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Life Science Journal 2012 Volume 9, Number 3, Part 17 ISSN:1097-8135



Volume 9, Number 3, Part 17 September 25, 2012 ISSN:1097-8135

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**MARSLAND PRESS**  
Multidisciplinary Academic Journal Publisher

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# Life Science Journal

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# CONTENTS

358	<b>Generalized Projective Synchronization for Four Scroll attractor</b> M. M. El-Dessoky and E. M. Elabbasy	2477-2483
359	<b>Semi- Settled Pastoralists’ Sources of Information and Utilisation of HIV/AIDS Prevention Techniques in South West Nigeria</b> Oladele O.T, Olujide, M.G, Oladele O.I,	2484-2487
360	<b>Factors Influencing Households’ Access to Portable Water in Rural Nigeria</b> Oyekale, A.S. and Ogunsanya, O.A.	2488-2494
361	<b>Investigation the effect of maternal education on nutritional status of children aged 2 to 5 years in Zanjan, Iran</b> Iran Ghasemi, Azam Roshandel, Tayyebeh Samadpour, Vida Sadeghzadeh	2495-2500
362	<b>Agricultural Wastes And Activated Carbon From Them For Furfural Removal From Water Solutions</b> Ghazi Aidan	2501-2505
363	<b>Indicators to determine the usefulness of mixed and pure culture systems of triticale (<i>X Triticosecale</i>. Wittmack) and green pea (<i>Lathyrus sativus</i> L.) in rainfed conditions of Iran</b> Khosro Azizi, Saeed Heidari and Amir Akbari	2506-2511
364	<b>Comparison of competences between Problem-Based Learning (PBL) and Non-Problem-Based graduate nurses in a Provincial Hospital in South Africa</b> Useh U, Mosebudi D, Tsolo G, Kgwakgwa D.K	2512-2517
365	<b>The effects of an eight-week aerobic exercise training program on serum leptin and cardiovascular risk factors among obese men with type II diabetes</b> Mohammad Ali Sardar , Seyyed Mahmud Hejazi , Raminah Abedini	2518-2523
366	<b>Development of Height-Age Model and Site Index Curves for <i>Pinus rigida</i> Plantations in South Korea</b> Yeon Ok Seo, Roscinto Ian C. Lumbres, Young Jin Lee	2524-2528
367	<b>Effects of Moderate-intensity Exercise on Serum Proinflammatory Cytokine Levels in Obese and Non-obese Men</b> Vahdat Boghrabadi, Seyyed Mahmud Hejazi , Ali Hoseinzadeh Gonabadi , Hasan Sanian , Farnaz aminian	2529-2532
368	<b>Heavy metal poisoning as a possible cause of massive fish mortality and mongoose in the gold mining area around Khutsong, North west province , South Africa.</b> Mathew Nyirenda, Vincent V Thekiso, Blessing M Dzoma, Lebogang E Motsei, Rendani V Ndou, Francis R Bakunzi	2533-2537
369	<b>The awareness of the HPV’s association with cervical cancer and the HPV vaccine among Saudi females</b> Abdulrahim Gari; Ahmed Asiri; Amr Mohammed; Fahad Al-Malki; Mohammad Melibari; Mohammed AlSheikh; Moayad Kalantan; Nader Al Qethami; ShaddyFuttiny; Sultan Al-Essi; Yasser Al Shomrany and ZiyadAlihiby	2538-2546
370	<b>Changes in socioeconomic status, community health and environmental conditions of fishermen by transmigration (<i>transmigrasi</i>) in Lampung Timur, Indonesia</b>	2547-2556

Anton Setyo Nugroho and Tsukasa Inaoka

- 371 Ameliorative Role and Antioxidant Effect of Propolis and Ginseng against Reproductive Toxicity of Chlorpyrifos and Profenofos in Male Rats** 2557-2567  
Ahmed A. Hendawy, Mansour H. Zahra, E I-Sayed A. Abd El-Aziz, Abd El-Aziz A. Diab, Reham Z. Hamza
- 372 Eye Affection Syndrome Wild and Cultured Fish** 2568-2575  
Noor El Deen, A. I. E and Mona S. Zaki
- 373 Sustainable strategies in Iranian houses** 2576-2580  
Shadi Babaei , Nasim Fazeli , Behnam Ghasemzadeh
- 374 Diagnostic Accuracy of Ultrasonography for Evaluation of Internal Derangement of the Temporomandibular Joint** 2581-2587  
Khaled Alashiry, Mahmoud E. Khalifa and Ashraf Abo Khalaf
- 375 The Subject and His Desperate Attempts to Regain the Lost Realm of the Real** 2588-2592  
Mehdi Khoshkalam Pour
- 376 Barriers to condom use among Men Living with HIV: A Qualitative study in Iran** 2593-2599  
Homeira Fallahi, Sedigheh Sadat Tavafian, Farideh Yaghmaie, Ebrahim Hajizadeh, Ali Rastegarpour
- 377 Redescription of Three Cichlidyrids (Monogenea: Ancyrocephalidae) and One Gyrodactylid (Monogenea: Gyrodactylidae) Infecting *Oreochromis niloticus* (Cichlidae) From the River Nile** 2600-2611  
Kareem Morsy; FathyA. Abdel-Ghaffar; Abdel-Rahman Bashtar; Mohamed Shazli; Hamed Fayed; Faten Adel
- 378 General Overview of Effective Posters in Islamic Revolution of Iran and their Symbolic Connotations** 2612-2614  
Hamid Alami
- 379 Origin and domestication of the goat and history of the Angora goat and the mohair industry** 2615-2618  
Tofiq Froghi, Azad Hosaini
- 380 Some nutritional strategies to reduce subacute ruminal acidosis in dairy cattle** 2619-2624  
Tofiq Froghi, Azad Hosaini
- 381 Effect of dietary protein levels on carcass traits and fleece characteristics of Markhoz goats** 2625-2628  
Farzad Abdollahzadeh, Rahim Abdulkarimi

## Generalized Projective Synchronization for Four Scroll attractor

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**Abstract:** This paper investigates an active control method is proposed to generalize projective synchronize two identical chaotic dynamical systems by constructing the response system no matter whether they are identical. The proposed technique is applied to achieve generalized projective synchronization for the Four - scroll attractor, where all state variables are in a proportional way. A strategy for practical implementation of a secure communication strategy is also discussed. Finally computer simulations are done to verify the proposed methods, and the results show that the obtained theoretic results are feasible and efficient.

[El-Dessoky MM, Elabbasy EM. **Generalized Projective Synchronization for Four Scroll attractor.** *Life Sci J* 2012;9(3):2477-2483] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 358

**Keywords:** Projective synchronization; Chaotic system; Active control; Four-scroll attractor, Secure communication.

### 1. Introduction

Researchers from different areas, such as mathematicians, physicists, chemist, as well as control engineers have devoted themselves to examine the issue of synchronization over the past decade (Pacora and Carroll, 1990; Carroll and Pacora, 1991; Kocarev et al.,1992). Chaotic systems, in particular, have been applied to the development of secure communications, chemical reactions, biological systems and so on (Kocarev et al.,1992; Yuan and Jun, 2009; Zhu, 2009; Lu et al., 2002; Hua et al., 2005; Juan et al., 2012; Rafael and Yu, 2008 ). The system which received the most attention among chaotic communication systems perhaps is the Chua oscillator (Kocarev et al.,1992). This system belongs to general class of Lure systems (Khalil, 1996).

Chaos control and synchronization have attracted a great deal of attention from various fields since Huber published the first paper on chaos control in 1989 (Hubler, 1989). Over the last decades, many methods and techniques have been developed, such as OGY method (Ott et al., 1990), PC method (Pacora and Carroll, 1990; Carroll and Pacora, 1991), feedback approach, nonfeedback control methods, adaptive method, nonlinear control, active control, and backstepping design technique, etc (Wang et al., 2001, Elabbasy et al., 2004; Wang and Ge, 2001; Jiang et al., 2002; Sun and Zhang 2004).

There are many applications to chaotic communication (Fallahi and Leung, 2010; Elabbasy and El-Dessoky, 2010) and chaotic network synchronization (Chow et al., 2001). The techniques of chaotic communication can be divided into three

categories, (i) chaos masking (Kocarev et al., 1992), the information signal is added directly to the transmitter; (iii) chaos modulation (Boutayeb et al., 2002), it is based on the drive – response (master-slave) synchronization, where the information signal is injected into the transmitter as a nonlinear filter; (ii) chaos shift keying (Parlitz et al., 1992), the information signal is supposed to be binary, and it is mapped into the transmitter and the receiver. In these three cases, the information signal can be recovered by a receiver if the transmitter and the receiver are synchronized.

In 1963, Lorenz found the first classical chaotic attractor. In 1999, Chen found another similar but not topological equivalent chaotic attractor the Chen attractor (Chen and Ueta, 1999). In 2002, Lü and Chen found a new critical chaotic system (Lü and Chen, 2002), bearing the name of Lü system. It is noticed that these systems can be classified into three different types by the definition of Vaněšek and Čelikovsky (Vaněšek and Čelikovsky, 1996): the Lorenz system (Lorenz, 1963) satisfies the condition  $a_{12} a_{21} > 0$ , the Chen system (Chen and Ueta, 1999) satisfies  $a_{12} a_{21} < 0$  and the Lü system (Lü and Chen, 2002) satisfies  $a_{12} a_{21} = 0$ , where  $a_{12}$  and  $a_{21}$  are the corresponding elements in the linear part matrix  $A = [a_{ij}]_{3 \times 3}$  of the dynamical system.

The early projective synchronization (PS) is usually observable only in a class of systems with partial-linearity (Xu et al., 2001; Xu and Chee, 2002; Xu and Li, 2002, Wen and Xu 2005), but recently some researchers (Zhigang and Daolin,

2001; El-Dessoky, 2010) have achieved control of the projective synchronization in a general class of chaotic systems including non-partially-linear systems, and termed this projective synchronization as generalized projective synchronization (GPS) (Yan and Li, 2005; Changpin and Jianping, 2006; El-Dessoky and Salah, 2011).

