32.0833	5.28610
	External	300	28.9233	4.87682
Vandalistic Behaviors		300	53.1400	10.14545

Table 2: Correlation coefficient between religious orientation of parents and vandalistic behaviors

Vandalistic Behavior	Religious orientation	Correlation coefficient	Degree of freedom	Sig level
Vandalistic Behavior	Internal religious orientation	0.062	300	0.29
	External religious orientation	0.088	300	0.13

Table 3: Correlation coefficient between parenting styles of parents and vandalistic behaviors

Vandalistic Behavior	Parenting style	Correlation coefficient	Degree of freedom	Sig level
Vandalistic Behavior	Permissive style	0.13	300	0.023
	Authoritarian style	0.14	300	0.018
	Authoritative style	-0.03	300	0.66

Nasrin Barsalani *et al.*

Table 4: Correlation coefficients between religious orientation of parents and parenting styles

Religious orientation	Parenting style	Correlation coefficient	Degree of freedom	Sig level
Internal religious orientation	Permissive style	0.34	300	0.0001
	Authoritarian style	0.31	300	0.0001
	Authoritative style	0.14	300	0.019
External religious orientation	Permissive style	0.03	300	0.55
	Authoritarian style	0.06	300	0.31
	Authoritative style	-0.05	300	0.36

Table 5: Regression model summary

Model	R coefficient	R square	Adjusted R square	Estimation standard error
1	0.12	0.014	0.007	10.1078

Table 6: Variance analysis of data fit with regression

Model	Sum of squares	Degree of freedom	Mean of squares	F	Sig level
Regression	432.248	2	216.124	2.115	0.122
Residual	30343.872	297	102.168		
Total	30776.12	299			

Table 7: Regression for prediction of vandalistic behaviors based on religious orientation of parents

Model	non-standardized coefficients		standardized coefficients	T	Sig. level
	B	SD	Beta		
Constant	41.93	5.55		7.56	0.0001
Internal orientation	0.156	0.11	0.081	1.385	0.167

Nasrin Barsalani *et al.*

External orientation	0.215	0.12	0.10	1.76	0.80

Table 8: Regression model summary

Model	R coefficient	R square	Adjusted R square	Estimation standard error
1	0.16	0.03	0.015	10.07026

Table 9: Variance analysis of data fit with regression

Model	Sum of squares	Degree of freedom	Mean of squares	F	Sig level
Regression	758.705	3	252.902	2.49	0.060
Residual	30017.415	296	101.410		
Total	30776.120	299			

Table 10: Regression for prediction of vandalistic behaviors based on parenting styles of parents

Model	non-standardized coefficients		standardized coefficients	T	Sig. level
	B	SD	Beta		
Constant	49.502	2.826		17.514	0.0001
Permissive style	0.15	0.131	0.093	1.15	0.25
Authoritarian style	0.12	0.118	0.080	1.017	0.31
Authoritative style	-0.091	0.093	-0.059	-0.981	0.33

RESEARCH ARTICLE

A Comparative Study of Body Builder's Physical Status in Rural and Urban Areas of Andhara Pradesh, India

Kaukab Azeem

Faculty, Physical Education Department, King Fahd University of Petroleum & Minerals, Saudi Arabia

*Address for correspondence
Dr.Kaukab Azeem
Faculty, Physical Education Department
King Fahd University of Petroleum & Minerals,
Saudi Arabia

ABSTRACT

Introduction: Physical education contributes to the wholesome development advancement and perpetuation of the nation's culture. Bodybuilding is the mother of all sports and beneficial to all athletes. Bodybuilding is described as one of the components of physical fitness. An individual develops his body to the maximum extent various exercises to keep him fit. The purpose of the investigation was to compare the bodybuilder's physical status in rural and urban areas of Andhra Pradesh.

Method: For this study a group of 500 subjects were selected randomly from the different districts of Andhra Pradesh, India. The age of the bodybuilders was between 18 to 25 years. The subjects were segregated into two groups namely rural (N=250) and urban (N=250). The physical status was considered for this study for the both groups. A physical variable consists of, Anthropometric measurements, static strength, muscular endurance, and flexibility. For analyzing the data to find out the effect of different groups on the performance of the bodybuilders cross tabulations with chi square was utilized. Mean, standard deviation has been computed for studying the nature of variations in physical parameters of the subjects. Further to know the effect of different categories on the performance of the bodybuilders with multi parameters is handled by employing the techniques of discriminant analysis with help of SPSS software.

Results and Discussion: Analyzing data shows that the urban subjects were physically well developed than the rural subjects. This is because of various reasons, since the urban population has well developed and hi-tech infrastructural facilities apart from the well balanced guidance and suggestions from the experts and technical sound professionals of the game.

Kaukab Azeem

Conclusions: It is concluded that the anthropometric measurements shows no significant difference among them. It is concluded that with regard to physical parameters both the groups differ significantly, further more it shows that the urban bodybuilders are better performers than the rural counterpart.

Key words: Bodybuilder's, Physical, Anthropometric, Performance

INTRODUCTION

Physical education contributes to the wholesome development advancement and perpetuation of the nation's culture. Physical education has much to contribute during the school years, as when an individual can develop his body into a strong and beautiful physique, endowed with skillful movement and coordinated action. It has major contribution to make in the growth and development of all individuals. Bodybuilding is the mother of all sports and beneficial to all athletes. Bodybuilding is described as one of the components of physical fitness. An individual develops his body to the maximum extent various exercises to keep him fit.

The progress of any country depends mainly on the degree of physical fitness of India adopted a scheme of "National Physical Efficiency Drive" according to Victor "fitness is a transitory state and the physically fit person of the movement can be unfit tomorrow, if he fails to keep up the habit of regular exercises"

Physical fitness is demonstrated through physical performance. Greater the physical fitness greater is the Physical education and precision of movement. "Harrison Clarke" points out that physical fitness is an organic soundness Consisting of three components: I) Muscular strength, 2) Muscular Endurance and 3) Circulatory and Respiratory endurance. The effective of all body movements depends upon the status of their inter-related components. Physical fitness is a capacity for sustained Physical activities. It is the key to success, in every walk of life. McPartlon Opines "A fit man is well adjusted to his environment whose mind and body ate in harmony and who can make the normal demands made on him; both mentally and physically without undue fatigue".

Body Building is a component highly essential for every individual to keep fit and is also highly beneficial to all athletes. Now a day's every individual wants to be fit, physically powerful and more impressive in looking. Body Builders use Body Building techniques to develop their muscles from Neck to Calf and then compete with one another on stage by exposing their muscles to determine who has matched the highest level of development of the body. Body Building these days is more popular than it was in the past. Earlier, there was only competition in this sport but mow it has developed as a recreational sport. Body building sport evolves Physical fitness, health, and developing confidence and a better self-image. Orthopedics professionals use this sport as a means of rehabilitation for patients with certain types of Physical problems. It is being used by elderly people as a means if combating many of the debilitating effects of aging. It is also becoming more important in sports training as many athletes, find that body building can greatly enhance their performance, women, children, and even whole families are becoming involved in bodybuilding program. Body Building is a socially relevant sport and has become the fourth largest sport in the world. The international Federation of Body Building under the guidance of its president Ben Weider now has 160 member countries. In addition, the Mr. Olympia title is now recognized as the top professional championship in Body Building – Which is comparable to Wimbledon in tennis or the U.S. Open Golf. Body Building got official recognition from the International Olympic Committee in 1997, making the sport of physique Competition a full member in the International amateur sports community.
Bodybuilder's train very high intensity of training to improve muscles size and muscular strength, endurance, flexibility, cardio-vascular endurance and also to maintain fat percentage to display the muscles during the show. Keeping the above facts into the total frame of my mind this study was taken-up to study the facts of bodybuilders of rural and urban areas to find the significant differences among them.

Significance of the Study

The findings of this study will be of great help on understanding physical status of bodybuilder's in rural and urban areas of Andhra Pradesh. Furthermore the findings of this study will be helpful to the sports officials, physical Director's, coaches to identify the body builders and to select them for participation at various levels such as national and All India Inter varsity level. This study may help in a small way as a contribution to professional literature on Body builders in India.

The purpose of the investigation was to compare the bodybuilder's physical status in rural and urban areas of Andhra Pradesh.

METHODS

Plan

The present study was under taken for Body Builders who have participated at the State Level and above in the rural and urban areas of Andhra Pradesh. The subjects were selected at random, and the sample was also drawn from them.

Design

A group (n=500) bodybuilders i.e., 250 Body Builders from each of the rural and urban areas were selected randomly for the study. For this study only those body builders who have participated in the state Level and above were considered.

For studying the physical parameters the following tests were conducted for the study.

Sample

For the present study Bodybuilders of Andhra Pradesh who have participated in Body Building Competition at Sate Level, Inter Collegiate Level and above were only considered. The selection of subjects was done in two stages. The sampling units at the first stage were Gyms/Vyayamshalas. The sampling units at the second stage were Body Building Competitions. All the Body Builders of Andhra Pradesh were stratified into the two categories (a) Rural (n=250) (b) Urban (n=250).

Procedure

In order to achieve the objectives of the study, five physical parameters were selected. The procedure for conduct of the investigation has been explained along with the description of the events.

Physical parameters

Shoulder Width, Purpose: To measure shoulder width.
Procedure: The testee is asked to stand in a comfortable position.   The measurement was taken with the help of a steel tape and recorded in centimeter from one deltoid to other.

Chest Circumference, Purpose: To measure circumference of the chest.

Kaukab Azeem

Procedure: The testee is asked to stand in comfortable position. Then he is allowed to expand his chest as wide as possible. The steel tape is applied in such a manner that it touches the lower angle at shoulder blades in the back and directly above the nipple of the pectolaris.

Waist circumference, Purpose: To measure the circumference of the waist.

Procedure: The circumference is measured at the level of umbilicus with the help of the steel tape. The testes is asked to stand in a comfortable position this measurement is taken in a relaxed phase. The reading is recorded in centimeters.

Thigh Circumference, Purpose: To measure circumference of the right thigh.

Procedure: Thigh circumference is measured just below the gluteal fold or maximal thigh girth. A Testes is asked to stand in a relaxed position with feet slightly apart and weight equally distributed on both the feet. Steel tape is located horizontally around the right thigh at point of greatest girth. Reading is recoded in centimeters.

Calf Circumference, Purpose: To measure circumference of the right calf muscle.

Procedure: The testes is asked to stand with his feet slightly apart and his weight equally distributed on both legs. The circumference of the calf is Measured by the steel tape and recorded in centimeters.

Dynamic Strength, purpose: To measure power in upper and lower limbs.
      (i)   Parallel bench press. (ii) Half Squat

Purpose: To apply force for one maximum contraction & relaxation against a   maximum resistance. To measure power in upper and lower limbs.

 Half Squat: Facilities and equipments:
    (i)   Power squat stand. (ii) Power Rod 7″ – 4″ in length. (iii) Challenge plates in Kgs.

    (iv) Training belt.

Procedure: The testes will step under barbell on the squat stand so that the Barbell rest on the shoulder and hold the bar and steps away. The testes stand straight with Feet Flat on the floor placing his Feet 16-20 inches apart. Keeping his head up with back straight, he bends his knees and lowers himself until his thighs are parallel to the Floor or half way down and he should come back to the same position.
Scoring: One chance will be given with maximum weight. The bodybuilder will be cleared if the half squat is done perfectly.

Bench Press

Bench (ii) Power Rod (iii) Challenge Plates in Kgs

Procedure: The testes will lie down on a bench, with feet on the floor, grip should be Shoulder apart. The bar should be lifted off the rack and held at arm's length above. The arms should be bent slowly lowering the barbell straight down wards until it touches the lower pectorial line and held for a movement, again the testes has to press the bar upward until the arms are fully locked out.

Scoring: One chance will be given with maximum weight. The bodybuilder will be cleared if the bench press was done perfectly.

Static Strength, Purpose: To measure the maximum strength by pulling grip dynamometer.
Facilities and equipment: Grip dynamometer

Procedure: The testes takes grip on a grip dynamometer and slowly pulls the lever and
    Hold's it for a second to record the performance for both the hands alternatively.

Scoring: One chance will be given to pull maximum with each hand.
The body builders will be cleared if the execution was done perfectly and the score in the dynamometer is recoded.

Muscular Endurance
1.   Modified Sit-ups   (ii)   Push-ups

Purpose: To measure muscular endurance capacity

Modified Sit-ups
Facilities and equipment: (i) Mat (ii) Stop watch

Procedure: The testes assumes a lying position on back with knees bent, feet flat on the
Floor, hands on the outside of the thighs & chin pressed under the chest. He Should sit up and bring his head as close to his knees as possible. He Should then slowly come back to floor again.

Scoring: One-minute chance will be given for maximum repetitions. The body builders will be cleared if the modified sit-ups are done perfectly and the no. of repetition in one minute will be recorded.

Push-ups
Facilities and equipments: (i) Mat (ii) Stop watch

Procedure: Placing hands on the floor, the testes will take grip shoulder distance apartand keeps his legs on the floor, face facing towards the floor. He holds his Arm's length, at above the floor, and then he slowly lowers his chest and Touches the floor, then he pushes   back to the starting position until the arms are fully locked.

Scoring: One minute chance will be given for maximum repetitions. The body builders will be cleared if the push-ups are done perfectly and the No. of push-ups done in one minute are recoded.

Sit and reach test

Purpose: To measure hip and trunk flexibility
Facilities and equipments: (i) Mat (ii) Measuring scale (iii) Stem board

Procedure: The testes is made to sit on the floor, with back straight he touches the wall Legs separated enough to straddle the stem board the feet are placed on the footprints and pressed firmly against the cross board. The arms are extended forward, with the hands placed palms down on the upper surface of the scale the subject has to bend forward and hold the position of maximum reach the knees must remain straight. If the hands reach unevenly the hand reaching the shorter distance determines the score. The score is recorded to the nearest half inch.

Kaukab Azeem

Scoring: One chance will be given to the participants to perform sit and reach test. The Testes will be cleared if the execution is done perfectly and the distance needed is recorded as the score.

Statistical analysis

For analyzing the data Mean, standard deviations have been computed for studying the nature of varieties in physical parameters among the participants. Further to know the effect of different categories on the performance of the Bodybuilders with multi parameter, evaluation is handled by employing the techniques of discriminant analysis.

RESULT AND DISCUSSION

The analysis and the interpretations of the data to find out the better performance between the Rural and Urban Bodybuilders in the physical aspects like the Anthropometric measurements where the proportion of the body builders, is the better performance. In dynamic strength, static strength, muscular endurance and flexibility the higher total in Kgs /centimeters is treated as better performer.

 In order to study the difference between rural and urban with respect to the performance of the body builders in physical variables the factor analysis, and discrimination analysis has been used for physical variables.

An attempt is made to **c**hoose an appropriate analytical technique when the problem involves a categorical dependent variable, as Rural and Urban with several metric independent variables as physical variable of the Bodybuilders. Moreover when the dependent variable consist of two groups rural and urban with the corresponding physical independent variable. For this type of a situation discriminant analysis technique easily handles the two groups with regard to the various characteristics and this technique can be evaluated by setting the variates for each variable relative to the with in-group variance. This technique is an appropriate technique for testing the hypothesis whether the two categories are different or not using the various characteristics. Discriminant analysis are computed and presented in the tables from 3.1 to 7.3.

From the table no 3.1 of test of equality of group means it was found that both urban and rural Body Builders differ significantly with regard to anthropometric measurements with no misclassification.

Also, from the table 3.1 of classification results classify that Rural and Urban body builders are classified correctly with 97.8%. A rural body builder misclassified as urban body builder is with a chance 2.4%. Similarly an urban body builder misclassified as a rural body builder is with a 2% chance hence the group means do not differ with respective to the Anthropometrics Measurements.

Similarly analysis has been done for other characteristics such as Dynamic strength from table no. 4.1 to 4.3 and found that the group means do differ significantly and there is a 57% of the Rural and Urban Body Builders dynamic strength differs significantly, giving a 43% misclassification.

Also, Static strength from table no 5.1 to 5.3 characteristics are evaluated for both the groups found that these characteristics differ significantly with regard to urban and rural body builders. These two categories are correctly classified with 53% with a 47% misclassification.

Similarly the Muscular Endurance from table no 6.1 to 6.3 characteristics are also different in the both the groups giving a 54% correct classification and giving a 46% misclassification overall this technique highlights the two categories differ significantly except with the Anthropometric Measurements this is because the measurements do not differ in the two categories.

Kaukab Azeem

Flexibility from table no. 7.3 is also different in both the groups giving only 60% correct classifications. From the time immemorial the body part measurements occupied a prominent place people used to measure various body parts and know how fit one is and used to compete with one another. In body building the practice of developing various parts of the body was prevailing from the 8th century wherein the Greeks were the great exponents. They used to develop the Body and praise the esthetic figure and give awards. The same has been carried forward and with the invention of various gadgets and modalities it became highly competitive in this millennium. Body Builders especially from the urban areas who have access to various bi-tech equipment and facilities plan their training systematically and have a pretest of measuring their body parts and check out the body parts after undergoing the schedule of training. There will be a posttest after a few weeks to find out whether the training schedule is working out properly. Along with proper exercise, which should be done, meticulously there is a great role of nutrition in the development of body parts. A balanced diet with specific exercise goes a long way in shaping the body and there will be marked difference in the Anthropometrics Measurements. It is said that no training is complete without the guidance of a coach. He is the only person who can jot down the mistakes and keeps an eye on the shortcomings. His advice goes a long way in the success of the body builders. Apart from shaping the body t its proper size, the coach can with this experience guide to prevent injuries and adverse effects of various aspects. The urban body builders have an advantage over the rural body builder since the infrastructure and the lack of knowledge of guidance is a barrier for their proper anthropometrics development. Added to this the rural body builders consumes more fatty foods, and salt which adversely affect the musculature of the body whereas due to the knowledge and also guidance of the coach the urban body builders has a diet which is predominant with carbohydrates and proteins which helps in the development of muscularity. When people today talk about physical fitness, especially if they know what they are talking about, they are likely to mean, health fitness. For example when someone asks, " Are you physically fit"? You assume that the person is referring to health fitness. The same is true of questions? Such as "are you attending a fitness class? Or does your school/college have a good Program that does not mean that motor performance fitness is not important it simply means that it is difficult. The difference is that motor performance fitness is not related to basic health or to the prevention or remediation of degenerative disease, Being well coordinated, strong, fast, powerful and agile will not help you to prevent or retard the onset of degenerative disease and will not help you to score well on a health fitness test either. As Bill Bowarmen, a famous Track Coach of University of Oregon said, " After all, when you are past 30, bulging biceps and pleasing pectorals may boost your ego, but your life and the health may depend upon how fit your heart and lungs are", the fitness of heart and lungs is called as Cardio Respiratory endurance or fitness. This is one of the great indicators of health of an individual. There are different training program to develop this special aspect of fitness.

CONCLUSION

It is concluded that there is no significant difference in the anthropometric measurements between both the groups. They are almost same.

It is concluded that as far as all other parameters they do differ significantly in the following: Dynamic Strength, Static Strength, Muscular Endurance and Flexibility. The Urban body builders are better that the rural body builders.

ACKNOWLEDGEMENT

Kaukab Azeem

REFERENCES

1. Arnold Schwarzaneger with Bill Dobbins, First Edition, 1987 p.12-18.
2. Arnold Schwarzeneger, Encyclopedia of body building revised Edition by Bill Dobins in 1999.p.2,4,5,31,33,42.
3. Application of Measurement to Physical Education, sixth edition, H. Harrison Clurke David H. Clarke, New Jersey, 1987.
4. "AAHPER Youth Fitness Test Manual", Washinton D.C, American Association of Health, Physical Education & Recreation, 1958.
5. Amateur Athletic Federation of India hand book,1982, Published by Special Organizing Committee of Asiad, 1982, New Delhi.
6. Dissertation Abstracts International 44:1(July 1998):103-A.
7. Barrow, M.H. and McGee, R.., " A Practical Approach to Measurement in Physical Educational", Philadelphia, Lee and Febiger, 1971.
8. Best, J.W., " Research in Education", 1977.
9. Baumgartner, A. and Jackson, S.A., " Measurement for Evaluation in Physical Education", Hanghton Mitton Co., First Edition, 1975.
10. Barbanthi Valdir Jose, " A Comparative Study of Selected Anthopometric and Physical Fitness Measurements of Brazillian and American School Children" Dissertation Abstracts International(June 1983)-3840-A.
11. Barrow and McGee, Practical Approach to Measurement in Physical Education.
12. Burley, L.R., Dobell, H.C. and Farrell, B.J., "relation of Power, Speed, Flexibility and Certain Anthopometric Measures of Junior High School Girls", Res. Quart.1961.
13. Burkhardt, " Statistical Comprehension for Graduate Students in Physical Education Test and Norms"Completed Research in Health, Physical Education and Recreation XII(1970).
14. Deborach B. Dowdy; Kirk J. Culcton Murry P. Du Val' and Marvey Ga Ouzas, "The Effect of Aerobic Dance on Physical work Capacity, Cardio-Vascuar Function and Body Composition of Middle Aged Women," Research Quarterly for Exercise and sport3:111 (May 1988) p,227.s
15. David v. Golding , "The Relationship of the Cardio-vascular Step Test with Selected Anthropometric Measurements of College Men," Completed Research in Health, Physical Education and Recreation 12 (1979):21
16. Dannis James Selder, "Antropoetric, Cardio-Vascular and Motor Performance Characteristics of University Ice Hockey Players," Completed Research in Health Physical Education and Recreation 7(1975): 41.
17. Donald Dwaine Lackey, "Movement Exploration and Explanation –Demonstration – Performance – Analysis Methods of Instruction – A Comparative Study," Dissertation Abstracts International 32(November 1988) : 2468-A.
18. Emest D. Micheal Jr. and Arthur J. callon, "Pulse wave and Blood Pressure Changes occurring during a Physical Training Program." Research Quarterly 31:1 (March 1960) p.43.
19. Elmer William Yoest, "Relationship Between Cardio-vascular Fitness ands Selected Anthropometric Measurements of English Grade Boys and Colleges Men," Dissertation Abstracts International 34 (November 1980) : 2374-A.
20. E. Nerman Gardiner Greek Athletic sport & festivals Macmillan, London. 1910.
21. Garry J. Berg. " Relationship between Selected Body Measurements and Success in Standing Broad Jump," Completed Research in Health, Physical Education and Recreation 11(1978):23.
22. Garry De L,; Lourse Levine and Lindsay J.E. Carter, Genetic and Anthropological studies of Olympic Athletes(London: Academic Press Inc, 1989), P.189.
23. Gayle Dyndon Brengden, " A Comparison of Physical Fitness and Anthropometric Measurements of Pre-Adolescent Mexican American and Angle American Males, " Dissertation Abstracts International 33(May 1985):6157-A.
24. Harold Wilson Pearcy, " Correlation of Leg Power, Leg Strength, Leg Speed and Certain Anthropometic Measurements," Completed Research in Health, Physical Education and Recreation 15(1987):138.

25. Harrison Clarke, " Toward a Better Understanding of Muscular Stength,"Physical Fitness Research Digest 3(January 1983):18.
26. JOE WEIDER'S " Mr. Olympia Training Encyclopedia"p.60 1989.
27. JE. Lindsey Carter et al., physical Structure of Olympic Athletes (San Diego, 1973),p.145
28. Journal of sports traumatology and allied sports sciences, dec 2004.
29. J.E. Kindsay Carter, Physical Structure of Olympic Athletes (Switzerland: Werner Bruck AG, Basel Press, Inc, 1999),p.130.
30. John D. Road, "Anthropometric and Strength Characteristics of High School Completive Gymnastics," Completed Research in Health, Physical Education and Recreation 10 (1971) : 36
31. Kenneth A. Leithood, "The Personality Characteristics of three Groups of Weight Trainers," Completed Research in Health Physical Education and Recreation 10(1976) :14.
32. Katsunori Ikeda, "The Causal Relationship between Physical Ability, Self Perception of Physical Activity," Dissertation Abstracts International 43 (July 1995) : 108-A.
33. Karpovitvh, Peter. V and Simming Wagne, E., "Physiology of Muscular Activity", Philadelphia, W.B. Saunders, 1971.
34. Lerry Ward; Jack I. Goppel and Michcal Stone, :Anthropometry and performance in Master and First Class Olympic Weight lifters," The Journal of Sports Medicine and Physical Fitness 19(June1999):205
35. Lenon, Roger. T., "A Glossary of 100 Measurement Terms," Service Note Book No. 13, New York, Harcourt, Brace and world, Inc. 1966.
36. Louise Chlore King, " An Investigation of the Effects of Two Training Programme on selected Cardio-respiratory Variables of College Women," Completed Research in Health, Physical Education and Recreation 5(1966) p.101.
37. Leverne W. Baacke, " Relationship of Selected Anthropometric and Selected Physical Performance Measures to Performance in Running Hop Step and Jump," Research Quarterly 35(March 1975):107.
38. Students in an Inner City, Urban and Suburbun Setting, " Dissertation Abstracts International 42:10(April 1995) :4352-A.
39. Mayers, R.C., " Measurement in Physical Education", The Ronald Press Company, New York Second Edition,1974.
40. M.II Slaughter; T. G. Lohman and J. Misner, " Relationship of Sematotype and Body Composition to Physical Performance in Seven to Twelve Year Old Boys,"Research Quarterly 48(March 1989):159.
41. Michael L. Associates and Pollock, " Effect of Walking as Body Composition and Cardio-Vascular Functioning of Middle Aged men, " Research Quarterly 30:1(January 1971)p.126.
42. Max Well, Albert E. Analyzing Qualitative Data, New York, John Wiley & Sons, 1961.Nancy L. Greer "Prediction of Aerobic Capacity from Step-up Exercise and recovery Heart-rate on 6,87,12 and 6 inch bench heights, Abstracts 1980(American Alliance for Health, Physical Education, Recreation and Dance, Washington,1980)p.13.
43. NIPES Journal Quarterly, February 2004 p.6.
44. Priest Nita Nelson, " Comparative Effect of Two Program of Aerobic Dance on the Flexibility, Body composition and General Physical Condition of Selected College Women, " Disseration Abstract International 44:7 (January 2000) p.2086.
45. Russel F. Wells, " The Relationship of Leg Strength Body Weight Ratio and Length of the Lower Limb Segments to Vertical Jump, "Completed Research in Health, Physical Education and Recreation 6(1973):78.
46. Shisly Anne Lancy, " Anthropometric and strength Correlates of Dynamic Balance, "Dissertation Abstracts International 34(November 1987): 1472-A.
47. Smith L.E., Whitley, J.D., " Influence of the different Training Program of Strength and Speed or a Limb Movement", Res. Quartz. 1966.
48. Tara's body building Journal Quarterly, September, 2003 p.26.
49. Tara's body building book " by Sunil Hastir Jalandhar, India, 2004 P.5,105.
50. The Athletic Institute and the American Atliance for Health, Physical Education, Recreation Dancc, Planning Facilities for Athletics Physical Education and Recreation, Reston, Va, 1985.

51. Thomos Krick Cureton Jr. Physical Fitness of Champion Athletes(Urbane: The University of Illinnis Press, 1954)p. 49.

Table-1, shows the selected physical parameters and test variables

Sl. no	Physical parameters	Test
1	Anthropometric Measurements	Shoulder, chest, waist, thighs and calves
2	Dynamic Strength	Half Squat and Bench press
3	Static Strength	Grip dynamometer for Left and Right hand
4	Muscular Endurance	Modified sit-ups for one minute, and push-ups for one minute
5	Flexibility	Sit and Reach Test

Table-2, Showing the Sample of Body Builders of Rural and Urban areas of A. P

	Places of Interview Schedule		No. of Bodybuilders	
Sl.no.	Body Building Competitions	Other places	Rural	Urban
1	Selection trials for South India / Junior National / Senior National	-----------	25	42
2	Senior Inter Dist. Championship	-----------	95	75
3	Inter Collegiate Competitions	-----------	35	28
4	Junior Inter Dist. Championship	-----------	60	40
5	-------------------------------------	Gyms/ Vyayamshalas	35	65
			------- 250 -------	------ 250 -----

Sample of Body Builders of Rural and Urban areas of Andhra Pradesh (AP)

Kaukab Azeem

Discriminant for Anthropometric Measurements both rural and Urban
Table no. 3.1   Group Statistics

Rural Anthropometric Measurements (250)	Mean	Std. Deviation
Shoulder	45.9926	3.0511
Chest		
Waist	104.1550	8.1458
Thigh		
Calf	80.0626	5.2577
	62.5232	6.1280
	39.9018	3.8780
Urban Anthropometric Measurements (250)	**Mean**	**Std. Deviation**
Shoulder	50.3926	3.0511
Chest		
Waist	111.2550	8.1458
Thigh		
Calf	77.7626	5.2577
	61.2932	6.1280
	39.1018	3.8780

Table no.3.2, Test of Equality of Groups Means

Anthropometric Measurements	Wilks' Lambda	F	Df1	Df2	Sig.
Shoulder cir	.657	259.966	1	498	.000
Chest cir					
Waist cir	.840	94.964	1	498	.000
Thigh cir					
Calf cir	.954	23.921	1	498	.000
	.990	5.036	1	498	.025
	.989	5.320	1	498	.021

Kaukab Azeem

Table no: 3.3, Classification Results

Grouping	Predicted Group Membership		Total
Orginal Count rural Urban	244 5	6 245	250 250
% rural	97.6 2.0	2.4 98.0	100.0 100.0

Discriminant for Dynamic Strenght for both urban and rural

Table no. 4.1, Group Statistics

Grouping	Mean	Std. Deviation
rural dynamic strength_half squat kgs dynamic strength bench press kgs	181.2440 85.7120	53.8969 25.4878
urban dynamic srength_half squat kgs dynamic srength bench press kgs	186.1240 90.7520	53.7484 25.5221

Table no:4.2, Test of Equality of Group Means

	Wilks' Lambda	F	Df1	Df2	Sig.
Dynamic srenght _half squat kg	.998	1.028	1	498	.311
Dynamic srength bench press kgs	.990	4.881	1	498	.028

Table no: 4.3, Classification Results

Grouping	Predicted Group Membership		
	Rural urban		Total
Original Count rural Urban	117 103	133 147	250 250
Rural	46.8 41.2	53.2 58.8	100.0 100.0

4280

Kaukab Azeem

Discriminant for static strength both urban and rural

Table no: 5.1, Group Statistics

Grouping		Mean	Std. Deviation
Rural	Static strength_left hand kgs	32.9500	10.0350
	Static strength_right hand kgs	32.9840	10.0413
Urban	Static strength_left hand kgs	32.0120	10.2390
	Static strength_right hand kgs	32.0500	10.2406

Table no: 5.2, Tests of Equality of Group Means

	Wilks' Lambda	F	Df1	Df2	Sig.
Static Strength_left hand kgs	.998	1.070	1	498	.301
Static Strength_right hand kgs	.998	1.060	1	498	.304

Table no.5.3, Classification Results

Grouping	Predicted Group Membership		
Orginal	Rural urban		Total
Orginal Count rural	117	133	250
Urban	103	147	250
Rural			
	46.8	53.2	100.0
	41.2	58.8	100.0

Discriminant for Muscular Endurance both urban and rural participants

Table no:6.1, Group Statistics

Grouping	Mean	Std. Deviation
Rural muscular endurance modified sit-ups for 1 min	17.6080	3.3194
muscular endurance push-ups for 1 min	45.7760	8.9840
Urban muscular endurance modified sit-ups for 1 min	16.6080	3.3194
muscular endurance push-ups for 1 min	45.4040	8.7752

4281

Table no:6.2, Test of Equality of Group Means

Test	Walks' Lambd A	F	Df1	Df2	Sig.
Muscular endurance modified sit- ups for 1 min	.978	11.3	1	498	.001
muscular endurance push-ups for 1 min	1.000	.219	1	498	.640

Table no: 6.3, Classification Results

	Predicted Group Membership		
Original Count grouping	Rural	Urban	Total
Urban	135	115	250
	114	136	250
Urban	54.0	46.0	100.0
	45.6	54.4	100.0

Discriminant for flexibility, (sit and reach test for urban and rural participants)
Table no: 7.1, Group Statistics

Grouping	Mean	Std Deviation
Rural sit and reach test cm	21.5480	2.9013
Urban sit and reach test cm	20.3400	3.4163

Table no: 7.2, Tests of Equality of Group Means

Test	Wilks'	F	Df1	Df2	Sig.
Flexibility Sit & Reach (cm)	.965	18.160	1	498	.000

Table no: 7.3, Classification Results

		Predicted Group Membership		
Grouping Count	Rural	Urban	Urban	Total
	Urban	167	83	250
	Rural	120	130	250
	Urban	66.8	33.2	100.0
	Urban	48.0	52.0	100.0

RESEARCH ARTICLE

Effect of Gamma Irradiation on Chemical composition, Fibre Fractions of Brewers Spent Grains

Senthil Murugan. S

Department of Animal Nutrition, College of Veterinary and Animal Sciences, Kerala Veterinary and Animal Sciences University, Pookode 673 576, India

*****Address for correspondence**
Senthil Murugan. S

Department of Animal Nutrition,

College of Veterinary and Animal Sciences,

 Kerala Veterinary and Animal Sciences University,

Pookode 673 576, India

Tel: +91-9446233030,

E-mail: s_senthilmurugan@hotmail.com

ABSTRACT

Brewer's Spent Grain samples were tested for chemical composition and fibre fractions after being irradiated at dose levels 0, 7 and 14 kGy. Gamma irradiation had no effect on crude protein, total ash, acid insoluble ashand nitrogen free extract, neutral detergent fibre (NDF), Acid detergent fibre (ADF), Hemicellulose, cell content but the crude fibre,ether extract, cellulose and acid detergent lignin content in γ-irradiated BSG decreased (p<0.05) compared to untreated BSG. The crude fibre content of 7 and 14 kGy γ-irradiated BSG wasdecreased (p<0.05) by 9.0 and 16.7 per cent respectively. Like that, ether extract content was decreased by16.23 to 19.0 per cent at 7 and 14 kGy doses of gamma irradiation. The average cellulose (104 g/kg) content (on dry matter basis) in un treated BSG was decreased (63 g/kg) significantly (p < 0.05) when it irradiated at 14 kGy. In the case of Acid Detergent Lignin (ADL) content of BSG, there was significant decrease (p< 0.05) from 207 to 138.8 (g/kg) at 7 kGy dose and reduced to 119.8 (g/kg) at 14 kGy.

Key words: Brewers spent grains, Gamma irradiation, Pellet production rate (kg/hour), Pellet Durability Index

Senthil Murugan

INTRODUCTION

Brewers' spent grain (BSG) is the major by-product of the brewing industry, representing around 85 per cent of the total by-products generated. Wet brewers' grains contain water content of 74 per cent, which requires some special consideration prior to its utilization as a feed resource. (NRC, 2001).Common brewery practice involves the malting of barley, during germination; the enzymes convert starch to malt sugar. The partially-germinated barley is barley malt. The sprouted barley is dried by heating to stop enzymatic activity. Barley malt is mixed with other grains, generally corn rice and a flavoring agent, hops, to form a mash by adding hot water at 45 -76 ºC. This mash is pressed to give the wort as end-product which used for beer production and the solid residue is brewer's grains or brewers spent grains or brewery waste. Gamma irradiation has been recognized as a reliable and safe method for improving the nutritional value and inactivation or removal of certain anti-nutritional factors in foods and feeds (Farkas, 2006; Gharghani et al., 2008; Taghinejad et al., 2009).During 1981, the US Food and Drug Administration (FDA) concluded that food irradiated at 50 kGy or less can be considered safe for human consumption (FDA, 1981).

There is no detailed information in the literature about the effects of γ-irradiation on chemical composition of BSG in cattle. Therefore we conducted this study in order to explicate effects of various doses of γ-irradiation on chemical and pellet-ability characteristics.

MATERIALS AND METHODS

Sample collection and preparation

The Brewers Spent Grain (BSG) in fresh, wet form was collected from local brewery companies (Malabar Brewers Ltd and United Breweries Ltd, Kerala State, India). About 3000 kg of wet brewer's grain collectedwas sun dried and preserved for chemical composition, gamma irradiationand feeding trial studies. About 1000 gm of sample was dried in a hot air oven at 60ºC for 48 hours and ground to passthrough 1 mm sieve and preserved in air tight containers for further chemical analysis.

Chemical analyses

The dry matter content was determined in sun driedBSG samples and cattle feed samples by 55°C for 48 h. The crude protein inBSG samples was determined according to AOAC (Method 984.13; AOAC, 1995). Ash was determined by burning duplicate 2 g samples at 600°C for 2 h in a muffle furnace (Method942.05; AOAC, 1995). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were analyzedaccording to the method of Van Soest et al. (1991), using an automatic fiber analyzer (Fibra Plus, Pelican Equipments, India equivalent equipmentto Fibertec System M, Tecator, Sweden). Standard methods were also used to determine ether extract (AOAC, 1995).

Gamma Irradiation treatments

The sun dried BSG was gamma irradiated at Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala Veterinary and Animal Sciences Universityfor chemical composition studies. About 2000 kg dried BSG required for pellet production and feeding trial was gamma irradiated at commercial facilities available in Board of Radiation and Isotope Technology, Department of Atomic Energy, Navi Mumbai, India for pellet production studies.

Statistical Analyses

Statistical analysis for chemical analyses results were studied by using the general linear model procedure for multivariate analysis in SPSS (v.16.0).The effect of gamma irradiation on chemical composition, for its statistical significance by Least Squares Means and Duncan descriptive post hoc methods describe in the software package.

RESULTS AND DISCUSSION

Gamma Irradiation effects on chemical composition of Brewers Spent Grains

The proximate composition, fibre fraction, content of BSG and effects of gamma irradiation are listed in Table 1. Gamma irradiation had no effect on crude protein, total ash, acid insoluble ash and nitrogen free extract, but the crude fibre and ether extract content in γ-irradiated BSG decreased (p<0.05) compared tountreated BSG. The crude fibre content of 7 and 14 kGy γ-irradiated BSG was decreased (p<0.05) by 9.0and 16.7 per cent respectively. Like that, ether extract content was decreased by 16.23 to 19.0 per cent at 7 and 14 kGy doses of gamma irradiation.The average cellulose (104 g/kg) content (on dry matter basis)in un treated BSG was decreased (63 g/kg) significantly (p < 0.05) when it irradiated at 14 kGy. In the case of Acid Detergent Lignin (ADL) content of BSG, there was significant decrease (p< 0.05) from 207 to 138.8 (g/kg) at 7 kGy dose while it was subjected to gamma irradiation and further the dose was increased to 14 kGy, it was reduced to 119.8 (g/kg). The other fibre fractions of BSG *viz* Neutral detergent fibre (NDF), Acid detergent fibre (ADF), Hemicellulose, cell content of BSG were not significantly altered at 7 and 14 kGy gamma irradiated dose.