In this paper, we generalize active control to GPS, and demonstrate this technique by some typical chaotic systems, for example, the chaotic Lorenz system and the chaotic Chen system such that GPS is achieved. The results from numerical simulations show that the method works well.

The paper is organized as follows. In Section 2, the generalized projective synchronization with active control is applied to synchronize two identical Four-scroll attractor and numerical simulations are presented to show the effectiveness of the proposed method. In Section 3, a scheme of secure communication based on the active control of Four-scroll chaotic system is presented. Conclusions are finally given in Section 4.

**2. Generalized projective synchronization (GPS) of two identical Four-scroll chaotic attractor**

The projective synchronization means that the drive and response vectors synchronize up to a scaling factor  $\alpha$ , that is, the vectors become proportional. First, we define the GPS below. Consider the following chaotic system:

$$\dot{x} = f(x, t) \tag{1}$$

$$\dot{y} = g(y, t) + u(x, y, t) \tag{2}$$

where  $x, y \in R^n$  are the state vector of the systems (1) and (2), respectively ;  $f, g \in R^n \times R \rightarrow R^n$  are two continuous nonlinear vector functions,  $u(x, y, t)$  is the vector control input. If there exists a constant  $\alpha$  ( $\alpha \neq 0$ ), such that  $\lim_{t \rightarrow \infty} |y - \alpha x| = 0$ , then the GPS of the systems (1) and (2) is achieved, and we call  $\alpha$  is a scaling factor.

Now, we apply the adaptive feedback control method for generalized projective synchronization of two identical Four-scroll attractor (Lü et al., 2002 & 2004; Liu and Chen 2004; Elabbasy et al., 2006; El-Dessoky, 2010) which can be described by:

$$\begin{aligned} \dot{x} &= ax - yz \\ \dot{y} &= -by + xz \\ \dot{z} &= -cz + xy \end{aligned} \tag{3}$$

where  $a, b$  and  $c$  are positive control parameters. This system exhibits a strange attractor at the parameter values  $a=0.4, b=12$  and  $c=5$ . This system bridges the gap between the Lorenz (Lorenz, 1963) and Chen attractors (Chen and Ueta, 1999), i.e.  $a_{12} a_{21} = 0$ . The divergence of the flow (3) is given by

$$\nabla \cdot F = \frac{\partial F_1}{\partial x} + \frac{\partial F_2}{\partial y} + \frac{\partial F_3}{\partial z} = a - b - c < 0,$$

Where

$$\begin{aligned} F &= (F_1, F_2, F_3) \\ &= (ax - yz, -by + xz, -cz + xy). \end{aligned}$$

Hence the system is dissipative when:  
 $a < b + c$ .

Science the system of Four-scroll attractor (3) is a dissipative system thus the solutions of the system of equations (3) are bounded as  $t \rightarrow \infty$  for  $a < b + c$ . If  $ab > 0, ac > 0$  and  $bc > 0$  then the system has five equilibrium points:

$$\begin{aligned} E_0 &= (0, 0, 0), E_1 = (\sqrt{bc}, \sqrt{ac}, \sqrt{ab}), \\ E_2 &= (-\sqrt{bc}, -\sqrt{ac}, \sqrt{ab}), E_3 = (-\sqrt{bc}, \sqrt{ac}, -\sqrt{ab}), \\ E_4 &= (-\sqrt{bc}, -\sqrt{ac}, -\sqrt{ab}). \end{aligned}$$

Differing from other known similar systems, system (3) has five equilibrium, and does not have Hopf and pitch bifurcations [38, 39]. Of most interesting is the observation that this chaotic system not only can display a two-scroll chaotic attractor when  $a=4.5, b=12$  and  $c=5$  (Figure 1), but also can display a Four-scroll chaotic attractor when  $a=0.4, b=12$  and  $c=5$  (Figure 2).

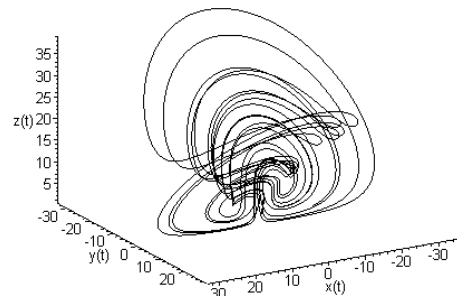


Figure 1: The chaotic attractor of two- scroll attractor at  $a=4.5, b=12$  and  $c=5$  in 3-dimensional.

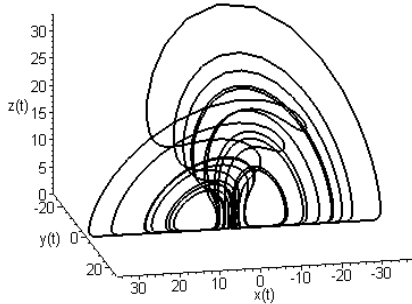


Figure 2: The chaotic attractor of Four- scroll attractor at  $a=0.4$ ,  $b=12$  and  $c=5$  in 3-dimensional.

In this section we apply the generalized projective synchronization of two identical Four-scroll chaotic attractor. In order to observe the generalized projective synchronization behavior in the Four-scroll system, we have two Four-scroll systems where the drive system with three state variables denoted by the subscript 1 drives the response system having identical equations denoted by the subscript 2. However, the initial condition on the drive system is different from that of the response system. The two Four-scroll systems are described, respectively, by the following

$$\begin{aligned} \dot{x}_1 &= ax_1 - y_1 z_1 \\ \dot{y}_1 &= -by_1 + x_1 z_1 \\ \dot{z}_1 &= -cz_1 + x_1 y_1 \end{aligned} \tag{4}$$

and

$$\begin{aligned} \dot{x}_2 &= ax_2 - y_2 z_2 + u_1 \\ \dot{y}_2 &= -by_2 + x_2 z_2 + u_2 \\ \dot{z}_2 &= -cz_2 + x_2 y_2 + u_3 \end{aligned} \tag{5}$$

There are three control functions  $u_i$ , ( $i=1, 2, 3$ ) to be determined later.

Define the error vector as

$e_x = x_2 - \alpha x_1$ ,  $e_y = y_2 - \alpha y_1$  and  $e_z = z_2 - \alpha z_1$  where  $\alpha$  is a desired scaling factor. Then one obtains the error dynamical system by subtracting (4) from (5)

$$\begin{aligned} \frac{de_x}{dt} &= ae_x - y_2 z_2 + \alpha y_1 z_1 + u_1 \\ \frac{de_y}{dt} &= -be_y + x_2 z_2 - \alpha x_1 z_1 + u_2 \\ \frac{de_z}{dt} &= -ce_z + x_2 y_2 - \alpha x_1 y_1 + u_3 \end{aligned} \tag{6}$$

Referring to the original methods of active control, so we choose the three control functions  $u_i$ , ( $i=1, 2, 3$ ) as follows:

$$\begin{aligned} u_1 &= y_2 z_2 - \alpha y_1 z_1 + v_1 \\ u_2 &= \alpha x_1 z_1 - x_2 z_2 + v_2 \end{aligned} \tag{7}$$

$$u_3 = \alpha x_1 y_1 - x_2 y_2 + v_3$$

then the error dynamical system (6) is described by

$$\begin{aligned} \frac{de_x}{dt} &= ae_x + v_1 \\ \frac{de_y}{dt} &= -be_y + v_2 \\ \frac{de_z}{dt} &= -ce_z + v_3 \end{aligned} \tag{8}$$

The error system (8) to be controlled is a linear system with a control input  $v_1$ ,  $v_2$  and  $v_3$  as function of the error  $e_x$ ,  $e_y$  and  $e_z$ . As long as these feedbacks stabilize the system (8),  $e_x$ ,  $e_y$  and  $e_z$  converge to zero as time tends to infinity, which implies that GPS of two identical Four-scroll systems is achieved with a scaling factor  $\alpha$ . There are many possible choices for the control  $v_1$ ,  $v_2$  and  $v_3$ . In order to make the closed loop system (8) be stable, the proper choice of the control should guarantees that the feedback system must have all eigenvalues with negative real parts. For simplify, we choose

$$\begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix} = A \begin{bmatrix} e_x \\ e_y \\ e_z \end{bmatrix} = \begin{bmatrix} -2a & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} e_x \\ e_y \\ e_z \end{bmatrix} \tag{9}$$

In this particular choice, the three eigenvalues of the closed loop system (8) are  $-a$ ,  $-b$  and  $-c$ . Since the closed loop system has all eigenvalues that are found to have negative real parts, the system will be convergence. In other words, this choice will result in a stable system and the GPS of two identical Four scroll systems. What deserves to be mentioned is that the values of the eigenvalues play an important role in the stability of the error system. In order to quicken the rate of convergence, we should make them get smaller.

### 2.1 Numerical Results

By using Maple 12, we select the parameters of the Four-scroll attractor as  $a=0.4$ ,  $b=12$  and  $c=5$ . The initial values of the drive system and response



system are taken as  $x_1(0) = 0.23, y_1(0) = 0.1, z_1(0) = 0.32,$   
 $x_2(0) = 1.77, y_2(0) = 0.9$  and  $z_2(0) = 0.44$  respectively. If we take the scaling factor  $\alpha = 2$  hence the error system has the initial values  $e_x(0) = 1.29, e_y(0) = 0.7$  and  $e_z(0) = -0.12$ . then the generalized projective synchronization between two identical Four-scroll attractor are shown in Figure 3. If we take the scaling factor  $\alpha = -0.2$  hence the error system has the initial values  $e_x(0) = 1.818, e_y(0) = 0.94$  and  $e_z(0) = -0.504$  then the GPS between two identical Four-scroll attractor are shown in Figure 4. If we take the scaling factor  $\alpha = 1$  hence the error system has the initial values  $e_x(0) = 1.54, e_y(0) = 0.8$  and  $e_z(0) = 0.12$  then the complete synchronization between two identical Four-scroll attractor are shown in Figure 5. If we take the scaling factor  $\alpha = -1$  hence the error system has the initial values  $e_x(0) = 2, e_y(0) = 1$  and  $e_z(0) = 0.76$  then the anti synchronization between two identical Four-scroll attractor are shown in Figure 6.