Changes in the chemical composition of Brewers Spent Grains

The present findings of chemical composition on untreated BSG are in agreement with the data previously btained(Senthil Kumar*et al*, 2012; Senthil Murugan *et al*, 2012; Senthil Murugan*et al.*, 2013)in Indian breweries. In the present study, we estimated the effect of gamma irradiation at different doses on chemical composition of BSG.The major portion of grains used for beer production in brewery industry is malted barley; the effect of gamma irradiation on barely up to 30 kGy had no effect in dry matter, crude protein, crude fibre, ether extract and ash content (Shawrang*et al.,*2012). The other research findings in different raw materials reveals that up to 60kGy, gamma irradiation had no effect on chemical composition of Soyabean (Diaa El-Din and Farag, 1998; Taghinejad*et al.,* 2009*)*and rice bran (Amber *et al.,*2004).

Changes in Fibre fractions of BSG

The present study reveals that gamma irradiation had no effect on crude fibre, NDF, ADF, hemicellulose and cell content of BSG except there was significant (p<0.05) reduction in cellulose and ADL content.Other investigators reported that,there was no significant difference in full fat soyabean seeds NDF, ADF content at different gamma radiation doses of 15, 30 and 45 kGy (Taghinejadet al., 2009). However, therewere reported decrease in crude fibre content of alfalfa hay, grain straw, corn cobs, and wheat bran due tode-polymerization and delignification (Sandev and Karaivanov., 1977). The decrease in crude fibre, NDF and ADF content were directly proportional to the increasing dose of radiation (Amber *et al.,* 2004; Tanget al., 2012) and the de- polymerization and delignification was random in nature due to gamma radiation (Sandev and Karaivanov., 1977).

Cellulose is the most important source of carbon and energy in ruminant's diet. Plant fibre contains higher proportion of cellulose and hemicellulose as ligno-cellulosic compound which is main factor restricting animal's digestion of high-fiber content forage because the animal itself does not produce effective cellulose-hydrolyzing

enzymes (Czerkowski, 1986).Each glucose residue of cellulose has inter and intra molecular of two hydrogenic bonds and these bonds stabilize the long and parallel chains of cellulose (Krassig, 1993).Gamma irradiation affects these glucosidal bonds with modification in hydro glucose ring (Takacs*et al.*, 1999) and causes the wander-valls power weakens (Iller *et al.*, 2002; Muto *et al.*, 1995), where breaking of hydrogenic bonds, formation of carbonyl groups of cellulose at the presence of oxygen that helps cellulose breakdown and results in the degradation of the inter-linkages in lignin structure (Muto *et al.*, 1995).

CONCLUSION

It could be concluded that, gamma irradiation causes decrease in cellulose and lignin to certain extent.The changes in BSG due to gammairradiation may make things easier, rumen microorganisms can effectively utilize cellulose and other plant carbohydrates as their source of carbon and energy as it de-lignified or depolymerized or degraded. Further study is needed to determine economic benefits of gamma irradiation processing in comparison with other processing methods.

REFERENCES

1. AOAC.1995 Official Method of Analysis. 16thedn. Association of Official Analytical Chemists. Arlington, V.A.

2. Amber,K., El-Niely,H., Ibrahim, R.M. 2004. Effects of Feeding diets containing irradiated rice bran supplemented   with Porzyme on performance of growing newzealand white rabbits. Egyptian poult. Sci.Jl.24(1): 15-39.

3. Czerkawski, J.W.(1986). Chapter XI - Manipulation of rumen fermentation: An introduction to rumen studies. Pergamon press, Britain, 4th Edn. pp:191-204.

4. Diaa El-Din, M. and H. Farag. 1998. The nutrietive value for chicks of full-fat soybeans irradiated at up to 60 kGy. J. Anim.Feed Sci. Technol. 73:319-328.

5. Farkas, J. 2006. Irradiation for better foods. Trends in Food Science and Technology.17:148-152.

6. Food and Drug Administration.1981. Irradiation in the production, processing, and handling of food; final rule. 21 CFR Part 179. Federal Register 51:13376-13399.

7. Gharaghani, H., M. Zaghari, G. shahhoseini and H. Moravej. 2008. Effect of gamma irradiation on anti nutritional factors and nutritional value of canola meal for broiler chickens. Asian-Aust. J. Anim. Sci. 21:1479-1485.

8. Iller, E., A. Kukielka, H. Stupinska and W. Mikolajczyk, 2002. Electron-beam stimulation of the reactivity of cellulose pulps for production of derivatives. Radiat. Phys. Chem., 63: 253-257.

9 . Muto, N., K. Takahashi and H. Yamazaki, 1995. Effect of electron beam irradiation on characteristics of paper. Jap. Tappi. J., 49: 1086-1097.

11. Sandev, S., Karaivanov, I .1977 The composition and digestibility of irradiated roughage treatment with gamma irradiation. Tierernahr. Fuetterung. 10: 238-242.

12. Senthilkumar. S, T.V.Viswanathan, A.D.Mercy, P.Gangadevi, K.Ally and K.Shyama.2010. Chemical composition of Brewery waste. Tamilnadu J. Vet. andAni.Sci. 6 (1):49-51.

13. Senthil Murugan S., E.Fiji.,G.Seena.2012.Chemical Composition and Microbial Quality of Spent Brewer's Grains.Indian Vet. J. 89 (1): 94 – 95.

13. Senthil Murugan S., E.Fiji.2013. Fractionation of Non-Starch Polysaccharides and Enzymes of Brewer's Spent Grains. Indian Vet. J. 90 (4):105-106.

14. ShawrangParvin, Abbas Majdabadi, Ali Asghar Sadeghi.2012.Changes in cell wall compositions and degradation kinetics of electron beam-irradiated sugarcane bagasse Turk. J. Vet. Anim. Sci. 36(5): 527-532.

15. SPSS. 2007. SPSS User's Guide, version 16.0, SPSS Inc., New York, USA.

16. Taghinejad, M., A. Nikkhah, A. A. Sadeghi, G. Raisali1 and M. Chamani .2009. Effects of Gamma Irradiation on Chemical Composition,Antinutritional Factors, Ruminal Degradation and In vitro Protein Digestibility of Full-fat Soybean.Asian-Aust. J. Anim. Sci. 22, (4): 534 – 541.
17. Takacs, E., Wojnarovits, L., Borsa, J., Foldvari, C.S., Hargittai,P., Zold, O.1999. Effect of gamma-irradiation on cotton-cellulose. Radiat. Phys. Chem. 55: 663-666.

Table 1: Proximate composition and Fibre fraction of untreated and irradiated Brewers spent grains (BSG)

Parameters	Untreated BSG	Gamma Irradiation Dose (kGy)		SEM	SE
		7	14		
Crude Protein (g/kg)	219.2^a+ 1.52	218.3^a+1.44	223.9^a+1.41	97	21.
Crude Fibre (g/kg)	219.4^a±0.751	199.6^b±0.460	182.7^b±0.531	70	17.
Ether Extract (g/kg)	50.5^b±1.67	40.9^{ab}±0.78	42.3^{ab}±0.95	8	14.
Acid Insoluble Ash (g/kg)	15.9^a+ 0.55	16.6^a+0.22	17.0^a+0.20	5	1.4
Total Ash (g/kg)	30.7^a+0.22	35.1^a+0.10	34.8^a+0.16		
Nitrogen Free Extract (g/kg)	486.4^a ± 0.56	502.4^a ± 0.71	490.5^a ± 0.75		
Neutral Detergent Fibre (g/kg)	687.5^a ± 0.72	690.5^a ± 0.55	679.9^a ± 0.58	89	14.
Acid Detergent Fibre (g/kg)	337.4^a ± 1.41	313.3^a±0.86	308.4^a ± 0.99	33	48.
Hemicellulose* (g/kg)	350.12^a+1.26	377.3^a+0.77	371.5^a+0.89	04	54.

4287

Senthil Murugan

Cell content* (g/kg)	$437.5^a \pm 0.65$	$429.3^a \pm 0.40$	$443.9^a \pm 0.46$	14.89
Cellulose (g/kg)	$104^a \pm 1.19$	$90.1^a \pm 0.66$	$63.0^b \pm 1.40$	
Acid detergent lignin (g/kg)	$207^a \pm 5.83$	$138.8^b \pm 2.99$	$119.8^b \pm 2.56$	

[a,b]Mean values with different superscripts in a row differ significantly ($P < 0.05$)

*Calculative values Hemi cellulose = NDF-ADF., Cell content = 100 – NDF

RESEARCH ARTICLE

Impact of Soccer Training on Motor Learning and Some Selected Fitness Variables among Male Students

Abdulhameed Al Ameer[1]* and Kaukab Azeem[2]

[1]Associate Professor, Physical Education Department, King Fahd University of Petroleum & Minerals, Saudi Arabia

[2]Faculty, Physical Education Department, King Fahd University of Petroleum & Minerals, Saudi Arabia

*Address for correspondence
Dr.Abdulhameed Al Ameer
Associate Professor,
Physical Education Department,
King Fahd University of Petroleum & Minerals,
Saudi Arabia.

ABSTRACT

The purpose of this study was to find out the impact of soccer training on motor learning and some selected fitness variables among male students.

Method: A group of (N=50) untrained males were selected randomly for this study from the various classes of physical education orientation course; age of the subjects was between 18-20 years. The soccer training was employed on the subjects for 09 weeks, 45 minutes of training per session, two days of training per week at the evening session. The student's motor learning ability was tested by two tests namely dribbling with the ball, and tackling. Some of the selected fitness variables were 50.M sprint, standing broad jump. To find out the mean differences from pre to post test, mean, S.D and t-tests were computed by means of Statistica Software. Results and Discussion: The analyzing of data reveals that the mean and standard deviation with regard to motor learning of the participants from pre to post test were; dribbling ability (11.51, 2.44), and (10.35,2.06); tackling ability (5.70, 2.98), and (5.78, 3.20). The analyzing data pertaining to the selected fitness variables from pre to post test were; With regard to 50M sprinting performance with mean and S.D were (8.62, 1.80), and (7.72, 1.49); Standing broad jump performance with the mean and S.D were (1.63, 0.335) and (1.81, 0.352). Conclusion: It is concluded that the impact of soccer training on motor learning abilities among the participants from pre to post test and shows

significant performance. It is also concluded that the participants had shows improved performance from pre to post test with regard to the selected fitness variables.

Key words: Training, Motor learning, Soccer, performance

INTRODUCTION

Physical fitness is one of the most important factors that determined the performance level of an individual. Physical fitness is considered as essential to one and all for living efficiency and because of this, every country interested now developing and maintains the physical efficiency of its people. Globally today most of the countries have a number of schemes for the development of such physical fitness. Physical fitness has become the slogan of modern day. Fitness is a very broad term and it consisted of physical fitness, mental fitness, motor fitness and cardio-vascular efficiency, (A.Yobu, 1988). Physical fitness is not a static factor and it varies from individual to individual and in the same person from time to time depending factors, (David H. Clarke and et.al, 1989).

Soccer is most popular and loveable sport in the world. Soccer is a team sport and played between two teams consists of eleven players at each side. Game is played on the rectangular grass field or artificial turf field, with a goal post on each side, end of the rectangular field. The main objective of the soccer game is to score a goal against the team by driving the ball into the opponent's goal post. Dribbling means to move around the field while controlling the ball at the same time and different techniques can be used to get through defenders and open space for the teammates. Dribbling is an important skill in soccer and it is the ability to carry the ball past an opponent while being in control, it is also a basic of soccer skills, if a player not able to dribble the ball, and he is not able to play the soccer. Shooting is a very important skill for the soccer players for making an attempt to score a goal by shooting in the opponent's goal post. Shooting is a complex skill because it involves many movements that should be performed perfectly. Shooting skill is required lot of serious and strenuous training to be better soccer player and needs dexterity during the training to be a good performer.

Soccer match play is characterized by an intermittent activity profile where brief periods of high intensity activity are interspersed with prolonged periods of moderate –intensity activity. Soccer players may cover 10-12 km in each game where high-intensity and sprinting distance can range from 0.5-1.5 km and 0.3-0.6 km, respectively (James Morton, 2014). Soccer is a physically demanding sport which requires a combination of fitness attributes, including muscular power required for explosive actions during the training and match (Zouita & et.al, 2014). According to (Rampinni E.et al 2007), the key fundamentals of soccer players includes' ability to perform repeated high intensity effort while maintaining efficient skills during the possession of the ball. Many recent studies have focused on the measurement of skill and validity of the field based tests as they important and relate to soccer performance. The ability of kicking the ball straight as well as with a curved trajectory is primary skills for soccer players. Some researchers have analyzed the kinematic ball flight properties between different kicks, with previous studies employing either different method, (Alcock, A. etal. 2012). According to (Davis & et al, 2000), Motor fitness refers to the ability of an individual to perform successfully in their relative sport. Agility is also one of the important variables of skill related fitness. Agility is the ability of an athlete which enables him rapidly to change his body position and direction in a precise manner, (Davis & et al, 2000). In soccer game power also plays an important role in the performance of an athlete. Power is a skill related fitness variable and relates to the rate at which athlete can perform work (Nieman, 2011).

The purpose of this study was to find out the impact of soccer training on motor learning and some selected fitness variables among male students.

METHODS

In the following heads the methodology was explained in detail;

Selection of subjects

A group of 50 participants were selected for this study from the various classes of orientation physical education course (PE-001), first semester, at King Fahd University of Petroleum & Minerals, Saudi Arabia, during the year 2012-13. The age of the subjects was between 18-22 years. The purpose and importance of this study was explained to the participants.

Experimental Design

The subjects were selected and in one group and soccer training was employed on them. The training program was employed for 12 weeks, 45 minutes of training per session, two days in a week. The soccer training program was employed on the participants; warm up, soccer training and cool down.

Procedure of testing

The student's motor learning ability was tested by two tests namely; dribbling with the ball (10.M), and tackling the ball (for maximum 10 counts, each tackling is awarded 1 score). The some of the selected fitness test considered for this study was muscular power (standing broad jump in cms), speed (50.M sprint in seconds). A Pre and post test was conducted before and after the 9 weeks of soccer training. The training was given in the evening session at the Physical education Department, King Fahd University of Petroleum & Minerals, Saudi Arabia. All the scores were recorded for analyzing the data.

Statistical Analysis

To compare the mean differences between pre to post test, mean, Standard deviation and t-tests were computed by means of Statistica Software. A significance level at 0.05 level was adjusted.

RESULTS

The analyzing data for group is presented in the table -2 by the help of statistical tools i.e. mean, standard deviation and t test.

The analyzing of data reveals that the mean and standard deviation with regard to motor learning of with regard to dribbling ability of the participants from pre to post test were (11.51, 2.44), and (10.35,2.06). Mean and standard deviation with regard to the tackling ability from pre to post test were (5.70, 2.98), and (5.78, 3.20). The analyzing data pertaining to the selected fitness variables from pre to post test with regard to 50M sprinting performance with mean and standard deviation were (8.62, 1.80), and (7.72, 1.49). Standing broad jump performance with the mean and standard deviation from pre to post test were (1.63, 0.335) and (1.81, 0.352).

DISCUSSION

The main intension of this research study was to analyze the impact of soccer training on the selected variables namely motor learning abilities i.e. dribbling and tackling abilities and for selected fitness variables i.e. speed and muscular power. The results of the present study indicate that the soccer training group had significantly increased

4291

Abdulhameed Al Ameer and Kaukab Azeem

in the motor learning abilities i.e. dribbling and tackling abilities. The participants had shows weak performance in the pre-test and during the soccer training the participants were trained enthustically. At the post test it was encouraging results and had shows improved performance in motor learning abilities among the subjects. This is evident from the results that the participants had shows lot of interest and the soccer training for weekly twice is also had an positive impact in improving motor abilities. The participants had also shows improved performance with regard to the selected fitness variables i.e. speed and muscular power from pre to post test. This is evident that the soccer training is also important and valuable for improving once fitness level. The results of the study is consonance with (Pagaduan, JC., et al.2012), investigated impact of various warm-up protocols on jump performance among college football players and had shows superior gains in the counter movement jump performance. This study also supported, investigated by (Sridhara Subramanian, 2011). In this study it was investigated to find out the effect of modified badminton training on selected physical fitness and skill performance variables of school badminton players and had shows significant improvement in all the selected criterion variables.

CONCLUSION

It is concluded that the impact of soccer training on motor learning abilities i.e. dribbling ability and tackling ability among the participants from pre to post test and shows significant enhanced performance. It is also concluded that the participants had shows improved performance from pre to post test with regard to the selected fitness variables i.e. speed performance and muscular power respectively.

ACKNOWLEDGEMENT

REFERENCES

1. A.Yobu, (1988), The measurement and evaluation, (first ed.,), (madras: Raj Mohan   Pathipakam, pg:417.
2. Alcock, A. etal. (2012). J. Appl. Biomechanical. 28(1), 70-772.
3. David H. Clarke and Harrison H. Clarke, (1989), Application of measurement health and physical education, (Englewood Cliffs, new Jersy: Prentice Hall Inc.,), pg:50.
4. Davis, B., Bull, R., Roscoe, D. (2000). Physical education and the study of sport, Mosby publications, London.
5. James Morton, (2014), Carbohydrate periodisation: Practical strategies to maximize performance and training adaptations. World conference on science and soccer 4.0, Abstract book, pg no: 13.
6. Nieman, D.C.(2011). Exercise testing and prescription. A health related approach, New York, USA, Mc Graw - Hill publishing.
7. Pagaduan, DC, Pojskic, H, Uzicanin, E., & Babajic E, (2002), Effect of various warm-up
8. protocols on jump performance in college football players, Journals of Human
9. Kinetics,35;126-32 .
10. Rampinni E.et al (2007), Technical performance during soccer matches of the Italian Serie Aleague: Effect of fatigue and competitive level. Journal of science and medicine in sports.
11. 3: 228-35.
12. Zouita etal, (2014), strength training reduces injury rate in elite young soccer players during one season. World conference on science and soccer 4.0, Abstract book, pg no: 26.

Abdulhameed Al Ameer and Kaukab Azeem

Table-1: The below table showing the details of motor learning and fitness variables i.e. dribbling, tackling, speed and muscular power

Sl.no	Motor learning and fitness variables	Test
1	Dribbling	10.M dribbling with the soccer ball
2	Tackling	Tackling with soccer ball for 10 attempts. (1 score is awarded on each attempt)
3	Speed	50 M, Sprint (seconds)
4	Muscular power	Standing broad jump (cms)

Table-2

Variables	Test	N	Training Group		
			Mean	**S.D**	**P-value**
Dribbling	Pre	50	11.51	2.44	0.000*
	Post		10.35	2.06	
Tackling	Pre	50	5.70	2.98	0.000*
	Post		5.78	3.20	
Speed	pre	50	8.62	1.80	0.000*
	Post		7.72	1.49	
Muscular power	pre	50	1.63	0.335	0.000*
	post		1.81	0.352	

RESEARCH ARTICLE

Irradiance Effect on Microalgae by Dual-Modulation Kinetic Fluorometer in Terms of Quantum Yield.

Kritika Dixit*, Shailendra Kumar Singh, Adi Nath, Md.Akhlaqur Rahman and Shanthy Sundaram.

Centre of Biotechnology, University of Allahabad, Allahabad, Uttar Pradesh, PIN-211002.India.

*Address for correspondence
Kritika Dixit
Centre of Biotechnology,
University of Allahabad,
Allahabad, Uttar Pradesh, PIN-211002. India

ABSTRACT

Biofuels from algae and cyanobacteria are highly attractive as renewable energy sources to replace, at least partially, fossil fuels. Major factor that has a seminal influence on productivity is light availability. Light energy fully supports growth however leads to oxidative stress upon excess illumination. In this work, the influence of light intensity on the growth and pigment levels of *Nostoc muscorum*, *Scenedesmus dimorphus* and Synechocystis PCC6803 was investigated. The influence of light intensity was checked with continuous illumination, darkness and alternation of light and dark cycles. Results show that these species can easily use even very intense light if dark cycles occur allowing reoxidation of the electron transporters in photosynthetic cycle. If the alteration of light and dark is not optimal, species undergo radiation damage, and photosynthetic productivity is significantly reduced. Another regulation commonly observed in these organisms exposed to various light intensities is the alteration of chlorophyll content per cell and the ratio of carotenoid and chlorophyll. Under excess illumination, Chlorophyll content decreases to reduce light-harvesting efficiency, and carotenoids, active in protecting against oxidative stress, are accumulated. It is found that the algae growth had a non-linear relationship with light exposure levels. There was an optimum standard of light duration during a light and dark cycle. The 24 hours on and 24 hours off samples grew the most based on weight. Our results demonstrate that, *Nostoc muscorum, Scenedesmus dimorphus* and Synechocystis PCC6803 have efficient photosynthetic activity in optimized dark and light cycles. So these species, also capable of accumulating large amounts of lipids, may thus represent suitable feedstock and an attractive alternative to biofuel production.

Key words: oxidative stress, photosynthetic apparatus, illumination, biofuel

INTRODUCTION

Microalgae have vast potentials as a source of valuable pharmaceuticals, pigments, and other fine chemicals.The history of the commercial use of algal cultures spans over 50 years with various applications. The applications of algae have been expanded to the area of wastewater treatment, agriculture, and CO2 fixation with the atmosphere regeneration. However, high-density algal cultures were hampered by light limitation and thus the widespread use of high-density algal cultures.

The light regimes to which the cultures are submitted are considered to be an important factor in the productivity and yield of photosynthetic reactions.Earlier experimental investigations have also revealed that the increase in light duration is directly proportion to growing number of cultivated microalgae as well as the rise in the light intensity. Various studies have been carried out focused on the effect caused by different photon flux densities incident on photobioreactors, but few reports can be found on the impact of the duration of the day and night cycles.Thus, a comparison of different photoperiods is necessary in order to determine the most efficient light regimes for industrial purposes.Therefore, the objectives of the present study were to evaluate the effect of the photoperiod on biomass production, and photosynthetic efficiency by the *Nostoc muscorum, Scenedesmus dimorphus* and Synechocystis PCC6803 in laboratory conditions.

MATERIALS AND METHODS

Strains and Culture Condition

Nostoc muscorum, Scenedesmus dimorphus and Synechocystis PCC6803 were the microalgae strains used to study the effect of varying photoperiods. These strains were grown in BG-11 inorganic medium.

Pigment analysis and Growth Studies

A fixed amount of the homogenous culture was taken for chlorophyll and carotenoid analysis with respect to control. Chlorophyll and carotenoid pigments were extracted in methanol. The absorption was measured at 660 nm for Chlorophyll a and 480 nm for carotenoid. OD was recorded for growth at 750 nm for Zero[th] hour, 24th, 48th, 72th and 90th hour.

Pulse Amplitude Modulated (PAM) Fluorometer Configuration and Measurement Procedure

In our experiments, chlorophyll a fluorescence induction was measured with pulse amplitude modulated (PAM) fluorometer (Dual-Modulation Kinetic Fluorometer, Photon Systems Instruments, Czech Republic) to provide saturating flashes.

The analysis of fluorescence quenching is usually based on a comparison of the maximal fluorescence emission (F_{max}, F_{max}')before and during exposure to Actinic light. The F_{max} is measured as fluorescence emission that corresponds to the reduction of the primary quinone acceptor in all PSII reaction centers. The Quenching analysis Protocol is based on Kautsky effect, the difference is only in added F_{max}(F_{max}') measurements. Prior to the actinic light period, the F_{max} is measured in a short series of a single turnover saturating flashes. The measurement of F_{max}' is repeated during the actinic light period when various quenching mechanisms are becoming active. The protocol for Quenching analysis was designed in FluorWin editor, which generated well-defined states of the photosynthetic apparatus in a short series of a single turnover saturating flashes.

RESULTS AND DISCUSSION

Growth of *Nostoc muscorum, Scenedesmus dimorphus* and Synechocystis PCC6803 at various illumination intensities

The influence of light intensity on growth of *Nostoc muscorum, Scenedesmus dimorphus* and Synechocystis PCC6803 was assessed in the laboratory under optimum condition. All experiments were performed with low optical density cultures to avoid excessive growth. CO_2 and nitrogen (as nitrate) were provided in excess, in order to prevent growth limitation due to these nutrients and to reveal illumination effects only. Growth had a linear relationship with illumination when 12 hours of light and 12 hours of darkness were provided for growth (Fig. 1). In 24 hours of continuous illumination, the growth was substantially hindered whereas, in 24 hours of darkness, the growth was less than the growth obtained in intermittent light cycle. This was expected as light may be limiting for growth but, if in excess, leads to oxidative stress resulting in cell death. However, since the light provided was almost double or maybe high, light usage fell by more than 50%. This indicated that when most external cells are exposed to intense illumination, they can cope with the resulting stress, but they use available energy with lower efficiency.

Pigment analysis at optimal alternation of light and dark

Pigment concentrations were determined spectrophotometrically. Under excess illumination, Chlorophyll a content decreases to reduce light-harvesting efficiency, and carotenoids, active in protecting against oxidative stress, are accumulated. Chlorophyll a increased with time showing linear relationship with illumination when given at intervals of 12 hours (Fig.2). Carotenoid levels increased with time showing traces of oxidative stress due to the accumulation of light for several hours (Fig.3).

Effect of Illumination on Photosynthetic Apparatus measured by PAM Fluorometer

F_v/F_m (F_{max}-F_{min}/F_{max}) (Fig.4a) was monitored in all cultures and cells grown at different levels of illumination. F_v/F_m is a useful parameter to evaluate photosynthetic efficiency in algae and mainly to highlight photoinhibition due to excess illumination. PAM fluorometry results indicated that at optimal alteration of light and dark cycles the quantum yield is most (Fig.4b) whereas in continuous illumination (Fig.4c) or continuous darkness the quantum yield is low. In all cases along with the impaired growth, a reduction in F_v/F_m was also observed, indicating that the cells also underwent photoinhibition, although they were exposed to a low total amount of photons. The quenching analysis by PAM fluorometer gave the measure of photosynthetic efficiency in terms of quantum yield. The F_v/F_m series parallels the evolutionary sequence of these organisms and reflects several possible sources for improving the efficiency. An important measure of practical utility is the photochemical quantum efficiency for PSII charge separation attainable at full solar flux. At total solar flux, F_v/F_m decreases relative to its dark-adapted level, owing to losses from increased probability of charge recombination in PSII as the proton/electron circuits back up.

CONCLUSION

Khoeyi Z., et. al., 2011, used three algae samples placed in different light conditions (photoperiod, intensity), there was an enormous difference in the growing concentration of them as the maximum biomass was recorded between 0.1 g and 2.05 g when the algae culture exposed to 62.5 µmol photons m-1 s-1 for a 16:8 h light/dark photoperiod duration, while the maximum percentage of total saturated fatty acids (SFA) was 33.38 % at 100 µmol photons m^{-2}s^{-1} for a 16:8 h light/dark photoperiod duration. Posten C., 2009, reviewed the different parameters for designing photobioreactors that effect the growth of algal mass.

There are several suggestions to increase light distribution along with sufficient agitation, aeration and energy demand for higher performance. The suggested way to increase light rather than increasing the transparent surface and bringing the algal growth to the light is to use alternative ways to achieve light in the biomass layers by using milli and micro scaled multi structures – fleece of glass fibers can be used – or a build in light conductive structure can be used to guide light into a compact closed reactor. Another way is to use lenses effect or LEDs light to

Kritika Dixit *et al.*

distribute the light uniformly inside the reactor. Mata T., et. al., 2012, analyzed the factors that may affect the production of biomass and the treatment of brewery wastewater. Many parameters were studied to reach the highest biomass production and the most suitable conditions for cultivating algae. Those conditions were in an aerated culture and exposing the growth to a 12 h period of daylight at 12000 lux intensity.

The maximum biomass obtained was 0.9 g of dry biomass per liter of growth on the 9th day. Two fundamental concepts exist for the control of growth by resource availability: the continuous or multiple factor control principle (Mitscherlich- Baule's concept) and the discontinuous or minimum factor control principle (Liebijj-j-Blackman concept) (Tailing 1979) stated by Sommer, U. (1982). Theoretical considerations, as well as empirical data, show that, in any given set of conditions, only one-factor limit growth of monospecific assemblages; the ratio of resource demand to resource availability determines which factor that is. Only if the resources are available in the same proportion as required, can more than one-factor limit growth simultaneously. However, this situation is highly unlikely to occur in nature because such systems are very unstable.

Resource utilization efficiency is a good indication of resource limitation. B.Shuter in 1978 stated that because microbes frequently take up excess nutrients beyond their current demand (Fuhs et al. 1972), internal nutrient pools have to be recorded in addition to ambient concentrations (Rhee 1980). In photoautotrophic organisms, light as well as nutrients is equally important in controlling growth. Besides being able to survive the extreme light conditions, cyanobacteria can sustain the biomass under low-light conditions better than eukaryotic algae. The main reasons are their low maintenance energy requirements at low light levels and efficient light harvesting by phycobilins (Zevenboom & Mur 1984; Loogman & Mur 1986).

Non-photochemical quenching (NPQ) processes occur in almost all photosynthetic eukaryotes, and they help to regulate and protect photosynthesis in environments in which light energy absorption exceeds the capacity for light utilization. NPQ can be divided into at least three different components according to their relaxation kinetics in darkness following a period of illumination, as well as their response to various inhibitors (Horton and Hague, 1988). The major and most rapid component in most algae and plants is the pH or energy dependent component, qE. A second element, qT, relaxes within minutes and is more significant in algae, but rather negligible in most plants during exposure to excess light. This component is due to the phenomenon of state transition, the uncoupling of LHCs from PSII. qT will not be considered further here because it does not seem to be important for photoprotection (Niyogi, 1999). The third component of NPQ shows the slowest relaxation and is the least defined. It is related to photoinhibition of photosynthesis and is therefore called qI.

Under more prolonged, severe light stress qE is replaced by a sustained, slowly reversible component of NPQ, called qI. In contrast to qE, qI is much less characterized and might be due to a mix of photoprotection and photodamage. Chl fluorescence measurements can help to distinguish between photoprotective mechanisms and photoinhibition. The minimum fluorescence level in the dark-adapted state, Fo , is decreased in direct proportion to the maximal fluorescence, Fm , by the photoprotective quenching like qE, whereas photoinhibition typically increases the Fo level while reducing the Fm level (Gilmore et al., 1997). Based on physiological studies, the primary function for qE seems to be the protection of PSII from photoinhibition. However, when qE is impaired, other mechanisms can compensate for long- term acclimation, at least in the absence of additional stresses. Further studies for validation of these experiments and theories, using qE mutants, are necessary to test the ecological importance of qE and for uncovering other significant photoprotective mechanisms that complement qE. The application of new and diverse techniques, from chemistry to biology to genetics to environmental science will be necessary for understanding qE, a nearly ubiquitous response of photosynthetic algae to excess light energy.

Kritika Dixit *et al.*

ACKNOWLEDGMENTS

REFERENCES

1. Al-Qasmi, M., Raut, N., Talebi, S., Al-Rajhi, S., & Al-Barwani, T. (2012). A review of effect of light on microalgae growth. In Proceedings of the world congress on engineering (Vol. 1, pp. 4-6).◉

2. Arsalane W, Rousseau B, Duval J-C (1994) Influence of the pool size of the xanthophyll cycle on the effects of light stress in a diatom: competition between photoprotection and photoinhibition. Photochem Photobiol 60:237–243. ◉

3. Bugos RC, Hieber AD, Yamamoto HY (1998) Xanthophyll cycle enzymes are members of the lipocalin family, the first identified from plants. J Biol Chem 273:15321–15324.

4. Gilmore, A. M. (1997). Mechanistic aspects of xanthophyll cycle-dependent photoprotection in higher plant chloroplasts and leaves. Physiologia Plantarum,99(1), 197-209.

5. Gilmore AM, Ball MC (2000) Protection and storage of chlorophyll in overwintering evergreens. Proc Natl Acad Sci USA 97:11098–11101.◉

6. Harwati, T. U., Willke, T., & Vorlop, K. D. (2012). Characterization of the lipid accumulation in a tropical freshwater microalgae Chlorococcum sp. Bioresource technology, 121, 54-60.

7. Horton, P., & Hague, A. (1988). Studies on the induction of chlorophyll fluorescence in isolated barley protoplasts. IV. Resolution of non-photochemical quenching. Biochimica et Biophysica Acta (BBA)-Bioenergetics, 932, 107-115.

8. Li XP, Björkman O, Shih C, Grossman AR, Rosenquist M, Jansson S, Niyogi KK (2000) A pigment-binding protein essential for regulation of photosynthetic light harvesting. Nature 403:391–395.

9. Mata, T. M., Melo, A. C., Simões, M., & Caetano, N. S. (2012). Parametric study of a brewery effluent treatment by microalgae Scenedesmus obliquus.Bioresource technology, 107, 151-158.

10. Müller, P., Li, X. P., & Niyogi, K. K. (2001). Non-photochemical quenching. A response to excess light energy. Plant Physiology, 125(4), 1558-1566.

11. Niyogi, K. K. (1999). Photoprotection revisited: genetic and molecular approaches. Annual review of plant biology, 50(1), 333-359.

12. Post, A. F., Loogman, J. G., & Mur, L. R. (1986). Photosynthesis, carbon flows and growth of Oscillatoria agardhii Gomont in environments with a periodic supply of light. Journal of general microbiology, 132(8), 2129-2136.

13. Posten, C. (2009). Design principles of photo-bioreactors for cultivation of microalgae. Engineering in Life Sciences, 9(3), 165-177.

14. Rhee, G. Y., & Gotham, I. J. (1980). Optimum n: p ratios and coexistence of planktonic algae1. Journal of phycology, 16(4), 486-489.

15. Seyfabadi, J., Ramezanpour, Z., & Khoeyi, Z. A. (2011). Protein, fatty acid, and pigment content of Chlorella vulgaris under different light regimes. Journal of Applied Phycology, 23(4), 721-726.

16. Sforza, E., Simionato, D., Giacometti, G. M., Bertucco, A., & Morosinotto, T. (2012). Adjusted Light and Dark Cycles Can Optimize Photosynthetic Efficiency in Algae Growing in Photobioreactors. PLoS ONE, 7(6), e38975. doi:10.1371/journal.pone.0038975◉

17. Shuter, Brian. "A model of physiological adaptation in unicellular algae." Journal of theoretical biology 78.4 (1979): 519-552.

18. Sommer, U. (1982). Vertical niche separation between two closely related planktonic flagellate species (Rhodomonas lens and Rhodomonas minuta v. nannoplanctica). Journal of Plankton Research, 4(1), 137-142.