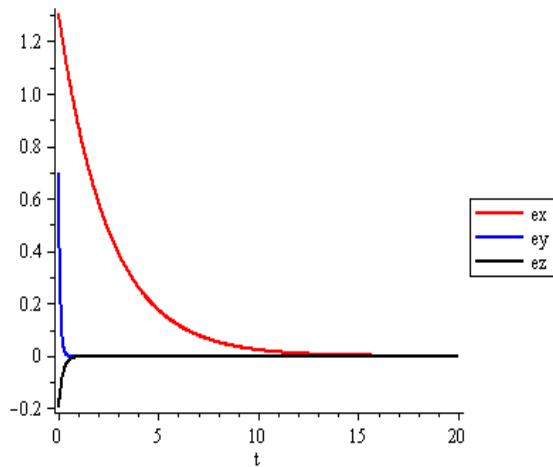


Figure 3: Shows the trajectories of  $e_x, e_y$  and  $e_z$  of two identical Four- scroll attractor with scaling factor  $\alpha = 2$  for generalized projective synchronization.

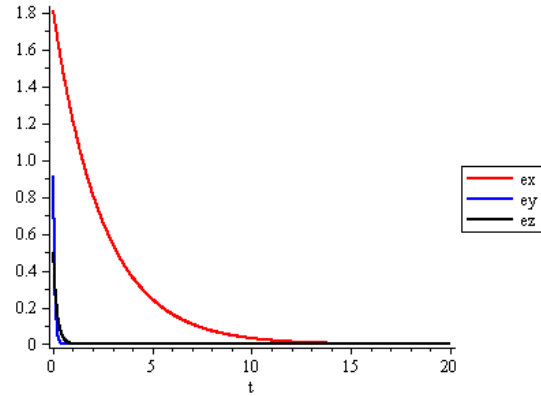


Figure 4 : The trajectories of  $e_x, e_y$  and  $e_z$  of two identical Four- scroll attractor with scaling factor  $\alpha = -0.2$  for generalized projective synchronization.

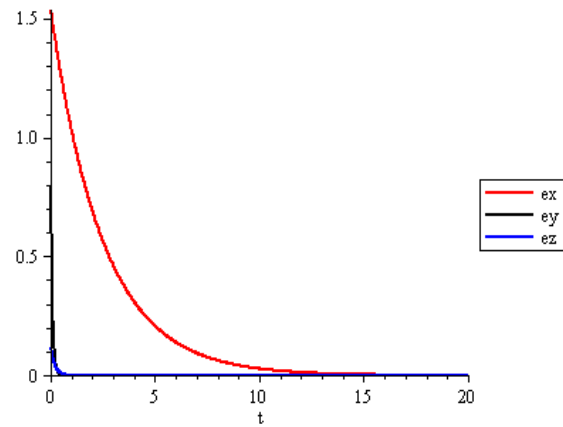


Figure 5: The trajectories of  $e_x, e_y$  and  $e_z$  of two identical Four- scroll attractor with scaling factor  $\alpha = 1$  for complete synchronization.

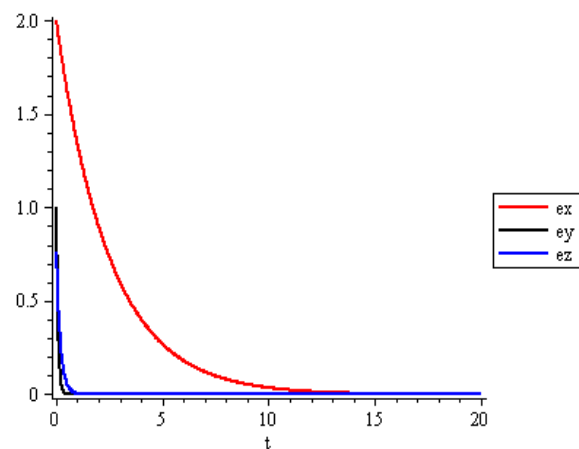


Figure 6: The trajectories of  $e_x, e_y$  and  $e_z$  of two identical four- scroll attractor with scaling factor  $\alpha = -1$  for anti synchronization.

### 3. The application in secure communication

In this section, we will apply the adaptive scheme derived above to secure communication using the Four-scroll attractor. Assume that  $m(t)$  is the message signal, adding it to the right hand side of the second equation for the transmitter (drive system), then we have

$$\begin{aligned} \dot{x}_1 &= ax_1 - y_1z_1 \\ \dot{y}_1 &= -by_1 + x_1z_1 + m(t) \\ \dot{z}_1 &= -cz_1 + x_1y_1 \end{aligned} \tag{9}$$

Select the output  $y(t)$  of the system (9) as the transmitted signal, then construct the receiver as follows:

$$\begin{aligned} \dot{x}_2 &= ax_2 - y_2z_2 \\ \dot{y}_2 &= -by_2 + x_2z_2 + p(t) + u_1 \\ \dot{z}_2 &= -cz_2 + x_2y_2 + u_2 \\ \dot{p} &= -k(y_2 - \alpha y_1) \end{aligned} \tag{10}$$

where  $k$  is a positive parameter.

Let

$$e_1 = y_2 - \alpha y_1, e_2 = z_2 - \alpha z_1 \text{ and } e_3 = p - \alpha m$$

Then the error system can be described by

$$\begin{aligned} \dot{e}_1 &= -be_1 + x_1e_2 + e_3 + u_1 \\ \dot{e}_2 &= -ce_2 + x_1e_1 + u_2 \\ \dot{e}_3 &= -ke_1 - \alpha \frac{dm}{dt} \end{aligned} \tag{11}$$

Referring to the original methods of active control, so we choose the three control functions  $u_i, (i = 1, 2)$  as follows:

$$u_1 = -x_1e_2 \text{ and } u_2 = -x_1e_1 \tag{12}$$

then the error dynamical system (11) is described by

$$\begin{aligned} \dot{e}_1 &= -be_1 + e_3 \\ \dot{e}_2 &= -ce_2 \\ \dot{e}_3 &= -ke_1 - \alpha \frac{dm}{dt} \end{aligned} \tag{13}$$

Then we take the Lyapunov function :

$$V(e) = \frac{1}{2}(ke_1^2 + e_2^2 + e_3^2) \tag{14}$$

It is clear that the Lyapunov function  $V(e)$  is a positive definite function. Now, taking the time derivative of equation (14), then we get

$$\begin{aligned} \frac{dV(e)}{dt} &= ke_1\dot{e}_1 + e_2\dot{e}_2 + e_3\dot{e}_3 \\ &= -ke_1^2 + ke_1e_3 - ce_2^2 - ke_1e_3 - \alpha \frac{dm}{dt}e_1 \\ &= -ke_1^2 - ce_2^2 - \alpha \frac{dm}{dt}e_1 \end{aligned}$$

Since the eigen-frequency of the message signal  $m(t)$  is much less than the oscillating frequency of the chaotic system in practice  $\alpha \frac{dm}{dt} \approx 0$ . It is easy

to have  $\frac{dV(e)}{dt} < 0$ . This can derive

$e_3 = p - \alpha m \rightarrow 0$  as  $t \rightarrow \infty$ , that is  $\frac{p(t)}{\alpha}$  can recover the message signal  $m(t)$ .

Taking  $m(t) = 0.1 \sin(0.1t), k = 100$ , initial values

$$\begin{aligned} x_1(0) &= 0.23, y_1(0) = 0.1, z_1(0) = 0.32, \\ y_2(0) &= 0.9, z_2(0) = 0.4 \text{ and } p(0) = 6. \end{aligned}$$

Figures 7(a, b) show shows that the trajectory of  $e_3$  of the error system with scaling factor  $\alpha = 0.3$  and  $\alpha = -0.4$ , respectively.

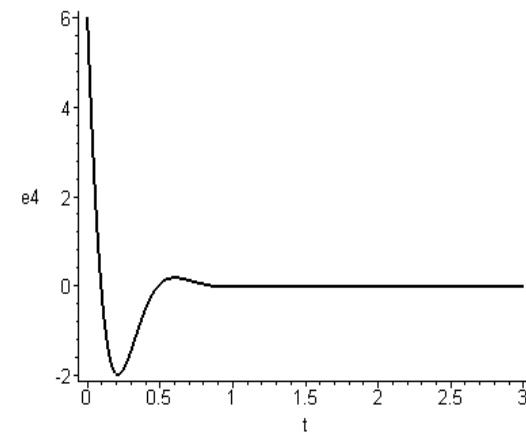


Fig. 7 (a): display the trajectory of  $e_3$  of the error system with scaling factor  $\alpha = 0.3$ .

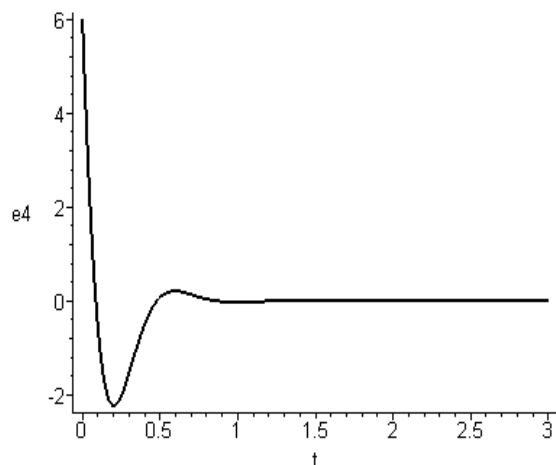


Fig. 7 (b): display the trajectory of  $e_3$  of the error system with scaling factor  $\alpha = -0.4$ .