19. Zevenboom, W., & Mur, L. R. (1984). Growth and photosynthetic response of the cyanobacterium Microcystis aeruginosa in relation to photoperiodicity and irradiance. Archives of microbiology, 139(2-3), 232-239.
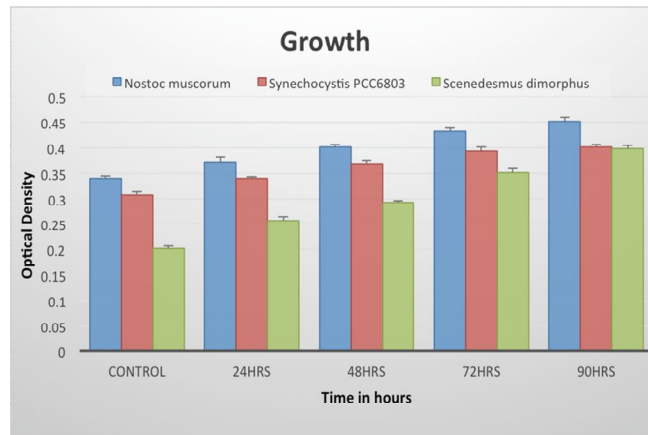
Figure 1 O.D. at 750 nm depicting growth of algal cultures in 12 hours of light and 12 hours of darkness (optimal alternation of light and dark)
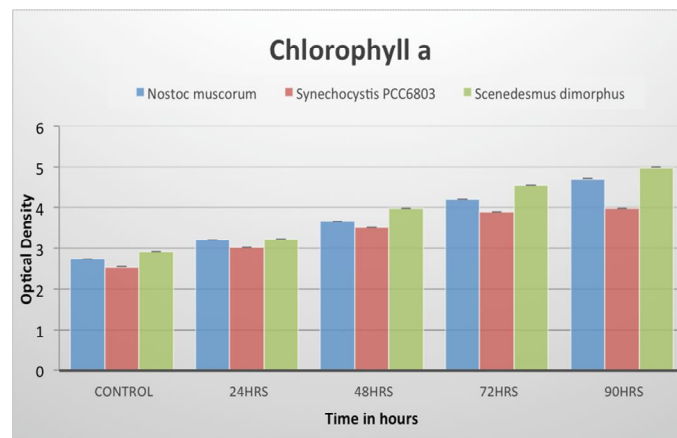

Figure2 O.D. at 660 nm depicting Chlorophyll a content in 12 hours of light and 12 hours of darkness (optimal alternation of light and dark)
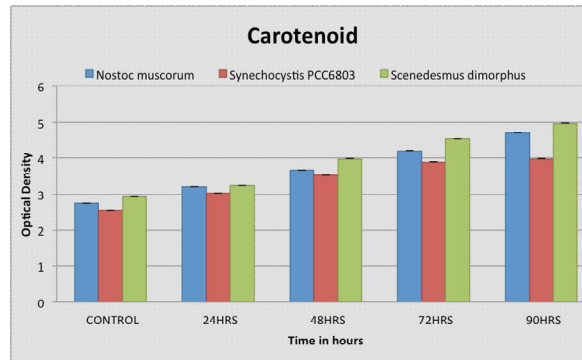
Kritika Dixit *et al.*

Figure 3 O.D. at 480 nm depicting Carotenoid content in 12 hours of light and 12 hours of darkness (optimal alternation of light and dark)
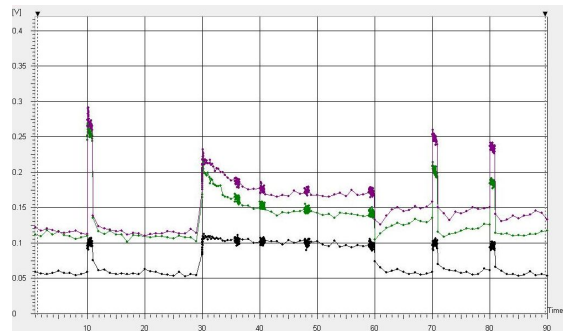

Figure 4 a) Quenching Analysis of the three species in continuous darkness(24 hours); highest quenching was found in *Nostoc muscorum*(Purple), then in Synechocystis PCC6803(Green) and minimum in *Scendesmus dimorphus* (Black).Y axis depicts Fluorescence quenching and X axis depicts Time in seconds.
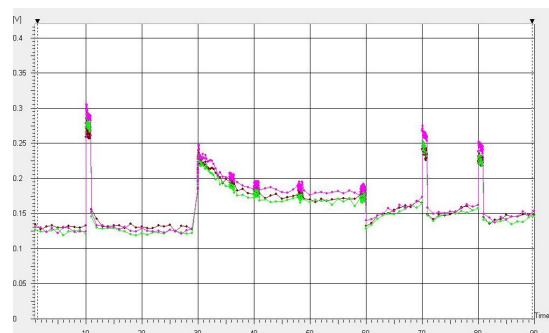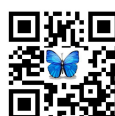

Figure 4 b) Quenching Analysis of the three species in optimal alteration of light and dark (12 hours light and 12 hours dark); highest quenching was found in *Nostoc muscorum*(Pink), then in Synechocystis PCC6803(Brown) and minimum in *Scendesmus dimorphus* (Light Green).
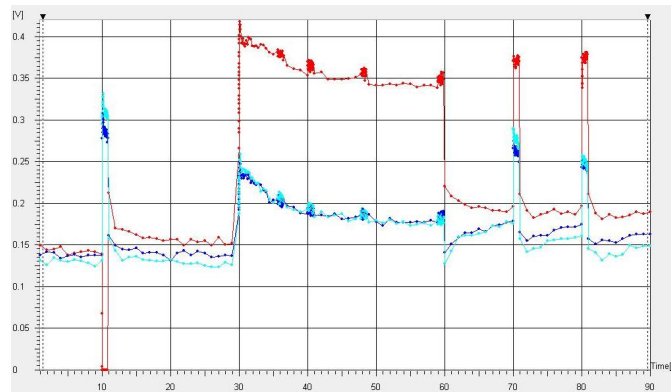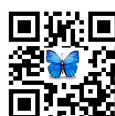
Figure 4 c) Quenching Analysis of the three species in continuous illumination (24 hours); highest quenching was found in *Nostoc muscorum*(Red), then in Synechocystis PCC6803(Light Blue) and minimum in *Scendesmus dimorphus* (Dark Blue).

RESEARCH ARTICLE

Screening of Antagonistic Activity of Bacteria against *Tilletia indica*

Geetika Vajpayee, Sugandha Asthana, Shalini Purwar and Shanthy Sundaram*

Center of Biotechnology, University of Allahabad, Allahabad, 211002.

*Address for correspondence
Shanthy Sundaram
Center of Bio-technology,
University of Allahabad,
Allahabad, 211002.
Mobile: 91-9956359786
E-mail-shanthy_cbt@gmail.com

ABSTRACT

Bacteria are known to have broad spectrum antagonistic activity against plant pathogen (antibiosis). This property makes bacteria a good candidate for biological control of plant pathogens. Karnal bunt (KB) is caused by the bunt fungus, *Tilletia indica* (*T. indica*) and is spread by soil-borne spores. Seeds pre-treated with fungicides have been used to reduce bunts but none are known to kill KB spores on seeds or soil. The problem with all current fungicides is that once the chemical is washed off the seeds, the KB spores re-germinate. The searches for alternatives to chemical fungicide are in progress and attempts to use biological agents have gained momentum in the recent years due to the emergence of fungicide resistance in pathogens. Growth inhibitory effect of different gram positive and gram negative bacteria were tested against wheat pathogenic fungus, *T. indica*. The growth of *T. indica* was measured every 7 days interval upto 50 days. The results indicated that a specific species of *Pseudomonas* inhibits the growth of *T. indica*. The compound/s (enzymes / secondary metabolites) were isolated from the bacteria and were tested to see its antifungal activity which in turn is responsible for the antagonistic activity against *T. indica*. The work is useful for the commercial development of a biocontrol agent against *T. indica*.

Key words: Karnal bunt, biofungicide, *T. indica*, antifungal.

INTRODUCTION

Karnal bunt is a fungal disease of wheat, durum wheat, rye [1], and triticale (a hybrid of wheat and rye). KB was first reported in 1930 near Karnal, India [2]. Since then, it has been found in all major wheat-growing states of India, Pakistan, Iraq, Mexico, and Afghanistan. In India, the disease is mainly widespread in regions with low temperatures

and high humidity like Delhi, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan, Madhya Pradesh, Jammu and Kashmir, West Bengal and Gujarat [3]. KB is known as a serious disease for international trade in wheat because it degrades grain quality [4] and has a very restricted distribution, being limited largely to the Indian subcontinent and a small area of Mexico and the south-western United States of America [5,6]. The survival of the fungus occurs on seeds for about 2 years and cannot be fully eradicated. The teliospores germinate in the soil, normally at temperatures between 20 and 25°C [7]. The visual detection of Karnal bunt (dry seed inspection) is difficult for quarantine purposes as low levels of KB infection might pass undetected [8] and even minimal seed infections can substantially contaminate healthy seeds [9]. Consequently, stringent quarantine measures have been adopted in several countries, which may not only affect the wheat grain trade but also germplasm. High nitrogen applications and excessive irrigation favor the disease [10]. Crop rotation may help to control the pathogen, but its value is questionable since *T. indica* can survive upto 4 years in the soil. Chemical seed treatments have proved to be ineffective in killing the teliospores of *T. indica*, with the exception of mercurial compounds [11] which are, however, banned in most countries. Since the pathogen is seed, soil and air borne, a limited control is achieved through the application of fungicides [12]. In contrast to Common bunt, KB is much more difficult to control. This is because the infection of growing plants with the *T. indica* spores responsible for causing KB occurs by windborne distribution of the spores. The disease cycle is completed when teliospores are deposited on the soil and when the wheat is harvested and threshed. Teliospores beneath the soil surface or residing on buried infected seeds apparently do not contribute to infection [4, 13, and 14]. Teliospores of *T. indica* are resistant to extremes of heat, cold, and harsh chemical treatment [15] and can survive upto 4 years in field soil [16]. Germination begins after 5-6 days of incubation under optimal conditions of high soil moisture and temperature of 15-22°C [15, 17]. Seed treatments with mercury compounds, formaldehyde and copper carbonate [18], hot water [19, 4], were reported to reduce KB. These treatments were reported to reduce teliospores germination [19-21] but may not prove effective in limiting soil infestation due to KB spores.

The bacterial species of genera Pseudomonas have their general ability to produce a diverse array of potent metabolites like phytohormones, antibiotics, siderophores [22-23] and these compounds have been known to have biocontrol activity [24]. These include simple metabolites such as 2, 4-diacetylphloroglucinol [25, 26], phenazine [26] and pyrrolnitrin [27] as well as 2, 3-de-epoxy-2, 3-didehydrarhizoxin [28]. Plant Growth-Promoting Rhizobacteria (PGPR) is reported to be able to positively affect the plant growth, influence plant vigor and soil fertility [29]. Pseudomonas sp. has many traits that are comparable to PGPR and thus, can also be used as growth promoting bacteria.

The present study focuses on the interaction of *T. indica* with different gram negative and gram positive bacteria to validate their antifungal activity. This study would be beneficial for the development of environmental friendly biocontrol agent against Karnal bunt.

MATERIALS AND METHODS

Organisms and maintenance

Different strains of *T. indica* were collected from G.B. Pant University of Agriculture and Technology, Pantnagar and maintained on Potato Dextrose Agar (PDA) at 21 ºC in BOD incubator. The bacterial cultures (*P. fluorescens, P. aeruginosa and Cellulomonas sp.*) were obtained from the Center of Biotechnology, University of Allahabad and cultured on Nutrient Agar at 37 ºC in bacterial incubator.

Geetika Vajpayee *et al.*

Test for antagonism

In order to test for antagonism pairings were made between *P. fluorescens, P. aeruginosa* and *Cellulomonas sp.* and *T. indica* using streak plate and pour plate method by dual culture technique [30]. In the streak plate method, agar disc of 4 mm size in diameter was taken from the *T. indica* stock culture and transferred on the center of test PDA plates. Two parallel bacterial streaks 3 cm from the *T. indica* disc were done. In the pour plate method, 1000 μl of culture from *P. fluorescens, P. aeruginosa* and *Cellulomonas sp.* were mixed in PDA during plating and agar discs from the *T. indica* were transferred to the center of test plates. Three replicates were made of each pairing, and the experiment was repeated twice. The degree of antagonism was determined by measuring the radial growth of pathogen with test bacterial culture and control.

Morphological study

The morphological changes observed in *T. indica* with the three bacterial species (*P. fluorescens, P. aeruginosa* and *Cellulomonas sp*). were studied using Lacto phenol cotton blue staining method. The changes in samples were analyzed using an inverted Microscope (Leica).

Antagonistic studies

Minimum inhibitory concentration

To analyze the efficacy of inhibition, different concentrations of cells from 10^1 - 10^7 cells ml^{-1} ($OD_{600\ nm}$ from 0.5 to 2.0) of *P. fluorescens, P. aeruginosa and Cellulomonas sp.* were taken in modified agar medium along with fungal disc (4 mm) at 21 °C. The Minimum inhibitory concentration values were calculated on 7th and 14th day of experiment. The percentage of mycelial growth inhibition was calculated by the equation given below [31]. All the data was statistically analyzed with level of significance P≤ 0.05.

$$Percentage\ of\ Inhibition = \frac{C-T}{C} \times 100 \quad .... (1)$$

Where, C= Radial growth of fungus in control plates (mm) and T= radial growth of fungus on the plate inoculated with antagonist (mm).

Biomass estimation

The antagonistic activity of the three bacteria against *T. indica* was studied by measuring the fresh weight (grams) of *T. indica* alone and with the bacteria (*P. fluorescens, P. aeruginosa and Cellulomonas sp.*). All the data was statistically analyzed with level of significance P≤ 0.05.

Harvesting of fungal mycelia

The fungal mycelia from the test plates were collected by scrapping from PDA plates and were stored at -20°C for 4-5 days. The dried mycelia were powdered by crushing with liquid nitrogen in a mortar and pestle.

Protein isolation and estimation

Protein was isolated from bacterial cultures using sonication method.The bacterial cultures were centrifuged at 10,000 rpm for 15 minutes. The pellet was collected and mixed with protein lysis buffer and sonicated at 4 cycles pulse of 30 seconds. The ruptured cell lysate was centrifuged at 13,000 rpm for 5 minutes. The supernatant was stored at -20 ºC till use. The fungal protein was isolated from mycelia powder mixed with protein isolation buffer. The mixture was centrifuged at 10,000rpm for 15 minutes and the supernatant was used for further use. The total protein of bacterial and fungal protein was measured by Lowry et al, 1951 [32] taking bovine serum albumin (BSA) as standard. All the data was statistically analyzed with level of significance P≤ 0.05.

Protease assay using tyrosine release method

The enzyme extracts were assayed for protease activity by the modified method of Anson, 1938 [33]. The enzyme isolates from *T. indica* alone and interacted with *P. fluorescens, P. aeruginosa, Cellulomonas* sp. were collected in eppendorf tubes. In each tube, 150 ml of 10 mM $CaCl_2$ was added followed by the addition of 250 ml of 50 mM, Tris–HCl (pH 7.5) and 250 ml of 0.12 % gelatin (substrate). All the tubes were shaken and incubated at 37 °C for 4 h. After incubation, the reaction was stopped by adding1ml of trichloroacetic acid (10 %) containing 0.22 M acetic acid and 0.33 M sodium acetate to each tube and incubated at 48 ºC for 1 hour. After the second incubation, all samples were centrifuged at 48 °C and 10,000 rpm for 10 min. The concentration of tyrosine in the supernatant was determined by the Lowry method and comparing with the tyrosine standard curve. All the data was statistically analyzed with level of significance P≤ 0.05. One unit enzyme activity was defined as the amount of enzyme that releases 1 μg of tyrosine per ml per min. Specific enzyme activity was expressed as unit/mg of protein [34].

RESULTS

Antagonistic effects of different bacteria against *T. indica*

The in vitro evaluation of antagonistic effect of the three bacteria against *T. indica* was studied on the 7th and 14th days of incubation as shown in Fig.1 and Fig.2. The study was carried out with *T .indica* without any bacteria and on interaction with *P. fluorescens, P. aeruginosa and Cellulomonas sp.* on PDA using dual culture technique. From first to 7th day, the fungus started proliferating and by the 14th day the fungal growth could not cross the bacterial streak in the interaction with *P. fluorescens*. In case of *P. aeruginosa and Cellulomonas sp.* there was excessive growth and proliferation even after the 14th day and the entire plate was covered with fungal growth. Among the three bacteria, *P. fluorescens* showed significant antagonistic activity. Similar finding were observed in the pour plate method.

Check the efficacy of Antagonistic activity of Bacteria against *T. indica*

The percentage inhibition over control was calculated for three bacteria shown in Table 1 after 7th and 14th day of incubation. The different concentration of bacterial cells also affected the minimum inhibitory concentration (MIC) of fungal growth as shown in Table 2. On 7th day, *P. aeruginosa* showed 17% inhibition and *Cellulomonas sp.* showed 10.6% inhibition whereas, *P. fluorescens* showed maximum inhibition of 74%, while on 14th day, the percentage inhibition of *P. aeruginosa, Cellulomonas sp. and P. fluorescens* was 22%, 13.8% and 82.5% respectively as shown in Fig. 3.

The fresh weight of *T. indica* (control) was 1.277gms, and on interaction with the three bacteria, *P. aeruginosa, Cellulomonas sp. and P. fluorescens* as shown in Fig. 4 was 1.31gms, 1.42gms and 0.09gms respectively; there was significant decrease in weight in case of *P. fluorescens* as compared to the control.

Morphological Analysis

The morphological studies of the antagonistic effect on *T. indica* control and on the interaction with the three bacteria, *P. fluorescens, P. aeruginosa* and *Cellulomonas sp.* using Lacto phenol cotton blue staining wee studied. The microscopic examination using Lacto phenol cotton blue stain has been shown in Fig. 5. The analyses showed that the *T. indica* interacted with *P. aeruginosa* and *Cellulomonas sp.* showed thread like structures of mycelia with tapering ends, which were found similar to the control *T. indica* (not interacted). Contrary to this, shrinkage in fungal mycelia, with globular ends was observed in *T. indica* with *P. fluorescens.*

Protein Estimation

The protein content of *T. indica* alone and the three bacteria was used as control and the samples with interaction were extracted and estimated using Lowry *et al* (1951) shown in Table 3 and Fig.6. The concentration of protein was found more in control samples of *P. aeruginosa* (153µg/g), *Cellulomonas sp.* (125µg/g), *P. fluorescens* (142µg/g) and *T. indica* (96µg/g) as compared to *T. indica* interacted with *P. aeruginosa* was 18.75%, with *Cellulomonas sp.* was 13.54% and *P. fluorescens* was 45.83%.

Determination of Protease Activity

The specific protease activity was measured using tyrosine as standard. The activity of protease in the bacteria, *P. aeruginosa* was 0.14 Unit/mg, *Cellulomonas sp.* was 0.18 Unit/mg and *P. fluorescens* was 0.16 Unit/mg. The results of the protease activity as a result of fungus – bacterial interactions was 0.091 Unit/mg with *P. aeruginosa*, 0.093 Unit/mg with *Cellulomonas sp.* and 0.12 Unit/mg with *P. fluorescens.* The specific protease activity of control samples were higher compared to the fungus-bacterial interaction. Thus, we can conclude that with decrease in weight of *T. indica* with *P. fluorescens*, its protease activity increases.

The comparative study of protease activity using fresh weights of T. *indica* as control and with the three bacteria are shown in Table 4 and Fig. 7.

DISCUSSION

The efficient approach to disease management in crops is to use bacteria and their secondary metabolites. The use of biocontrol agents in agricultural fields not only improves the quality of soil thereby making them fertile for years, but also affects the growth of plants.This approach is economical and environment-friendly for agricultural development. In the present in vitro study of antagonistic effect of the three bacteria, *P. fluorescens, P. aeruginosa* and *Cellulomonas sp.* against *T. indica* was investigated. The interaction of different bacteria with *T. indica* was carried out for 50 days. *Pseudomonas* isolates showed antagonistic activity against R. solani and P. oryzae [35]. It was observed that the interaction of bacteria like *P.aeruginosa and Cellulomonas sp.* with *T. indica* showed no significant (P≤0.05) effect, i.e. 17-22% and 10.6-13.8% respectively, as the fungal mycelia overcomes the growth of bacterial streak. In contrast to this *P. fluorescens* showed highest inhibition with significant (P≥0.05) antagonistic activity of 74-82.5% inhibition against *T. indica*. The inhibition in the growth of fungal mycelia was observed as it interacts with the P. fluorescens, which suggests that this bacterium or its secondary metabolites could be potential candidates for fungal bio control agents in the research program against Karnal Bunt of wheat. *P. fluorescens* has potential to produce known secondary metabolites like HCN, siderophores and proteases which are toxic to plant pathogens like *Pythium sp. and Fusarium sp.* [36]. The decrease in fresh weight was observed in *T. indica* interacted with *P. fluorescens* as compared to *P. aeruginosa and Cellulomonas sp.* This infers that the presence of *P. fluorescens* inhibits the growth of fungus. The morphological analyses of the interaction of *T. indica* with *P. fluorescens* showed suppression of mycelia growth with globular endings called theca and reduced fungal hyphal length, while, the interactions of *T. indica* with *P. aeruginosa and Cellulomonas sp.* showed no changes in the morphology as compared to the control fungus.

Geetika Vajpayee *et al.*

In response to the antagonistic activity against plant pathogenic fungus, bio control agents' produces extracellular lytic enzymes alongwith other antifungal secondary metabolites [37]. Protease was the most common enzyme produced by the antagonistic strains [38]. The enzymatic protease activity assays were carried out for both interacted and control fungus. The three bacterial species showed high protease activity as compared to the control *T. indica*. *T. indica* interacted with *P. fluorescens* showed increase in specific protease activity 0.12U/mg as compared to T. indica that interacted with the other two bacteria, *P. aeruginosa* (0.091 U/mg) and *Cellulomonas sp.*(0.093 U/mg) as shown in Fig.8. The higher activity of the protease enzyme in *P. fluorescens* showed that it produced higher amounts of proteases which may degrade the wall of fungal pathogen which may be the cause of antagonism against *T. indica*. In bacteria, proteases are found in several species such as *Bacillus subtilis, B. amyloliquefaciens, Pseudomonas* sp., Lysobacter enzymogenes and *Escherichia coli* [39]. The observations also showed the inverse relationship between fresh weight and protease activity of *T. indica*. Many in vitro studies have already demonstrated that the interaction of pathogenic fungi with lytic enzymes such as chitinases, proteases or glucanases can result in the degradation of the matrix of the pathogenic fungal cell walls [40]. The result of the antifungal activity of *P. fluorescens* indicates a probable role of the bacteria and its secondary metabolites as a biofungicidal agent against *T. indica*. This work can be exploited at the commercial level after identification of the specific inhibitor. Future prospects of this work are to target other plant fungal pathogens using *P. fluorescens* and to screen for more antifungals from other bacterial sources.

CONCLUSION

The uninterrupted use of chemical pesticides over biological agents by the farmers and lack of adequate knowledge on the mechanism of inhibition by these biological agents contributes to the downfall in use of these biocontrol agents. Considering the above facts, the use of bacteria which have the ability to degrade the pathogenic fungus would immensely help in overcoming the drawbacks caused by the use of other agents. This study provides the evidence of potential use of *P. fluorescens* against devastating pathogenic fungus, *T. indica*. The morphological changes in the fungal mycelia confirmed the antagonistic effect of *P. fluorescens* on *T. indica*. The presence of higher amount of protease (protein degrading enzyme) in *P. fluorescens* suggests its ability as an effective biological control agent for the efficient management of the disease.

ACKNOWLEDGEMENTS

REFERENCES

1. Aujla, S.S.; Indu, S.; Sharma, I. (1987) New host records of Neovossia indica. Indian Phytopathology 40, 437.
2. Mitra, M. (1931) A new bunt on wheat in India. Annals of Applied Biology 18, 178-179.
3. Singh, D.V.; Srivastava, K.D.; Joshi, L.M. (1985) Present status of Karnal bunt of wheat in relation to its distribution and varietal susceptibility. Indian Phytopathology 38, 507-515.
4. Bedi, S. K., Sikka, M. R., and Mundkur, B. B. 1949. Transmission of wheat bunt due to Neovossia indica (Mitra) Mundkur. Indian Phytopathol. 2:20-26.
5. Ahmadzadeh M, H. Afsharmanesh, M. Javan Nikkhah, A. Sharifi-Tehrani. Indentification of some molecular traits in fluorescent pseudomonas with antifungal activity, Iranian journal of Biotechnology 14:245-253. 2006.

6. Anonymous. 1955. Report of the division of mycology and plant pathology. Pages 87-99 in: Sci. Rep. Agric. Res. Inst. New Delhi, 1953-1954.

7. Krishna, A.; Singh, R.A. (1982) Effect of physical factors and chemicals on the teliospore germination of Neovossia indica. Indian Phytopathology 35, 448-455.

8. Agrawal, K.; Yadav, V.; Singh, T.; Singh, D. (1986) Occurrence and detection of Karnal bunt in wheat seed in Rajasthan. Indian Journal of Mycology and Plant Pathology 16, 290-291.

9. Aujla, S.S.; Kaur, S.; Mohan, C. (1988) Correlation between spore load of Neovossia indica per wheat seed and grade of infection. Seeds and Farms 14, 39-40.

10. Warham, E.J. (1986) Karnal bunt disease of wheat: a literature review. Tropical Pest Management 32, 229-242.

11. Warham, E.J.; Prescott, J.M.; Griffiths, E. (1989) Effectiveness of chemical seed treatments in controlling Karnal bunt disease of wheat. Plant Disease 73, 585-588.

12. Dupler, M., Smilanick, J. L., and Hoffmann, J. A. 1985. Effect of matric and osmotic potentail, temperature, and pH on the germination of Tilletia indica teliospores. (Abstr.) Phytopathology 75:1297.

13. Joshi, L. M., Singh, D. V., Srivastava, K. D., and Wilcoxson, R. D. 1983. Karnal bunt: A minor disease that is now a major threat to wheat. Bot. Rev. 49:309-330.

14. Smilanick, J. L., Hoffmann, J. A., Royer, M. H. 1985. Effect of temperature, pH, light, and desiccation on germination of Tilletia indica teliospores. Phytopathology 75:1428-1431.

15. Smilanick, J. L., Dupler, M., Hoffmann, J. A., and Wiese, K. 1985. Evaluation of seed treatments to prevent germination of Tilletia indica teliospores. (Abstr.) Phytopathology 75:1331.

16. Krishna, A., and Singh, R. A. 1982. Investigations on the disease cycle of Karnal bunt of wheat. Indian J. Mycol. Plant Pathol. 12:124.

17. Dupler, M., Smilanick, J. L., and Hoffmann, J. A. 1985. Effect of matric and osmotic potential, temperature, and pH on the germination of Tilletia indica teliospores. (Abstr.) Phytopathology 75:1297.

18. Mitra, M. 1935. Stinking smut (bunt) of wheat with special reference to Tilletia indica Mitra. Indian J. Agric. Sci. 5:51-74.

19. Mitra, M. 1937. Studies on the stinking smut or bunt of wheat in India. Indian J. Agric. Sci. 7:459-478.

20. Munjal, R. L. 1975. Studies on spore germination and control of Neovossia indica, the causal agent of Karnal bunt of wheat. In: INDO-USSR Symp. Wheat Dis. Krasnador, USSR.

21. Warham, E. J., and Prescott, J. M. 1984. Effect of chemicals on teliospore germination of Karnal bunt, Neovossia indica. (Abstr.) Phytopathology 74:885.

22. Leisinger T and Margraff R, Secondary metabolism of Fluorescent pseudomonads. Microbiol Rev 43:422±442 (1979).

23. Patten, C.L. and B.R. Glick, 2002. Role of pseudomonas putida indoleacetic acid in development of the host plant root system. Applied Environ. Microbiol., 68: 3795-3801. DOI: 10.1128/AEM.68.8.3795-3801.2002

24. Mubarik, N.R., I. Mahagiani, A. Anindyaputri, S. Santoso and I. Rusmana, 2010. Chitinolytic bacteria isolated from chili rhizosphere: Chitinase characterization and its application as biocontrol for whitefly (Bemisia tabaci Genn.). Am. J. Agric.Biol. Sci., 5: 430-435. DOI:10.3844/ajabssp.2010.430.435

25. Dowling DN and O'Gara F, Metabolites of pseudomonads involved in the biocontrol of plant disease. Trends Biotechnol12:133±140 (1994).

26. Keel C, Schnider U, Maurhofer M, Voisard C, Laville J, Burger U, Wirthner P, Haas D and DeÂfago G, Suppression of root diseases by Pseudomonas ﬂuorescens CHA0: importance of the bacterial secondary metabolite 2,4-diacetylphloroglucinol. Mol. Plant-Microbe Interact 5:4±13 (1992).

27. Vincent MN, Harrison LA, Brackin JM, Kovacevich PA, Mukerji P, Weller DM and Pierson EA, Genetic analysis of the antifungal activity of a soilborne Pseudomonas aureofaciens strain. Appl Environ Microbiol 57:2928±2934 (1991).

28. Thomashow LS and Weller DM, Role of a phenazine antibiotic from Pseudomonas ﬂuorescens in biological control of Gaeumannomyces graminis var tritici. J Bacteriol 170:3499±3508 (1988).

29. Pfender WF, Kraus J and Loper JE, A genomic region from Pseudomonas fluorescens Pf-5 required for pyrrolnitrin production and inhibition of Pyrenophora tritici-repentis in wheat straw. Phytopathology 83:1223±1228 (1993).

30. Wright SAI, Lindberg A and Gerhardson B, The genetic basis for the production of a fungitoxic compound by the biocontrol agent MA 342, Proc 9th Internat Symp Molec Plant-Microbe Interact, July 25±30, 1999, Amsterdam, The Netherlands (1999).

31. Dastager SG, Deepa CK, Pandey A (2011) Potential plant growth-promoting activity of Serratia nematodiphila NII-0928 on black pepper (Piper nigrum L.). World J Microbiol Biotechnol 27: 259-265.

32. Lowry O.H., Rosebrough N.J., Farr AL and Randall R.J, (1951). Protein measurement with Folin phenol reagent, J Biol Chem, 193: 265-275.

33. Anson, M.L. (1938) .The estimation of pepsin , trypsin, papain and cathepsin with hemoglobin, J. Gen. Physiol,22:79-89.

34. Rangeshwaran R, Prasad RD (2000). Biological controlof Sclerotium rot of sunflower. Indian Phytopathol. 53:444-449.

35. Riungu GM, Muthorni JW, Narla RD, Wagacha JM, Gathumbi JK (2008). Management of Fusarium head blight of wheat and deoxynivalenol accumulation using antagonistic microorganisms. Plant Pathol. J. 7:13-19.

36. McDonald, C.E. and L.L. Chen, 1965. Lowry modification of the Folin reagent for determination of proteinase activity. Anal. Biochem.,10: 175-186.

37. Rosales AM, Thomashow L, Cook RJ, Mew TW (1995). Isolation and identification of antifungal metabolites produced by rice associated antagonistic Pseudomonas spp. Phytopathol. 85:1029-1032.

38. Siddiqui I A, Haas D & Heeb S, Extracellular protease of Pseudomonas fluorescens CHA0 a biocontrol factor with activity against the root-knot nematode Meloidogyne incognita, Appl Environ Microbiol, 71(2005) 5646.

39. Fujishige A, Smith KR, Silen JL, Agard DA (1992) Correct folding of a-lytic protease is required for its extracellular secretion from Escherichia coli . Cell Biol 118: 33-42

40. Lorito, M., Peterbauer, C., Hayes, C. K. & Harman, G. E. (1994). Synergistic interaction between fungal cell wall degrading enzymes and different antifungal compounds enhances inhibition of spore germination. Microbiology 140, 623±629.

Figure 1: Antagonistic effect of the three bacteria against *T. indica* using streak plate method at (a) 7th day (b) 14th day.

Geetika Vajpayee *et al.*

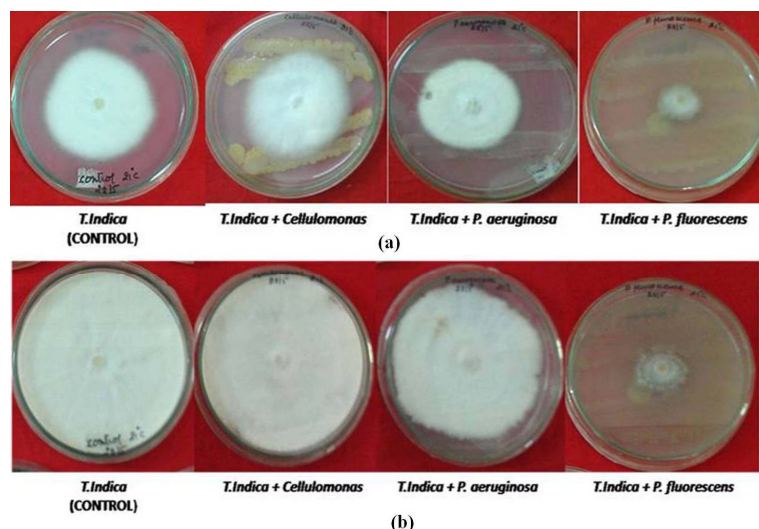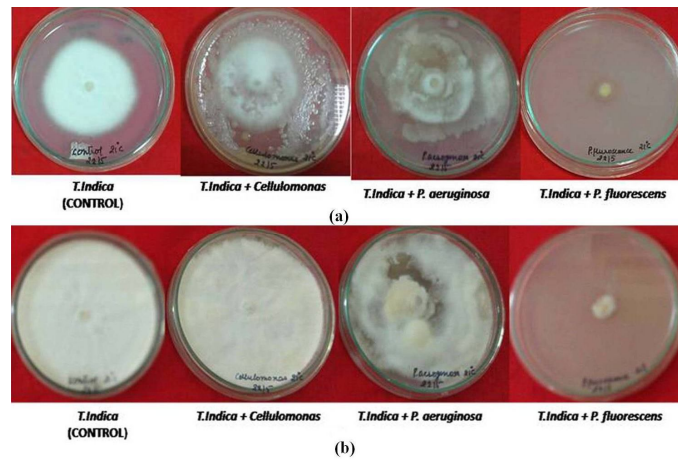**Figure 2: Anagonistic effect of the three bacteria against *T. indica* using pour plate method at (a) 7th (b) 14th day.**
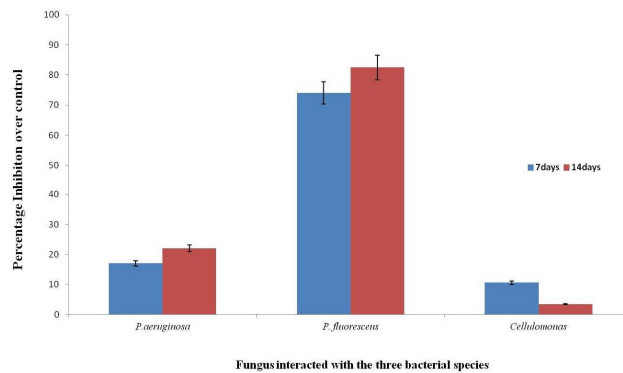
Figure 3: The percentage inhibition of *T. indica* interacted with the three bacteria on 7th and 14th day (P≤0.05).
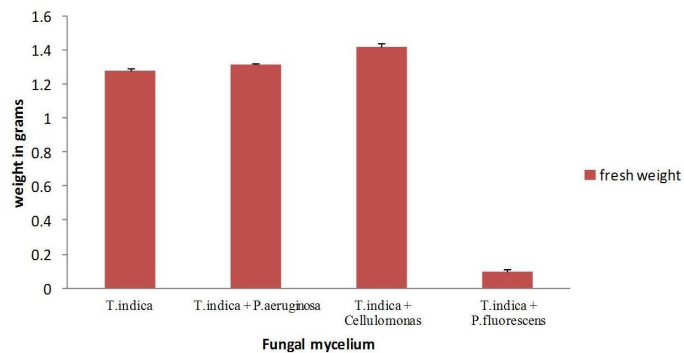
Figure 4: The measurement of fresh weight (grms) of *T. indica* as control and interaction with the three bacteria. (P≤0.05)

Indian Journal Of Natural Sciences

www.tnsroindia.org. © IJONS

Vol.5 / Issue 29/ April 2015

International Bimonthly

ISSN: 0976 – 0997

Geetika Vajpayee *et al.*
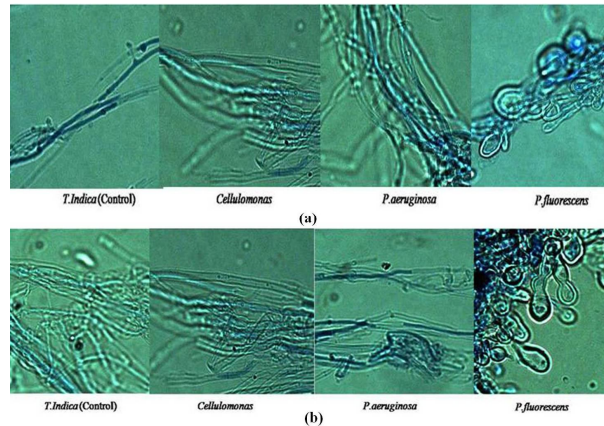
Figure 5: Morphological analysis of the three bacteria against *T. indica* **using Lacto phenol cotton blue staining at (a) 7th day (b) 14th day of interaction.**
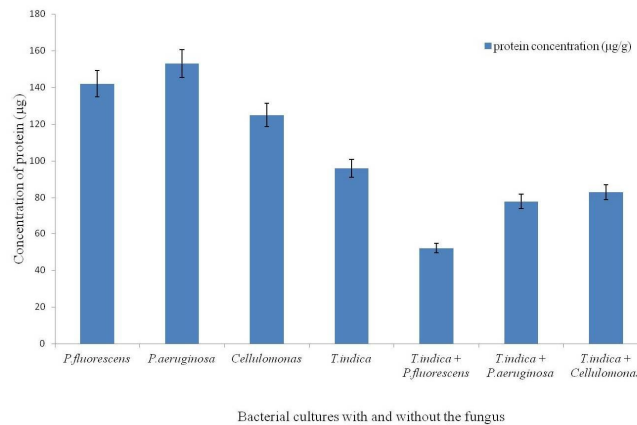
Figure 6: The measurement of total protein (μg/g) in *T. indica* **control and on interaction with the three bacteria.**
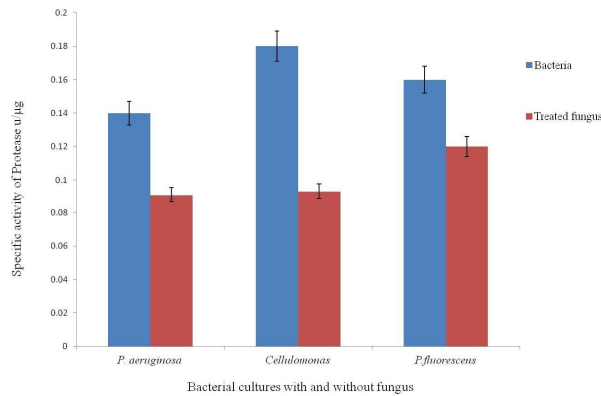
Figure 7: Comparative measurement of specific activity of protease (Unit/mg) of bacteria as control and on interaction with *T. indica.* **(P≤0.05)**
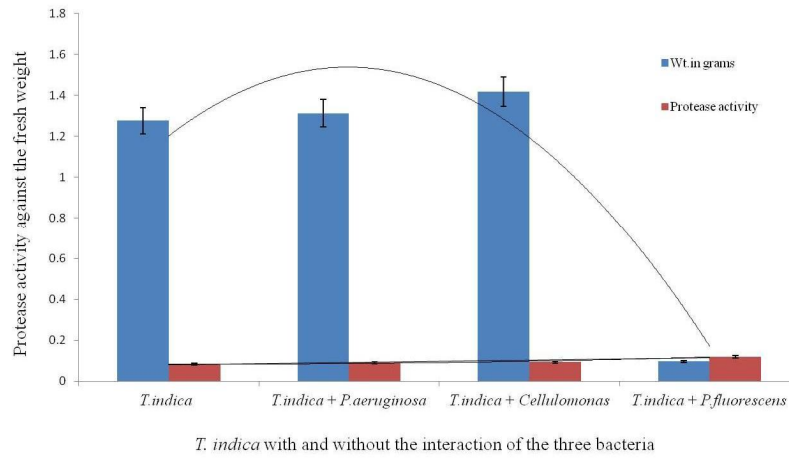
Figure 8: Comparative analysis of protease activity of *T. indica* with and without interaction with the three bacteria against their fresh weight. (P≤0.05)

TABLE 1: Bioefficacy of different bacteria against *T. indica*

Bacteria	*Tellitia indica*			
	Radial Growth (mm)		**Inhibition over control (%)**	
	7days	**14days**	**7 days**	**14 days**
P. aeruginosa	39	67	17	22
P. fluorescens	12	15	74	82.5
Cellulomonas sp.	42	83	10.6	13.8
Control	47	86	-	-

TABLE 2: Minimum Inhibitory Concentration (MIC) of the three bacteria against *T. indica* at different concentrations on 14th day.