#### 4. Conclusion

In this paper, an active control method is proposed for manipulating generalized projective synchronization in a general class of chaotic systems. This method is effective and convenient to generalized projective synchronize two identical systems and two different chaotic systems. Also we have proposed a scheme for a practical implementation of secure communication based on a active control method. Numerical simulations are also given to validate the proposed synchronization approach.

#### Acknowledgements:

This project was funded by the Deanship of Scientific Research (DSR), King Abdulaziz University, Jeddah, under grant no. 341/130/1432. The authors, therefore, acknowledge with thanks DSR technical and financial support. The authors would like to thank the editor and the anonymous reviewers for their constructive comments and suggestions to improve the quality of the paper.

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9/6/2012

## Semi- Settled Pastoralists' Sources of Information and Utilisation of HIV/AIDS Prevention Techniques in South West Nigeria

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**Abstract:** This paper examined Semi- Settled Pastoralists' Sources of Information and Utilisation of HIV/AIDS Prevention Techniques in South West Nigeria. This was predicated on the fact that There is need to ascertain whether the semi-settled pastoralists -who because of the nature of their occupation live in the remote part of the rural – are adequately informed about HIV/AIDS prevention techniques and the extent to which they utilise the HIV/AIDS prevention techniques. The derived savannah areas of Oyo and Ogun states of Nigeria were selected for the study due to high concentration of semi-settled pastoralists who are distributed within 5 and 10 Local Governments Areas (LGAs) in Ogun and Oyo States respectively. Fifty percent of the LGAs were randomly selected from each state. Ninety-four semi-settled pastoralists' households were randomly selected from 1,174 in Ogun State, while 236 households were selected from 2,942 in Oyo State. An adult respondent was selected in each of the households to give a total of 330 respondents for the study. Structured interview schedule was used to collect data relating personal characteristics, sources of HIV information and utilisation of HIV/AIDS prevention techniques. The result shows that 94.7% and 74.2% of the respondents in Ogun State and Oyo State respectively made up the 80.0% of the respondents across the state that received information on HIV/AIDS prevention techniques through radio. Other sources of information used by the respondents to access information on HIV/AIDS prevention techniques are mosque (29.4%) and friends (27.0%). There is poor accessibility by respondents to information on HIV/AIDS prevention techniques from television (1.5%), billboard (1.2%) and public lecture (0.6%). It shows further that out of the 8 sources of information used by semi-settled pastoralists to obtain information on HIV/AIDS prevention techniques, 5 were significantly related to utilisation of HIV/AIDS prevention techniques. These were mosque ( $\chi^2 = 4.87, p < 0.05$ ), friends ( $\chi^2 = 4.47, p < 0.05$ ), customers ( $\chi^2 = 7.07, p < 0.05$ ), television ( $\chi^2 = 6.09, p < 0.05$ ) and market ( $\chi^2 = 9.85, p < 0.05$ ).

[Oladele O.T, Olujide, M.G, Oladele O.I. **Semi- Settled Pastoralists' Sources of Information and Utilisation of HIV/AIDS Prevention Techniques in South West Nigeria.** *Life Sci J* 2012;9(3):2484-2487] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 359

**Keywords:** Pastoralists Information Sources, HIV/AIDS Prevention Techniques, Nigeria

### Introduction

In Nigeria, an estimated 3.6 percent of the population are living with HIV and AIDS. Although HIV prevalence is much lower in Nigeria than in other African countries such as South Africa and Zambia, the size of Nigeria's population (around 162.5 million) means that by the end of 2009, there were an estimated 3.3 million people living with HIV. (UNAIDS 2008) Approximately 220,000 people died from AIDS in Nigeria in 2009. With AIDS claiming so many lives, Nigeria's life expectancy has declined significantly. In 1991 the average life expectancy was 54 years for women and 53 years for men. In 2010 the overall life expectancy had fallen to around 52 years (UNDP (2011)). The rapid spread of HIV across communities, counties and continents is a testimony of the linkage between population movement and the growing HIV/AIDS epidemic.

Migration has been identified as one of the risk factors for the acquisition of HIV infection in

wide range of setting (IOM 2003). Previous studies have also identified that mobile group of population (e.g. truck drivers, traders, militaries. etc) were the first to be highly infected by HIV during the early epidemic. In many countries the variation in HIV infection with in regions is also due to high seasonal and long-term mobility. The semi-settled pastoralists who are the major provider of national animal protein source to man are also characterized by short and long migration and movement depending on the availability of the pasture and water for their herds; health status of the animals and presence of conflict in a particular place (Oladele, 2004). Higher rates of infection can also be found along transport routes in border regions. A study conducted in Senegal by Pison (1993) shows that seasonal rural population mobility is a major contributor to the HIV/AIDS epidemic as it increases the number of sexual partnerships as well as contact with high risk sexual groups such as sex workers. In this case loneliness and insecurity, freedom from social norms provide an

impetus to risky sexual behaviour. Migration is a two-way process, different studies indicated that migration and mobility increases susceptibility to HIV infection not only for those who are mobile but also has an implication on the propagation of HIV between communities as mobile population with increased HIV risks up on return from migration may transmit to lower risk groups in areas of origin as well as destination (Boerma et al., 2002 and Talile Asres Gebremariam 2008). Due to factors such as emotional or financial support a partners left behind may also engage in high -risk behavior (IOM, 1998). Rural sending communities can perceive rural –urban migrants to be disease carriers and such migrants are frequently identified as bridging populations for HIV transmission between rural and urban areas. In Ogun state the HIV prevalence rate is higher in rural areas than that of urban area (Odebode, 2007) and this is the area where the population of the semi-settled pastoralists is highest due to abundance of pasture compared with the urban areas.

One of the most important elements of the fight against AIDS is the prevention of new HIV infections. HIV prevention campaigns that have been successful within African countries need to be highlighted and repeated (AVERT, 2007). Ilo and Adeyemi (2010) in their own opinion submit that information is the most potent weapon available for the prevention and cure of HIV & AIDS. As Nigeria is such a large and diverse country, media campaigns to raise awareness of HIV are a practical way of reaching many people in different regions. Radio campaigns like the one created by the Society for Family Health are thought to have been successful in increasing knowledge and changing behaviour. "Future Dreams", was a radio serial broadcast in 2001 in nine languages on 42 radio channels. It focused on encouraging consistent condom use, increasing knowledge and increasing skills for condom negotiation in single men and women aged between 18 and 34. In 2005, a campaign was launched in Nigeria in a bid to raise more public awareness of HIV/AIDS. This campaign took advantage of the recent increase in owners of mobile phones and sent text messages with information about HIV/AIDS to 9 million people.

Nwafor-Orizu (2003) while describing sources of information dissemination in the rural areas in Nigeria, avers that, oral sources like face-to-face interaction, radio, television, traditional institutions, associations, and written sources like newspapers and magazines aims to facilitate rural information transfer as a way of eliminating ignorance and superstition. The present information and education campaign to forestall the spread of the disease should be pursued with vigor but some energy has to be dissipated to the

care of people already afflicted. (Akanmu and Akinsete 2006.) Mooko and Aina (2007) opine that every individual, whether literate or illiterate, needs information for a variety of issues essential for his or her survival. It is therefore, not surprising that information is needed for awareness, increase productivity, health and so on. There is need to ascertain whether the semi-settled pastoralists -who because of the nature of their occupation live in the remote part of the rural – are adequately informed about HIV/AIDS prevention techniques and the extent to which they utilise the HIV/AIDS prevention techniques. The general objective of this study is to ascertain the semi-settled pastoralists' sources of information and utilisation of HIV/AIDS prevention techniques in south west Nigeria.

#### **Materials and Methods**

The study area is south west Nigeria The western zone lies between latitude 5<sup>0</sup> N and 9<sup>0</sup> N with an area of 114, 271 square kilometres with a population of about sixty million (Nigeria Population Census Reports 2006). . There are six states in the southwest, they are; Ekiti, Lagos, Ogun, Ondo, Osun and Oyo. These states share homogenous culture and tradition. The inhabitants of this region are direct descendants of Oduduwa-the progenitor of Yoruba race. It has heterogeneous population of Yoruba, Tiv, Agatu, Ibo, Hausa and Fulani (Igbinosa, 1994). The main occupation of majority of the indigenes in the area are farming and trading. The abundance of savanna region especially in Oyo and Ogun states of southwest favours the rearing of ruminant animals in the area. Pastoralism is practiced majorly by the Fulanis and Hausas. The semi-settled pastoralists in the south west Nigeria are the population of the study. The derived savannah areas of Oyo and Ogun states of Nigeria were selected for the study due to high concentration of semi-settled pastoralists who are distributed within 5 and 10 Local Governments Areas (LGAs) in Ogun and Oyo States respectively. Fifty percent of the LGAs were randomly selected from each state. Ninety-four semi-settled pastoralists' households were randomly selected from 1,174 in Ogun State, while 236 households were selected from 2,942 in Oyo State. An adult respondent was selected in each of the households to give a total of 330 respondents for the study. Structured interview schedule was used to collect data relating personal characteristics, sources of HIV information and utilisation of HIV/AIDS prevention techniques. On source of information on HIV/AIDS prevention techniques respondents were asked to indicate the source(s) of information available to them on HIV/AIDS prevention techniques. Respondents were asked to indicate which of the HIV/AIDS prevention techniques they make use. Scoring: Utilised = 1; Not

Utilised = 0. Data were analysed using descriptive statistics and Chi-square at  $p=0.05$ .

### Results

Table 1 presents respondents' sources of information on HIV/AIDS prevention techniques;

Table 2 shows respondents categories based on Utilisation of HIV/AIDS prevention techniques while Table 3 shows the Chi-Square analysis showing relationships between sources of information and utilisation of HIV/AIDS prevention technique.