Day%	10^2cells/ml	10^3cells/ml	10^4cells/ml	10^5cells/ml	10^6cells/ml	10^7cells/ml	10^8cells/ml
Cellulomonas sp.	1.7	2.3	2.8	3.2	3	3.45	3.48
P. aeruginosa	12	12.4	13.2	13.7	15	18.5	22
P. fluorescens	52.4	53.6	54.2	6 4.2	72.5	78.2	82.5

Shanthy Sundaram *et al.*

TABLE 3: Estimation of total Protein with and without interaction of *T.indica* with different gram (+) and gram (-) bacteria.

Cultures	Protein concentration (µg/g)	Percentage increase in protein concentration
P. fluorescens	142	-
P. aeruginosa	153	-
Cellulomonas sp.	125	-
T.indica	96	-
T.indica + P. fluorescens	52	45.83
T.indica + P. aeruginosa	78	18.75
T.indica + Cellulomonas sp.	83	13.54

TABLE 4: Estimation of Protease with and without interaction of *T.indica* with different gram (+) and gram (-) bacteria.

Cultures	Specific activity of protease (unit/µg)
P. fluorescens	0.16
P. aeruginosa	0.14
Cellulomonas sp.	0.18
T.indica	0.083
T.indica + P. fluorescens	0.12
T.indica + P. aeruginosa	0.091
T.indica + Cellulomonas sp.	0.093

RESEARCH ARTICLE

Hydrotreated Rice Bran Oil as a Biodiesel in Agricultural Based Engine – An Experimental Study

Hemanandh J[1]* and Narayanan K V[2],

[1]Research scholar, Department of Mechanical Engineering, Sathyabama University, Chennai – 600 119, TamilNadu, India.
[2]Professor, Department of Mechanical Engineering, Sathyabama University, Chennai – 600 119, TamilNadu, India.

*Address for correspondence
Hemanandh J
Department of Mechanical Engineering,
Sathyabama University,
Chennai – 600 119,
TamilNadu, India.

ABSTRACT

Environmental pollution, fast depletion of fossil fuels, and the steep increase in diesel price have been impelling researchers to look for an alternative fuel. In India, rice is the major crop in agriculture. From the bio waste rice husk, oil is produced and refined. The refined rice bran oil is hydrotreated with Ni-Mo/Al$_2$O$_3$ as catalyst. The properties of the hydrotreated refined rice bran oil are better than those of diesel. The blends of B25 and B100 were prepared using hydrotreated refined rice bran oil and tested in a 4S DI diesel engine without any modification. The enigne was allowed to run at a constant speed of 1500rpm at various loading conditons. The specific fuel consumption decreased by 25%, whereas brake thermal efficiency increased by 23.56%. The emission parameters, namely CO, HC, NOx, and smoke reduced by 16.67%, 44.6%, 14.25%, and 29.45% respectively. The results showed that B100 gave better performance with low emission, and suitable for agricultural diesel engines.

Key words: Hydrotreated refined rice bran oil, Diesel engine, and Performance and Emission characteristics.

INTRODUCTION

In Tamil Nadu, Rice is the major crop and abundantly available over the decades and its agricultural residue, namely rice bran/husk is also abundantly available. Rice husk has good potential in converting the fuel and chemical properties. It consists of lignocellulosic material which helps to produce fuel. It contains 70% of organic volatile material and about 8 -10% of moisture content.

Nithya devi and velayutham [1] found that the biodiesel could be produced from the fungi due to the presence of 70% intracellular lipids. Saravanan [2] et al., showed that the presence of more oxygen content would oxidize the unsaturated fatty acid leading to better combustion and reducing the smoke and NOx. They experimented with unrefined rice bran oil and could reduce the CO and unburnt hydrocarbons. The 25% blend unrefined rice bran oil shows lower viscosity, lower heat release rate, and better combustion. Murugu Mohan Kumar Kandasamy and Mohanraj Thangavelu [4] found that the preheated rice bran B40 blend showed better performance and change in the combustion temperature. Kapil Tyagi [5] investigated with the mixture of water and phosphoric acid that was found to be the best degumming agent causing decrease in the viscosity, melting point, unsaponification matter, and the iodine value in the rice bran oil. Ram Prakash [6] prepared the different blends of transesterified rice bran oil and tested the blends in different loading conditions resulting in lowering density, exhaust temperature, and the emissions. Umesh [7] experimented with the methyl esters of rice bran oil that were tested in the diesel engine with different blends at various loads. He could achieve reduction in CO_2, HC, and NO_x with higher blend percentage. Venkata Subbaiah [8] et al., showed that the brake thermal efficiency, carbon mono oxide, and NOx increased by the use of ethanol biodiesel blend, whereas HC, smoke decreased. .Narasimha [9] prepared the rice bran biodiesel using the ethyl hexyl nitrate as additives. 10% ethanol was added and the results showed that CO, HC, and NOx decreased, while brake thermal efficiency increased. Gotz A. Westphal [10] et al., tested the biogenic hydrotreated rapeseed methyl esters and jatropha methyl esters in a diesel engine resulting in the reduction of CO and HC and an increase in NOx. Seok Ki Kim [11] experimented with the hydrotreated soyabean oil using Ni and CoMoSx as catalysts at 300°C to 400°C at a hydrogen pressure of 2.5 -15Mpa resulting in the removel of oxygen from the oil using batch process.

The aim of this work is to study the properties of the hydrotreated oil and compare them with those of the diesel fuel. The different blends of diesel fuel were prepared (B25 and B100) and tested in the 4S diesel engine. The performance and emission characteristics of the hydrotreated rice bran oil were also studied.

Nomenclature:

RRO	-	Refined Rice bran Oil
HRBO	-	Hydrotreated Rice bran Oil
PD	-	Petro Diesel
HTRB B25	-	25% Hydrotreated Rice bran oil with 75% diesel fuel.
BIS	–	Bureau of Indian Standards
LHSV	-	Liquid Hourly Space Velocity
B25	-	Hydrotreated Refined Rice bran oil biodiesel 25% blend
B100	-	Hydrotreated Refined Rice bran biodiesel 100%
CO	-	Carbon monoxide
HC	-	Hydrocarbon
NOx	-	Nitrogen Oxide
FSN	-	Filter Smoke Number
SFC	-	Specific fuel consumption
BTE	-	Brake thermal efficiency

MATERIALS AND METHODS

The Refined Rice Bran Oil was purchased in the local market, in Chennai, Tamilnadu, India. The hydrogen gas cylinder and Ni-Mo/Al$_2$O$_3$, catalyst were procured from the retailer. In the first phase, the refined rice bran oil was hydrotreated in a Hydrotreating pilot plant. In the second phase hydrotreated refined rice bran oil was tested in the 4S, Kirloskar DI diesel engine and the emission and performance were observed.

Production of hydrotreated refined rice bran oil

The green diesel was produced using hydrotreatment process. The refined rice bran oil was preheated up to 120 °C in a high pressure trickle bed reactor. The hydrogen gas was mixed with preheated refined rice bran oil at a pressure of 60 bar and temperature of 350°C in the presence of the catalyst Ni-Mo/Al$_2$O$_3$. The ratio of feed rate of the oil to the volume of the catalyst was 1.5 hr $^{-1}$. The reaction that took place and removed the oxygen and Nitrogen molecules; and then hydrogen was added to the oil. The vegetable oil was converted into paraffinic oil. The sodium anhydrous was added to the paraffinic oil and stirred well and allowed to stand for an hour. The tiny water drops in the oil is were separated from the oil and filtered. Thus the high quality green diesel was obtained. The refined rice bran oil, hydrotreated vegetable oil, and the blend B25 are shown in the Fig.1, Fig.2, and Fig.3 respectively.

Specification of High pressure Catatest Unit:

The design operating conditions of the high pressure catatest unit are as follows:

1. Temperature   -   up to 550° C
2. Pressure   -   250 kg/cm^2
3. Liquid flow meter   -   600 ml/hr
4. H$_2$ flow rate   -   30 – 300 SLPH

The properties of RRO and HRBO were analyzed and compared with those of petro diesel Euro – IV bharat stage diesel as shown in the Table – 1. The calorific value and the cetane number were found to be higher for HRBO oil. The kinematic viscosity was within the range prescribed for diesel. The calorific value and the density were found to be higher than those of the petro diesel.

Type	: Kirloskar Oil Engine TAF 1, Vertical, 4S, Single acting, high speed C.I Diesel Engine
Combustion	: Direct Injection
Rated Power	: 4.3 kW
Rated Speed	: 1500 rpm
Compression Ratio	: 17.5: 1
Injector type	: Jet injector with 3 holes
Fuel injection pressure	: 210 bar
Dynamometer	: Eddy current

Experimental setup

The Hydrotreated rice bran oil was tested in the kirloskar DI diesel engine at a constant speed of 1500 rpm and at various loading conditions. The 3- hole injector was used as an injector. The DI diesel engine specifications are shown in Table - 2. The various emission parameters such as CO, HC, NO$_x$, and smoke were analyzed for B25 and B100 and were compared with those of petro diesel. The exhaust gas emissions and smoke were measured by AVL DIGAS 444 analyzer and the AVL smoke meter 415..

The engine was allowed to run for 15 minutes for each blend at no load condition. The loads were gradually applied, in steps of 25%, to the engine using the eddy current dynomometer. The experiments were conducted at different loadings (0%, 25%, 50%, 75%, 100%) and for various fuel blends such as B25 and B100.

RESULTS AND DISCUSSION

Carbon mono oxide (co) :

Fig.5 depicts the emission of CO for hydrotreated refined rice bran oil with respect to load. The CO emissions of the blends of B25 and B100 were compared with those of petro diesel. The decrease in B25 and B100 were noticed from the graph compared with petro diesel. The CO emissions of B25 decreased at initial loads and increased gradually and remained the same at full load condition. Use of the B100 could decrease CO at full load condition by 16.67%. This might be due to higher cetane number. The reduction was more pronounced in hydrotreated refined rice bran oil.

Hydrocarbon (hc)

The HC emissions of hydrotreated refined rice bran oil are shown in figure 5. A significant decrease was observed in the hydrocarbon in B25 and B100 by 11.5 % and 44.6% when compared with diesel fuel. This could be due to the presence of more hydrogen in the fuel that would have facilitated complete combustion.

Nitrogen oxides (no$_x$):

Fig. 7 shows the NOx emissions of hydrotreated refined rice bran oil compared with those of diesel fuel. The remarkable reduction in NOx was observed for B25 and B100 by 8.56% and 14.25% respectively. This might be due to the lower combustion temperature compared with diesel fuel.

Smoke

The smoke emissions of the hydrotreated oil and the diesel fuel are shown in figure 8. A marginal decrease for B25 was observed. The B100 fuel showed reduction by 29.45% when compared with petro diesel. This could be due to the higher hydrogen content in the B100 that would have led to complete combustion.

Fig.9 depicts the variation of specific fuel consumption of B25, B100 of the hydrotreated refined rice bran oil and the diesel. The B25 fuel showed a marginal decrease as load increased. 25% decrease in the fuel consumption at full load condition was observed for B100 fuel. This might be due to the lower kinematic viscosity of the hydrotreated fuel.

Brake thermal efficiency:

The variations in the brake thermal efficiency of the fuels are shown in figure 10. The increase in the brake thermal efficiency of B25 and B100 by 5.64% and 23.56% respectively was observed when compared with diesel fuel. This might be due to the higher calorific value of the hydrotreated refined rice bran oil.

CONCLUSION

The experimental investigations on hydrotreated vegetable oil in a diesel engine at a constant speed of 1500 rpm led to the following observations:.

1. The CO, HC, NOx, Smoke, and SFC decreased for B100 by 16.67%, 44.6%, 14.25%, 29.45 % and 25% respectively when compared with diesel fuel.
2. The increase in brake thermal efficiency for B100 by 23.56 % was observed when compared with diesel fuel.
Hence the study revealed that the B100 hydrotreated refined rice bran oil could lower the emission and improve the performance of the diesel engine. It is, therefore, the best alternative fuel and is suitable for agricultural diesel engines.

ACKNOWLEDGEMENT

REFERENCES

1. Nithya Devi .M and Velayutham .P. Biodiesel Production from Fungi, Indian Journal Of Natural Sciences, 2011; 5: 271-281.
2. S. Saravanan, G. Nagarajan, G. Lakshmi Narayana Rao, S. Sampath. Combustion characteristics of a stationary diesel engine fuelled with a blend of crude rice bran oil methyl ester and diesel Energy, 2010; 35, 94–100.
3. S. Saravanan, G. Nagarajan, G. Lakshmi Narayana Rao, Feasibility study of crude rice bran oil as a diesel substitute in a DI-CI engine without modifications. Energy for Sustainable Development 2007; 3: 83 - 92.
4. Murugu Mohan Kumar Kandasamy and Mohanraj and Thangavelu, Investigation on the Performance of Diesel Engine Using Various Bio Fuels and the Effect of Temperature Variation Journal of sustainable development. 2007; 2:
5. Kapil Tyagi, M. A. Ansari, Shweta Tyagi and Ankita Tyagi, A novel process for physically refining rice bran oil through degumming. Advances in Applied Science Research, 2012; 3:1435- 1439.
6. Ram Prakash , S.P.Pandey, S.Chatterji , S.N. Singh, Emission analysis of CI engine using rice bran oil and their esters. Journal of Engineering Research and Studies, 2011; 2 : 173 – 178.
7. Umesh T , Manjunath H N , Rukmangadha P , Dr.Madhu D. Experimental Study of Performance & Emission Analysis of Rice bran oil as an Alternative fuel for an I.C.Engine. IOSR Journal of Mechanical and Civil Engineering. 2014; 4: 130 - 134.
8. G. Venkata Subbaiah , K. Raja Goal , Syed Altaf Hussain , B. Durga Prasad & K. Tirupathi Reddy. Rice bran oil biodiesel as an additive in diesel- ethanol blends for diesel engines. 2010; 3: 334 – 342.
9. Ch.Narasimha and M.Rajesh, Performance And Emissions Characteristics Of Diesel Engine Fuelled With Rice Bran Oil, International Journal of Engineering Trends and Technology, 2013; 4: 4574- 4578.
10. Goꞏtz A. Westphal, Juꞏrgen Krahl, Axel Munack, Nina Rosenkranz, Olaf Schroꞏder, Jens Schaak, Christoph Pabst, Thomas Bruꞏning, and Juꞏrgen Buꞏnger. Combustion of Hydrotreated Vegetable Oil and Jatropha Methyl Ester in a Heavy Duty Engine: Emissions and Bacterial Mutagenicity. . Environ. Sci. Technol. 2013; 47: 6038−6046.
11. Seok Ki Kim , Steffen Brand , Hong-shik Lee , Yunje Kim , Jaehoon Kim , Production of renewable diesel by hydrotreatment of soybean oil: Effect of reaction parameters, Chemical Engineering Journal, 2013; 228: 114–123.

Fig – 1 Refined Rice Bran Oil (RRO)
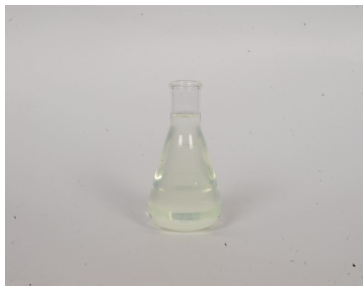
Fig – 2 Hydrotreated Rice Bran Oil (HRBO)
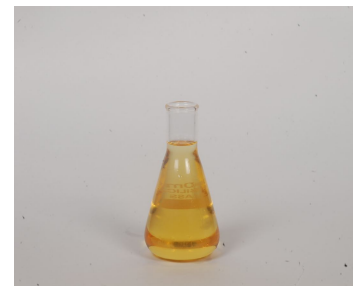
Fig - 3 HTRB B25

Table - 1 Comparison of properties of Diesel, Biodiesel standards, RRO, and HRBO

S.No.	Properties	Euro - IV Bharat stage *1460:2005* Diesel	RRO	HRBO
1.	Cetane Number	51	37	82
2.	Density at 15 ° C kg / m³	820 – 845	924.4	793.2
3.	Kinematic Viscosity at 40 ° C cst	2 – 4.5	29.7	3.9
4.	Flash point ° C min	35 ° C	218	94.2
5.	Calorific Value kJ/kg	42,500	38,578	43,902
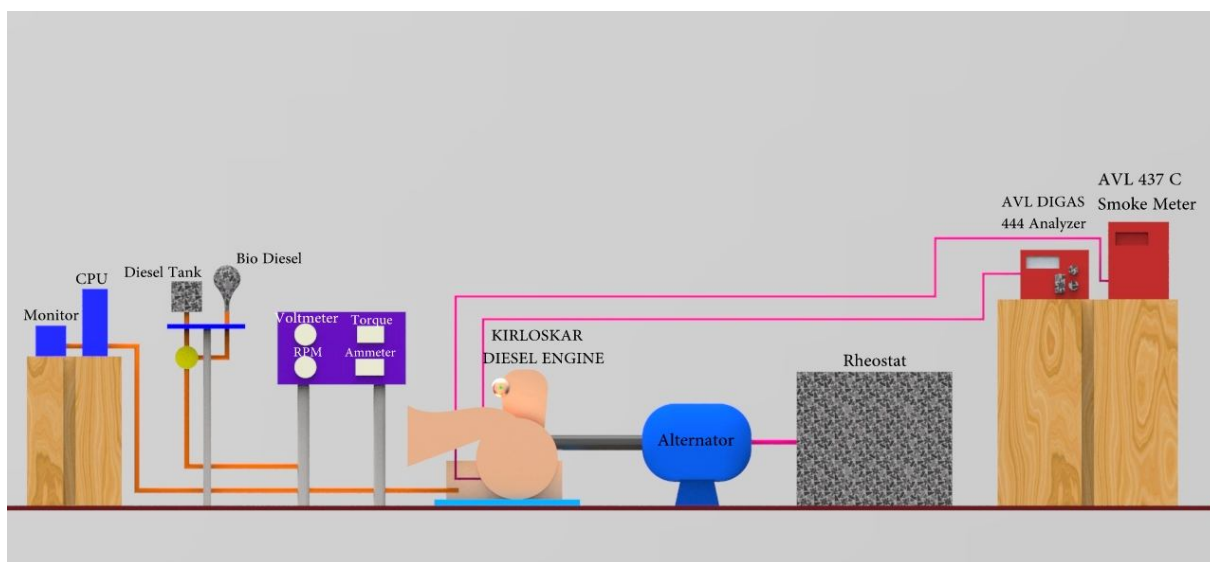
Fig – 4 Experimental Set-up of the Compression Ignition Engine

Hemanandh and Narayanan
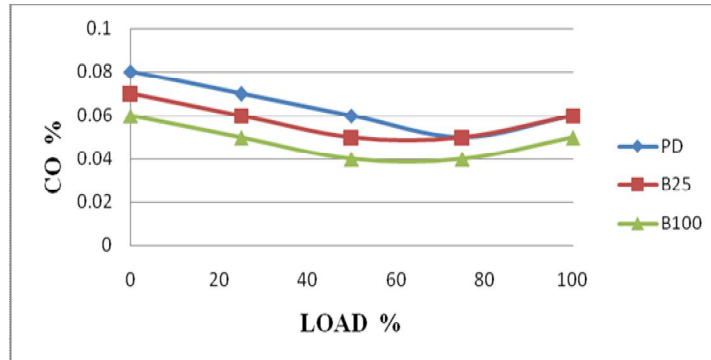
Fig – 5 Variation of CO with respect to PD, B25, and B100 hydrotreated vegetable oil
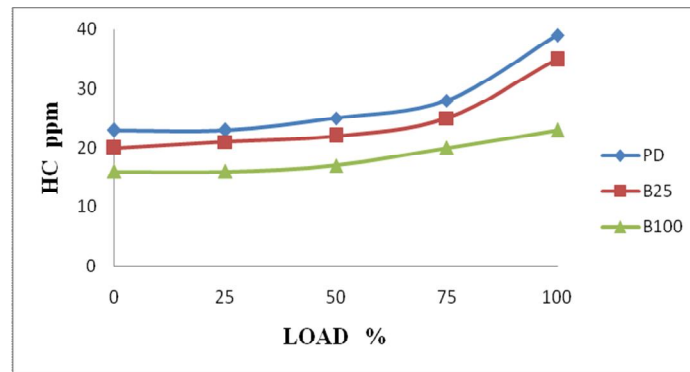
Fig - 6 Variation of HC with respect to PD, B25, and B100 hydrotreated vegetable oil
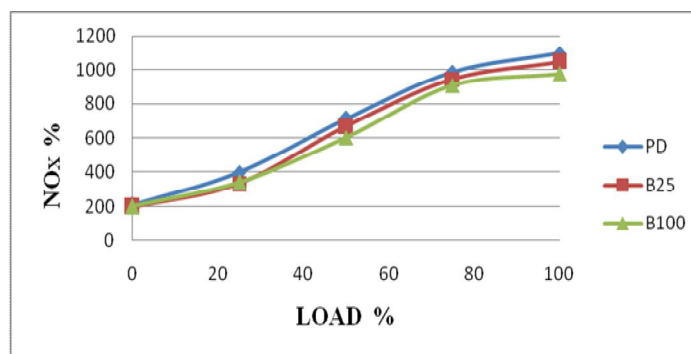
Fig - 7 Variation of NOx with respect to PD, B25, and B100 hydrotreated vegetable oil

Hemanandh and Narayanan
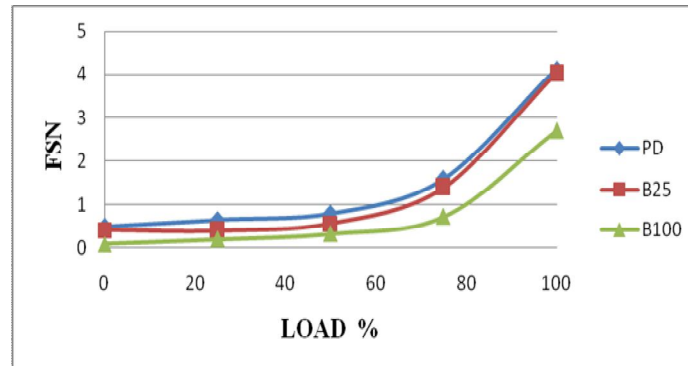
Fig - 8 Variation of Smoke with respect to PD, B25, and B100 hydrotreated vegetable oil
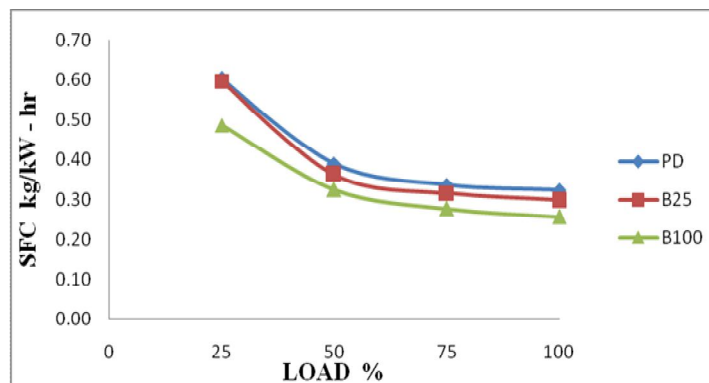
Fig - 9 Variation of Specific fuel consumption with respect to PD, B25, and B100 hydrotreated vegetable oil
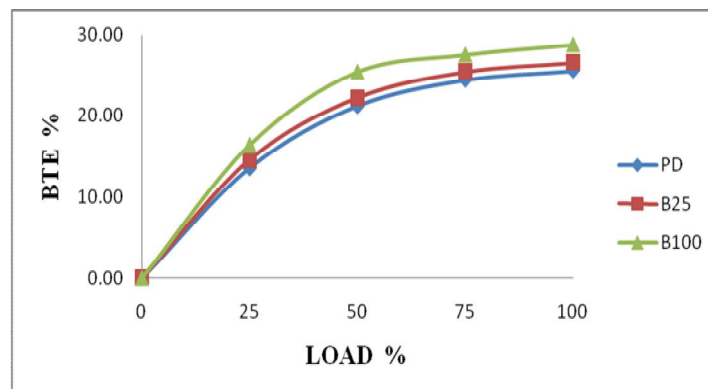
Fig - 10 Variation of Brake thermal efficiency with respect to PD, B25, and B100 hydrotreated vegetable oil

RESEARCH ARTICLE

Influence of Feeding Wet Brewer's Grains on Dry Matter Intake and Milk Quality and Quantity in Lactating Cows

Senthil Murugan S[1]*, Sakkariya Ibrahim[1], Seethalakshimi M [2], Ramanathan A [2], Raja T.V [1] and Joseph **M**[2]

[1]Assistant Professor, [3]Professor and Head, Instructional Livestock Farm, College of Veterinary and Animal Sciences, Pookode, Wayanad, Kerala,
[2]Faculty of Agriculture and Animal Husbandry, Gandhigram Rural Institute, Dindigul, Tamil Nadu.

*Address for correspondence
Senthil Murugan. S
Assistant Professor,
Instructional Livestock Farm,
College of Veterinary and Animal Sciences,
Pookode, Wayanad, Kerala,
Tel: +91-9446233030,
E-mail: s_senthilmurugan@hotmail.com

ABSTRACT

The present feeding experiment was conducted to study the effect of feeding wet brewer's grains on dry matter intake, milk yield, milk constituents and efficiencies of milk yield (milk yield/ DMI) and 4 per cent fat corrected milk (FCM/DMI) in lactating cows. WBG was included at 0 (T_1), 20 (T_2), 30 (T_3) per cent of ration dry matter replacing cattle feed quantity. The overall mean DMI was 12.073 kg/cow/day which ranged between 12.4 kg to 12.5 kg in control animals during 8 weeks period. There was significant decrease in DMI in T_3 (30 per cent DM) compared to T_2 and T_1 groups. Highly significant ($p < 0.01$) increase on milk yield (kg per day) in T_2 groups was observed and no changes were recorded in milk fat, SNF and total solids. The income over feed cost (Rupees/cow/day) was significantly more for T_3 group because the efficiencies of milk yield (milk yield/DMI) and 4 per cent FCM (FCM/DMI) were significantly ($p < 0.05$) more compare to control group. WBG could be included at 30 per cent DM of ration for lactating dairy cows and the body weight loss need to be taken care, if WBG is continuously used.

Key words: feeding value, four per cent FCM, milk yield, wet brewer's grains

INTRODUCTION

Wet Brewers Grains (WBG) is a byproduct of brewery industry which uses malted barely grains as feed stock to produce beer; primarily the starch is utilized, leaving behind a protein rich residue locally known as "Beer Waste". The moisture content of fresh WBG ranges between 62.30 to 86.10 per cent (Senthil Murugan *et al.* 2012). Brewer's spent grains (BSG) are rich source of protein, especially rumen un-degradable protein, which has high concentrations of methionine and lysine (Belibasakis and Tsirgogianni, 1996). WBG have been used in lactating cows ration as such or in compounded cattle feed formulations after drying (Dhiman *et al.* 2003) and field observations suggest that WBG may stimulate feed intake (West *et al.*1994). Feeding brewers' grain dry or wet to dairy cows had no influence on feed intake, fat corrected milk yield (Salihu and Muntari. 2011), actually increase milk yield, milk total solids, milk fat yield (Belibasakis and Tsirgogianni.1996). Khidzir *et al.* (2010) stated that for every 100 liters of beer produced; 14 - 15.6 kg of BSG was generated. In India during year 2011, about 10 million hecto-liters of beer were produced from 38 breweries. As the ethanol industry grows, greater quantities of BSG will become available for use as animal feed. The utilization of WBG is limited because its high moisture content which affects the amount of nutrients cattle will receive from a kg of byproduct and together with moisture, polysaccharide and protein makes BSG susceptible to microbial growth and subsequent spoilage in a short period of time (7 to 10 days) (Stojceska *et al.* 2008). However, interest in feeding wet brewer's grains has increased among dairy farmers because of comparatively less cost. The per cent inclusion of WBG in lactating cows ration will be decided upon by dry matter intake and efficiencies of milk yield. The present feeding experiment was conducted to evaluate dry matter intake, milk yield, milk composition and efficiencies of milk yield by replacing 0, 20 and 30 per cent of dry matter of lactating cow's ration.

MATERIALS AND METHODS

Experimental Animals

The lactating animals at dairy farm of Instructional Livestock Farm Complex of College of Veterinary and Animal Sciences, Pookode formed the experimental group for the study. Eighteen crossbred cows recorded with a minimum peak yield of eight liters in the previous lactation were randomly divided into three groups of six each. All the cows were housed in the same shed with facilities for individual feeding and free access to clean, wholesome drinking water. Hybrid Napier grass was fed in 3 divided lots every day and the cattle feed and WBG were fed twice daily, in the morning and afternoon before milking. The leftover feed materials were weighed separately every day to calculate the actual dry matter intake of each animal.

Experimental Ration

The experimental rations were formulated according to Indian Council Agriculture Research (1998) based on the average body weight of 350 Kg cross bred animals, recorded average yield of 8.0 kg per day with 4.5 per cent milk fat content. The nutrient requirements calculated were 5.22 kg TDN, 0.590 kg of DCP and 10.5 kg of dry matter. The different experimental groups were fed with three different diets *viz.*, T_1 (0 per cent), T_2 (20 per cent dry matter (DM) content of ration as WBG) and T_3 (30 per cent DM content of ration as WBG). The calculated dry matter quantity fed through experimental ration is presented in Table-1. The WBG were fed to the animals one week prior to the start of experimentation to facilitate the adaptation to the feeding diets and the feeding trial was continued for eight weeks.

The fresh wet WBG was sourced out from brewery located 200 km away from the research site and checked for physical quality before feeding as its high moisture content (74-78 per cent) may lead to spoilage.
The hybrid napier grass was collected from fodder plot daily and cattle feed was fed in place of concentrate. The required salt, mineral mixture and calcite powder were included in the experimental ration. The surface layer of

Senthil Murugan *et al.*

WBG was removed daily to avoid feeding of mold and decomposed material. The fed WBG, napier grass and cattle feed were sampled daily and composited for 8-weeks. The quantity of cattle feed; WBG and hybrid napier grass offered and the balance left behind were calculated every day. Dry matter content of the ration was determined everyday and the composite samples were taken after pooling the samples collected on all the seven days of the trial. Milk samples were collected at fortnightly intervals and were analyzed for total solids, fat and solid not fat (SNF). Data on milk production of individual animal was recorded daily throughout the experimental period. The 4 per cent Fat corrected milk (FCM) was calculated as per Gaines (1928).

The calculated crude protein content of experimental rations T_1, T_2 and T_3 were 11.9, 13.3 and 13.89 per cent, respectively. The concentrate (cattle feed) and WBG which was fed to the animals were analyzed and found 19.8 per cent and 19.3 per cent crude protein on DMB. Since the ration crude protein content showed very little, no protein source materials were added to adjust the crude protein content. Similarly, the calculated Total Digestible Nutrients (TDN) content in the experimental rations were 49.69 per cent (T_1); 48.81 per cent (T_2) and 48.43 per cent (T_3). The calculated TDN fed as per ration was not iso caloric and iso-nitrogenous there was 15 per cent and 25 per cent decrease in TDN content of T_2 and T_3 experimental rations respectively.

RESULTS AND DISCUSSION

Wet Brewer's Grains and Dry matter Intake

All rations were consumed without digestive disturbances or metabolic disorders even though amount of WBG fed were large. The dry matter intake of cows during this period ranged between 12.4 kg to 12.5 kg with overall mean value of 12.07 kg/cow/day. The analysis variance study on dry matter intake indicates that highly significant ($p<0.01$) decrease was noticed between treatment groups and within week; when WBG included at 30 per cent of ration dry matter (Table-3). Murdock *et al.* (1981) found no depression of dry matter intake when wet brewer's grains included at 30 per cent of total ration dry matter but highly significant depression was recorded in lactating dairy cows (Davis *et al.* 1983). The other researcher Lahr *et al.* (1983) reported that decrease in DMI linearly proportional to dry matter content of total mixed ration declined. The decreased diet dry matter could depress DMI because of increased water intake from the diet. The high dry matter intake results high nutrient intake and ensures high milk yield as its potential.

Wet Brewer's Grains, milk yield and efficiency of milk yield

The inclusion of WBG at 15 to 30 per cent of dietary dry matter content in lactating dairy cow's studies explained that no significant difference was observed (Murdock *et al.* 1981; Hoffman and Armentano, 1988; West *et al.* 1994 and Miyazawa *et al.* 2007).

Mean while, Chioua *et al.* (1998) observed significant reduction in milk production of dairy cows fed with diets containing wet brewer's grain. The results obtained in this study revealed that the milk production (kg per day) was significantly ($p<0.01$) increased where 20 per cent dry matter of the ration was included by WBG replacing cattle feed. The finding of this study was supported by Polan *et al.* (1985) who tested and found that the cows fed WBG up to 29.0 per cent of dry matter content of ration produced more milk compared to basal diet. The increase in milk yield might be due to WBG have a larger degradable fraction of protein, that protein is converted into microbial cell protein which is digested and absorbed in the duodenum. However, WBG providing the duodenum with protein differently, there seems to be a sufficient amount of amino acids being supplied for milk production (Murdock *et al.* 1981).

The results in this study reveals that the ration with WBG replacing 20 per cent or 30 per cent of total ration dry matter content by replacing cattle feed quantity showed no significant ($p< 0.01$) changes were recorded in Milk Fat (%), SNF (%) and Total Solids (%) and diets did not depress milk fat (Table - 5).

Senthil Murugan *et al.*

The overall efficiencies of milk production (milk yield/DMI) and 4 per cent FCM (FCM/DMI) were 0.666 and 0.715 respectively. In this study, efficiency of milk production (milk yield/DMI) was significantly ($p<0.05$) more in T_2 (0.680) and T_3 (0.681) compared to control group animals. Although the milk yield was significantly less in T_3 (30 per cent DM) group; efficiencies of milk production and 4 per cent FCM did not significantly differ with T_2 (20 per cent DM). The similar findings were reported by Davis *et al.* (1983) and improved efficiency apparently was a result of the use of body stores to support milk yield, because the researcher reported cows lost increasing amounts of body weight as brewers grains content was increased in total mixed ration.

Economics of feeding Wet Brewers Grains

The feed cost per Kg of dry matter increased with addition of WBG (Rs.6.00 per kg as fed) in the ration because the dry matter content in WBG was less compare to other feeding materials included in the diet.
The feed cost per day per cow significantly less in T_3 (16 kg of WBG) compared to T_2 (10 kg of WBG) and control group (Table-4).The milk income and income over feed cost per day per cow was significantly ($p< 0.05$) more for T_2 and T_3 group compare to other group of animals. The economics of feeding raw materials for lactating dairy cows especially wet by products like WBG was decided upon by the feed cost per day, feed cost per kg of milk production, ratio between feed cost and milk yield and feed efficiency. However calculation of income over feed cost accurately reflects the feed costs, milk production, milk price and economics of feed intake (West *et al.* 1994).

The inclusion of WBG advantageous over dried brewers grains (Dhiman *et al.* 2003) and specifically to replace concentrate as protein source (Johnson *et al.* 1987) in lactating cows ration. Based on the results obtained in this investigation revealed that, WBG could be included in lactating cows ration by replacing cattle feed (concentrate) up to 16 kg or at 30 per cent dry matter of ration. However, the problems associated with maintaining quality upon storage and cows lose body weight to support milk yield (Davis *et al.* 1983) need to be seriously considered.

REFERENCES

1. Belibasakis NG, Tsirgogianni D.1996. Effects of wet brewers grains on milk yield, milk composition and blood components of dairy cows in hot weather. Anim. Feed Sci. Technol. **57:** 175 – 181.
2. Chioua, P.W., Chena, C.R., Chenb, K.J. and Yua, B. (1998). Wet brewers' grains or bean curd pomance as partial replacement of soybean meal for lactating cows. Anim. Feed Sci. Technol**. 74**: 123-134.
3. Davis C.L., D.A. Grenawalt and G.C. McCoy. 1983. Feeding value of Pressed Brewers' Grains for lactating dairy cows. J. Dairy Sci. **66:** 73-79.
4. Dhiman, T.R, H. R. Bingham, and H. D. Radloff. 2003. Production Response of Lactating Cows Fed Dried Versus Wet Brewers' Grain in Diets with Similar Dry Matter Content. J. Dairy Sci. **86:** 2914–2921.
5. Gaines W. L. and F. A. Davidson.1928.Relation between percentage fat content and yield of milk .Correction of Milk Yield for fat content. Bulletin number 245. Agricultural Experiment Station. University of Illinois.
6. Hoffman, P.C and L. E. Armentano. 1988. Comparison of brewers wet and dried grains and soybeanmeal as supplements for dairy cattle. Nutr. Rep. Intl**. 38:** 655–663.
7. ICAR. 1998. Nutrient Requirements of Domestic Animals. Indian Council of Agricultural Research, New Delhi, India, p. 11.
8. Johnson, C.O.L.E. Huber, J.T and King, K.J(1987). Storage and utilization of brewers wet grains in diets for lactating dairy cows. J. Dairy Sci. **70:** 98 - 107.
9. Khidzir, K. M. Noorlidah Abdullah and Agamuthu, P. 2010. Brewery Spent Grain: Chemical characteristics and utilization as an Enzyme Substrate. Malaysian Jl. Sci. **29 (1):** 41-51.

10. Lahr. D. A, D. E. Otterby, D. G. Johnson, J. G. Linn, and R. G. Lundquist .1983. Effects of moisture content of complete diets on feed intake and milk production by cows. J. Dairy Sci. **66**: 1891.

11. Miyazawa, K., Sultana, H., Hirata, T., Kanda, S. and Itabashi, H. 2007. Effect of brewer's grain on rumen fermentation, milk production and milk composition in lactating dairy cows. Anim. Sci. J. **78:** 519-526.

12. Murdock F.R., A.S.Hodgson and Robert E.Riley,JR.1981. Nutritive value of Wet Brewers Grains for Lactating Cows. J. Dairy Sci. **64:** 1826-1832.

13. Polan, C.E., Henington, T.A., Wark. W.A.and Armentano, L.E.1985. Milk production response to diets supplemented with dried brewers grams, wet brewers grains, or soybean meal. J. Dairy Sci. **68:** 2016-2026.