Table 1 Respondents' sources of information on HIV/AIDS prevention techniques

Sources of information	Ogun State	Oyo State	Across the States
Radio	89 (94.7)*	175 (74.2)	264 (80.0)
Mosque	34 (36.2)	63 (26.7)	97 (29.4)
Friends	49 (52.1)	40 (16.9)	89 (27.0)
Customers	00 (00)	25 (10.6)	25 (7.6)
Cattle market	15 (16.0)	26 (11.0)	41 (12.4)
Television	00 (00)	5 (2.1)	5 (1.5)
Bill board	00 (00)	4 (1.7)	4 (1.2)
Lecture	00 (00)	2 (0.8)	2 (0.6)

\*Figures in parentheses are percentage

Table 2 Respondents categories based on Utilisation of HIV/AIDS prevention techniques

Categories	Ogun State	Oyo State	Across the states
Low utilisation (2.0 - 7.5)	12 (12.8)	138 (58.5)	150 (44.5)
High utilisation (7.6 – 11.0)	82(87.2)	98(41.5)	180(55.5)
Mean score	9.2	7.0	7.6

Source: Field survey, 2010

Table 3 Chi-Square analysis showing relationships between sources of information and utilisation of HIV/AIDS prevention techniques

Variables	Ogun state		Oyo state		Across states		Remarks	Contingency Coefficient
	$\chi^2$	P	$\chi^2$	p	$\chi^2$	P		
Sources of information								
Mosque	6.12	0.002	5.52	0.001	4.87	0.030	S	0.12
Friends	7.22	0.001	6.720	0.050	4.47	0.020	S	0.12
Customers	9.55	0.010	8.520	0.010	7.07	0.040	S	0.15
Radio	2.03	0.740	1.98	0.590	2.71	0.450	NS	0.02
Television	8.62	0.020	7.44	0.010	6.09	0.030	S	0.14
Market	8.76	0.030	8.95	0.020	9.85	0.020	S	0.17
Bill Board	1.99	0.550	2.32	0.470	3.22	0.520	NS	0.10
Lecture	1.56	0.690	1.19	0.990	1.79	0.660	NS	0.09

### Discussion

Table 1 shows that 94.7% and 74.2% of the respondents in Ogun State and Oyo State respectively made up the 80.0% of the respondents across the state that received information on HIV/AIDS prevention techniques through radio. This agrees with Adelere, Olujide and Popoola (2006) that radio is the major source of information to rural dwellers on HIV/AIDS while Ndakotsu (2001) observes that radio, is a powerful facilitator of educating rural dwellers This corroborates George (1990) that, worldwide, radio reaches larger audience of individuals of less education and lower socio-economic status. Olowu and Igodan (1989); Mohammed and Wanaso (1992) specifically gave credence to radio as a major source

of information to farmers among various types of mass media in Nigeria. Other sources of information used by the respondents to access information on HIV/AIDS prevention techniques are mosque (29.4%) and friends (27.0%). The poor accessibility of respondents to information on HIV/AIDS prevention techniques from television (1.5%), billboard (1.2%) and public lecture (0.6%) justify the assertion of Francis (2000) that Nigeria's mass media do not serve rural areas. Table 2 presents the categorisation of respondents based on level of utilisation of HIV/AIDS prevention techniques. The table shows that majority respondents in Ogun state (87.2%) had higher utilisation HIV/AIDS prevention techniques than those in Oyo state (41.5%). However,

across the states 55.5% of the respondents had high utilisation of HIV/AIDS prevention techniques, while 44.5% of the respondents had low utilisation. The mean utilisation score was 9.2, 7.0 and 7.6 in Ogun State, Oyo state and across the states respectively.

Table 3 shows that out of the 8 sources of information used by semi-settled pastoralists to obtain information on HIV/AIDS prevention techniques, 5 were significantly related to utilisation of HIV/AIDS prevention techniques. These were mosque ( $\chi^2 = 4.87$ ,  $p < 0.05$ ), friends ( $\chi^2 = 4.47$ ,  $p < 0.05$ ), customers ( $\chi^2 = 7.07$ ,  $p < 0.05$ ), television ( $\chi^2 = 6.09$ ,  $p < 0.05$ ) and market ( $\chi^2 = 9.85$ ,  $p < 0.05$ ). The significance of the sources of information stresses the fact that person to person information sources seem to be more credible among semi-settled pastoralists than the mass media. The mosque seems to be the most trusted means of information among semi-settled pastoralists. The experience and evidential messages that accompany mosque, friends, and customers might be responsible for the trend observed in this result. The ability to back up audio with visual could be associated with the significance of the television as a source of information. The majority of semi-settled pastoralists being illiterate will be able to observe and learn the demonstration on the use of any of the HIV/AIDS prevention techniques through visuals. This will help to overcome the constraints of technicality that had earlier being reported as a major constraint to the use of HIV/AIDS prevention techniques in this study. The display and drama in market places on HIV/AIDS prevention techniques could be associated with the significance of this information source. This affords the semi-settled pastoralists the opportunity to see and learn the practical implementation of some of the HIV/AIDS prevention techniques. Although radio was the most popular source of information among semi-settled pastoralists, it has no significant relationship with the utilisation of HIV/AIDS prevention techniques. This may be connected with the fact that in the study area, the prominent languages of presentation on radio are Yoruba and English languages of which semi-settled pastoralists' level of understanding and comprehension are limited. The popular radio programmes on HIV/AIDS prevention such as; *abule olokemerin*, *omonla*, *etiemelo*, jingles on radio and newspapers,

that are on-going then, were not presented in Fulfulde which is the best language understood by semi-settled pastoralists (Adelore, Olujide and Popoola (2006). The contingency coefficient of mosque (0.12); friends (0.12); customers (0.15); radio (0.02); television (0.14); market (0.17); bill board (0.10); and lectures (0.09) revealed a weak relationship between them and the utilisation of HIV/AIDS prevention techniques.

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9/5/2012



## Factors Influencing Households' Access to Portable Water in Rural Nigeria

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**Abstract:** Inability to access safe drinking water is one of the strongest indicators of underdevelopment because it is basic need of man. In Nigeria, compared to pre-independence era, access to safe water has drastically declined, despite the country's assent to the Millennium Development Goals (MDGs). This study analysed the factors that influence access of rural people to safe water using the Demographic and Health Survey (DHS) data of 2008. The data were analysed with descriptive and Probit regression methods. Results show that ignoring distance, about 57.30 percent of the households obtained their drinking water from sources that are unimproved, while 57.40 percent obtained non-drinking water from unimproved sources. About 27.7 percent and 27.8 percent obtained drinking and non-drinking water respectively from flowing or stagnant water sources such as rivers, dams, lakes, streams. About 20.50 percent had the water in premises of their houses while 39.26 percent would have to trek less than 20 minutes to the water sources. Also, only 13.9 percent were treating water before use. Probit model results show that North East zone (-ve), North West (+ve) South East (-ve), South South (-ve), distance from main source (-ve), sex (-ve) among other were statistical significantly ( $p < 0.10$ ) influencing access to safe water. It was recommended that efforts to resuscitate water supply in the rural areas should be put in place while creation of awareness on the need for water treatment is important.

[Oyekale, A.S; Ogunsanya, O.A. **Factors Influencing Households' Access to Portable Water in Rural Nigeria** *Life Sci J* 2012;9(3):2488-2494] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 360

Keywords: safe drinking water, water supply, rural, Nigeria

### Introduction

Water is life. This phrase aptly describes the important role that water plays in human development and survival. After air, the next important and essential need of human is water. The relevance of water to humans and their environment is definitely unlimited, and the environment is central to the survival of any human society. Gbadegesin *et al* (2007) made reference to water as a precious natural resource that is vital for life, development and the environment. It can be a matter of life and death, depending on how it occurs and how it is managed. When it is too much or too little, it can bring destruction, misery or death. Irrespective of how it occurs, if properly managed, it can really be an instrument for economic survival and growth.

Therefore, the usefulness of water cannot be over-emphasized. It can be an instrument for poverty alleviation, lifting people out of the degradation of having to live without access to safe water and sanitation, while at the same time bringing prosperity to all. However, when it is inadequate in either quantity or quality, it can be a limiting factor in poverty alleviation and economic recovery, resulting in poor health and low productivity, food insecurity and constrained economic development. Progress towards reducing inequality in access to safe water has gone far globally, considering the fact that this has been a major

target of the Millennium Development Goals (MDG) which seeks to half the proportion of those without access to safe water and basic sanitation by the year 2015.

Water is not distributed evenly over the globe. Fewer than 10 countries possess 60 percent of the world's available fresh water supply. Less than 3 percent of the world's water is fresh; the rest is seawater and not fit for drinking. Of the 3 percent that is fresh water, 2.5 percent is frozen, locked up in Antarctica, the Arctic and glaciers, and not available to man. Thus humanity must rely on the remaining 0.5 percent for all of man's water needs. It has become a cause for concern that many rural areas lack access to clean, safe water and basic sanitation services. Many times over, the rural areas have fallen outside the jurisdiction of development programs relating to water and sanitation. An important factor responsible for this is that such people without access to clean, safe water and sanitation are difficult to reach due to remoteness of their living conditions (Anand, 2006; UNDP, 2006).

It was reported that more than 1.2 billion of people living in river basins live in conditions of water scarcity and another 1.6 billion people live in areas of economic water scarcity, where human, institutional and financial capital limits access to water (WHO/UNICEF 2006). These are conditions that are prevalent in Southern Asia and sub-Saharan Africa.

Symptoms include lack of or underdeveloped water infrastructure, high vulnerability to short- and long-term drought, and difficult access to reliable water supplies especially for rural people.

Olorunsogo (2006) reports that Nigeria ranks amongst the countries with the lowest level of portable water supply in the world despite being signatory to the International Water Decade (1981-1990). It is to this end that there is a general agreement that the utility services in Nigeria of which water supply is an example, is failing to provide and develop the services, and the infrastructure required for social and political development. Water supply systems have therefore become unreliable and underdeveloped.

In response to the limitations of water supply, 44 percent of households in Nigeria have their own private boreholes and many rely on water vendors whose high prices amount to more than 30 percent of households' income for the poorest (Hall, 2006). As a result, a large proportion of poor households resort to drawing water from unhygienic sources. Rural status of supply is characterized by low level coverage which might be as a result of low political commitment, lack of maintenance culture for existing facilities and sometimes poor workmanship and prevailing corruption by the contractors and government workers.

In a research conducted on water and electricity in Nigeria, Hall (2006) was of the opinion that between 60 percent and 70 percent of the population is currently without either water or waste water services. It was found that in the rural areas, about 49 percent of the population have access to safe water. Areas where low coverage of water supply is felt especially in the rural areas is in terms of community health and productivity as majority of rural people resort to unhygienic sources of water for drinking and other domestic uses. As a result of lack of access to safe water, people suffer from water-borne diseases such as typhoid, cholera, and dysentery etc., leading to the observed mortality rates in the rural areas.

Favourable advances in many fields have been made in the global community but the basic needs of man; which are clean water and basic sanitation continues to be a mirage. Safe drinking water, sanitation and good hygiene are fundamental to health, survival, growth and development. However, these basic necessities are still a luxury for the world's poor. Safe drinking water and basic sanitation are so obviously essential that it becomes a risk if taken for granted. For many in the rural areas, access to clean, safe water and basic sanitation remain a luxury. Lack of safe and improved water supply and basic sanitation had in more than one way inhibits the productivity of the rural people who are mostly farmers. These are people charged with the "most important" work of

providing food for the global population. In addition, the learning abilities of millions of school-aged children who are infested with intestinal worms transmitted due to inadequate sanitation facilities leading to the prevalence of water-borne diseases and poor hygiene is seriously affected.

Water coverage in rural areas in virtually the entire developing world remains unacceptably low. Urban drinking water coverage remained the same from 1990 to 2004 at ninety five percent, whereas, in rural areas, coverage increased to seventy three percent in 2004 from sixty four percent in 1990. This is still low considering the fact that in 27 developing countries, less than fifty percent of the rural population has access to improved drinking water. Rural areas still lag far behind urban areas in terms of drinking water coverage and in terms of drinking water supply from improved sources, so efforts and investments need to be intensified to decrease the back log of rural people who remain without access to safe water and reduce the huge health risks brought about by the absence of improved drinking water infrastructure in rural areas.

The regions representing the lowest coverage of sanitation has as an example of sub-Saharan Africa, where many are obliged to defecate in the open or use unsanitary facilities, with a serious risk of exposure to sanitation related diseases. If the MDG water and sanitation target is to be achieved, innovative approaches need to be developed for efficient service delivery. While believing that human welfare and general economic development depends on the use of water and that water resources management and utilization is crucial to the nation's efforts to reduce poverty, grow the economy, ensure food security and maintain the ecological systems, Gbadegesin *et al* (2007) earlier cited, said that the issue of water resources management in the country focuses mainly on water supply and it receives only minimal attention by government. This approach may be attributed partly to the disjointed sectoral approach to development planning in the country and the idea that water is a public good.

The objective of this paper is to examine the factors influencing access to safe water by rural dwellers in Nigeria. This is vital because the former Secretary-General of the United Nations, Mr. Kofi Annan, in March 2005, in a bid to emphasize the urgency and immediacy that access to safe water deserves, said that "We shall not finally defeat AIDS, tuberculosis, malaria, or any of the other infectious diseases that plague the developing world until we have also won the battle for safe drinking water, sanitation and basic health care." However, the problem is far from being over in Nigeria, especially in the rural areas. In the remaining parts of the paper,

materials and methods, results and discussions and conclusion and recommendations have been presented.

## Materials and Methods

### Study area

The area of the study is the Federal Republic of Nigeria. The Federal Republic of Nigeria, with an area of 923,769 square kilometres (made up of 909,890 Square kilometres of land area and 13,879 square kilometres of water area), is situated between 3<sup>o</sup> and 14<sup>o</sup> East Longitude and 4<sup>o</sup> and 14<sup>o</sup> North Latitude. The longest distance from East to West is about 767 kilometres, and from North to South 1,605 kilometres. The country is bordered on the west by the Republics of Benin and Niger; on the east by the Republic of Cameroon; on the north by Niger and Chad Republics and on the south by the Gulf of Guinea.

Nigeria is divided into 36 states and stratified into 6 geo-political zones, which are: Southwest, South South, Southeast, North Central, Northwest, and Northeast. The rural-urban distribution of the country is 56 percent and 46 percent respectively. The major occupation of the rural people being agriculture, cultivating food crops such as maize, cassava, millet, among livestock and other crops, just to mention a few.

### Methods of Data Collection

This study made use of survey-based secondary data that were collected by the National Bureau of Statistics (NBS) as the Demographic Health Survey (DHS) 2008. The data consist of a total sample size of 34,070 respondents which includes both urban and rural Nigeria. The rural respondents were purposively selected from the whole data and consist of 23,346 respondents.

### Analytical Approaches

Descriptive statistics such as frequency distribution tables, mean and standard deviation were used to analyse the data. The Probit model or equally known as the Normit model, which is based on the cumulative distribution function, was adopted for the analysis of the factors influencing rural households' accessibility to safe water. The Probit model is a regression model for situations in which the dependent variable is a discrete outcome, such as a "yes" or "no" decision. The Probit model examines the effects of a set of independent variables (Xs) on the probability of success or failure on the dependent variable P(Y). The observed occurrence of a given choice (i.e., success or failure) is taken as an indicator of an underlying, unobservable continuous variable, which may be called "propensity to choose a given alternative." Ordinary Least Squares (OLS) is not appropriate for this because in OLS, the variable that we seek to

explain must have real values and can run from positive infinity to negative infinity. If OLS is inappropriately applied in this situation, the estimates from this 'linear probability model' are inconsistent.

The model is stated as

$$Y_{ij} = \alpha_j + \beta_j \sum_{j=1}^n X_{ij} + e_i$$

The major challenge is how to determine the factors that would influence access to improved water sources. However, Larson *et al.* (2006) hinted that the type of water source used by households in developing countries is related to their socioeconomic status, among other factors. In this study, we have postulated that access to improved water can be influenced by  $X_{ij}$  which comprise of geopolitical zones {North Central zone (yes = 1, 0 otherwise), North East zone (yes = 1, 0 otherwise), North West zone (yes = 1, 0 otherwise), South East zone (yes = 1, 0 otherwise), South South zone (yes = 1, 0 otherwise), time to get to water source (minutes), sex of household head (male =1 0 otherwise), age of household head (years), share toilet with other households (yes = 1, 0 otherwise), location of source of water (in building =1, 0 otherwise), person fetching water, water treatment (yes = 1, 0 otherwise), number of households sharing toilet, member of household died last 12 months, education, marital status (married =1, 0 otherwise), member sick last 12 months (yes = 1, 0 otherwise), suffer from river blindness (yes = 1, 0 otherwise), any drug taken for guinea worm (yes = 1, 0 otherwise), main floor material (improved =1, 0 otherwise), any drug taken for bilharzias (yes = 1, 0 otherwise) and wealth index.

## Results and Discussions

### Sources of drinking and non-drinking water

Table 1 shows the distribution of the sources of drinking water in rural Nigeria. Specifically, for the sources of drinking water, our definition of improved sources is derived from UNICEF (2010) as households' pipe connections, public standpipes, borehole, protected dug wells, protected springs and rainwater, while unimproved sources are unprotected wells, unprotected springs, vendor-provided water, bottled water and tanker truck provided water}. The results reveal that about 57.30 percent of the households obtained their drinking water from sources that are unimproved. Abebaw *et al.*, (2010) found that in Ethiopia, 28.90 percent of rural households had access to improved water sources. Specifically, only 5.30 percent had access to piped water either in the dwellings, yard or in public. Tube well and protected well was used by 33.6 percent, while 22.6 obtained water from unprotected wells. It should also be noted that 27.7 percent of the rural respondents obtained

their drinking water from flowing or stagnant water sources such as rivers, dams, lakes, streams.

Vasquez *et al.* (2009) and Kleemeier (2000) indicated that in many developing countries, improved water supply is no longer functioning properly. Our findings can be buttressed by the assertion of Afripol (2010) that access to improved water sources by Nigerians in the 1960s to early 80s was far better than what obtained in the 1990s and upward. The problem was blamed on inadequate planning to cater for the water needs of the rapidly growing population. With dilapidating water infrastructure, many rural households that often lack the financial means of getting connected to government water services are now abandoned to depend on unclean waters from ponds, rivers and lake.

Table 1: Sources of drinking water

Water sources	Frequency	percent
Piped into dwelling+	200	0.9
Piped to yard/plot+	128	0.5
Public tap/standpipe+	900	3.9
Tube well or borehole+	4,917	21.1
Protected well+	2,918	12.5
Unprotected well	5,279	22.6
Protected spring+	139	0.6
Unprotected spring	1,085	4.6
River/dam/lake/ponds/stream/canal/irrigation channel	6,461	27.7
Rainwater+	776	3.3
Tanker truck	117	0.5
Cart with small tank	160	0.7
Bottled water+	108	0.5
Other sources	152	0.7
Total	23,340	100.0

+ improved water sources

Table 2 shows the distribution of the sources from where rural households obtained non-drinking water. It shows that about 57.6 percent of the households obtained their non-drinking water from sources that are unimproved. About 5.40 percent of the respondents had access to piped water either in the dwellings, yard or in public for non-drinking purpose. Tube well and protected well was used by 33.8 percent, while 22.6 obtained non-drinking water from unprotected wells. It should also be noted that 27.8 percent of the rural respondents obtained their non-drinking water from flowing or stagnant water sources such as rivers, dams, lakes, streams.