14. Salihu Aliyu and Muntari Bala. 2011. Brewer's spent grain: A review of its potentials and applications. African J. Biotec. **10(3)**: 324-331.

15. Senthil Murugan S., E.Fiji.,G.Seena. 2012.Chemical Composition and Microbial Quality of Spent Brewer's Grains. Indian Vet. J. **89 (1):** 94 – 95.

16. Stojceska V, Ainsworth P, Plunkett A, Ibanoglu S. 2008. The recycling of brewer's processing by-product into ready-to-eat snacks using extrusion technology. J. Cereal Sci. **47**: 469-479.

17. West J. W., Ely, L.O. and Martin, S.A.1994. Wet brewer's grains for lactating dairy cows during hot, humid weather. J. Dairy Sci**. 77:** 196–204.

Table -1   Quantity of Dry Matter in Experimental Rations (Kg)

	--------- Quantity of dry matter (kg) ---------		
	0 (T_1)	20 (T_2)	30 (T_3)
Hybrid Napier Grass	6.13	6.13	6.13
Wet Brewer's Grain	0.0	2.25	3.60
Cattle Feed	5.34	3.12	1.78
Total DM fed	11.47	11.5	11.51
DM required as per ICAR (1998) (Kg)	10.5	10.5	10.5

Table -2 Ration components and Nutrient composition of WBG fed experimental rations

	Ration Mixture (Kg/Day/Cow) (As fed quantity)		
	Control (T_1)	Ration (T_2)	Ration (T_3)
Hybrid Napier Grass	24.5	24.5	24.5
Cattle Feed	6.0	3.5	2.0
Wet Brewers Grains	0.0	10.0	16.0
Mineral Mixture	0.5	0.5	0.5
Salt	0.5	0.5	0.5
Calcite Powder	1.0	1.0	1.0
Total	32.5	40	44.5
Calculated Nutritive composition			
DM fed (Kg)	11.47	11.50	11.51

Senthil Murugan *et al.*

TDN(Kg)	7.8	6.6	5.88

Table-3 Analysis of Variance for Mean Sum of Square values for Dry Matter Intake, Milk Yield, Milk Fat, 4 % FCM, SNF, Total Solids on Feeding Wet Brewers Grain

	Dry Matter Intake, Kg	Milk Yield, Kg	Milk Fat (Per cent)	SNF (Per cent)	4 % FCM , Kg	Total Solids (Per cent)
Week (7)	4.711**	3.833**	3.893*	11.029*	13.792**	78.299*
Treatment (2)	29.249**	13.701**	0.786	0.318	12.315**	3.370
Treatment x Week (14)	3.724**	5.891**	2.606	9.487	8.067*	87.854
Error (144)	5.576	12.944	29.029	81.699	53.588	706.019

Figures in Parenthesis indicates degrees of freedom, ** highly significant ($p<0.01$), *Significant ($p<0.05$)

Table-4 Feed costs, milk income, and income over feed costs in experimental animals fed with wet brewers' grains (WBG)

Parameter	T_1	T_2	T_3
Feed Cost Rs/Kg of DM	12.78	15.79	17.14
Feed Cost Rs/day/cow	211.75[a]	195.49[b]	147.36[c]
Milk Income Rs/day/cow	234.01[a]	251.80[b]	238.21[a]
Income Over Feed Cost* (Rs/day/cow)	22.26[a]	56.31[b]	90.85[c]

Mean values bearing the same superscript in different columns did not differ significantly ($p<0.05$).*Income over feed cost =Milk income (Rs/day/cow) – Feed cost (Rs/day/cow)

Table – 5 Mean $\pm$ SE values for Dry Matter Intake, Milk Yield, Milk Fat, 4 % FCM, SNF, Total Solids on Feeding of WBG

	DMI, Kg	MY, Kg	Milk Fat (Percent)	SNF (Percent)	4 % FCM, Kg	Total Solids (Percent)	Milk Production Efficiency (MY/DMI)	FCM efficiency (FCM/DMI)
Over All Mean $\pm$SE	12.073 $\pm$ 0.009	8.029 $\pm$ 0.017	4.493 $\pm$ 0.033	7.714 $\pm$ 0.055	8.619 $\pm$ 0.043	11.659 $\pm$ 0.160	0.666 $\pm$ 0.003	0.715 $\pm$ 0.004
Week								
1	11.634[a]	7.768[a]	4.341[a]	7.405[ab]	8.165[a]	10.709[a]	0.669[bc]	0.702[ab]
2	12.169[b]	7.844[ab]	4.318[a]	7.250[a]	8.221[a]	10.537[a]	0.645[a]	0.677[a]

Senthil Murugan *et al.*

3	12.169[b]	7.960[bc]	4.593[ab]	7.639[abc]	8.672[b]	11.551[ab]	0.655[ab]	0.712[ab]
4	12.142[b]	8.258[f]	4.489[a]	7.746[c]	8.860[bc]	11.583[ab]	0.680[c]	0.730[bc]
5	12.131[b]	8.106[cd]	4.459[a]	7.918[c]	8.655[b]	12.249[b]	0.669[bc]	0.714[ab]
6	12.117[b]	8.102[cd]	4.823[b]	7.779[c]	9.094[c]	11.877[ab]	0.670[bc]	0.752[c]
7	12.125[b]	8.059[cd]	4.527[a]	8.061[c]	8.681[b]	12.606[b]	0.665[abc]	0.717[bc]
8	12.101[b]	8.133[de]	4.393[a]	7.918[c]	8.606[b]	12.164[b]	0.672[bc]	0.712[ab]
Treatment								
T1	12.355[a]	7.818[a]	4.589[a]	7.695[a]	8.508[a]	11.666[a]	0.635[a]	0.677[a]
T2	12.382[a]	8.432[b]	4.442[a]	7.775[a]	8.992[b]	11.830[a]	0.680[b]	0.726[b]
T3	11.484[b]	7.835[a]	4.447[a]	7.674[a]	8.358[a]	11.483[a]	0.681[b]	0.741[b]

Mean values bearing the same superscript in different rows for a factor did not differ significantly (p<0.05)

RESEARCH ARTICLE

The Founders of the City of Benefactors and Scholars in Iranshahr

Ali Akbar Amini[1]* and Ebrahim Fereydoon Samadi[2]

[1]Assistant Professor of Department of Political Sciences, Faculty of Political Sciences, Central Tehran Branch, Islamic Azad University, Tehran, Iran.
[2]PHD Student of Department of political sciences, Faculty of political sciences, Central Tehran Branch, Islamic Azad University, Tehran, Iran.

*Address for correspondence
Ali Akbar Amini
Assistant Professor of Department of Political Sciences,
Faculty of Political Sciences,
Central Tehran Branch,
Islamic Azad University,
Tehran, Iran.

ABSTRACT

The city of benefactors that is called nowhere city sometimes is an inaccessible ideal society and utopia but like the desire for flight or building heaven on earth has caught the heart and soul of the idealists through the history. In ancient Iran there were people who were fascinated and enchanted to the issue just like those who were charmed in the Greek society. In Iran after Islam there were also intellectuals like Farabi, Avesina, KhajehNezamalmolkToosi, Nezami Ganjavi and … who were charmed to them.
One of the reasons to inclining to the city of benefactors was not fantasizing or illusionism but role modeling and making samples. it means that the founders of the city could build a perfect city to show to people and leaders that what criteria a happy society must have and what ways must have taken to get near to that city. In this society scholars and values are dominant. There is no toughness and strictness and immaturity and fanaticism and illiberality and meanness, law is the ruler of society. Justice and honesty are the most important standard of this society. Guileless,purity,pledge, wisdom and freedom are among other standards of this city.

Throughout the history there were intellectuals and politicians who made the city of benefactors as their Mecca and tried to get near to that city.

Key words: Utopia, City Of Benefactors, Scholars, Happy Society.

Ali Akbar Amini and Ebrahim Fereydoon Samadi

INTRODUCTION

Hegel: "Iran emperor was not patriarchy kingdom like china, not static and moves less like India, not ephemeral like Mongol and not brutal like Turkish emperor."

The notion of the ideal city and scholar ruling were twisted to each other through the history. The ideal city has been a great deal inaccessible and lost idol of human being. But it has been a road map and sample for all justice seekers and benevolent and well-intentioned people .The ideal city is a kind of heaven in this world in which everything is fulfilled and truth loving and ashamed heart are satisfied there .There is no pain and hurt and bad living or suffering in this society .Human life is in compete accordance with the nature.A never ending and merciful nature with endless and vast horizon which favors width and spread to human heart and eye. Limited and mean and small minded human becomes benevolent with broad mind and tries to describe himself loving and perfect by looking to this bare nature that is full of secrets and codes and diversity and beauty. Although the opponents of the ideal city may argue that reclining on the ideal city may take people away from political realism and trail them to illusion and have harmful effects for people and society, even it may become an excuse for autocrats and tyrants to justify any oppression and suppression and sacrifice the present and watching generation for imagery and promised and supposed "the city of benevolent s'' and give today cash to illusionary credit. Like what Stalinists did and sacrificed thousands of people to the ideal society (communism) and so did Nazi! Andin the third world the promises of Nasser in Egept, Ziyaalhagh in Pakistan, ghadafi in Libya and Nomeiri in Sudan are all examples of this issue! So the other side of ideal city is horrible according to historical proofs and there is no doubt about it! But the question is that is it a false idea about the notion of the ideal city? In this essay we try to research about the 'notion' of the ideal city in the arena of politic and political history of Iran.

Plato as Bertrand Russell, the greatest philosopher of all times, says was among those who spoke of the ideal city. He established his ideal government based on Greek events. We can refer to the defeat of Atena in Plopenzi wars and its destructing effects on their political and ethical life. In addition the change among aristocrats and reach people and freedom seekers and trial of Socrates and his execution in the time of democracy made it worse. Socrates described benefaction and god deeds in his ethical teachings scientifically andreasonably. He said that people never do devilish deeds knowingly and intentionally, it is because of mistake and ignorance. (Bloom, 1994) so we should try to know and introduce the good deeds,because when they distinguish good from evil, they will choose it. So Socrates believes that a justice man is one who knows what the truth and justice is, after knowing this he will use it in politics automatically. Plato like his master, gave a new model about scientific scholars which were effective in the life of human according to psychology (Forooghi, 1993) his notion was based on justice and he believed that gods never forget a person who considers justice eagerly with heart intentions.(shariat, 2002)

Plato says that a perfect person is who has power and wealth without lust and over ambition and the best in knowledge and wisdom and justice, so observes politics in the arena of ethic and wisdom. He believes that they are correlative and imperfect and lapsed without each other, with one origin and necessary for human happiness, "the best government is one in which ruler is scholar and scholar is ruler." (Tomas, 2002)

The main notion of his book "republic" is creating a heavenly kingdom on earth and it seems that the best type of ruling is aristocratic one with especial features on his philosophical theories, in fact he thinks that politic is the end of wisdom and political act is dedicated to scholar and philosopher. Generally Plato describes the best rulings from the ethical point of view. (Enayat, 1992)

The notion of scholar is seen in the thoughts of Aristotle as well but hear "class" is replaced by person and the middle class (bourgeoisie) carries all of the scholars and good deeds which is away from immoderation. (Aristotle, 1985) happy life is continence with moderation and modesty as it is the best and the safest ways and it is not created unless beyond good deeds and thoughts, as happiness is the consequence of right deed and behavior based

Ali Akbar Amini and Ebrahim Fereydoon Samadi

on wisdom. So he believes that the form of ruling considering social and geographical situation and peoples position is different and changing in every place and time but in creating a moderate ruling that makes a scholar society it is needed to a middle class between inferior class and noble class to keep the modesty and bring freedom and fairness between the members and all have the same amount of freedom, right of voting, …(Azizi: 125).One of the other famous politicians and scholars who has written about the city of benefactors is Tomas moor (1478-1535) a philosopher who died for his opinion. He wrote utopia or the imagery city or the ideal city in 1518.

In this imagery city, according to Moor, the reach never deceives the poor. There is no hatred and detest or any cruelty. There is no unlimited pride and selfishness which he calls "the mother of corruption":"everything is public"according to utopia there are 44 cities with the same design to create enough peace for everyone. The length of the streets and the houses are the same. One door of every house opens to street and the other to garden! Everyone is wealthy enough to earn living so theft is reduced a lot. He speaks about religion in ambiguous words. Priests "must be very pure and sacred so their numbers are very little "Moor truly praised those shepherds who refused fattening themselves by eating sheep and on the other hand quarreled with some of religious leaders like cardinal Velzi who had a high rank in church and hated them and believed that this group had mixed religious duties with human over ambition. He did not see any relation between God and gold: "let our clergymen have lighter pockets and softer hearts".

Those who rule the country are selected by people because they were wise and intelligent and loyal and peacemaking in politics. As the utopian people have no interest in gathering money they have no desire to fight. They never fight with other nations. (Tomas, 2008)

The City of Benefactors in Ancient Iran:

In ancient Iran kingdom was based on responsibilities and sacred obligations that even if a Macedonian wanted to do it he could not as the king of Iran must be Iranian by religion and tradition and selected by Ahoora Mazda (Rajaee, 1996) and he could not be selected unless he acquired everything was necessary for kingdom. (Kenedy, 2002) As it is said in inscriptions Ahoora Mazda has given them the kingdom so they are king for His selection. It shows that one was sselected as king based on their beliefs, abilities and merits. So the king of Iran was the viceroy of Ahoora Mazda on earth and for this divine selection had a unique and great superiority. Although he was inferior than God but he was higher than other people. As the Greek like Plutarch said that Iranian kings had a divine or angle soul. (Ibid)

The king of Iran was like a dish selected from God and full of especial powers that had specific effects around him. This method is seen in the carvings on Persepolis, Naghsh-e-RostamsndBistoon. This selected king, had wisdom and knowledge and thinking power and he was related to God through dream or other mediums. He also had the power and military personality and braveness and right leading of military operation. He kept the country safe from natural disasters. As it is shown in Takht-e-Jamshid carvings: we see the king killing diverse demons who are the symbol of chaos and natural disasters and this is the obeying of what Ahoora Mazda wants in turning whole of Asia to a united country with peace and friendship and it was preserving the superior national God of Persia, honesty, higher natural universe, Iranian religion and the nobles. The kings were creating justice and whatever they had given to the world by the policy of cities and country were the best kind as they insisted on creating justice. (Ibid)

This creating of justice had its origin in their dialectical belief in good and evil. One way of establishing justice in society is intensifying honesty. In fact good and honesty and justice are mixed with considering class limits (Amini, 2006) that everyone must respect his class and preserve his place and situation of his class. On top of this class pyramid, is the ruler that if he rules with wisdom, disciplines braveness, knowledge and thinking so the society will be scholar?

Ali Akbar Amini and Ebrahim Fereydoon Samadi

The ruler could preserve the country by watching and taking part in the ceremonies. The image of Iranian society without him, who was the guidance and creator of specific order,was impossible.

So the main core of Iranian political religion has three branches:

1) The king is the agent of God on earth as he has the ability to do superior deeds in spiritual and celestial arena.
2) The king is the guardian "Arteh" and responsible in front of Ahoora Mazda. His ruling is based on ethical standards. His victory is triumph of good on evil. Triumph of order and peace and benefaction on evil and war and cruelty.
3) People are obedient and docile and pliant of the king and should obey his orders.

After creation of these features in the core of political affairs in society the city of benefactors or God is created. The role he model of such society is seen in "Denikret"which the world is renewed by the savior and it is the same perfect society for Iranian people. If this society is mixed with religion and kingdom the world will be free fromdeficit, full of art, honesty, happiness and goodness. (Rajaee, 1996) the mixture of religion and politics are two main parts of such city. The king in this city gains his credit by God (religion) and as long as got it the city will remain in peace and security and welfare.

It is written in KarnamehArdeshirBabakan, thatArdeshir gained victory as God was with him. So, ancient Iranian believed that no one deserves to be king by power or political power unless having the credit of God. (MohitTabatabaii, 1988)

It is seen in Shahnameh that God chooses the king according his spiritual and celestial featurs and take care of him and his descendants, guide and support him in deeds and free from dangers and win in wars and cope with the problems.

Whoever wants to destroy the king and take the crown isa sinner and evil and the enemy of God. With a justice king everywhere is prospers and nature is great, farmer is happy and people are reach but with cruelty there is drought and no prosperity. In Shahnameh kingdom is divine and God favor it to a religious, justice,winner, artful, powerful,intelligent and harmless person. For example Hooshang shah Pishdadi called himself God selected when he was crowned:

As he sat on superior position
He said on   kingdom throne
I am the king of seven realms
The winner and ruler everywhere
On the order of great God
Trying hard to forgiveness and justice
The city of benefactors in political history of Iran

The beginning of Iran history is with mad dynasty. They ruled at western part of Iran. Azarbayjan was called little Mad in north west and Rey in Tehran at north west of central Kavir, Hamedan, Kermanshah, Lorestan was called great Mad. Their capital was Hegmataneh that was changed to Ekbatan later. Fighting with Ashoors(8 century A. C.), showed the need for a powerful central ruling that lead to the first Ariyaii kingdom in Iran. Mads chose Diaeko for creating central power that was the core of a kind of government that is based on a social contract in the history of modern notion.(Zarinkoob, 2007) Then Farvartish came to throne that spent most of his 22 years of ruling to order Mad tribes and fighting with foreign enemies. Mad dynasty reached its climax when Hovakhshatarheh came to throne. Mad army was defeated for several times and he had a rival like Asoorbanipal and his great

4332

commanders in front of him. He had to rearrange the defeated army and he entered Asoor and had a great victory against them. It was the first victory of Iran against a foreign army. (saloor, 1961)

Mad kings were too busy fighting with foreigners and establishing security they had no time to think about the idealcity.

Hakhamaneshian were first local kings of Pars and then they were the greatest kingdom in the world. Gezenfon writes about Iran of Hakhamaneshiin"raising ofKorosh"or (gyropedia) that Iranian were realy great in raising polititians and ruling the country and they were known as master or As Hakhamaneshian believed that they were agent of God on earth selected by Ahoora Mazda they could create a united country in Asia.

Asikholoos (Ashil) also says from one of his characters in a play that Zeus (Ahoora Mazda) has made it as a natural law that only one man rules Asia and that man is Koroosh as he has done whatever God wanted him.(Kandi, 2002) Koroosh with the modesty of an earthly man came to rule the world. He had all the features of a great commander; hard work, braveness, and wisdom mixed with manhood and magnanimity and in addition to that his soldiers and people loved him because of his personal attraction and respect him. He has the apparent characteristic of first kings of dynasties that come to throne by their attempt and try and lead their people desire to create a winner society in the best way. (IslamiNodoshan, 1999)

Professor Girshman has written about him:" there are not a lot among kings who had good name after them like Koroosh. He was a great commander and the leader of people and he was lucky as well. He was generous and benevolent and did not make the conquered countries to have the same method. (Girshman, 2009)

Under his kingdom there blow a new wind all over the world. He saved the cities from unfair sacrifices and killings. Extinguished the fires of robbed cities and freed people from captivity and slavery. (Islaminodooshan, 1999)

His religious believes were the origin of his other characteristics. His deeds were of a real worshiper of Mazda as he ruled his great territory with justice and benevolenceaccording to Asheh.

The second great Hakhamaneshi king, Dariush, not only added to the kingdom territory and top of vastness, but organized it and created ordered and centered affaires for that. If the Hakhamaneshiempire could remain for more than two centuries and a half, one reason was that it ruled based on what Dariush had established.(enayyat, 1992) Generally the HakhamaneshiEmpire was based on two important things:

Zoroastrian religion that affected the life style, policy of inside and outside affairs, including living in one place based on cultivation and also the dimension of beyond universe of this religion which affected outside policies. As it means that this religion must not limited to internal borders and gets worldwide.

The theory of king as the ultimate goal and its characteristics as theoretic justification and explanation of king symbol.

Dariush had tried to defeat the demonstrations of Doroogheh (lying) and live according to Asheh (honesty) and establishing justice on earth. (as he believed lying is the reason of every rebellion against ruller) he says: "Ahoora Mazda and other Gods helped me as I was not an enemy, not a liar, neither me nor my family did not do any lye. I behaved according to justice and did not hurt a weak or strong person. (Script of Bistoon, column 4, line 62-65)
I rewarded good to one who was good, I punished badly to one who was bad." (Ibid, column 1,line 21-22)
Dariush even gave presents to Anirani people from his property to lead them to Zoroastrian religion (Bevis, 2002)

Ali Akbar Amini and Ebrahim Fereydoon Samadi

Hakhamaneshiempireended by Alexander of Macedonia.It seems that Iran was divided between his commanders and its great part was for Sulukoos the first and Sulukian dynasty was established. After a while Parts invaded and defeated Sulukian. As it is seen in events of Ashkanian dynasty(specifically Mehrdad the firsrt) their policy was to revive the glory of Hakhamaneshi dynasty.(Pirnia,2002)

We can notice the effect of Zoroastrian religion on Parts by the somehow hostile sources of Roman historians but even by these grudging sources it is apparent that Ashkanian generally were responsible to important ethical rules and kindness and honesty and respect of their religion. They treated in good manners and kindness and respect with the captives and refugees. They noticed to their promises carefully and were loyal to their pledge. The heroes of Zoroastrian religion were defending that against pagan armies in east and west and devastation of their dynasty even by Iranian rivals, was an event that shuddered Zoroastrian society. (Bevis, 2002)

According to Avesta ancient Iranian society was divided to three classes of Asravan(clergies), Arteshtaran(militants),and Astaryooshan (farmers). In Iranian society always had power and grandeur and they were sometimes on top of other classes and sometimes after militants or Arteshtaran. According to Tansar in ArdeshirBabakan dynasty clergy'swere higher than all other social classes.Arteshtaran(carriage riders) had an important role in firs Iranian societies as it was the power of their sword and spear and bow that made Ariaee tribes superior to other local and Sami tribes in Falat-e-Iran orBeinoalnahrein. But the third class or Astaryooshan were cultivating in dry and waterless areas of Iran. (AzariDamirchi, 1994)

Social division of Iranians to three groups of clergies and militants and farmers is likely to be the same as what Plato made it his sample in Utopia (the ideal city) and believed the perfection aim for society as:

Philosophers and intellectuals (head) 2)Militants or soldiers (chest) 3) Workers or astriushan(belly) (enayat, 2002)

It was in Sasanian ruling that some changes appeared in this class system. Sasani dynasty created great cultural system in politics and ruling, ethics, social healthy relation and art. Some Greek books in the time of Shapoor the first of Sasaniwas translated to Pahlavi but it was probably turned to Pahlavi from Soryani in KhosroAnooshiravan time. This king was familiar with Aristotle and Plato ideas. Roman emperor, Yusetin, in 529 A.D. orders to close AtenaSchoolthat seven philosopher took refuge in Iran and settled down in Tisfoon after that. (tafazzoli, 1997)

It seems that these factors were reasons for effects of Aristotle and Plato ideas and notions on Sasanikings, especiallyAnooshiravan about the ideal city.(Rezaii,2011)

Anooshiravan tried to solve the strictness on farmers and workers and asked for clergies help as he had a great relation with them. According to what Dinkard says, this king ended bad traditions like innovation and cruelty totally. (Bevis, 2002)

He is known as a just king in most of Persian and Arabic works and he had such great deeds that probably were the source and origin of all the innovation and changes of Sasani dynasty.(Yarshater, 2004)

As it was in the ruling of Anooshiravan that the prophet of Islam was born that Moslem historians had specific attention to him, including an Arabic translation of a little work, KarnamehAnooshiravan which is a report of his ideas and deeds. This work shows that how he got the name of "just" as it has the issues he did: " I thank God…for all the blessings He favored me …we should thank a lot one who give us a lot and it brings a lot of favors. Then as I noticed some gratitude in saying and some in deeds, I saw what God loves the most. What He has created sky and earth and mountains and rivers and creatures to it and it is nothing but justice and fairness."(bevis, 2002)

The city of benefactors in the notion of Islamic scholars

Ali Akbar Amini and Ebrahim Fereydoon Samadi

After Islam the notion of building the city of benefactors continues. Farabi, great philosopher of the third and fourth century, is one of the famous lovers of this city. Aboonasr Mohammad ibnFarabi was born on 259 or 260 hejri at Farab, a territory in east of Iran.

The era of Farabi was the era of corruption and disability of Abasian ruling and over ambition commanders. In eastern part of Iran there were kings that khalifeh had no control on them and sometimes like Yaghoobleyss safari threatened Baghdad. He was affected by the chaos of his time in his notion and political aims. But he noticed Greek wisdom including Plato in his political philosophy which has common points in cases like justice, ideal city and philosopher king. (Asil, 1992)

The role of leadership is very important in creating a happy society.
Farabi as a Moslem believes that perfection is the consequence of obeying Islamic rules and on the other hand by obeying of Plato it is the product of ethical and reasonable perfection. He says that ideal city is a society that first the true happiness is the ultimate goal and second all of his members help eachother to reach this aim and third all members behave as the taste of the leader of ideal city: 1-health 2-powerfull perception 3-strong memory 4-smartness 5- fluency in expression 6 wisdom 7-moderation in eating and pleasure 8-honesty 9-continence 10-hatred of mony11-justice 12-braveness and constant attempt (Enayat, 1998).

Then Farabi refers to two qualities as he knows that cannot have the least of them:
1) If group of people each of them have one of those qualities.
2) There must be a man aware of ancient customs and also has the power of speech and fight. (Sajadinia, no date)
Half a century later on 370 hejri, Avesina in Afshaneh?a village near Bokhara was born. He did not isolate himself in that chaos but was involved even choosing to be a minister. His political notions are not in an independent book but inside his works like Shafa, Esharat, Tanbihat and Esbatalnabovvah. His ideal city is under the control of the Prophet. He says the Prophet has two duties:1-ordering and organizing the life in this world or ruling by suitable political organization. 2- Providing happiness in the other world. So he is an ultimate leader and a transcendental gift and divine blessing. He considers some virtues for commanding according to Plato and Farabi, including: braveness, moderation, wisdom and knowledge. He must have a perfect skill in knowing rules and dedicating its commands and being superior than others and beyond ruling such a leader forms the just society of Avesina or idea city of Farabi. (Ghaderi, 2006)

KhajehNasiraldinToosi was one of other scholars believing in ideal city and had referred to it. He defines the city of benefactors or the ideal city as: ideal city was a strong community trying to create gooderness and defeating evil. (Toosi, 2008)

There are also some refers to ideal city and ethical virtues in the works of poets like Jami and Nezami. Nezami was not only a poet but a canonist and he was good at wisdom and Gnosticism.(Brown, 2007). He was looking for justice and ideal city all of his lifetime, considering a specific place for justice and human purpose and talks a lot about justice and fairness in his book MakhzanolAsrar . He also says Alexanderis the ideal king in KhosroShirin, that has an ultimate characteristic as he got the factor of king, philosopher and prophet all together:

Some call him throne owner
One who conquers cities and countries?
Some wrote from his law
His script with wisdom
Some accepted him as a prophet
As he was pure and religious
In his nice city, society has no class and people have the same position and rank. (Zarinkoob, 1984)

Ali Akbar Amini and Ebrahim Fereydoon Samadi

People has a simple and fair life, they do not backbite and have moderation in every aspect. Its economy is cultivation. They believe in honesty and goodness of man nature and preventing chaos by government that destroys living in peace and working of people together. " the city of benefactors " of Nezami, was the realm of virtue, the land of conscience and as a western researcher said "the land of happiness and goodness "…what Nezami said in answering Alexander from citizens about their way of living is very enchanting and advising and dreamy that we refer to a part of that:

Know it a truth that we, this group
Who live in this plain and mountain?
We have closed the door of wrongdoing
We have lived with honesty
We say no lye in any case
We do not dream badly at night
When our friend needs help, we help him
When there is toughness, we tolerate
When one of us has a problem
And we become aware of it
We give him from our property
We feed him by our asset totally
No one has more than others
We all have the same asset
We consider all of us as a family
We never laugh when other one cries
We do not fear of thieves
We have no guardian or watcher in town
We have no lock or bind
No guardian with our cow and sheep
We never learned backbiting of any one
We ignored the faults of the others
We grieve with the sadness of the others
We rejoice with the joy of the others
We never say behind someone in hidden
That we do not say in his presence
We never seek for what others eat
We never cry out what others did
One stays calm with us
That is pure and continent like us
If he turns away of what we behave
He will be out of our place

This justice land that Alexander found it a reward of all of his hard travels, was the sample of an ideal city… plot of this city with these explanations in the source of Nezami is likely to be the same as what has come in anecdotes that is in the interpretations of Koran by the news about Zolgharnein of Koran (83-94/18). What has come in Kashfolasrarof Meibodi in Zolgharnein and his story of building the dam of Yajooj is an example of interpreters' sayings that might be the source of Nezami or, the same root of his source. There are images of this ideal city in other interpretations including Abolfotoohand even somewhere in the translation of Tabari interpretation there is an anecdote related to ascention of RasoolAkram that might be the source of Nezami inspiration or his source of this city of benefactors. It is like the ideal city of Plato, the necessity of establishing this order is for justifying the concept of humanitarian justice. Nezami apparently wanted to show that it is possible to make the goodness order

4336

Ali Akbar Amini and Ebrahim Fereydoon Samadi

and ultimate system in the man world like cosmetic world and consider this existed world of the man dimension in harmony with the ultimate system that is ruling the whole world.(Zarinkoob, 2010). Jami, imitating of Nezami wrote his Nice City, but his poems had Gnostic and continent notion. His ideal city has a nice plot and the artistic and aestheticism of Nezami notion is apparent on them. But with surrender and more contentment and less inflexibility that is rooted in his continence and shows his hatred of the blessings of this world. (Rashidi, 2005)

CONCLUSION

There is a need to personal and social catharsis forestablishing the city of benefactors that movement in it starts from inside to outside. Both a person and society must show their virtues and values in establishing this city. Both ordinary people and rulers must take part there, and there is the ultimate king on top of that city! Intellectuals like Konfosios in China, Plato and Aristotle in Greek, Farabi, Avesina, KhajehNasiroldin, Nezami and Jami in Iran and...have argued about this and all referred to what a virtual society must have. Justice, honesty, wisdom, ability of ruling and having order and security are signs of this society. According to the idea of intellectuals and scholars with a virtual ruler (just and wise) the ideal city appears that skill and wisdom and talent of people are considered in it. It is not the color, race, wealth, power or heritage that makes a man ruler but his abilities, merits and talents.

Ancient Iranian believed that they are not ordinary people but those who have divine spirit or Farah Izadi and chosen by Ahoora Mazda to lead and create peace and order and security in world. According to data and documents of ancient Iran consisting Mads, Hakhamanesian, Solookian, Ashkanian and Sasanian, onlyan, only in Mad, Hakhamaneshi and Sasani ages there are examples of Farah Kiani that is a branch of Farah Izadi.

In Mad era, Hovakhshatareh, and in Hakhamaneshi era, korosh and Daryush were examples of Mazdaparasti, and they could rule the society with thought and wisdom based on justice and "Asheh" beside spreading religion. In Sasani era also KhosroAnooshiravan could get the title of just as he could reform the tax system and give ruling of different parts to skilled people and create peace and security. They were founders and lovers of the ideal city and to establish such society, they tried hard to spread human virtues and ethical values. Several intellectuals as theorists of the ideal city, tried hard in establishing the city that Farabi and Nezami were the most famous of those theorists.

REFERENCES

1. The ideal city in Iranian notion, HojatolahAsil, Tehran,Ney publication.1992
2. The history of political ideas of the ideal city, Mohsen Azizi,Bita,Bija
3. The passage of wisdom in Europe, Mohammad Ali Forooghi, EntesharatZavar,1993
4. Political and economical data 179-180 August and september2002FarshadShariat
5. Theories of political system, Wiliam Tee.Bloom,translated by Ahmad Tadayyon, Tehran, Aran publication,1994
6. Masters of philosophy, Henri Tomas, translated by FereydoonBadreii, Ketab Publication,2011
7. The base of political philosophy in west, Hamid Enayat,Rozane Publication,2002
8. Institutions and political notion in Iran and Islam, Hamid Enayat with introduction of SadeghZibakalam, Rozaneh Publication, 1992
9. The notions of the ideal city, Farabi, translated by JafarSajadi, High council of culture and art,1975
10. Political and economical data 179-180-year 16, August and September2002, essay, AlirezaSanbarianMoosaAbadi
11. AkhlaghNaseri,khajehNasialdinToosi, Behzadi publication,2003

12. Political notion in Islam and Iran, HatamGhaderi, Samt Publication,2006

13. The history of political philosophy, BahaaldinPazargad,second volume

14. Political and economical data 221-222, year 20,number6 and, 2005,Ali Rashidi page 59

15. Evolution of political notion in east, FarhangRajaii,Tehran2002

16. Custom of kingdom in east, Samuel Kenedi Edi, translated by FereydoonBadreii, Tehran2002

17. Kingdom and kings from the point of view of Iranian based on ShahnamehFerdowsi, Ministry and cultureand art,AligholiEtemadMoghadam,year1921

18. Institute of Iran kingdom,SaboktakinSalor,Tehran 1961

19. The evolution of ruling in Iran after Islam,Mohammad MohitTabatabai,Tehran,Besat,1988

20. Iran and Greece in histirsory,Mohammad Ali IslamiNodooshan,Sherkatsahami Enteshar-year1999

21. Girshman,translated by Mohammad Moin,ketab Publication,2009

22. Zoroastrian (their beliefs and religious customs),Mary Bevis, translated by AsgarBahrami,year2002

23. Ancient Iran, Hassan Pirnia,Asatir publication,2009

24. An introduction on the social and cultural structure of ancient Iran,AlaedinAzariDamirchi, Maratif Publication,1993

25. The history of Iran literature before Islam, Ahmad Tafazoli,by ZhalehAmoozgar,1997

26. Iranian history,AbdolazimRezaii,Dor publication,2011

27. History of Iran,EhsanyarShater,translated by Hassan Anoosheh, AmirKabir, 2004,third part,season 4

28. Eras,history of Iran from beginning to the fall of Pahlavi kingdom,AbdolHosseinZarrinkoob, Sokhan,1999

29. Politics,Aristitle,translated by Hamid Enayat,Tehran,EnghelabEslami publication,1992

30. Literary history of Iran, Edward Brown,translated by GholaHosseinSadryAfshar, Tehran,Morvarid,2007

31. Basis of political structure in ancient Iran,AliAkbarAmini, Law and politics Journal,Tehran science and research,2006

32. With the carriage of notion, AbdolHosseinZarinkoob,Tehran,Amirkabir,1984

33. PirGhanjeh Dar JostejoyNakojaabad,AbdolHosseinZarrinkoobTehran,Sokhan2010

34. History of Iranian people before Islam,AbdolHosseinZarrinkoob,Tehran,Amirkabir,2007

35. Everlasting adventures in philosophy,Henry Tomas and Danali Tomas,translated by Ahmad Shahsa,Tehran,Ghoghnoos,2008

RESEARCH ARTICLE

Justice in Ancient Iran

Ali Akbar Amini[1]*

[1]Assistant Professor of Department of political sciences, Faculty of political sciences, Central Tehran Branch, Islamic Azad University, Tehran, Iran.

*Address for correspondence
Ali Akbar Amini
Assistant Professor of Department of political sciences,
Faculty of political sciences,
Central Tehran Branch,
Islamic Azad University,
Tehran, Iran.

ABSTRACT

Justice in ancient Iran is the key to happiness. This word used to cover a range of meanings among ancient Iranians. The most conclusive concept of this word could be traced back into the word "R'at" or "Artah" (Ashe, A'sha) meaning truthfulness. The meaning of 'Asha' overlaps the meaning of justice in general and implies a range of concepts including law and obeying law, moderateness, non-covetous, observing one's limits, not violating others' privacy and being committed to one's vow. This meaning has also to do with honesty in speech and sincerity in action. Justice takes special meaning in the field of judgment and law. Furthermore, a prerequisite to a justice-practicing society is that the wrongdoers see the corollary and retribution of their deeds, and arbiters issue verdicts upon clear-cut and proper law and do not enforce penalties heavier than due sentences, otherwise the accused would become the oppressed and the arbiter and judge would turn out to be an oppressor.

Key words: Vow, Asha, Justice, Law, Moderateness, Trustworthy, Lie

INTRODUCTION

Ardashir Babakan said "Property could not be conserved without a man and a man has not a shelter without property and property could not be earned without justice and politics… The means to conquer the world is property and the elixir of property is justice and politics, and the benefit of having expertise in justice and politics and their preference over other virtues is that … construction and raising products and increasing incomes and reviving barren lands and helping dervishes and facilitating life conditions and the income of knowledgeable people and so on and so forth all belong to justice, and security of routes and uprooting corrupts and preserving roads and territories and

4339

torturing oppressors and making the friends tranquil and so on and so forth all depend on politics and there are no other pillars as firm as these two for the world survival". "Kalileh and Demneh Preface"

"Justice" in the religion of Islam comes together with a range of concepts including "monotheism, Resurrection, aspiration of canonizing prophet-hood, rational behind leadership, criterion for individual's perfection and indicators of social health." (Motahari, 2002:55)

As many Islamic scholars like Abu al-Hasan Mawardi (death: 450AH), Mohammad Ghazali (death: 505AH), Ibn Jama'ah (death: 733AH), Najma al-Din Razi (death: 654 AH) say, one of the most outstanding attributes of a ruler and one of the main pillars of any reign is observing justice (K. S. Lambtun; 1979), a concept which was treated exceedingly in ancient Iran. One of the primary manifestations of this could be observed in ancient Iranian myths. In the mythical section of Shahnameye Ferdousi – the richest ancient Iran political document – justice and equality stand on the most elevated position. In the Epic of Kaveh the blacksmith, Fereydoun and Zahhak, justice is the focal point of the whole myth. In this unparallel myth, the serpent-shouldered Zahhak is the symbol of despotism while Kaveh represents justice-seeking and Fereydun is the icon for justice-practicing. In fact, throughout Shahnameh, the conflict occurs between two main fronts, i.e. justice-seekers and evil-doers. The justice-seekers front is overfilled with magnanimity, chivalry, beauty and magnificence while the rival front is packed with filth, abjection, nastiness and turpitude. The dialectic language of Shahnameh is set up on the basis of battle between these two camps. Interestingly, sometimes the battle occurs between the good and the evil within a single camp when Rostam, the hero of justice front, faces Isfandiyar who has been charmed by power and ambitions and left the justice front for the demon front. At other times the confrontation is drawn outside the front and Rostam stands against the cruel Afrasiyab. The delicate point here is that justice is not defined in terms of people, race or geography! Hence, one could witness that within the same front, a group of individuals stand in the virtuous front and others take side with the evil front! There are even guys outside the camp and in the enemy front who are virtuous. For example: Jarireh, the daughter of Piran Viseh , Forud mother who is one of the two wives of Siyavosh, Farangis the daughter of Afrasiyab, Siyavosh's loyal wife, Keikhosro's mother and even somehow Piran Viseh!

What brings about this binary categorization is the extent to which individuals' behaviors and deeds are just or unjust!

Different Concepts of Justice

Khajeh Nizam al-Molk Tusi says: in all ages, since the creation of Adam, justice and rectitude have been practiced in all nations and governments and, hence, countries were conserved. (Tabatabayee, 1988:26)

Justice has been perceived in two different forms throughout history; one is in the form of an extraterrestrial, independent and separate thought which stems from a sublime source; the other has been deemed as a social vision having a mundane root and stemming from human dreams and wishes. (Fourkush, 2006: 218) Although in the Iranian ideology, the second concept of justice has been given more attention, the spiritual facet of it has been moderately used as the basis of Iranians behaviors and deeds. This wide range of justice applications has attached various meanings to the word 'justice' in the history and has turned it into a milestone against which good and bad, warmongering and peace-seeking, merit and demerit, wisdom and indiscretion, freedom-seeking and dictatorship, faithfulness and unfaithfulness, equality and inequality, and more important, truthfulness and lie were assessed; even justice itself appeared in life to challenge lying in its general meaning and gained the current significance mostly through this very confrontation, because all the hardship started at the point that, as Dariush puts it, lying spread across the world (Bois, 2006: 82). In the following we will bring some of the meanings attached to justice in ancient Iran.

Ali Akbar Amini

Justice and War

Apparently, the word 'fair war' is somehow paradoxical. Twin Bi, the well-known historian, writes: why fratricide could be a just war? War among humans is tragic but fair war is legitimate in that avoiding it brings about more evildoing. During the World War II, I profoundly felt this was a just war. (Toynbee, 1966)

Karl Jaspers, the distinguished philosopher of the 20th century, says: The origin of these reigns (ambitious governments) was the necessity to fend off the threat of nomad tribes against civilized territories. To reach that goal, the united people had to rein in all the nomads around (this way ambitious governments in Syria, Egypt and then in Iran took up new forms). (Jaspers, 1955)

For the same token, the wars ancient Iranians fought could be thought of as just wars or at least their imperialistic aspects could be overlooked. Some of the battles mentioned in Shahnameh are assessed as the following:

"Iranian national epics are built upon an ever-lasting struggle between good and bad or virtue and evil. The evil forces include injustice and lie, magic and deception, breaking promise and petulance, destruction and death which are all manifested in the nature of natural blights, demons, Turan and greyhounds. Virtuous traits include justice, kindness, reconciliation, construction and happiness which are all manifested in the nature of heroes. None of Iranian wars in Shahnameh aim to invade and conquer other territories and impose Iranian traditions and ideology and gain plunders… Vengeance for those who were killed oppressively is also a reason behind such wars; e.g. the battle of Fereydun and Manouchehr against Salam Tour to take revenge for Iraj, the wars between Rostam and Keikhosro to take revenge for Siyavosh. The rational is that oppression and wrongdoing should not remain unpunished! (Riyahi, 2004: 199)

As we will see, when the idea of truthfulness comes out of justice, it stands against the concept of lie. John Hinnells, one of the contemporary well-known mythologists, gives such a basis to ancient wars: "The universe big battle was one between truthfulness (justice) and lie." (Hinnells: 1973). In other words, goodwill was the driving force of these wars which all sought a just goal, while most of the modern world wars have been after plundering territories and dominating others or satisfying the greed of their mean leaders. Wars led by Alexander, Genghis, Napoleon and Hitler were all barbarian invasions rather that just wars. Only in the 20th century nearly 100 million people lost their lives in vein in the wake of unjust wars. (Hobsbawm, 1994)

Justice and wisdom

"Islamic call was, in nature, an invitation to institutionalize wisdom in the territory of thinking and realization of justice in social relations, two spheres dismissing ignorance and oppression." (Hamid Abu Zayd: 1994)
Sometimes, wisdom and justice balance and complete one another. Alsadr Mc Entier (an expert on Herbert Marcuse) says: any suggestion of justice comes together with an idea of wisdom and any image of wisdom embeds an impression of justice. (Movahhed, 2002: 33)

Hossein Ali Rashid, a contemporary distinguished scholar, maintains that civilization and human materialistic advancements are the result of justice; and justice is a sign of wisdom, and tyranny brings about destruction and breaches wisdom and human's spiritual nature. (Rashid 2002: 327)

Mohammad Ghazali (death: 505AH) says: oh king! Be sure that justice sprouts out of wisdom perfection; perfection of wisdom means that one could see things as they are and understands their reality without being deceived by their façade. (Black, 2002)

Ali Akbar Amini

Ibn Sina, like Plato, describes justice as resultant of being moderate at three attributes. He believes that the motivation behind human actions falls into three categories: lust, anger and wisdom. Being moderate in lust is called chastity; being moderate in anger is called bravery; and being moderate in using wisdom is called prudence. Justice is the sum up of these three virtues. (Movahhed, 2002: 124) As could be observed, Ibn Sina sees a relationship between wisdom and justice. Ferdousi sometimes bind wisdom and justice with their opposites i.e. ignorance and injustice.

There's also a relationship between justice and freedom. Nasr Hamid Abu Zayd, Egyptian contemporary Islamic scholar (death: 2007) says the presupposition to God's justice is to punish individuals for sins and rewards the virtuous people. For this justice to be realized, human should be free to make choice.

Justice and rights

Rights and justice are so intertwined terms that are occasionally used interchangeably and as Rawelz says, justice is sometimes more transparent and stands above rights. (Lessnoff, 1999) What is more, in eastern thought, justice is rooted in natural and intrinsic rights, i.e. it could be found somewhere far from politicians who usually like to depict their behaviors and deeds as the very justice. We can see in ancient Iranian myths that despite all his oppressions and cruelty, the serpents-shouldered Zahhak asks people to confirm his fairness and sign a scroll in favor of him.

Interestingly, when Zahhak wants to kill the 18th sibling of Kaveh, he goes to the serpent-shouldered ruler and implores to save his son and asks: where is your justice then? Following Kaveh's censure, Zahhak was taken aback.

In ancient Iranian thought, justice is built upon rights and is not therefore a tool in the hands of politicians. Contrarily, it's a semi-spiritual phenomenon situated over swords and in the hands of armies and powers and thus, is a milestone against which deeds are judged! When justice and right come together, the level of right-seeking and commitment to rights is indicative of the level of justice-seeking and justice-practicing. Thus, it could be stated that there's a significant relationship between judiciary system and justice. That's why justice has always been at the core of attentions in ancient Iran because individuals enjoyed remarkable rights at that time. (Joneidi, 2010) Any system of governance in which human rights is the basis of politicians' actions and law and law-abiding is observed, the foundation for justice and practicing justice is built.

Relationship between justice and political system

Ancient Iranians have established one of the pillars of democracy (Straus, 1994). It's been said that ancient Greeks established a government on two accounts: one was gaining isonomy and economic justice; the other was to gain autonomy (Rozental, 1986). In other words, establishing a just society was a significant part of the philosophy of a government. The nature of a political system is determined by justice. Fascism and despotism show up where "fear" becomes the basis of governance and the driving force behind union and obedience; while democracy is established where justice becomes the basis of governing a society (Neumann, 1952).

In the myth of Prometheus in which Protagoras narrates it for Socrates, justice is introduced as the unifying drive bringing about security in the society. In this myth, Hermes asks Zeus: how shall I divide the gift (the justice) you sent for organizing the community and reconciliation between people? Shall I give it to a few people? Zeus said: No! Give it to all. I want everybody to have a share. Because if only a few people enjoy these virtues, there would remain no city then… In Islamic tradition, justice is sometimes has ties to political system too. For Muslims, the concept which stands against despotism is not freedom it's rather justice. In this case justice conveys two meanings: first, the ruler does not gain the throne through coercion and usurpation; secondly, he should rule according to God's laws or at least the known moral and legal codes (Lewis, 2005: 84). In Avesta, justice enjoys an elevated status. In the 29th anthem of Gathaha, the conditions for the rise of Zoroaster are explained. Here, the soul of the creation complains

before God about oppression, rift and cruelty dominating people and implores Him to send a messenger to rectify the chaos.

A part of the 29th anthem says: The soul of the creation complains before God that he's pestered over the anger, oppression and cruelty of people and asks God to free him from all these oppression and coercion. And when Zoroaster rises, he says: Oh Ahura Mazda! Bestow upon me such power as to establish peace and security and uproot oppression! Grant me and my companions such force and power as to establish virtue (Razi, 1994: 108). In the 45th anthem, Zoroaster describes his religion and duty before a large crowd. The anthem says: Choose your path using thought and wisdom and do not let bad instructors destroy your lives; there are two lifestyles, careers or ways of life in the world; one is good and the other is bad and these two are not compatible at all. Those who choose the bad way would be losers. The almighty Ahura Mazda who created the world wants the world overfilled with virtues, justice and law (110; Ibid).

Practically, people and some of the rulers were also committed to justice and its necessity in life. In Ardashir Babakan's biography written at the end of Sassanid era, a story has been quoted about justice and its requirement for any goals: One day Ordovan went for hunting. All of a sudden a zebra appeared before him. Ardashir and Ordovan's older son chased the zebra. Ardashir shot it down. When Ordovan reached to the scene asks who shot the zebra. Ardashir responds 'me' and Ordovan's son answers 'me'! Ardashir turned to Ordovan son and says: one can't assume skill and chivalry through coercion, indecency, lie and oppression (Safa, 2005: 134).

In Iranian thought almost confirmed by historical experiences, rising and falling of dynasties could be interpreted and justified through justice or cruelty milestones. Medians reached power by their commitment to justice while they lost power because of practicing cruelty. Dia-Eko, their first king, could promote from a simple arbiter and alderman to reign, while Astiyag, their last king, was toppled because of his cruelty and violence and outrage (Zarrin Kub, 2007: 106). This is one of the main themes in Ferdousi's Shahnameh. Its most important and political ode, i.e. Ferdeydoun and Zahhak story, has turned into the symbol of fighting oppression in our literature as well as the world literature as one of the most eloquent existing stories. Shahnameh is full of the benefits of justice and consequences of injustice for communities' fate. Cruelty will also put a political system in danger and disturbs natural order.

As Herzfeld says, justice in ancient Iran guarantees the natural order and universe system (Herzfeld, 2002). Ferdousi has also paid attention to the concept of justice and deems lack of justice as the cause of destruction.

The relationship between Arteh or Ash'a (truthfulness) with justice

It might be said that Arteh or Ash'a (truthfulness) is a word with a wide range of meaning in Avesta.

Ash'a in Zoroaster idea means law and order, respect to personal rights, work and endeavor, agricultural economics, social and group life styles, justice and equality, etc. The opposite word is lie meaning chaos, cruelty, plunder, piety and hypocrisy, exploitation of people in the name of religion, sacrificing useful animals, intoxication and primitivism under the cover of worship, irregularity and keeping being homeless (Razi, 1994: 112).

When we bring Arsh'a and its opposite, lie, together, we could realize the wide range of meanings attached to it. We could see that it's the source of happiness because it covers many aspects of life. The anthem 31 reads: God is the essence of truthfulness. He has created this true world for the people who agree with truthfulness, rectitude, efforts, order and justice to be able to lead a perfect life and satisfy their physical and mental needs, and decorate their soul with knowledge and insight. Daruis the Great says in his will: Oh God! Preserve this country from enemies and draught. Daruis calls all those who oppose the kings as liars (Hinnells, 1973); not because he deems himself as the axis of virtues and symbol of truthfulness, rather because enemies fight against the established law and order and the

Ali Akbar Amini

society's values which are all in line with the will of Ahura Mazda. A good and just king is the symbol of God justice and His reign. This indicates the victory of truthfulness and rectitude over oppression and lying. But if the king overlooked justice and practiced cruelty, God would abandon him. Disobeying God or oppressing people was the reason behind this (Akhavan Kazemi, 1999: 11). In Zoroastrian religion, worshiping God depends on doing virtues. In Zoroaster's idea, is not only doing virtues and being truthful, but also he believes he could change the world with the help of his followers. As Sa'adi puts it:

"Worship is just serving people, it's not praying and mentioning God"

In the 50th anthem, it says:

"Oh Ahura Mazda! Who else can assist me but your justice and my good deeds… The helper and driving force of 'truthfulness' or the best law and order and justice is good deeds, wisdom and good thought. When all these are sought truly, they would be effective (Razi, 1948: 141). Zoroaster believed that a land, whose people live a just life, would be the land of scholars and scientists.

When you want to reach God, lightness and salvation, first try to guide other people and make them aware of the benefits of knowledge and truthfulness or order and rectitude. Pleasant life based on truthfulness and justice means law and order; because it gives you both mental calmness and physical happiness (ibid: 121). In ancient texts there's another word for 'law' which is 'Wachar'. From Darius era onward the word 'Dat' or 'Dad' was used for this. King's judges or arbiters used to guide the king over legal issues and people's customs and traditions (Anayat, 1998: 42). One can claim that the words 'Asha' (truthfulness), 'Dad' (Justice) and 'Qanun' (law) were in line with each other and would guarantee the existence of a good society.

Contract, Average and Justice

Justice sometimes means observing the middle and keeping one's vow or being moderate. Justice, average and moderateness in Iranian culture still convey such meanings. In ancient Greek, moderateness was a milestone for virtuous deeds. One of the opposite words for moderateness is unreasonableness. Moderateness stems from modus meaning being in the frame. In Greek, modus was he criterion for good behavior. This word had another meaning, i.e. limit which complements the first meaning. According to an ancient myth about the establishment of Rome, Romulus delineates the border and kills his brother due to his disrespect to the border; because he maintained that if the borders were not recognized, then there would be no 'civitus'. Heresies, on the other hand, would be introduced as a hero because he could stop the enemy at the borderline (Nietzche et al. 1998: 272). In Dinkerd book, one of the main Pahlavi resource books covering Sassanid era too, the word 'average' has been compared with the word 'Peiman' (contract). Contract means the middle of two extremes and is counted as a parallel to wisdom. However, extremism has to do with nastiness and greed (Akhavan Kazemi, 1999:10). In ancient Iranian language, contract bears sometimes the meaning of 'Mehr' (kindness) (Mitra). Without doubt, the primary and main duty of 'Mehrisht' is to guard contracts. Mehr is, therefore, the safeguard of social relations at all levels from international contracts to interpersonal agreements. It rises from the pick of Hara Mountain and rides on its axis and travels through the sky and follows the sun and guards the earth, punishes the frauds and backs justice (Gashowich, 2006: 571). So, Mehr, the most ancient essence of lightness in Zoroastrian religion, becomes the god of truthfulness and justice and held this very attribute in the West too (Kumon, 2004:159). Keeping promise and remaining committed to one's vow, is one of the Iranian values. Thus, "swearing is one of the most repulsive sins and undoubtedly is contrary to honor and dignity of human race, because one should respect his promise and for making a big alliance (contract), shaking hands is enough (Gershevich, 1985). However, in army, a contract or agreement is accompanied with swear. In other words, swearing in is part of the contract. That's why, as Franz Cumont says, being committed to a swearing in, would be considered a special dignity in a soldier's religion; a soldier whose first action in the army was obeying the commander and sacrificing for the sake of him.

Ali Akbar Amini

In ancient Iranian culture, the word contract has another meaning too which has to do with the concept of moderateness.

The Greek novelist, Achill (426-525 BC), who praises moderateness, quotes Darius as saying:

"The mortal human being should set his sail according to his word. Being too ambitious would sow the seeds of grudge and at the season of harvest it bears no fruits but regret. Zeus is always ready to punish ambitions (Malaurie, 1997). This moderateness which was paralleled with justice has another dimension, i.e. punishment. Excessive punishment is usually encouraged by those who are vengeful and consider severe punishments as necessary for prestige and deterrence. Such an ideology could easily lead to 'torture' which is, as Andre Malranux, the contemporary French scholar says, "the most barbarian act on part of a human towards his fellowman" (Malranux, 1988). In an article, Jack Miran also discloses the dreadful history of torture (Miran, 1994:48). Though punishment in ancient Iran was severe like any other spot in the world, in Zoroastrian religion and in Iranian tradition there are some recommendations as to fair punishment and the parity between punishment and the charge: one of the immortals is Ordibehesht (second month of the Iranian year). (Other immortals are: Bahman, Sepand Minou, Shahrivar, Khordad, Mordad, Espandarmod). Ordibehesht is the most beautiful one and is an alternative name for Asheh. It preserves law and order in even the Hell. It's even careful about the fairness of wrongdoers' punishment (Hinnells, 1994, 74). Before Anushirvan era punishments were so severe that "the pagans, bandits and those who escaped from the front would be sentenced to death immediately and those who committed such crimes as theft, banditry, adultery, cruelty etc. were sentenced to death or physical punishment. Tenser, the distinguished cleric during Sassanid era, quotes the then king as saying: such a person (a pagan) should be imprisoned and advised every now and then by scholars for a year and be provided with evidence and proofs so that he gets out of uncertainty. If he repented, they should release him, and if he insisted to be infidel, then they should kill him (Christensen, 2001, 500).

Generally, one should note that ancient Iranians respected and insisted on the enforcement of laws, rules and regulations; "deviating from what was known as law and justice" was considered a charge to be punished. Of course, such big emperors couldn't survive without supervising the enforcement of law and justice. Thus, sometimes in enforcing justice violence was used. For example, in one case a judge was skinned because of receiving blackmail and his son was forced to sit on his father's seat covered by the skin. In implementing the law, the kings used to exert excessive violence and therefore, Pars laws were unchangeable like that of Medians (Zarrin Kub, 2007, 219). Undoubtedly, one dimension of justice is to manage societies based on rules and regulations and if anyone at any position and social status should be punished over violating laws. To manage a society in ancient Iran, first laws were enacted and then they were fully respected and observed. After launching a clampdown on riots following the topple of Geomata, Darius enacted new laws. He says: "I did what was right; neither did I oppress the weak nor the powerful."

Undoubtedly, Darius was inspired by Mesopotamia and particularly from Hamurabi laws in legislation (Islami Nadushan, 1991, 31). The essence of justice is made up of respecting law and judgment based on law. As Christensen says, justice (in this meaning) enjoyed an elevated status in ancient Iran. There is adequate evidence from Hachamenian period that kings were careful about the proper enforcement of legal procedures and true judgment. In Sassanid era, all judges were remarkably respected. The kings used to appoint experienced and just people as judges who didn't need consultation. They used to tease Romans who usually employed erudite consultants to help their ignorant judges in case of legal fatwas. All judges were advisors to kings. The head of all judges was called 'government judge'. The courts in every region was managed by a clerical judge who checked if the verdicts and the measures of all non-clerical judges were based on justice or not. If someone did not get his right in local courts, he could always refer his case to the king. Most of the Iranian kings would stand on top of a hill on certain occasions and investigate the complaints of crown gathering around them.

Ali Akbar Amini

Moreover, it seems that the early kings of Sassanid dynasty used to forgive the prisoners and freed everyone (Christensen, 2001, 406).

This author also quotes Masudi in Marvaj al-Zahab as counting other cases of justice-practicing on part of Anushirvan. In the first part of the 33rd anthem of Avesta, it's narrated that judgment should be done through justice and truthfulness. Such justice in judgment should be subjective, no matter about whom it's being exerted (Razi, 1994: 118).

Justice and one-jobness

One of the pestering problems with which Iranian society grapples for the time being is the fact that some of the elites have more than one job at the same time. For example, they are both judges and university instructors; they're both parliamentarians and university instructors and Iran broadcasting employee; they are instructors in both public and private universities, …! Even they sometimes carry out several works at the same time. When asked the reason, they bring financial excuses or express passion for serving as the rationale behind their behavior! They state, in their heart, "we are high profile" and "multiple skilled" guys! Even if all these claims and illusions are true, such reasoning is not acceptable in a country in which youths are looking for job; hence these multiple-job guys, willingly or unwillingly, are practicing oppression towards these young people.

However, ancient Iranians paid special attention to this and deemed having multiple jobs at the same time as unjust. To observe this, one way was to delineate social classes. In Iranian and Indian social organization, the basis of subsistence was individuals' social classes so that everyone had to take on a job which was peculiar to his own class. Breaching the limits of a certain class meant having multiple jobs and this was a sin which, in turn, would bring about chaos, destruction, stagnation and injustice.

According to Tanser letter, "nothing is respected that much but the people's social status and class; because individuals' houses and status are like pillars which if were harmed, the whole society would be ruined. Keeping people busy doing their own jobs and preventing them from doing others' works, is a guarantee for the world maintenance and order, and a plays the role of rain which revives the earth; it's like the sun making everything fruitful; it's as the wind blowing life breath (Akhavan, Kazemi, 1999).

Although, observing this might promote an incomplete system and blocks progress, Iranians' aim of not carrying out others' jobs was to respect the rule of "having one job" and avoiding job chaos so that they could prevent unemployment and injustice.

Finally, one should say:

"Ancient Iran taught the lessons of forgiveness, justice, law and principle to the world; a world which was full of prejudice practiced by Ashuriyan, Babliyan, Egyptians and Jews… It taught the world if justice is practiced delicately and equally, it could bring as much peace and security as freedom could… It showed to the world that standing against whatever is satanic, is movement along with Ahura Mazda's will. That's why launching riot against Zahhak, Jamshid and Afrasiyab is practicing the very justice (Zarrinkub, 1999: 280).

CONCLUSION

Justice in Iranian thought enjoyed a elevated status and had such a wide range of meanings that observing it would ensure a healthy and flourished society. Iranian thought in this regard moved from a simple political perspective to a remarkable achievement, i.e. it gave justice such an grand meaning that it became the overseer and arbiter of the individuals' deeds and behaviors as well as those of politicians and the society. In better words, it turned into a

AliAkbar Amini

materialistic-spiritual milestone against which people's deeds were appraised. If there is a thought in the modern world that says there should be rules monitoring politicians' will and guide them while being above the power of the powerful and ambitious individuals, that idea is human rights! In Iranian thought such a rule has long been discovered. Weather in Iran or Aniran, weather in kings' lives or heroes', one factor is the criterion for wrong and right and that's justice. The hero Rostam challenging the prince Isfandiyar who bears the religion flag, is the right person because he's on the side of justice, while Isfandiyar with all his brilliant record is deemed an oppressor and evil-doer because he's been deceived by the Satan. In ancient Iran everyone who fails to observe justice is considered to be leaving the spiritual land for the satanic one. Those who keep practicing injustice, violate peoples' freedom, triggers chaos, and are ambitious and violate others' privacy and, more important, those who ignore justice and rely on lying are considered as evils who step foot in the satanic land. However, those who hoist the flag of justice are all like the justice-practicing Fereydon. To be so, they need not to be from a different race or nature.

REFERENCES

1. Fourkush, Moris Di (2006), Political culture and thought, translated by Khashayar Deyhami, Tehran Ney Pub.
2. Toynbee, Arnold J. (1966), The Historian and History. New York: Vintage, 1966.
3. Jaspers, Karl (1955), The Origin and Goal of History. translated by Michael Bullock. New Haven, CT: Yale University Press.
4. Riyahi, M. Amin, (2004), Ferdousi and Shahnameh Message, Economic-political Monthly, No 199-200
5. Hinnells John R. (1973), Persian Mythology, Hamlyn Pub.
6. Islami Nadushan M. Ali (1994) The letter of Officer, Tehran, Yazdan Pub.
7. Movahhed M. Ali (2002), Right and Justice, Tehran, Karnameh Pub.
8. Eric J. Hobsbawm. (1994), The Age of Extremes: A History of the World, New York: Pantheon Books.
9. Rashid, H. Ali (2002), Rashid Articles, Tehran, Itela'at Newspaper.
10. Black Antony, (2002), The History of Islamic political Thought: from the prophet to The present, Cambridge: Cambridge University Press.
11. Naser Hamid Abu Zayd (1994), The Critique of Religious Discourse. Translated by Yusefi Ashkavari H., Tehran, Yadavaran Pub.
12. Razi, Hashem (1994), Avesta, Tehran, Behjat Pub.
13. Cumont, Franz Valery Marie (1956) The Oriental Religions in Roman Paganism, Translated by Teimour Qaderi, Tehran, Amir Kabir Pub.
14. Gershevich, Ilya (1985), The Cambridge history of Iran: The Median and Achamenian Periods, Translated by Morteza Thaqef far, Tehran, Jami Pub.
15. Neumann, Franz Leopold (1957). The Democratic and the Authoritarian State: Essays in Political and Legal Theory. Free Press
16. Jonaidi, F. (2010), World Rights in Ancient Iran, Tehran, Balkh Pub.
17. Safa, Zabih Allah (2005), Epics in Iran, Tehran, Amir Kabir Pub.
18. Zarrin Kub, Abdol Hossein (2007), The history of Iranians before Islam, Tehran, Amir Kabir.
19. Zarrin Kub, Abdol Hossein (1999), Ages, Tehran, Sokhan Pub.
20. Akhavan Kazemi B. (1999), Justice and Dictatorship in Ancient Iran Political thought, Political-Economic Monthly, No. 143-144.
21. Anayat, Hamid (1998), Political Ideologies and Thoughts in Iran and Islam, Tehran, Rozaneh Pub.
22. Friedrich Wilhelm Nietzche et. al (1998), Modern Hermeneutics, translated by Babak Ahmadi et. al. Tehran, Markaz Pub.
23. Comte Joseph Arthur de Gobineau, The history of Ancient Iranians in Ancient time, Translated by Abutorab Khajeh Nuriyan, Tehran, Thaleth.
24. Malaurie Philippe (1997), Literature and law, Translated by Morteza Kalantariyan, Tehran, Agah Pub.
25. Miran, Jack (1994), The history of Torture, Translated by Manuchehr Khosravani, Hasti Journal.

Ali Akbar Amini

26. Christensen Arthur (2001), Iran in the Sassanian Period, Translated by Rashid Yasemi, Tehran, Donyaye Ketab Pub.
27. Islami Nadushan M. Ali, (1991), Iran: Old Luke, Tehran, Parvaz Pub.
28. Kalileh va Demneh, collected by Abdol al-Azim Qarib, Tehran, Iriyafar Pub.
29. Lessnoff Michael H. (1999). Political Philosophers of the Twentieth Century, Translated by Khashayar Deyhimi, Tehran, Nashr Kuchak Pub.
30. Riyahi, M. Amin (1996), Ferdousi, Tehran, Tarheno Pub.
31. Herzfeld, Ernst Emil (1941), Iran in the ancient East, translated by Homayun San'ati Zadeh, Tehran, Bahonar University of Kerman.
32. Tabatabayee, Javad (1988), An Philosophical Review over the History of Political Thought in Iran, Tehran. Foreign Ministry International Studies Department.
33. Malaurie Philippe (1997) …, Translated by Abol Hassan Najafi, Tehran, Kharazmi Pub.
34. Lewis Bernard (2002), what went wrong? Western impact and middle Eastern response, Translated by Shahriyar Khajiyan, Tehran, Akhtaran.
35. Strauss Leo, Natural rights and history (1994), Translated by Baqer Parham, Tehran, Agah Pub.
36. Zand, Shojayee, (2002). A Harmonic Impression of Justice in Constitutions, Economic-Political Information Journal, No.184-185.

RESEARCH ARTICLE

Talent Management Challenges In Keshavarzi Bank, Identifying Problems and Suggesting Solutions

Akbar Hassan Poor[1] and Ramin Jalali[2]*

[1]Assistant Professor of Kharazmi University, Department of Human Resource Management, Faculty of Management, Kharazmi University, Tehran. Iran
[2] PH.D Student of Kharazmi University, Department of Human Resource Management, Faculty of Management, Kharazmi University, Tehran. Iran

*Address for correspondence
Ramin Jalali
PH.D Student of Kharazmi University,
Department of Human Resource Management,
Faculty of Management,
Kharazmi University,
Tehran. Iran.

ABSTRACT

Talent management is one of the most important issues in human resource management in any organization. In competitive environment in the banking industry, what make a bank superior are talented human resources so that the concern of most banks in the country is the attraction, development and retention of these talents. In order to pay attention to this important issue, this paper attempts to provide definitions of talent management and existing models and providing a model for the banking industry. The statistic population of this research includes all staffs of Keshavarzi bank in Tehran. To measure the sample infinite population formula at 95 percent confidence level and the sampling error equal to 0.05 is used. The required sample for this study is 385 persons that to increase the rate of return, questionnaires were sent to 400 employees and 326 valid questionnaires were collected and its reliability was approved by Cronbach's alpha (greater than 0.7). Statistical hypothesis tests showed that the Infrastructure and processes of management and participation of managers is not confirmed and other aspects of talent management were approved. Most influence is related to political factors and the least influence is related to management factors.

Key words: Talent, Talent Management, Talent Identification, Talent Development, Retention of Talent.

Akbar Hassan Poor and Ramin Jalali

INTRODUCTION

Nowadays, human resources are considered as organizational capital and it is clear that people are the main factor of the survival of organizations in the competition. Human resources role has changed gradually by more complicated environment and diverse cultures and business in organizations.Today's organizations need the creative, flexible and responsive people and the attraction, development and retention of these talented people for organization is much more difficult than before.

Dynamic organizations operating in this competitive world are trying to create opportunities to attract talent and organization that does not comply with its human resource management with modern standards will be doomed. According to Wikipedia, talent management firm first introduced by Mckinsey Company in the mid-1990s and it is a professional term in management that has become popular recently among organizations.

Talent management is one of the most important and even the "most essential" (2006 Barlow) human resource management issues in the world and it is still one of the most severe problems in many organizations. Today, managers around the world grapple with the changing nature of work in and the forces required to comply itself with the terms of the variable. Enterprises to maintain the elite troops, in the future will have to have detailed plan to identify and encourage them to take action.

Talent management includes all activities of the organization to attract, select, develop and retain the best employees and placing them in strategic roles. Reasons that make special emphasis on talent management in recent years include:

1. The direct link between talent and organizational superior performance
2. The value creating talent
3. Business in the more complex and more dynamic environment
4. Increasing expectations of the Board of Directors
5. Change in employee expectations
6. Changes in the structure of the labor force

The goals of this paper is to define the concept of talent management, its importance, advantages and benefits of its implementation as well as the development of a model for talent management and it particularly focuses on how to use this talent management at the Keshavarzi Bank.

LITERATURE REVIEW

History of talent management

Talent management is a process that emerged in the 1990s and continues to travel the path of evolution.
In 1997, the word talent was first presented by the consulting McKenzie institute.
Mackenzie institute observed that the organizations that are more successful in the recruitment, development and retention of talented managers, will have higher levels of profitability. (Guy et al., 2009: 21)

Talent management developed assisted by consultants in McKinsey group in the late 90's. They invented the term "war for talent" to reflect the key role of employees in the success of the company.
In talent management discussion, there aren't words that specifically focus on the effective management of talent, and the obvious shortcoming is observed in the definition and scope of this term.

Akbar Hassan Poor and Ramin Jalali

Lewis and Hackman (2006), based on the definitions of authors and researchers in the field of human resource management and administration, defined three concepts as the basis for the term of talent management. In the first concept, talent management is defined as set of HR functions including recruitment, selection, training and development. In fact, talent management is a systematic method for performing tasks of human resource management responsibilities that is performed by the use of new technologies such as the Internet and related software with the goal of its performing at all levels of the organization.

The second concept specifically focuses on forecasting or modeling process of human resources within the organization based on factors such as the skills of the labor force growth and erosion and supply and demand that in this concept, talent management is more or less synonymous with human resources or workforce planning. The third concept of Lewis and Hackman focuses on talent people in terms of performance and potential. Individuals with high potential are more concerned in the use of labor and the organization has more try to attract them (Guy et al., 2009).

A research paper on the topic of the status quo and talent index development in the field of athletics was performed. In this study, variables such as the current talent identification in the world, the necessity of a pattern of talent, and the best agencies talent and developers have been investigated (Alijani, 2002)

Another research paper titled "Evaluation and selection of managerial talent in Tehran electricity company" was performed. These study first characterized managerial positions using interviews and questionnaires about working in the electricity company and then it used intelligence tests, Edwards's personality tests and managerial skills to measure these characteristics. Final result was the selection of talented individuals for management positions. (Jafari, 2008)

LITERATURE

Talent is a set of abilities including skills, knowledge and capacity for growth and development. (michael et al, 2001, 6). Storey, (2007), knew talent management different from the perspective of different people and examined it from three aspects. First, the development and training of new employees by interviewing, hiring and orientation of the organization so that new people can have association with the culture of the organization. Second, the development and maintenance of existing employees and third, attracting people with the high skills to work in an organization (Barron, 2008).

The structured talent management defined as the process systematically destroys the gap between human capital in the organization and leadership talent of the organization that is need to meet the challenges of the future.

It seems in the most theories the talent management is considered as a piece of human resource management that focuses on talent in the organization, the more detailed and focused directly on the management of a particular group of people.

Talent management is career development and facilitation of very talented and skilled individuals in the organization, using written instructions, resources, policies and processes (Guy et al., 2009)

Talent management is defined as investment in staff development, identifying talented people in the organization and emergent substitute them for various leadership position. (Guy et al., 2009).

Talent management objectives

In general, the main objectives of talent management include (Guy et al., 2009):
- Maintenance of key specialists

Akbar Hassan Poor and Ramin Jalali

-Recognition, development and maintenance of high-potential people
- Identify gaps in competence development and management positions
- Identification of vacant managerial jobs
- Explain the organization's strategic plan with a list of needs in the areas of usability and human skills
- Explain the current status of the capabilities and skills and find gaps and needs
- Measurement and continuous follow-up of existing capabilities and the distance to the desired capabilities and skills through educational strategies and programs
- Strengthen the insight of shareholders and customers
- Reduction the cost of external recruitment
- The challenging dealing with the development of management measures

Talent management process

Talent management process consists of the following components:
- Clear expression of the talent needed to execute business strategy.
- Identifying potential talents within the organization
- Assessing the readiness of talents to higher positions
- Accelerate the development of the talents (Cartwright, 2008).

Talent management functions in the organization

1. The direct link between talent and organization performance: Studies have shown that when an organization invests in talent, revenue will dramatically increase. As a result, talents can have an impact on performance and work.
2. The value creation of talent: the value of an organization depends on the quality of their talent and talent rapidly increases the organizational value.
3. Business in more complex business environment: intense competition makes it very difficult to maintain long-term competitive advantage. New products and new business models have a shorter life cycle and demand continues innovation. The only talented stuff can take the leadership responsibility in a complex and dynamic business environment.

Change in the expectations of employees

Today, employees are increasingly interested in doing things that are meaningful and challenging. They:
- are loyal to their profession rather than their organizations.
- are less adaptable with the traditional power source.
- want to determine the direction of their career development.
In Overall talent management is important for two reasons:
First, the implementation of talent management effectively causes successful obtaining and maintenance talent, and second that the talented staff will be selected for key positions in the future.

Talent management is a new approach that can change human capital management and solve weaknesses and problems of traditional approaches.

Conditions and environment of the implementation of talent management

Talent management program requires that the organization has an effective and appropriate appraisal system.
Through this system, the prone and competence stuff is identified and become visible Also, the organization must have a rational and efficient communication system so that which all employees according to their qualifications and

Akbar Hassan Poor and Ramin Jalali

performance can progress in their career and most important principle in the talent management is that managers should have coaching style so that employees can:

1. Find their solutions.
2. Develop their skills.
3. Modify and change their behaviors.
4. Revolutionize attitudes.
5. Achieve to their treasures of wisdom and tact. (Cartwright, 2008)

Talent management process

Identifying and recruitment of talented people

Manager should consider the individual differences of employees as an important factor to use these capabilities and potential properly and in the right place.
Towers perrin named the following factors as strategies to attract talented people for employment in the organization's:

1- Payment -based competition
2. The balance between work and life
3. Career formats
4. Competitive Advantages
5. The challenge
6. The salary increases based on individual performance
7. The development and learning opportunities
8. Organizational Reputation of being a good employer

Talent selection

The goal of the talented staff selection process is the selection of the source of qualified candidates who can do the best job.

Employing talents

People are selected through a) the appropriateness of the roles and b) their proportion with those roles.
Talent development

There are solutions to develop existing potential by effective talent management that include:
a) The career management; b) training and talent development; c) Performance Management; d) strategic human resource planning; e) recruitment and selection; f) succession planning; and g) Benefits and Compensation.

Retention of talent

The organization when is successful that after talent attraction can keep them by creating the job for them, Interpersonal communication, and effective and attractive environment for individuals reduce the possibility of their leaving.

Akbar Hassan Poor and Ramin Jalali

Results of talent management

Talent Management select a collection of individuals with high potential and the ability and by applying the appropriate times and creating an attractive working environment for them, creates the incentive in them and also provides an opportunity for progress and improvement work.
In total, talented people are energetic and dynamic forces that their properly management, cause improvement in individual and organizational performance.

Models of talent management

A model that is based on the organization's vision and goals and the demand for talent is determined based on the demand on the cultural and strategic priorities in organization. Talent management consists of 5 stages are:
1. Identifying existing potential.
2. Assessment of their preparedness
3. Developing talent
4. Select and use of Talent
5. Focus on talent performance
Model No.2 is conceptual model of talent management, including talent attraction, talent selection, capacity utilization, development and retention of talent.

Model No.3 shows talent management model of this study which consists of 4 steps:
These steps include: 1. identifying the talent 2. Talent development 3. Talent retention and 4. Evaluation of the potential storage capacity
Each of these steps include example that is shown in the table below.