Table 2. Source of non drinking water

Water sources	Freq	%
Piped into dwelling+	200	0.9
Piped to yard/plot+	129	0.6
Public tap/standpipe+	903	3.9
Tube well or borehole+	4,944	21.2
Protected well+	2,942	12.6
Unprotected well	5,285	22.6
Protected spring+	141	0.6
Unprotected spring	1,086	4.7
River/dam/lake/ponds/stream/canal/irrigation channel	6,481	27.8
Rainwater+	784	3.4
Tanker truck	119	0.5
Cart with small tank	160	0.7
Other	153	0.7
Total	23,327	99.9

Table 3 shows the distance of water in rural Nigeria. It shows that 20.50 percent of the respondents had the water in premises of their houses. However, 39.26 percent would have to trek less than 20 minutes to the water sources, while 23.59 percent would trek between 20 and 40 minutes.

Table 3: Distribution of time to water sources

Distance	Freq	%
On premises	4,787	20.50
<20	9,165	39.26
20<40	5,507	23.59
40<60	1,286	5.51
60<80	1,468	6.29
>=80	871	3.73
Don't know	136	0.58
No response	126	0.54
Total	23,346	100.00

Table 4 shows the distribution of person fetching water in relation to the distance of the water sources. It shows that sources where adult women fetch water from had the lowest average trekking time of 29.85 minutes. Water sources where adult men fetch water have average trekking distance of 33.28 minutes. Sources that were used by female children under the age of 15 years had average time of 29.99 minutes to trek, while that for male children less 15 years is 30.61 minutes. It is to be noted that adult women and men constitute the highest proportion of household members that were fetching water.

Table 4: Distributions of Household Members Fetching Water in Relation to Time to Water Sources

Person fetching water	Freq	Average time	Std dev
Adult women	6,360	29.85	63.467
Adult men	5,118	33.28	91.961
Female child under 15 years old	918	29.99	77.194
Male child under 15 years old	888	30.61	84.430
Adult woman with child	1,652	31.90	54.066
Others	428	107.29	275.458
Female and male child under 15 years old	748	35.18	97.647
Any household member	2,304	35.82	90.093
Total	18,416	33.79	89.092

Table 5 shows responses of rural people to whether they were treating their water before use or not. It shows that 13.9 percent were treating water before use. The table further shows that 1.8 percent were using chlorine while 0.8 percent were using water filter. Also, 1.1 percent would leave the water to settle while 4.6 percent used alum. Only 2.1 percent were boiling the water while 4.3 percent were straining the water through cloths.

Table 5: Water treatment methods used by rural households

Treatment methods	Freq / %	No	Yes	Don't know	Missing	Total
All methods	Fref	20,046	3,248	21	31	23,315
	%	85.9	13.9	0.1	0.1	99.9
Bleach/Chlorine	Fref	22,869	415	21	41	23,305
	%	98.0	1.8	0.1	0.2	99.8
Water filter	Fref	23,106	178	21	41	23,305
	%	99.0	0.8	0.1	0.2	99.8
Solar disinfection	Fref	23,270	14	21	41	23,305
	%	99.7	0.1	0.1	0.2	99.8
Stand and Settle	Fref	23,038	246	21	41	23,305
	%	98.7	1.1	0.1	0.2	99.8
Alum	Fref	22,213	1,071	21	41	23,305
	%	95.1	4.6	0.1	0.2	99.8
Boil	Fref	22,788	496	21	41	23,305
	%	97.6	2.1	0.1	0.2	99.8
Strain through a cloth	Fref	22,270	1,014	21	41	23,305
	%	95.4	4.3	0.1	0.2	99.8

#### Factors explaining access to portable water

Probit model was estimated for rural households' access to safe water. Drinking water was used as the dependent variable when estimating rural

households' access to safe water. From table 6, out of twenty-two independent variables used, fifteen had coefficients significantly different from zero ( $p < 0.10$ ). A negatively significant relationship ( $p < 0.01$ ) exists between rural households' access to safe water and residence in North East zone. This implies that respondents from North-East have significantly lower probability of having access to portable water. However, the parameter of North West zone dummy variable is with positive sign and statistically significant ( $p < 0.01$ ). This implies that residents from North-West zone have significantly higher probability of accessing portable water. The parameter of South East dummy is with negative sign and statistically significant ( $p < 0.01$ ). This shows that residence in the South East zone significantly reduces the probability of having access to portable water. Also, the parameter of South South zone dummy is with negative sign and statistically significant ( $p < 0.01$ ). This shows that residence in the South South significantly reduces access to portable water.

Table 6: Probit model estimation on rural households' access to safe water

Number of Obs = 23346

Log likelihood = -13139.993

Variables	Coefficients	Z	Coefficient of marginal effect	Z
North Central	.0285181	0.82	.0110036	0.82
North East	-.1148676*	-3.10	.0437332	-3.13
North West	.2506997*	7.15	.0977717	7.10
South east	-.1420482*	-3.78	-.053757	-3.85
South South	-.4316461*	12.39	-.1572697	13.32
Time to get to water source	-.0036093*	10.25	-.0013894	10.26
Sex of household head	-.1538164*	-5.56	-.0598781	-5.51
Age of household head	.0014159**	2.34	.000545	2.34
Share toilet with other H/h	-.092848**	-2.48	-.0354612	-2.50
Location of source of water	.2082464*	7.68	.0813574	7.60
Person Fetching water	.2020412*	8.90	.0785743	8.84
Water treatment	-.4723601*	17.00	-.1699481	18.67
Number of H/h sharing toilet	.0019972	0.34	.0007688	0.34
Member of H/h died last 12 months	.0046062	0.24	.0017731	0.24
Education	-.006617*	-3.22	-.0025472	-3.22
Marital status	-.0004206	-0.02	-.0001619	-0.02
Member sick last 12 months	.0100841	0.15	.0038868	0.15
Suffer from river blindness	-.0956051**	-2.50	-.0363561	-2.54
Any drug taken for guinea worm	.0322961	0.31	.0124829	0.31
Main floor	-.331212*	-	-.1266336	-

material		12.62		12.75
Any drug taken for bilharzias	.0121327	0.16	.0046777	0.16
Wealth index	9.72e-06*	47.83	3.74e-06	47.40
Constant	.485606	9.02	-	-

\*denotes significance at 1 percent, \*\* significance at 5 percent, \*\*\* significance at 10 percent

The relationship between distance from main source to house, average time spent to fetch from water main source to house and average number of trips per person per day to main source has been well emphasized in literature (Franceys, 1993; WHO and UNICEF, 2004). In the results, time to get to water source and rural households' access to safe water has a negatively significant relationship ( $p < 0.01$ ). As the time it takes households to get to water source increases, the accessibility of rural households to safe water declines. The marginal effect analysis revealed that the likelihood of rural households' access to safe water decreases by 0.001 as time to get to water source increases by one minute.

Sex of household head negatively affects rural households' access to safe water. The variable is a dummy. It implies male headed households have significantly lower ( $p < 0.01$ ) access to portable water. This is expected because women are domestically more inclined towards water fetching. Abebaw *et al.* (2010) similarly found that in Ethiopia, female headed household heads have higher probability of having access to improved water sources. One of the reasons adduced was the fact that women and children are directly responsible for fetching water and as heads and decision makers, they may be more inclined to invest in the effort of fetching clean water. Also, it was noted that because women are likely to be more risk-averse than men, there is likelihood of minimizing water-borne diseases by using improved sources of water.

Location of source of water is positively related to rural households' access to safe water and is significant at 1percent. As the location of source of water tends to be in the households' yard or plot, households' accessibility significantly increases. Rural households' access to safe water and person fetching water has a positively significant relationship ( $p < 0.01$ ). Its implication is that as more persons are engaged in the fetching of water for the household, the accessibility of the household to water increases.

Water treatment is negatively related to rural households' access to safe water and significant at 1 percent. Its implication is that as water treatment increases, the accessibility to safe water by rural households in Nigeria decreases. Educational attainment of household head and rural households' access to safe water has a negatively significant relationship ( $p < 0.01$ ). This implies that as educational

attainment of household head increases, the accessibility decrease. Main floor material is significant at 1percent and negatively affects rural households' access to safe water. It implies that an increase in main floor material of households decreases the accessibility of rural households to safe water. There exists a positively significant relationship ( $p < 0.01$ ) between Wealth index and rural households' access to safe water and implies that an increase in the wealth index of the households increases their accessibility to safe water.

Age of household head is significant at 5 percent, positively affects rural households' access to safe water and implies that an increase in the age of household head households increases the households' accessibility to safe water. Its marginal effect analysis shows that an increase of one year in household head's age increases accessibility by 0.0005. There exists a negatively significant relationship ( $p < 0.05$ ) between share toilet with other households and rural households' access to safe water. It implies that an increase in toilet sharing with other households decreases accessibility to safe water of rural households. Suffer from river blindness negatively affects rural households' access to safe water and significant at 5percent. It implies that an increase in members of household suffering from river blindness decreases the households' accessibility to safe water.

## Conclusion

Water is essential for domestic and production activities in rural Nigeria. When households lack access to safe water, several health consequences can result. Inability to access safe drinking water is one of the strongest indicators of underdevelopment because it is basic need of man. In Nigeria, compared to pre-independence era, access to safe water has drastically declined, despite the country's assent to the Millennium Development Goals (MDGs). This study has shown that majority of rural dwellers do not have access to portable water and they were not treating the water before using. Some policy issues can be derived from the findings. There is the need for government to put in place awareness programmes to sensitize rural households on the need to treat their water before using. Government should also reawaken her commitment towards provision of portable water.