Keshavarzi Bank

Keshavarzi Bank is one of the specialized banks supported by the Central Bank whose mission is to support the agricultural sector and its sub-sectors. Keshavarzi Bank was founded in the twenty-first of June 1933. Now the bank with the grounding eighty-one years of service are serving as a leading bank in providing banking services to all people across the country.
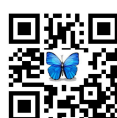
The bank, in order to maintain self-reliance since the early 70s with contribution to the country's monetary and financial centers and urban development department has tried to use the resources of businesses in favor of the development of the agricultural sector.

Talent management in the Keshavarzi Bank

Today, banks have been unprecedented in a dynamic environment and overcoming the challenges facing them as competition in the provision of banking services is not possible without the talent. This phenomenon is associated with the rapid growth of the retirement age and lack of skilled personnel due to the strong competition to attract and retain the talent they have.
So banks have been recruited towards new strategies to attract and retain skilled personnel. Today, the potential and capabilities of personnel management for the Keshavarzi Bank have become as a key priority for competitive advantage to achieve organizational goals are.

Leading banks emphasis on the present value of employee retention strategy and attract the best talent available outside the bank. They have recognized the importance of this strategy that with talent management and

Akbar Hassan Poor and Ramin Jalali

synchronization with the overall strategy, they will achieve sustainability in this turbulent environment. Faced with a potential crisis, banks ever will need valuable strategies to win the competition about employees.

Research hypotheses

1. Standardization has a significant impact on talent management in the Keshavarzi Bank.
2. Organizational strategy has a significant impact on the Keshavarzi Bank.
3. Organizational development has a significant impact on talent management in the Keshavarzi Bank.
4. The Bank's management perspective has a significant impact on talent management in the Keshavarzi Bank.
5. The existence of infrastructure and organizational processes has a significant impact on talent management in the Keshavarzi Bank.
6. The management factors have a significant impact on talent management in the Keshavarzi Bank.
7. The participation of managers in the organization has a significant impact on talent management in the Keshavarzi Bank.
8. Political factors have a significant impact on talent management in the Keshavarzi Bank.

Research method

The present study is a description in data collection vision and because it has been conducted over a relatively short time, it can be concluded that it is cross sectional type and it is field type in the collection data perspective.

Sampling and sample size

To determine the sample size, the infinite population formula can be used. In this study the cluster sampling method was used. The sample size will be determined depending on statistical rules and formulas. The target population is in total more than 3,000 people and therefore it is considered unlimited. The questionnaire was sent to 400 people and finally 326 correct questionnaires were collected.

THE RESULT ANALYSIS

In this section to answer the research hypotheses, techniques of t-test, the Pearson correlation coefficient and Friedman analysis is performed using SPSS version 19.

Table 2 shows the correlation matrix between research variables. The positive coefficient indicates a positive and direct relationship between the two variables and negative coefficient indicates a negative and reverse correlation between the two variables. All correlation coefficients are significant at 5% level. Cronbach's alpha is used to test the reliability of the questionnaire and the approval requires the higher reliability index value be more than 0.7.

All these coefficients are above 0.7 that indicate the reliability of the measuring instruments. A political factor variable doesn't have Cronbach's.

Data Normality test:

For normalization test of the model parameters KS test is used and in all tests statistical hypothesis are as follows.
H0: data are normal (data come from a normal population)
H1: data aren't normal (the data are not from normal population)
As it can be seen in Table 3, the level of significance was 0.05 for all variables so we concluded the null hypothesis, i.e. all research variables are normal.

Akbar Hassan Poor and Ramin Jalali

Hypotheses analysis: one-sample t-test results: The results of the talent management staff of the Keshavarzi Bank of Tehran

With respect to 5-point Likert scale selection for the questions forming the studied variables, the resulting values from respondents' views must be examined to clarify if their responses means was significantly different from mean of 3 (middle number of Likert scale) or not? Therefore, the comparison test one sample is used that its results are given below. Using the t-test needs conditions such as the distribution of the sample should be normal. If this condition is altered provided that the first sample volume is very low, and there wasn't an outlier values, this condition become negligible. But if the initial investigations indicate that the assumptions of t-test severely disrupted, the substituted non-parametric statistical tests could be used. Given the large sample size (greater than 30) and KS test result, the distribution of sample mean can be assumed normal based on the central limit theorem and the parametric t-student test can be used.

Null hypothesis (H0): the mean of responses are less than 3. (Assessment is not desirable)
Opposite assumption (H1): The mean of the responses is greater than 3. (Favorable assessment)
T-test results show staff assessment in Keshavarzi Bank of Tehran of the standardization of talent management, strategy, organization development, view point and political factors were higher than the mean value(mean response was greater than 3) and the null hypothesis based on the mean of 3 is rejected (the significance is less at 5% level). Critical one-tail test at alpha value of 0.05 is equal to 1.96. The standard size of the t-statistics for strategy, organization development, view point and political factors is greater than the critical value and a lower bound and an upper bound for factor is positive therefore the test results show it is desirable to evaluate and shows these dimensions of talent management in Keshavarzi Bank. The assessment of the infrastructure and processes, managing factors, Managerial contribution is not good. The mean response rate is lower than mean (mean response was less than 3) and the corresponding t-statistic is less than 1.96. As a result, at 95%, it can be said that the staff assessment of infrastructure and processes, and Managerial contribution is not desirable. Finally, the overall situation of talent management staff of the Keshavarzi Bank is favorable and significant. (Mean response is greater than 3) and the null hypothesis of the greater the mean of the 3 is confirmed (t-statistic value is larger than 1.96).

Friedman ANOVA test ratings for the various aspects of talent management

Hypothesis test: there is a significant difference between the evaluation of talent management in different dimensions.
H0: the rating of all factors is equal.
H1: the rating of at least two of the factors is significantly different.
Based on the output of Spss, significant value (sig) is less than 0.01 and close to zero and is lower than the standard significance level (α=5%).
So assuming H0 cannot be confirmed at confidence level of 95% and it can be said there were significant differences in scores and the rating of all factors aren't equal. Political factors had the most favorable rating (the highest mean rank), the second is organization development. strategy, standardization; infrastructure and processes and Managerial contribution have another ranking, respectively. Finally, the management factor had the lowest ranking. (It had the lowest mean rating).

CONCLUSION

Human resources in organizations are considered as strategic assets that improve the performance of individual employees and will thus improve organizational performance with proper management in order to meet the goals and objectives for each employee and creation of a mutual commitment. In this regard, the elite and talented workforce has a greater impact on this process so that this category of personnel management is considered as capital investment for organizations. As the test results of statistical assumptions show, the most impact of talent

management component of the Keshavarzi Bank is political factors and management factors are the lowest and assumptions related to infrastructure and processes (H5), the participation of managers (H7) and management factors (H6) have been rejected which indicates the lack of proper infrastructure for the implementation of talent management in banks and there is also a lack of preparation and participation of managers to implement talent management. It can be said the users of this information are senior managers of the Keshavarzi Bank and at the next level all individuals devoted to topics such as talent management, succession planning and those who want to discover new layers of human resource management that are known as indirect beneficiaries of the results.

SUGGESTIONS

1. According to rejection of the hypothesis of the existence of infrastructure and processes in Keshavarzi Bank (Hypothesis 5), it is proposed infrastructure of talent management and contextual factors should be provided so that the planning, creation and development of talent and succession management process become possible in the bank.

2. According to the results of a statistical hypothesis test and rejection of the hypothesis of involvement of management and directors (hypotheses 6 and 7) at the organization's talent management process, it is suggested manager by following the successful organization in elite-driven managers should establish the necessary infrastructures to identify and attract educated elite people to exploit the potential of human resources to reach the goals of the organization.

3. Elite Human resources attraction must be done based on specialized knowledge related to the scope of work in all areas of the bank including human resources, marketing, etc.

4. Application of talent only on the basis of their proportionality the job description and competency of employees and human resources employed in the bank should be eligible for roles in all areas of their business.

5. Relationship must be replaced with applying the rules in all areas of bank, including human resources.

6. The formation of human resources and identification of potential employees talent should focus on characteristics such as work experience, performance, education, etc., and use of people in those roles to suit their personality

7. The branch work plan with the freedom for staff

8. Move to the encouragement and reward to teamwork in the Bank

REFERENCES

1. Jafari, S. (2008). Assessment and selection of managerial talent in Tehran Power Company.

2. Abuallabi, B., and Ghafari, A. (2006). Future managers: talent management in Tehran: Department of Industrial Management, third edition, p. 285.

3. Ramazani, R. (1999). The management system of meritocracy in Tehran, the state employment office

4. Matlabi asl, S. (2007). Competency management, Tadbir magazine, No. 187.

5. Dehghanan, H. (2006). Merit based Management" Parliament and Research magazine, No. 53.

6. Rabeti, R. (2001). Meritocracy in government agencies, cooperative Quarterly, No. 121.

7.Wikipedia. Talent management concepts. Availeble from: http://en.wikipedia.org/wiki/Talent_management

8. Proceedings of the Conference on Human Resource Development. (2003). Tehran, November

9. Taj al-Din, M, Maali takhti, M. (2008). the war for talent, Tadbir Magazine, No. 192.

10. Armstrong, MI. (2007). Strategic Human Resource Management (guide), translated by Arabs, SM, Divine, D., Third Edition, Tehran, Office of Cultural Studies.
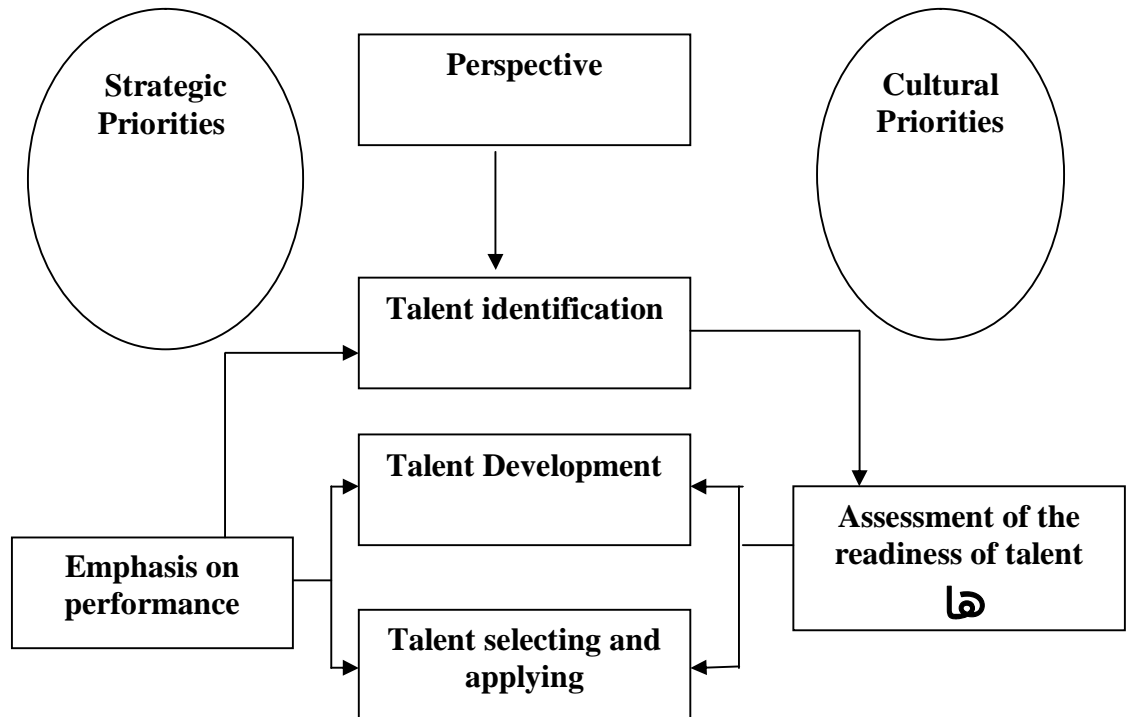
Figure 1: Model No.1
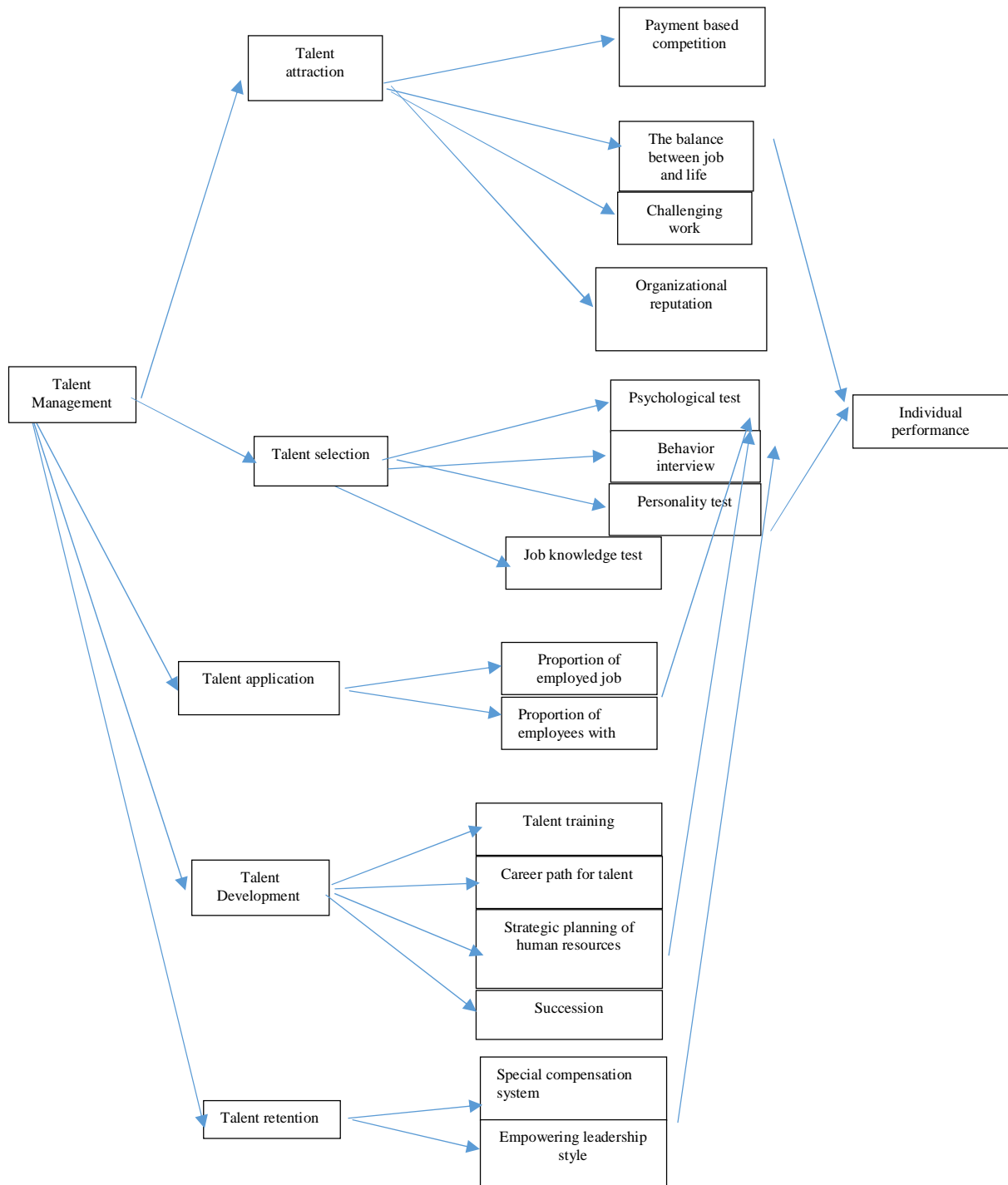
Akbar Hassan Poor and Ramin Jalali

Figure 2: Conceptual model of talent management (Model NO.2)
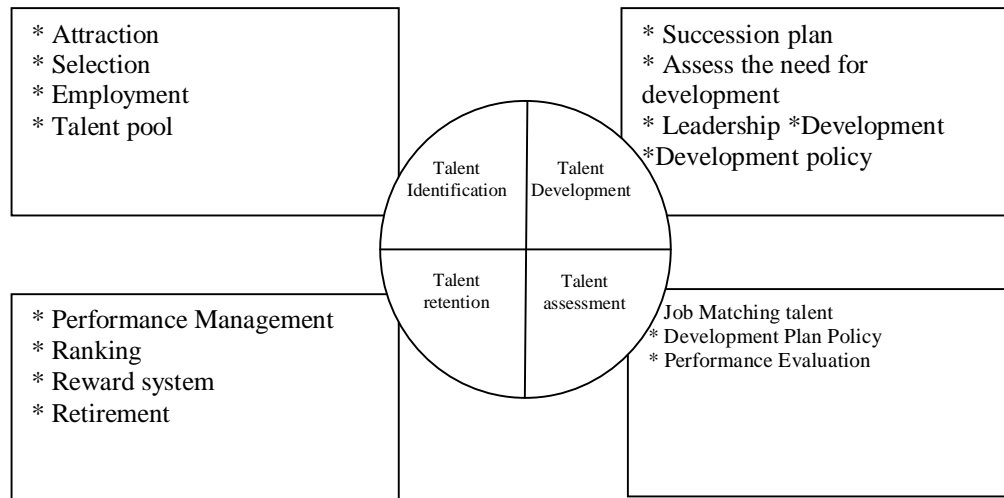
Figure 3 Model No.3

Table 1: Descriptive results of the demographic variables (sample size = 326)

		Frequency	**Percent**
Sex	Female	168	51.6
	Male	158	48.4
Age	Less than 30 years	198	60.7
	Between 30 to 40 years	107	32.8
	More than 40 years	22	6.6
Marital Status	Unmarried	185	56.6
	Married	141	43.4
Work experience	Less than 5 years	137	42.1
	Between 5 to 10 years	111	33.9
	Between 10 to 15 years	38	11.6
	Between 15 to 20 years	16	5.0
	More than 20 years	24	7.4
Education	Diploma and lowerر	19	5.8
	BSc	164	50.4
	MSc	92	28.1
	PhD	51	15.7

Akbar Hassan Poor and Ramin Jalali

Table 2: Correlation coefficients, reliability index

* All correlation coefficients are significant at 5% level.

Hidden variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Cronbach's alpha
(1)Standardization	1								0.702
(2) Strategy	0.225	1							0.829
(3) Development of organization	0.598	0.285	1						0.890
(4) View point	0.312	0.131	0.266	1					0.937
(5) Infrastructure and processes	0.185	0.541	0.238	0.147	1				0.918
(6) Management factors	0.444	0.305	0.440	0.185	0.281	1			0.846
(7) Managerial contribution	0.45	0.402	0.115	0.127	0.675	0.299	1		0.914
(8) Political factor	0.424	0.501	0.48	0.429	0.38	0.377	0.378	1	-

Table 3: Test results of KS test for research variables

Research Variables	Most Extreme Differences			Kolmogorov-Smirnov Z	Sig
	Absolute	Positive	Negative		
(1)Standardization	0.078	0.042	-0.078	1.3	0.068
(2) Strategy	0.114	0.088	-0.114	1.099	0.178
(3)Development of organization	0.098	0.06	-0.098	0.944	0.335
(4) View point	0.113	0.113	-0.068	1.089	0.186
(5) Infrastructure and processes	0.107	0.107	-0.099	1.034	0.235
(6) Management factors	0.128	0.128	-0.112	1.235	0.095
(7) Managerial contribution	0.116	0.116	-0.096	1.119	0.163
(8) Political factor	0.096	0.05	-0.096	0.941	0.339

Table 4: the results of one sample t-test

Research Variable	Mean	Standard Deviation	T-statistics	df	Sig	Confidence interval		Result
						Lower bound	Upper bound	
Talent management	3.2761	0.54006	9.229	325	0	0.2172	0.3349	favorable
(1)Standardization	3.2628	0.69464	6.83	325	0	0.1871	0.3385	favorable
(2) Strategy	3.5238	0.91862	10.295	325	0	0.4237	0.6239	favorable
(3) Development of organization	3.6881	0.93033	13.355	325	0	0.5868	0.7895	favorable
(4) View point	3.6399	0.74256	15.559	325	0	0.559	0.7208	favorable

Akbar Hassan Poor and Ramin Jalali

(5) Infrastructure and processes	2.8227	0.88368	-3.623	325	0	-0.2736	-0.081	unfavorable
(6) Management factors	2.6577	0.8848	-6.986	325	0	-0.4387	-0.2459	unfavorable
(7) Managerial contribution	2.7239	0.97689	-5.103	325	0	-0.3825	-0.1696	unfavorable
(8) Political factor	3.89	1.023	15.703	325	0	0.78	1	favorable

Table 5: The mean rating of the Friedman test

Variables	Mean rating	Chi 2	Significance level
(1)Standardization	6.172		
(2) Strategy	5.544		
(3) Development of organization	5.411		
(4) View point	5.275	631.319	0.001
(5) Infrastructure and processes	4.322		
(6) Management factors	3.279		
(7) Managerial contribution	3.101		
(8) Political factor	2.896		

RESEARCH ARTICLE

Arcadia (Pastoral) or Mountainous Poem in South Khorasan

Hamid Samsam and Fereshte Enayati*

Department of Literature, Faculty of Humanities, Branch Sistan and Bluchestan, Islamic Azad University, Zahedan, Iran.

*Address for correspondence
Fereshte Enayati
Department of Literature,
Faculty of Humanities,
Branch Sistan and Bluchestan,
Islamic Azad University,
Zahedan, Iran.

ABSTRACT

Arcadia is indeed the name of a mountainous region in Peloponnese. Later, Theocrat (Theocritus) ancient Greek poet selected the life of Sicilian shepherds as the subject of his pastoral poetry. Classical poets knew Arcadia as a symbol of rural peace and tranquility and harmony of golden age. In fact, pastoral poetry refers to a style in which the poem describes the rural, simple, imaginary, and ideal love of men and women, which differs from their real life. Pastoral poems. Pastoral poems typically deal with mythical world; the world is in a golden age in which the simplicity of rural life has been intact, and gods, goddesses and fairies are inhabited.

In Iran, pastoral poetry is found in rural and mountainous areas. South Khorasan should be considered one of the best contexts of pastoral poetry. In this area, the great poets began composing beautiful Do-baytis (two-line poems) in describing nature and its wonders. This article aims to investigate the poems of four of these poets with emphasis on symbolic, semantic and poetic implications. The poets are Ali Dashti, Mohammad Ali Vafadar, Ismael Hosseini Ahmadi, and Qasem Abedi.

Key words: Arcadia, Pastoral Poetry, South Khorasan, Poetry.

INTRODUCTION

Arcadia poetry is derived from the works a Greek poet called Theocritus (third century BC). His poems were a paradigm for the Roman poet Virgil (19-70 BC) whose pastoral poems influenced all pastoral poems and proses of the

Hamid Samsam and Fereshte Enayati

Renaissance in Europe. Poetic representation of the spoken language is one of the characteristics of pastoral poetry. Spoken language in the poems, comparing to official and settled language, has a higher position. (Farshidvard, 1979: 94).

It is necessary to say some words about colloquialism or the use of spoken language. Culture of the people or folklore covers a wide area of different concepts such as opinions, rituals, beliefs, customs, myths, legends, parables, lullabies and other branches of oral literature (Shakoorzadeh, 2000: 2). Some researchers of believe that folkloric dates back to Safavid period in Iran. Another group of scholars argues that folkloric studies were began in the early eighteenth century that Western travelers were interested in the region due to British control of the Indian subcontinent. In other words, when the official language in that areas was Persian (Tijana, 2011: 27).

About a century ago, Iranian intellectuals began to prefer the spoken language to the official language in the writings. Jamalzadeh was the first person who combines spoken language and local expressions and proverbs with a special interest in "Once upon a Time." Other writers such as Dehkhoda, Sadeq Choobak, Samad Behrangi, and Jalal Ale Ahmad followed this style. From that time until today, many studies have been carried out in most parts of Iran in particular, in the country in widespread and pervasive. In Khorasan, many studies have conducted by scholars and many works are available in this field. 'Dialect glossaries of Birjand and Ghaen', 'Boshruyeh's Adage', 'Letters of Birjand', 'Jewel of Desert' and 'Muhammad Mahdi Naseh's Do-baytis' (Zangoee, 2010: 49).

This is a field and descriptive-analysis study in terms of nature. In terms of subject, this article investigates pastoral poems of four Khorasanian poets. This investigation aims to understand and introduce the properties of pastoral poetry in South Khorasan. Undoubtedly, understanding the themes, concepts, narratives, and the literature used in this type of poetry will lead readers to a better awareness of folk literature of our country's remote regions.

Since few articles and research have been done in the field of pastoral poetry of South Khorasan, the number of available sources is less. However, there are some researches and books about folk literature and pastoral poetry; the most important works are:

"Literary types in Europe and Iran: A Comparative Study in Criticism" by Khosro Farshidvard, printed in Tehran University, Faculty of Literature and Humanities, in 2006, no. 99 and 100, pp. 42-69.
"Fundamental research and public culture: Arcadia motifs in children's literature in Europe" by Terachin Tijana, printed in Children's Book of the Month (Khordad), in 2011, no. 164, pp. 7-12.
"Typology of Iranian native songs" by Hasan Zolfaghari and Leila Ahmadi, printed in Research in Literature, in 2009, no. 7 and 8, pp. 143-170.
"Lullaby in the popular culture of South Khorasan" by Hossein Zangooei printed inThe growth of Persian Language and Literature, Fall 2010, no. 95, pp. 54-61.
"Birjandi Popular Do-baytis (two-line poems)" by Mohammad Mahdi Naseh, first edition, Tehran: Mohaqiq, 1994.

Characteristics of Pastoral Poetry in Khorasan

Pastoral poetry is not uniform in all areas of Iran. In terms of content and form, pastoral poetry of west of Iran is very different from Khorasanian pastoral poetry. Dialectal differences and distinctions in these areas is one of the reasons for such differences because oral literature changes basically due to its expression by different people and concord with its target society. Khorasanin pastoral poetry is also different in terms of the lines. Some of them like Do-bayti or rubaie have four hemistiches and some have less or more hemistiches like Qete'. In some mountainous regions of Iran, the number of lines may be more than usual.

In pastoral poetry of Khorasanian poets, symbols of human speech are containers for concepts representing thoughts, desires, wishes, tendencies and objections in wonderful and beautiful pictures. Some of the themes of the lyrics are

Hamid Samsam and Fereshte Enayati

emotional and spiritual. The poets are generally trying to explain the world around due to the circumstances in which he lives. The poet's explanation not only is from pure imagination but also is a narration of realities (Naseh, 1994: 26).

Ali Dashti

Referring to the poems of four Khorasanian poets, this article tries to explain semantic and symbolic implications and employed symbols in addition to the poetic world of the poems.

I got both feet on the pedal rod,
I **measured** ten kilos of gain,
 For five kiss from the lips of golden rose,
All my mouth was burned as much as I trick

Ali Dashti describes his passion to reach the beloved in the first line. He used the archaic word, "کیله" that means measure in the second line. Using local words with ear-catching and beautiful resonance, he is able to create a new linguistic combination. Besides, the poet engages emotionally the reader, or listener, in the poem by calling the grand and famous story of the lover and beloved in his Do-bayti. In the second line, the poet pushes the audience in a specific realm of semantic implications by using the proper name of "زرگل" that means 'golden rose'. "زرگل" is here a symbol of the beloved's beauty and elegance because "زرگل" refers to a beautiful flower. It also may be a symbol for a specific person called "زرگل" (Zargol). In this regard, the poet tries to use an irony to enrich his poem. Then, the poet he complains of his painful efforts to reach his beloved; the situation is weepy and perplexity for him.

Lover's complaint of his/her beloved is the source and theme of all lyrical poems. As the poet of a pastoral poem lives in natural environment of mountains and plains, he sees the beloved by his side. Poet is not far from the beloved in reality. He uncovers his conscience for nature and the beloved exists in unconsciousness.

The poet may lock up his poem intentionally in his own environment by stating the name of a specific person as the name of his beloved. Being trapped in customs and people around the poet is a general feature of pastoral poetry. The poet speaks of longings and his pleasures without any fear. Ali Dashti states the name of Mika in this regard. Doing so, he tells that the reader must know the specific environments of the poet. This important issue is never ignored by the poet. In fact, environment of the poet is the poet's poetic world. He looks at outside to express his inner feelings. He uses imaginary combinations for better expression of his surroundings reality. It should be noted about pastoral poetry that it is a poem about environment. It is under the influence of wild nature. The poet tries to portray this wild world using words.

The reader experiences a paradoxical mood in this type of poem. Although all lines explains the poet's separation from the beloved and discovers beauties or difficulties in nature, pastoral poems describes a world beyond the real world and life of the poet. Hence, pastoral poetry in influenced by both harsh environment and pleasant environment.

You have committed much oppression,
You made us poor,
I hope your flock of sheep dies,
You impose much oppression on us.

For example, the poet complains of a person called Malek "مالک" and calls him the reason for all his misfortunes. In this poem, the poet behaves as if the tiny world of the poet is the center of the world and all other problems are smaller than his difficulties. He complains about poverty that affected most villagers of Khorasan. When he decides

to curse Malek, he refers to his sheep and says, I hope your sheep die because you impose much oppression. In pastoral poetry, the poet is not afraid to express his simple and rural thoughts; therefore, we may see curses or complaints in these poems.

Another recurring theme in the pastoral poetry of South Khorasan is dialogue with nature and animals that assist the pastor, especially donkeys and dogs that help the pastor in the mountainous environments. In the following poem, the poet talks to his donkey called Luku, "لوکو", about his feeling about falling apart from the beloved. The lover suffers from the separation and the donkey suffers from its heavy load. This poem also explains the employment of surrounding objects, symbols and animals by the poet.

Now, whine Luku as I whine,
We both whine aside each other,
You complain of your heavy load,
I complais of the beloved distance.

This verse reflects the poet's loneliness and isolation from the human world around him. Artistic expression of human loneliness and homesickness is one of the features of pastoral poetry. Shepherd has no body except his sheep in mountains. He may spend many days and nights with his herd. Thus, he has no news from the world around. The poet's loneliness in mountains is a reason for dialogue with nature. The poet listens to his inner voice and begins to talk with the surrounding nature. The nature is silent and the poet is talking. Pastoral poetry is inner voice in this sense. It is a silent and unanswered dialogue with nature.

The following poem uses spoken forms of the words in writing.
Now, the long moon is followed by stars,
When you load the head of the caravan,
The head of caravan stays overnight,
 I will travel; follow me.

The above poem represents one of the most notable characteristics of pastoral poetry. This important characteristic is the use of spoken words instead of written forms. The poet enters the authentic and ancient forms of his dialect in writing regardless of the specific rules of writing. For instance, he uses "استاره" instead of the established form of "ستاره" meaning star. In western parts of Iran, this world is called "آساره".

Thus, the poet imposes his oral logic on the writing rules and makes the poem more intimate. The poet's intimacy to use his everyday language is a genuine and lasting characteristic of pastoral poetry. As pastoral poetry is not confined in the established forms of written language, the pastoral poet can express his perturbations and strange feelings through his ancient language. Hence, pastoral poetry contains some of the linguistic features because it shows that the dialect of some areas in Iran, especially in southern Khorasan, has poetic expressions to be considered in linguistic terms. Pastoral poetry of southern Khorasan has been able to maintain dynamic nature of its dialect by staying away from the capital dialects. In other words, this type of poetry has two main functions. First, it maintains its original and ancient dialects by he creation of poetry; second, the poet presents his inner feelings by the dialects spoken in his region in the truest form of expression. As a result, simplicity and his proximity to the language and dialect of common people are reasons for the persistence of the poems in the public memory of the village.
In this poem, the poet expresses his true intentions without any fear of the use of words. It is possible to say that the main trait of the village people is the representation of minds without any concealment and censorship. For example, the poet seeks to kiss the beloved's lips without any concealment in the below poem. Pastoral poetry is explicit and simple poetry. The poet utters his aspirations, dreams and desires without a language barrier. Pastoral poet is not trapped in the moral logic of written language. He makes himself free and has no fear of the exterior implications of written language. Therefore, he says:

Hamid Samsam and Fereshte Enayati

Tulips do not wet by dew,
The lover's hearts will not peace by seeing,
Give me five kiss from your lip,
The seawater will not finish by drinking.

Somewhere else, the poet says that I am following a sheep, "گوزل", in the Balhavar lands, "بلهوار". Here, the poet has created a new combination.

I step always in Balhavar lands,
I follow the sheep in pain,
I follow the sheep, as I am sick and homesick,
I am sick that I go.
He searches for his lost sheep in Balhavar lands. In this manner, the poet wants to connote his search for a beloved by describing his rural life.

An intrinsic property of pastoral poetry is employment of local words and expressions and calling proper names and places. The poet uses local words of a place called Sinider (سینیدر) in the following lines to express his inner desires in a symoblic form.

If Sinider has long canals,
They are shorter than sweetheart's trousers,
Tell the sweetheart's mother,
Sugar has Ambizo over lips.

As seen, using the name of a specific region with a specific feature, the poet analogizes his beloved ti the place. Simile is one of the most versatile literary devices in pastoral poetry. The poet works on the same theme in different form in the next poems.

My flower that carries a pot,
It has two tubal hooded eyes,
If I see her thousand times,
I am still anxious.
Black eye that blinks on me,
Sadden my heart from childhood,
From childhood and ignorance,
She put a bind on my heart.

In this beautiful song, the poet says that the beloved who carries a pot in his hands has two tubal hooded eyes. He misses her beloved. In this verse, eye implies the true essence of lover. Black eye is a symbol for the beauty of beloved that has attracted the lover. He is attracted by the beloved's black eyes from childhood.

In general, black eye is a common metaphor to imply a beloved in Persian language and literature. Dashti's poem has certain elegance with this metaphor. In another line, he describes that he is in a prison like his flock in the village Shar and the key of prison is in the hands of beloved. Here, the poet creates a poetic work by using simile. Since the key is in the hands of the beloved, his ambitions and desires are very much.

Hamid Samsam and Fereshte Enayati

Mohammad Ali Vafadar

Mohammad Ali Vafadar is another poet in the field of Khorasanian pastoral poetry. The same as Dashti, he has special skills in the use of specific linguistic elements in the South Khorasan. He also takes the advantages of semantic and symbolic implications. In the next poem, he defines his verse by stating the name of a specific person.

Ali Khan said that he was in Chahmir,
I was imprisoned of a hooded eye,
I was depressed homesick of the hooded eye
Like a lion in a chain.

The poet says that once Ali Khan (a person) was in Chahmir (a place) and he falls in love with a hooded eye. Using simile, he says that falling in love is the same as falling in a bind. The poet describes his own situation by using simile. Although Dashti uses mostly metaphor in his poems, Vafadar uses simile in this regard.
In the following poem, Vafadar talks about hunting season and season of flowers and buds. He sees himself free (Havar) and regards himself a fortune person.

Oh Muslims, I am on Havar throne,
Between flowers and spring,
If you do not know, know,
I have a gun on my shoulders and decide to go hunting.

Poetic narration is one of the main characteristics of Vafadar's poems. Unlike Dashti, Vafadar uses narratives in his poems. His poems have a beginning, a peak and an end like a story. In the first poem, this is notable. The next poem also has this narrative-like feature.

Red, white and arranged flowers,
Are rooted in marble,
I hope the marble breaks,
Because the beloved is alone.

Similarity with nature and the seasons is one of the oldest themes in pastoral poetry. The poet feels fortune where he sees himself in nature because he is free like nature.

The poet simulates his beloved to a deer lamb in another poem by using simile as a literary device. Somewhere else, the poet declares that he decides to go to Dalenj (a place) to tell his words to a person called Khalegh Dad. Here, we see a specific place in which the poet lives and a specific person. Like Dashti, Vafadar makes his poetry rural and native with the names of people and places in his own environment. The poet speaks of his hard times with the words rhyme and song in the following poem.

I left shepherding,
I grew up sheep,
My flock has died,
I do not shepherding,
Shepherding in the first year,
Crippled goats like camels.

Complaining about the instability of the environment and its hardness is another theme in pastoral poetry. It should be noted that the poet does not merely praise natural and pristine themes, but he regards any tyepe of financial loss

as a vanishing loss. Nature contains bittersweet events due to its natural instability and transformation so that o one can prevent it. A pastoral poet accepts this destiny. He knows that that nature has both beautiful and ugly appearances. Thus, he talks and accompanies to both of the appearances. A pastoral poet does not try to subdue nature. He stays in his shelter and is satisfy with the destiny that has been decided for him. Although his poems include many layers of complaints about nature, he has learned to comply with nature, not to tame or control it.

In the following poem, the poet is pleased that he is born in a nomadic family; he contends for fighting for his country against enemies.

I was born in a nomadic family; I am from pain,
I am fighting for my country,
Like our sheep wholesome and fat,
I m happy and analgesia.

Vafadar represents his happy, live and fresh mood in fighting for his country by the use of simile. It should be noted that a pastoral poet is not nationalist and idealist. Nationalism and idealism are seen less in pastoral poetry in general.

In the following poem, the poet praises his lamb (Khal Gardan).
Polka dot Khal Gardan,
I made carpet of your wool,
Useful carpets,
I lay them in blank places.

With his simple and pure view, he finds his world in wool. However, this type of view does not imply cultural poverty and a lack of literacy, but it signifies that the poet expresses his inner feelings through most trivial objects. Triviality here does not show the lack of importance, but they are tools to concede the true meaning by the poet.
In addition to simple symbolism, simple themes and general motifs, which are familiar to all people, can make a suitable situation. This expressing form gives the poem a general shape and attracts more audiences. As seen, the poet finds a link with his surrounding world through simple everyday and rural issues on the one hand. On the other hand, the simplicity is an approach to communicate with public audience. In fact, it is a method for addressing all human beings.

Ismael Hosseini Ahmadi

Ismael Hosseini Ahmadi is another Khorasanian poet. His famous Do-baytis have mostly romantic and lyrical themes. In a poem, he describes his beloved who attracts all human beings, even her enemies, due to her Kajak (hair of the front of the head).
Black Kajaks that you have,
Will not back to our house,
Because the enemies ambush,
You shall not be caught by enemies.
We see such romantic requests by the lover in all poems written by Ismael Ahmadi. Lover is afraid of losing her beloved. The fear to lose beloved is a proposed themes in the poetry of Ahmadi. This is a common theme in pastoral poetry; the poet is always fears of losing his beloved, and usually warns the beloved and himself.
The poem in which Ahmadi hopes for gun to punish the person who decides to separate him from his beloved is one of the best and most tender Do-baytis.

I pour sugar grains in your way,

Hamid Samsam and Fereshte Enayati

I cry to redden my belt,
That anybody who separate us,
Will be punished by butt stock in his chest.

Here, the poet has created a beautiful phrase by bringing together fresh ingredients and homophones words. In another poem, the poet says that his beloved will come to him in Lar (the name of a mountain in Khorasan) and he will sacrifice a ram in front of her as a scapegoat. The poet celebrates the sublime value of his mistress by sacrificing his biggest and most important wealth, ram. This Do-baytis uncovers another characteristic of pastoral poetry. He leaves one of his properties to reach the beloved. The poet does not refer to unrealistic demands, but he has recoursed to his assets. He uses the most important part of his assets as a measure for a valuable affair like love.

I am shepherding in Lar Mountain,
As the beloved comes, I celebrate,
I will choose a ram from the big ones,
Sacrifice it as a scapegoat.

In a poem, the poet considers himself as a lover shepherding the beloved's herd. He guides the herd to the best place called India (name of a place) to pasture and settles the herd in a destiny called Do Chahi (name of a place). He believes that one must endure difficulties to reach his beloved. In these lines, he aims to say that one must deal with the beloved's affairs in the best way to satisfy her.

In the fourteenth line of the poem, the poet reminds clear fact bitterly in an advice. The fact is that nature is the only property of a man. If nature is in a good position, everything is going well; but if the time of drought and water scarcity comes, everything will be destroyed. This dependence on the nature is one of the fundamental elements of pastoral poetry. The poet is aware of such dependency, and wants a rural man to beware of this fact.

When the year is spring,
The owner of livestock is very happy,
When the year is drought,
The livestock owner's voice is still.

Qasem Abedi

Qasem Abedi is another pastoral poet in South Khorasan. Describing the natural world with its entire annual the ups and downs is the main characteristic of Abedi's poetry. In the below nice poem, the poet describes with tearful eyes the poor state of famine that has come to him and his herd.

I was an ignorant rich,
I fed the herd much,
The drought came,
I grow up the sheep,
The sky would not fall,
The earth had nothing,
I led the sheep to in the stock,
 No one bought them,
I carried them to Sabzevar,
With tearful eyes,
I went to Yazd and Kerman,
The bazar was stagnant

Hamid Samsam and Fereshte Enayati

I sold them for the next year money,
I regret of going,
My loan has been multiplied.

Abedi represents a kind of environment based in his hometown. Three former poets focus less on themes like poverty and the poets were satisfied despite all environmental difficulties. Nevertheless, Abedi describes a feeling of unease and the lack of justice in the mechanism of the natural world. In this way of thinking, he regards pastoralism as nothing but poverty and misery. Abedi's song exists in the boundary between the natural world of village and the constructed world of town.

In his next Do-baytis, we see the poet's complaints and annoyance of herding and following the farce and difficult job of growing sheep. Thus, he wants God to end this situation and put him in another land. Abedie's poetry is indeed a kind of petition. It describes the difficulties of living in a village. It should also be noted that Abedi's poetry is affected by some sort of urbanization welfare. Previous poets have not a certain understanding of the world outside their villages; therefore, they do not doubt their place of living. Abedi not only doubt his surrounding world bu also reject it.

In another piece song, the poet tells his beloved (Zargol) to sit aside him to sing her Faraqi (a king of poem). The poet creates a beautiful linguistic and semantic combination of words by bringing homophones words.

The black hair have eaten Naru,
She is grown up and is my beloved,
I will die for her black hair,
That she is my treatment.

Once, the poet argues that he is worry when the herd rounds because he is afraid of the wolves' attack at night and kills all the sheep of his beloved. In many of the Abedi's poems, his utterances are entirely naturalistic and rural because he is describing his surrounding domestic animals. He claims that goats are like black ants and they will use different ways when they arrive at Kali (name of a place).

Goats have wonderful appearances,
They have black colors like ants,
When the clever goats arrive at Kali,
Each has separation dance in a different way.

In a poem, the poet describes his goats through lovely words. This Qete is one of the most notable works of Abedi in the realm of portraying rural world. He sacrifices himself for the goats whose ears are like pomegranate. He is alive for his beautiful ewes. He regards the sheep as his entire assets. In this poem, the poet expresses his shame because of the drought and his inability to provide food for their herd. It goes on to say that the sounds of his goats and sheep are the best sound for him.

CONCLUSION

In discussing the poets of South Khorasan, three major characteristics of pastoral poetry in this region should be considered.

1. The first characteristic is the explanation of nature as power in which lights the best manner of life is possible. Pastoral poets in South Khorasan find nature their refuge, sanctuary, and regards travelling in nature as an unfailing pleasure. Although they may portray nature as a violent and destructive force, the poet's surrounding nature,
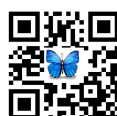
especially mountains, as a place in which he can can have the privacy and purify him. In fact, nature is origin and source of poetic expressions in South Khorasanian pastoral poetry. Not only nature is a recurring themes in the poetry but also nature is a place for the poet's discovery, witnesses, and intuitions. Understanding nature acts as a both constructive and destructive force, which should be endured because it is the only mother able to relax and free human beings.

2. Considering nomadic life and accepting it are another characteristic of pastoral poetry in South Khorasan. Pastoral poet knows his flock as his asset and spends his livelihood in ts light. In general, animal husbandry life brings a kind of condition in which compatibility with livestock is essential. While nature is a shelter and sanctuary for poet to foster his imaginations, livestock secures his living. Hence, the presence of animals is strong and influential in all pastoral poems because the poet supports his life through livestock and reduces the difficulties of life in mountains through animals like dogs and donkys.

3. Romantic and lyrical imagination is the main characteristic of pastoral poetry. A pastoral poet engages himself with realistic or unrealistic and imaginary beloveds to reduce the pressure of living in mountainous regions. This romantic expression allows the oet to endure such an environment and leaves him at a charming hand called love.
Pastoral poetry belongs to people with light, smooth and mellow mood. This kind of poetry is not a linguistic game made by educated and punctual people, but the result of attempts carried oud by people who do not consider themselves outside the live stream. Pastoral poets are existed in the real life. Therefore, their poems are absorbed by hearts and souls. The poem's unconscious purity comes from the poet's harmony with the mountains and his environment.

REFERENCES

1. Terachin T. (2011). Fundamental research and public culture: Arcadia motifs in children's literature in Europe, Children's Book of the Month (Khordad). Trans. Bahar Eshraq, no. 164, pp. 7-12.
2. Zolfaghari H., & Ahmadi L. (2009). Typology of Iranian native songs, Research in Literature. No. 7 and 8, pp. 143-170.
3. Zangooei H. (2010). Lullaby in the popular culture of South Khorasan, The growth of Persian Language and Literature, Fall 2010, no. 95, pp. 54-61.
4. Shakoorzadeh I. (2000). Beliefs and customs of the common people in Khorasan. Tehran: Iranian Cultural Foundation.
5. Farshidvard K. (2006). Literary types in Europe and Iran: A Comparative Study in Criticism, Tehran University, Faculty of Literature and Humanities, no. 99 and 100, pp. 42-69.
6. Naseh M. M. (1994). Birjandi Popular Do-baytis (two-line poems), first edition, Tehran: Mohaqiq.

RESEARCH ARTICLE

The Study of Organizational Learning Effects on Corporate Entrepreneurship in Keshavarzi Bank

Amirbabak Marjani[1] and Solmaz Jalali[2]*

[1]Faculity member at Central Tehran branch, Islamic Azad University, Tehran, Iran
[2]Department of management, Islamic Azad University, Central Tehran branch, Tehran, Iran.

*Address for correspondence
Solmaz Jalali
Department of management,
Islamic Azad University,
Central Tehran branch,
Tehran, Iran.

ABSTRACT

In this study, the role of organizational learning on corporate entrepreneurship is examined. The statistic population includes managers, assistants and employees of Keshavarzi Bank in Tehran that includes 106 people. In the present study census method is used because of the small size of the statistical community. Datarelated to organizational learning and entrepreneurship is collectedusing two questionnaires that their content validity and reliability was approved by Cronbach's alpha (alpha is equal to 0.89.).

The results showed that organizational learning has a significant and positive effect on corporate entrepreneurship (Simple linear regression analysis).Hypotheses test isperformed by multiple regression analysis to examine the relationships between variables showed that all aspects of organizational learning have a significant positive relationship with corporate entrepreneurshipthat the greatest impact is related to outdoor and experimentation and the minimum impact is related to management commitment.

Key words: learning, organizational learning, entrepreneurship, organizational entrepreneurship.

Solmaz Jalali and Amirbabak Marjani

INTRODUCTION

In modern world, people, organizations and countries are most successful that areentrepreneurial and use technical knowledge and technology to achieve prosperity.Scientists believe that technical knowledge and technology will convert to wealth, prosperity just by creative and entrepreneurpeople that destroy the previous inefficient practices and create new waysby their innovation and creation.

In other words, the cycle of economic development will move by entrepreneurship development and entrepreneurship is the engine of growth and development.On the other hand, in recent years the importance of the study and analysis of organizational learninghas increasedand several researchers have analyzed it with different approaches (Jerez-Gomez et al, 2005).

Among these approaches we can name psychological, social and organizational theoretical approach(Levitt and March, 1988: Daft and Weick, 1984).More recently it has been investigated from the perspective of organizational learning strategy.From this perspective, organizational learning is considered as a source of distinction between organizations and also as a base for competitive advantage(.aletLei:1999, .aletetLei: 1996, Grant: 1996)and the learning organization concept is derived from this viewpoint that it caused changes in the traditional methods of business management (.aletGomez-Jerez, 2005).

This study aims at clarify the role of organizational learning in organizational entrepreneurship. In the same direction, the present research is trying to find the answer to this question that what the organizational learning role in the corporate entrepreneurship is.

Theoretical background

Organizational learning literature:

With the development of technology and expanding the scope of business and development of new forms of organization such asVirtual organizations,Networks,expanded business, thebusiness environment has become the competitive environment and challengingand new paradigms have emerged that make the survival difficult for many firms.In such an environment, it is natural that the competitive scores transform.Hence the biggest competitive advantage in the new business paradigm is expressedlearning. Thus, organizations are more successful that learn sooner,faster and better than the other competitors.

This is why the concept of the learning organization and organizational learning has been proposed in recent yearsand hasincreasingly growth.Organizations instead of the traditional organizational behavior and movement in their best shape may spend part of their money to their training and as a result, will convert to organizations that ever learn that means their attempt is learning as a competitive score.

Blanken Hagen believed that the review of organizational learning literature is difficult because of the absence of an agreement on organizational learning.Organizational learning is a concept used to describe the activity of certain types that happens in an organization and is usually associated with other types of improvements.

However, despite the growing popularity of the subject, the problem is the lack of public consensus on a description, methodology, theory, models, processes or procedures. Therefore, equal to the number of the authors in this issue there are many organizational learning definition.

-Definitions of organizational learning:

Solmaz Jalali and Amirbabak Marjani

It can be expectedthatorganizational learning is a processwhere an organization differently than the past react to environmental and domestic stimuli and these changes are relatively stable and not coincidence.Indeed, organizational learning is similar with individual learning in term of increasing the organization capability in applying the effective activities and methods.

Organizational learning can be considered as a dynamic process of creation, capture and gathering knowledge and resources to develop capacity, which leads to better performance of the organization. (Lopez et al., 2005). In this form, a four-stage model presented in accordance with organizational learning that are shown as follows:
Knowledge acquisition, knowledge distribution, knowledge interpretation and organizational memory that these steps separately can be explained as follows:

 1-Knowledge acquisitionfrom the internal and external resources :Any attempt to gain knowledge is whether from internal resources or external sources and with Quotes of Dajsvn (1993) learning occurs when the organization obtain the required knowledge.Knowledge or truth acquisition occurs through the use of information systems for data storage, data processing, research, implementation, training, etc.

2-Distribution of Information:Distribution of information refers to the processthat organizationwas sharewith their membersand the department and learning will improve through it and new knowledge is created.

1.Thedata interpretation: information should be interpreted to be used jointly.Data interpretation is a process by which distributed information will find sharableand understandablemeanings.

It should be noted thatvarious factors affect the interpretation of the dataand all of these factors must be considered. Data interpretation has direct relationship with the perception and attitude of people, because people with different attitudes have different perceptions of the same information.

2.Organizational Memory: it refers to the resourceswhere knowledge is stored for future use. A part of organizational memory is placed in the minds of individualsthat based on their experience havegained this knowledge. Other Part of this knowledge is embedded in the organizational culture because the organizational culture includes people's past experiences that affect people.Information technology that is used to store information will form the organizational memory too.

Organizational learning factors:

Management commitment for organizational learning

Management must understand the importance of learning and create culture in the organization that considersthe acquisition, creation and transfer of knowledge in an organization as afundamental value (Garvin. 1999, stata, 1989). Management should clearly state the strategy of learning because organizational learning is a valuable tool to achieve long-term results (sinkula, 1994, slocum et al., 1994). The management should ensure that staffs understand the importance of learning as a key factor in the success of the organization (Ulrich et al., 1993, slate and narver, 1995).

Systematic vision

Various individuals and departments areas of the organization should have a clear vision of the organization's objectives and know how to help their goals development (Lei et al., 1996).The organization should be considered as thesystem.Although it is built from different departments with specific functions but they work togethercoordinately(Leonard – Barton, 1989; Stata , 1992).

Solmaz Jalali and Amirbabak Marjani

Attitude to the organization as a system implicitlyexpand recognition of the importance of communication based on the exchange of information and services (sinkula, 1994) and its result is the development of shared mental models (Kim, 1993).

Outdoor and experimentation

Creative learning or the second loop learning requires outdoor and it considers the importance new ideas and viewpoints inside or outside of the organization .This type of learning will cause personal knowledge to be renovated, expanded and improved(Leonard-Barton،1992، Slocum et al 1994.,Sinkula 1994)

Outdoor causes new ideas within the organization or outside the organizationare tested that this testing is an essential aspect for creative learning because this method search the creative and flexible ways to solve current and future problems by using modern methods and procedures

Knowledge transfer and integration

The fourth feature of the process is completely related to the transfer and integration of local knowledge which happen concurrently rather than sequentially.Efficiency of the process depends onthe previous capacity (Dibella et al., 1996). Capacity is the ability to identify, acquire, digestion and utilization of knowledge. It can remove internal barriers to knowledge transfer within the organization (Nunnally, 1978).
Knowledge transformationinclude a variety of internal knowledge acquired individually in which is primarily will obtain through conversation and interaction between individuals.

Entrepreneurship:

The term entrepreneurship is originated from the ENTREPRENDRE the French word meaning "to undertake". According to Webster new collegiate dictionary definition, the entrepreneur is the one who committed the risks of a business, organization, management (Hezarjaribi, 2008, 13)

 In 1933, entrepreneur is considered person who is independent and founder of economic firms (Kouchran, 1966, 90). Entrepreneurship means deployment concepts and management techniques, tools and processes for designing, building and standardization ofproduct and working based on training and then analyzing them (Upton et al., 1997: 5).

Entrepreneurial is known as a process of hunting opportunities by individuals alone (independent entrepreneur) or organization (organizational entrepreneur) without considering the resources they have at their disposal (Rezaeian, 2001, 84)

Entrepreneurship creation background:

Generally it can be said that entrepreneurship takes place in three areas: individual entrepreneurship, entrepreneurshipwithin the enterprise, organizational entrepreneurship. Individual entrepreneurship is a process that relied on financial resources and personality traits such as activity, risk-taking and being practical, entrepreneur takes newjoband continues it until reaching to success (Histrich and Peters, 1998).

Entrepreneurship within the organization is responsible for promoting the creation of innovation within the organization. In other words, it is a process in which an innovativeproduct or process is emerged through survival of entrepreneurial culture in an organization that are already established (Karbassi, 2002: 3).

Solmaz Jalali and Amirbabak Marjani

Corporate entrepreneurship means making process within the organization and with the characteristics of the spirit of perseverance, risk-taking, creativity and innovation where a group of people within the organization will convert into the work engine (Upton, 1997: 20).

Literaturesurvey

Organizational learning:

Ismaili (2005) conducted a study thatbased on the it, the organization have the mechanisms of organizational learningincluding the facilitator of learning, training and development recognition of needs learning, meet the learning needs of development and implementation of learned knowledge in practice.

Rashmeh (2006) conducted research that its obtained results showed that there is relationship between managers' attitudes to innovation and organizational learning.Abdoli (2007), in a study with more than 99% confidence concluded that there is a significant relationship between empowerment and organizational learning and thus it can be argued that the increased empowerment can promote organizational learning

Najaf beigi and Doroudi (2009) performed a study Research titled " learning organization model in the Islamic Republic of Iran Broadcasting ".Their findings indicated that IRIB is far from the effectiveness situation of a learning organization and employee performance in team learning and change in mental models is more satisfactory than their managers. In other characteristics, the efforts of the two groups are similar.Then to reduce the distance to the effectiveness condition for strengthen the skills of IRIB, a practical model and executive recommendations are suggestedbased on the analysis of the results of research and a theoretical discussion.

Entrepreneurship:

Wesper (1980), divided entrepreneurship into internal and independent sectionsand expressed that domestic entrepreneurs leadsEntrepreneurship in large organizations and provides a way for creation and establishment of an independent organizational units to deliver new services (Moghimi, 2004).

Collins and Moore (1970) were the first researchers who distinguish between independent and Administrative entrepreneurs and argued that independent entrepreneurs establish new organizations independently while the office entrepreneurs create new structures within or alongside of organizations' structure.

Paul, Andrew and Lowe (2000) indicatedOrganizations to maximize entrepreneurial solutions should use the participation of people in all sectors and processesand turn chaotic organizational contexts regular and safe environment for entrepreneurship in order to reveal the competencies and capabilities to enhance the performance.

Rezazadeh et al (2003) in a study examined the relationship between leadership style and organizational entrepreneurship.They concluded that the adopted management style and leadership style can fertilize new ideas and creative spirit in staff and generally play an important role in creation and strengthen the entrepreneurial and pioneering spiritorcause the destruction or fading of the spirit.

Mr. Pakjou in 2004 in a study investigated the relationship between organizational culture (Hofstede cultural model) and organizational features an interactive model of CE (Kuratko model) in the management of Tejarat bank branches in Tehran and WestAzerbaijan".The findings suggest that man-oriented dimensions, positive relationship and collectivism and power distance aspects, and uncertainty avoidance have negative relationship with entrepreneurial organizations (Pakjou, 2004).

Solmaz Jalali and Amirbabak Marjani

RESEARCH HYPOTHESIS

The main hypothesis:

Organizational learninghas significant relationship with corporate entrepreneurship.

Secondary hypotheses:

Management commitment has significant relationship with corporate entrepreneurship in Keshavarzi Bank.
Systematic vision has significant relationship with corporate entrepreneurship in Keshavarzi Bank.
Outdoor and experimentation has significant relationship with corporate entrepreneurship in Keshavarzi Bank.
Transformation and integration of knowledge has significant relationship with corporate entrepreneurship in Keshavarzi Bank.

The statistic population and sample

The statistic populationincludes administrators, assistants and staff employees ofKeshavarzi Bank in Tehran that includesabout 106 people. Because of the small size of the study population, a census method was used. (This researchhas not sampling).

Research Tools

In order to ask experts'opinions and viewpoints about the study, a questionnaire was used. In the questionnaire design the conversion of qualitative indicators to measurable quantitative indicators are essentialconsidering the defined scale and range. (Bazargan, Sarmad, Hejazi, 2005).

In general,scalesare used to measure attitudes, judgments, opinions, and other features that are not easily quantifiable.One of the most common scalesto measure attitude is the Likert scale.In the present study to assess the variables, scale of five variables as "very low, low, medium, high, very high," is used.

The questionnaire consisted of two major sections.

1)General questions:In general questions it have been tried that demographic information about the respondents were collected.
2)Specific questions:Questions is related to the research variables that are included 30 questions.For the design of the questionnaire, the index in books and scientific papersis used.

Validity:

Research validity in general is its ability to identify or detect accurately the relationship between the factors or variables in the statistics via the data collected to answer the research hypotheses.
The validity of the questionnaire used in this research is the content and validity.Content validity is a credit check that is commonly used to measurethe component instruments and is determined by experts and professors. Construct validity was performed using the regression method.

Reliability:

The reliability of is one of the technical characteristics of measuring instruments (Khaki, 2005).

Solmaz Jalali and Amirbabak Marjani

This concept deals with this issue that measures how offers the same result in similar situation in the same condition (Sarmadet al., 2006, p. 166).
In order to calculate the reliability, the Cronbach's alpha was used.
In the present study, before the data collection step, 30 questionnaires are typically distributed across individuals and by calculating Cronbach's alpha value, the reliability was investigated. Cronbach's alpha value was 0.89in general questionnaire, which indicates good reliability of the questionnaire survey.
Cronbach's alpha values for the variables and indicators of the questionnaire are presented in the following table.

Data Analysis

Since this study will be discussed about identification of the effect of the independent variable on the dependent variables to test the hypothesis, the simple and multiple linear regression and correlation techniques are used.Software used for these operations is SPSS16.

In This study to analyze the collected data, firstly, the descriptive level by statistical parameters used to describe and summarize the demographic characteristics of the study sample included gender, age, educational level and etc. and in the inferential statistics to verify hypotheses and investigate the relationship between the variables the "Pearson correlation coefficient" and "simple and multiple linear regression" is used

Kolmogorov-Smirnov test results:

To test Normalization parameters of the model, KS-test was used and in all tests, statistical hypotheses areas follows.
H0: Data are normal (data originates from a normal population)
H1: Data aren't normal (data doesn't originate from a normal population)

As seen in Table 2, Significant amount of variables is greater than 0.05errorsso the null hypothesis can be concluded that means all variables are normal.The use of parametric tests required to establish conditions including the distribution of the sample should be normal.Given the large sample size (greater than 30), according to the central limit theorem, and the normality of the variables distribution of the sample mean can be assumed normal and the parametric test can be used.

Examination of the regression assumptions:

1.normality of errors
Histogram charts assess the normality of errors as regression assumptions, assuming that the errors of the regression should have a normal distribution. Given that the majority of the rectangles in the diagramare inside the bell-shaped distribution, the assumption of normality is verified. In addition the Kolmogorov-Smirnov test (z=1.155, Sig=0.139>0.05) also indicates that the error distribution is normal.

2.The independency of errors
Another regression assumptionis independencythat the errors association must be denied. Watson statistic explores this hypothesis and for confirmation of the assumption,whatever the statistic be closer to 2,it showsmore the independency of the error. In this study, this statistic is equal to 1.88 (in the range 1.5 to 2.5) that indicates these assumptions are true.

3.The absence of severe collinearity between the independent variables
For this test, the VIF and tolerance index (value between zero and one) is used. The approval of this test requires VIF less than 2 while tolerance must be close to 1 and far from the zero. The following table verifies the assumptionthat there is no linear correlation between the independent variable.

Solmaz Jalali and Amirbabak Marjani

Hypothesis 1: learning organizational has a significant relationship with entrepreneurship in Keshavarzi Bank.
H0: Organizational learning has no significant relationship with corporate entrepreneurship in Keshavarzi Bank.
H1: Organizational learning has a significant relationship with corporate entrepreneurship in the Keshavarzi Bank.
The results in Table 4 show that the calculated effect of organizational learning on corporate entrepreneurship in Keshavarzi Bank is equal to 0.566 .With regard that the significance level is 0.000 and less than 0.05 (p<0.05)with the probability of 0.95 this claim that "organizational learning has a significant relationship with entrepreneurship in Keshavarzi Bank" is confirmed. The correlation coefficient is 0.32. The variable of organizational learning alone has 32 percent of CE in the Keshavarzi Bank.
Sub-Hypothesis 1: The systematic vision has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

H0: systematic vision has no significant relationship with corporate entrepreneurship in Keshavarzi Bank.
H1: systematic vision has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

The results in Table 5 indicate that the estimated effectofsystematic visionon corporate entrepreneurship in Keshavarzi Bank is equal to 0.241 that with regard to the significance level of 0.000 that is less than 0.05(p<0.05) with the probability of 0.95 this claim that "systematic vision has a significant relationship with corporate entrepreneurship in Keshavarzi Bank " is confirmed. With the regard of the positive beta coefficient it can be said that the systematic vision has a positive relationship with entrepreneurship in Keshavarzi Bank.

Sub-Hypothesis 2: management commitment has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.
H0: management commitment has no significant relationship with corporate entrepreneurship in Keshavarzi Bank.
H1: management commitment has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

The results in Table 5 indicate that the calculated effect of management commitment on entrepreneurship, management inKeshavarzi Bank is 0.081that with regard to the significance level greater than 0.186that is more than 0.05, with probability 0.95, researcher's claim that "management commitment has a significant relationship with corporate entrepreneurship in Keshavarzi Bank" is rejected.

Sub-Hypothesis 3: Outdoor and experimentation has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

H0: Outdoor and experimentation has no significant relationship with corporate entrepreneurship in Keshavarzi Bank.
H1: Outdoor and experimentation has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

The results in Table 5 indicate that the estimated effect ofOutdoor and experimentation relationship with corporate entrepreneurship in Keshavarzi Bank is equal to 0.420 that with regard to the significance level of 0.000 that is less than 0.05(p<0.05) with the probability 0.95 this claim that "Outdoor and experimentation has a significant relationship with corporate entrepreneurship in Keshavarzi Bank" is confirmed. With the regard of the positive beta coefficient, it can be said that the outdoor and experimentation has a positive and direct relationship with entrepreneurship in Keshavarzi Bank.

Sub-Hypothesis 4: The knowledge transfer and integration has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

Solmaz Jalali and Amirbabak Marjani

H0:The knowledge transfer and integration has no significant relationship with corporate entrepreneurship in Keshavarzi Bank.
H1: The knowledge transfer and integration has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

The results in Table 5 indicate that the estimated effect of the knowledge transfer and integration relationship with corporate entrepreneurship in Keshavarzi Bank is equal to 0.185and with regard to the significance level of 0.000 that is less than 0.05 ($p<0.05$) this claim that " transfer and integration has a significant relationship with corporate entrepreneurship in Keshavarzi Bank " is confirmedwith the probability 0.95.
The coefficient of determination for CE inKeshavarzi Bank is equal to 0.427 Thus;all four different aspects of organizational learning have explained 42.7 percent of variability about CE in Keshavarzi Bank.Regarding the path coefficient, it can be said outdoor and experimentation variable have the greatest relationship with the Bank's Corporate Entrepreneurship (regardless of the sign of the coefficient, it has the greater beta) andmanagement commitment has the lowest contribution than others.

RESULT AND DISCUSSION

The results of the analysis of the first hypothesis:

The systematic vision has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.
The first hypothesis test results indicate a positive correlation between systematic vision with corporate entrepreneurship and correlation analysis confirmed this assumption completely (R=0.740) that indicateswith the change of systematic vision, corporate entrepreneurship changes. Furthermore, regarding theobtained regression coefficient, it can be saidfor every one unit increase in the systematic vision, corporate entrepreneurship is changed with0.241unit.

The results of the analysis of the second hypothesis:

The management commitment has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.
The second hypothesis test results indicate the absence of positive correlation between management commitmentwithcorporate entrepreneurship and correlation analysisrejected this assumption completely (R=0.755) that indicates that with the change of management commitment, corporate entrepreneurship does notchange significantly. Furthermore, regarding theobtained regression coefficient, it can be said, for every one unit increase in the management commitment, corporate entrepreneurship is changed with0.081unit.
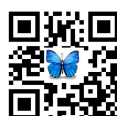
In this research the relationship between management commitment and organizational commitment was rejected.

The results of the analysis of the third hypothesis:

The outdoor and experimentation has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.
The third hypothesis test results indicate a positive correlation between outdoor and experimentation with corporate entrepreneurship and correlation analysis confirmed this assumption completely (R=0.718) that indicates that with the change of outdoor and experimentation, corporate entrepreneurship changes. Furthermore, regarding theobtained regression coefficient, it can be said, for every one unit increase in the systematic vision, corporate entrepreneurship is changed with 0.420unit.

In this research the relationship between outdoor and experimentation and organizational commitment was confirmed.

Solmaz Jalali and Amirbabak Marjani

The results of the analysis of the fourth hypothesis:

The knowledge transfer and integration has a significant relationship with corporate entrepreneurship in Keshavarzi Bank.

The fourth hypothesis test results indicate a positive correlation between knowledge transfer and integrationwith corporate entrepreneurship and correlation analysis confirmed this assumption completely (R=0.847) that indicates that with the change of knowledge transfer and integration, corporate entrepreneurship will change. Furthermore, regarding theobtained regression coefficient, it can be said, for every one unit increase in the systematic vision, corporate entrepreneurship is changed with 0.185unit.

Barriers and limitations of the study

In each work, the researcher is faced with obstacles and restrictions.Naturally, this research also does not exclude from this situationand important barriers are as follows:
◎ One limitation of the present study was that the only source ofcollected information is the questionnaires.
◎ The main limitation of questionnaire based research is that these research measure person perception of reality that may not be entirely consistent with truth. This issue is also applied in this research too.
◎ The findings are limited to the period of data collection and the results may vary by the changing circumstances of the time.

Suggestion

First hypothesis

It is proposed managers to increase the effectiveness of management's commitment to organizational learning should frequently involve employees in decision-making processes,abdicating authority and responsibility to employees can be more effective in this area.Managers should also look for new methods and they should encourage creative idea in work environment and reward this creative ideaoffered by the staff of the organization.

The second hypothesis

It suggested that Bank senior managers for greater effectiveness of systematic vision consider issues in their agenda such as Building public knowledge about the organization's goals, Participation of employees in order to achieve the main objectives, coordination of most sectors and organizational units and Creating a culture of teamwork.

The third hypothesis

To create outdoor and experimentation,the managers should encourage them as a way to improve the processes.They should use useful experiences and techniques and promote culture of ideas and recommendations presentation. Managers by establishing pilot projects among bank employees will provide the necessary space for the bank staff to offer creative and innovative projects of the bank.

The fourth hypothesis

It is recommendedthat errors and fails in each level to be analyzed and employees discuss about ideas, programs and activities to promote the ability of individuals and experiences and recommendations be included in the database to make it possible to use these ideas by others.

Suggestions for future research

In the field of organizational learning organizational little research has been done about the bank, the researchers are be recommendedthat examines the factors affecting organizational learning at other institutions and prioritize these factors based on their importance.Given that this study have been conducted only in service industries (banks) , in future,the studies should identify the relationships between organizational learning and corporate entrepreneurship in otherprivate and industry institutions to compare the results of thesestudies.

By investigation ofthe subject of this study in the overall level with the goal of comparison between different towns and regions,this research can be done in other statistical societiesto achieve effective factors. The use of other models to assess the impact of organizational learning on entrepreneurship.

REFERENCES

1. Abdoli, Z. Relationship between empowerment and organizational learning in education Tehran, Tehran University, Master's thesis, School of Management, 2007.
2. Adhami, H .investigation of the relationship between the needs of employees and their entrepreneurial activity in IRIB, MS Thesis, Tehran University, 2004.
3. Alegre,J.,Chiva,R,Assessing the Impact of Organizational Learning Capability on   product Innovation Performance : An Empirical Test, Technovation 28: 2008,PP.315-326
4. Amirkhani, AH, Designing and explanation of implementing of models of learning organizations, Tehran, Tehran University, Master's thesis, School of Management, 2000.
5. Andripoulos& Lowe A., Enhancing Corporate entrepreneurship : the process of perceptual challenging ,Journal of management Decision, Vol.38,p.734-742,2000.
6. Antonic,B.,R.D.Hisrich   (2004),Corporate   Entrepreneurship   Contingencies   and   Organizational WeathCreation,Journal of Management Development, 23(6):518-550.
7. Argyris,C.,Schon,D.(1978)Organizational learning: a theory of actionperspective: MA : Addison –Wesley.
8. Bennet.Alex and bennet .David, (2008).The Partnership between Organizational learning based on knowledge management.
9. Choe,J-M .(2004) the relationships among management accounting information, organizational Learning and production Performance: Strategic InformationSystem : 13,PP.1-85
10. Ismaili, V. the investigation of the effect of Organizational Learning at the National Iranian Oil Refining and Distribution based on four factors of LO, Tehran, Tehran University, Master's thesis, School of Management, 2005.
11. Marquardt, M (2006), creation of a learning organization, Translated by: Zali, first edition, Tehran, Tehran University Entrepreneurship Center.
12. Moghimi, SM, Designing and explaining entrepreneurial model for NGOs, PhD thesis, TarbiatModarres University, School of Management, 2006.
13. Moghimi, SM, entrepreneurship research institutions in civil society NGOs, Iran, Tehran University Entrepreneurship Center, Tehran University Press, 2004.
14. Pakjou, M. R. The relationship between dimensions of organizational culture and organizational features an interactive model of entrepreneurship within the management 6th zone of the Bank branches in Tehran and West Azerbaijan, MS Thesis, Tehran University of AllamehTabatabaei, 2004.

15. Rashmeh, J. The relationship between managers' attitudes for change and innovation with organizational learning in schools in Tehran, MS Thesis, Faculty of Psychology and Educational Sciences, Islamic Azad University of Roodehen, 2006.
16. Rezazadeh, H. Investigation of the relationship between organizational structure and corporate entrepreneurship in Tehran Social Security Administration, Master's thesis, Tehran University, 2003.
17. Samadaghaee, J. (2005) Anti-employment entrepreneurship, economic development engine.
18. ShahsavandHarati, E. investigation of Organizational Learning- Case Study of Part-makers, MS Thesis, University of Tehran, Faculty of Management, 2006.
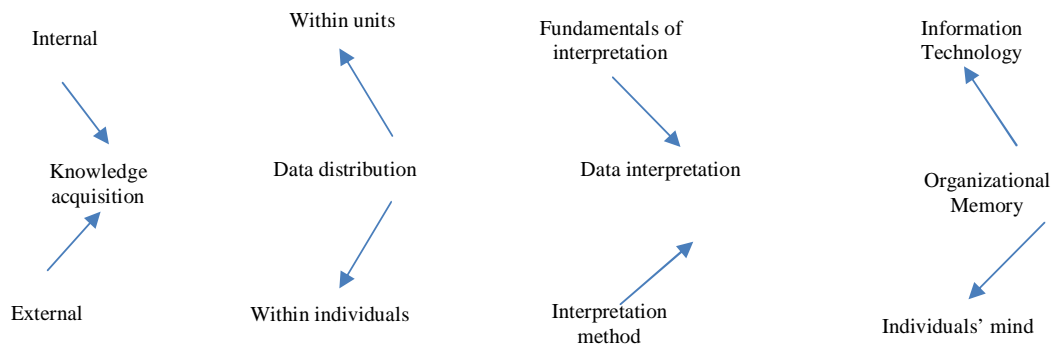
Figure 1 - Distribution of information in the knowledge interpretation and organizational memory

Table 1. The Cronbach's alpha coefficient for research variable

Questionnaire	Cronbach's alpha coefficient	Variable	Cronbach's alpha coefficient
Total	0.89	Organizational learning	0.78
		organizational entrepreneurship	0.81

Table 2. The results of KS tests

Research variables	Most Extreme Differences			Kolmogorov-Smirnov Z	Sig
	Absolute	Positive	Negative		
Systematic vision	0.078	0.042	-0.078	1.3	0.068
Management commitment	0.055	0.047	-0.055	0.907	0.383
Outdoor and experimentation	0.076	0.053	-0.076	1.265	0.082

Solmaz Jalali and Amirbabak Marjani

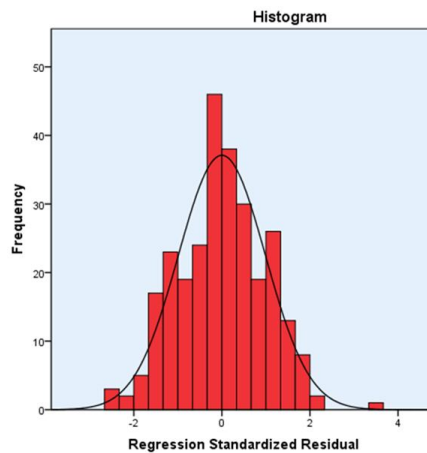|					
Transfer and integration	0.077	0.077	-0.06	1.276	0.077
Personnel creativity	0.09	0.06	-0.09	1.289	0.074
Organizational structure	0.086	0.064	-0.086	1.234	0.073
Creative culture	0.108	0.078	-0.108	1.201	0.103
Creative leadership	0.112	0.062	-0.112	1.204	0.102

Figure 2: Diagram of normality of errors

Table 3. VIF and tolerancsparameters

Independent variables	Ttolerance	Variance inflation factor (VIF)
Transfer and integration	0.667	1.498
Management commitment	0.78	1.282
Systematic vision	0.72	1.389
Outdoor and experimentation	0.832	1.202

Table 4. Results of simple linear regression

Dependent variable	Independent variable	Statistic index	Value
corporate entrepreneurship in Keshavarzi Bank	Organizational learning	The coefficient of determination)R^2(	0.20
		The beta value	0.66
		T value	10.22
		Significance level	0.00

Table 5: Results of multiple regressions to examine relationships between variables

Dependent variable	Independent variable	beta	t	Sig	R^2	The hypothesis situation	Relationship direction
corporate entrepreneurship in Keshavarzi Bank	Transfer and integration R=0.847	0.185	2.369	0.018	0.427	approved	direct
	Management commitment R=0.755	0.081	1.324	0.186		Rejected	Meaningless
	Systematic vision R=0.740	0.241	5.086	0.000		approved	direct
	outdoor and experimentation R=0.718	0.420	6.708	0.000		approved	direct

Table 6: Results of multiple regressions to examine relationships between variables

Dependent variable	Independent variable	beta	t	Sig	R^2	The hypothesis situation	Relationship direction
corporate entrepreneurship in Keshavarzi Bank	Systematic vision	0.241	5.086	0.000	0.427	approved	direct
	Management commitment	0.081	1.324	0.186		Rejected	Meaningless
	outdoor and experimentation	0.420	6.708	0.000		approved	direct
	Transfer and integration	0.185	2.369	0.018		approved	direct