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9/5/2012

## Investigation the effect of maternal education on nutritional status of children aged 2 to 5 years in Zanjan, Iran

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**Abstract: Background and Objectives:** child nutrition plays a vital role in the growth and development not only in infancy but also later in life. The mother's education is of great importance and has a strong theoretical and research background in increasing of the status of nutrition children 2-5 years old. The present study was designed to evaluate the effect mother's education package on the state of nutrition children 2-5 years old. **Subject and Methods:** It was an experimental study a total of 81 children 2-5 year's old Zangan city. They were divided into two groups, including experimental and control groups. The experimental group was participated in mother's education of the state of nutrition training course but the control group did not. The data were collected through measuring of weight and height; and questionnaires, which were completed by interviewing children's parents. The nutritional status was evaluated according to the weight-for-age (Gomes), weight-for-height (Waterlow) and height-for-age (Waterlow) methods. The two groups were consequently compared. The T-test was used for the statistical analysis. **Results:** The post-test mean scores with concern to increasing the Mothers information and changing the attitudes and nutrition children 0-2 years old in the experimental group were significantly different from those of the pre-test mean scores. **Conclusion:** To overcome the problems related to growth and development, revision of the current nutritional protocols and educational programs is essential. In addition, involvement of mothers, caregivers, elderly women, and all those involved in child care, in nutrition education activities are recommended.

[Iran Ghasemi, Azam Roshandel, Tayyebeh Samadpour, Vida Sadeghzadeh. **Investigation the effect of maternal education on nutritional status of children aged 2 to 5 years in Zanjan, Iran.** *Life Sci J* 2012;9(3):2495-2500] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 361

**Keywords:** Education, Nutrition, mothers, children 2-5 years old

### Introduction

Natural process of growth and physical development in childhood is very important, because every problem that the child is faced with can affect child's growth and development (1). Furthermore, normal growth (gaining weight, height or the size of different parts of the body) and development (increasing skills in different parts of body in doing natural functions) are related to good nutrition performance; and since child's mother is the main feeder, therefore, the mother has an important role in child's growth and development (1, 2, 3). And also infrastructure of proper child's nutrition that has a direct effect on child's mental and physical growth is the parents' rate of awareness. One of the most important factors in the formation of the society's dietary pattern is a set of food and nutrition habits and cultures of people in that society. These habits are formed at birth which is affiliated to the substrate that the society provides (5). But the set of factors that

makes this substrate has been taken from culture and tradition of each society which is affected by nutritional awareness of the people in the society especially mothers (2, 6). 2-5 years of age is a period that child usually spends in the family and the most impact of nutrition tradition is in these ages and the child's taste is formed (6, 7); and any neglect in this regard causes mental and physical growth failure in children that in the future in addition to diseases and mental and physical damages, imposes high costs of treating and caring the child or young patient to the parents and the society (2, 4). Child's stomach capacity is small and therefore a limited amount of food can be eaten at each meal. On the other hand, child's physical growth is rapid and requires much food. To put it simply, helping food that child can use in each meal should have a lot of nutritional value and contain nutrients needed for growth (3, 8). Sufficient nutrition and use of nutrients meal require mothers' awareness of proper nutrition culture. Unfortunately,



deficiency of mothers' awareness of proper nutrition and change in the pattern of food consumption in recent decades has led to substitute low-value food instead of high-value and proper meals (1, 5). Low consumption of milk and dairy (per capita milk consumption is 480 liters in Netherlands but 80 liters in Iran), lack of adequate energy and protein intake and increase in valueless junk foods make children susceptible to malnutrition (9). Feeding children is often difficult, they are often looking to play and unwilling to eat new foods and generally it seems that they don't eat much and insufficient knowledge of mothers makes it more difficult (1, 7, 8). Obviously, malnutrition due to food poverty and malnutrition resulting from welfare (overeating, bad-eating and their complications) are dramatically affected by nutritional awareness. Consumption problems in Iranian society are not confined to low-income class, but Iranian families with high income aren't also able to select the proper food items that provide their health, and their selection is sometimes problematic as well (4, 8). The main point is to make eating style and culture consistent with health and increase nutritional awareness. In Iran, 800 thousand children under 5 years have moderate and severe stunting (height of Iranian children has been shorter 6 cm due to improper nutrition (9). That is, due to lack of adequate food intake, they are chronically malnourished. Receiving little food at first causes child's weight loss and if this less food lasts, the child gradually comply itself with it. That is, its stature will be small to be able to survive with little food. Even if the children are free from malnutrition, some changes are created in their body composition. The ratio of fat to fatless tissue is increased and causes changes in the metabolism which is associated with obesity. When the child doesn't have enough nutrition in important periods of growth, their body will change to prepare the child for a poor diet throughout their lives (4). On the other hand, one of the most important reasons of parents for referring to doctors is nutritional problems and concerns of parents in their physical and mental growth. Various studies have showed that 70% of patients referred to health systems are due to lack of parental awareness of how children must be fed (4, 8). About the status of malnutrition and micronutrient deficiencies in Iran, national anthropometric survey in 1377 has reported that 11% of children (about 540 thousand children) have it, and 15% of children (about 800 thousand children) have moderate and severe nutritional short stature which demonstrates long-term chronic malnutrition. Losses caused by malnutrition of children have been estimated annually about 5.5 billion dollars which decreases capability and efficiency of the country (9). The last national survey conducted in 1380 indicated that there is anemia and

iron deficiency in a high percentage of population in different age groups, so that about 26% of 6-year old children suffer from iron deficiency. Due to harmful and irreversible consequences of iron deficiency anemia on brain growth and development and IQ reduction, immediate interventions is necessary to reduce the prevalence of the problem (9). Non-social causes and roots go beyond nutrition problem, but researchers have argued that nutrition is a missing key ring in non-social behavior (8). In terms of physical and mental chronic diseases in children under 5 years, analyzing the nutritional status of Iranian society indicates that currently besides malnutrition and food poverty, nutritional transition period is rapidly passing. Warning signs of metabolic diseases expansion are found in large cities after urbanization expansion and lifestyle changes. National health and disease survey in 1378 showed that about 30% of boys and 45% of girls have overweight and obesity, while their parents consider children's overweight as proper growth and are even proud of it (9). Sufficient food and nutrition in childhood as a timely alarm system for predicting emergency situations and timely planning for supporting groups at risk of malnutrition and starvation is very important (15). By ensuring better nutrition for children, parents can prevent their bad behavior in future. Unhealthy nutrition leads to low IQ that later can lead to non-social behavior (4). Willy and Wong believe that health care should not only focused on children's physical and mental health but it must be based on their quality, nutrition and growth. Because the concept of health doesn't mean lack of disease but the most important goal of growth management is to achieve the best quality of growth and development. Therefore, evaluating children's growth from the quality of nutrition is the biggest step that has been taken in recent decades; that is, its basis is parental education (7, 27). The present study was conducted to evaluate the impact of maternal education on the nutritional status of 2-5 years old children in Zanjan.

#### **Methods**

To evaluate the nutritional status of children, three indices of weight for age according to Gomez standard, child's weight to standard weight for height and height for age according to Waterloo standard were used respectively for different degrees of underweight, thinness, and stunting. Tools used in this study include analog scale and non-elastic tape which are standard tools for measuring height and weight. Equivalent reliability was used for measuring reliability. A child demographic questionnaire was completed for each caregiver. For parents who were illiterate or had low education, the questionnaire was completed by the researcher.

The booklet that was provided to the caregiver includes: child's growth and development

and factors affecting it, explaining growth percentile, common problems of children's nutrition, nutritional behavior, properties of some important foods, how keeping and preparing some foods. The manual was extracted from the curriculum of the Ministry of Health, and Willy and Wong's books and was completed under the supervision of nutrition consultant. The study population was mothers with 2-5 years old children and without diagnosed psychiatric problems (which has been stated in their medical record) who were selected by random sampling method.

Sample size was selected considering 90% confidence level and estimating standard deviation of impact of training, based on conducted studies at  $s=1$  value and assuming the least error equals  $d=10\%$ . The minimum sample size was calculated 81 that was divided into two witnessed and control groups. Sampling and data analysis method: in this study, stratified random sampling was performed in 3 regions of 14 districts of Zanjan. After the administrative process and obtaining introduction letter from Zanjan Azad University and presenting it to children's parents and taking their consent for performing the study, the researcher referred to the homes in the desired regions throughout the entire week (to reduce the risk of error) until the completion of sample size and obtaining written consent from the children's parents and ensuring them about keeping the questionnaire data and fidelity in preserving information in case of their approval to participate in the study, they completed the questionnaires at the same location. Time of sample collection was 60 days, 160 days training time and 40 days sample re-collection. Due to the possibility of samples removal because of different reasons such as chronic disease, lack of cooperation, long travel, etc. number of samples in the experimental group was considered more than control group (total number of samples removed during training was 7 persons). Age of children was between 24-month children to 4-year and 12-month children, that NCHS reference curve was use for comparison. Samples were randomly divided into two witnessed and control groups. The witnessed group samples were trained and control group wasn't given any training. Children's weight was measured standing, without shoes and with minimal clothing. Children's height was measured standing without shoes with a non-elastic tape attached to the wall so that hips, shoulders and heels attached to the wall and the child faces straight. Then the witnessed group was trained about children's proper nutrition singly, and booklet and contact number were provided to them; and parents and their child were trained for 160 days through direct contact or by telephone once a week, and their weight and height were measured every month. At the end, the demographic questionnaire was

re-filled by the intervention and control groups that include 2 additional questions about their satisfaction and personal opinions of the research process. Children with congenital disorders and lasted chronic illness weren't participated and parents who weren't able to respond to questions, the questionnaire was completed by the researcher. Children's height and weight at birth was recorded from their growth card. After data collection, data was used by the nutrition consultant to evaluate the nutritional status of children, to the three indices of weight for age according to Gomez standard, child's weight t standard weight for height and height for age according to Waterloo standard respectively for the prevalence, and varying degrees of underweight, thinness and stunting. Then data was divided as follows according to standard growth curve and under the supervision of nutrition consultant, below the third percentile of growth curve=1; between the third and 50<sup>th</sup> percentile of growth curve=2; between the 50<sup>th</sup> and 97<sup>th</sup> percentile of growth curve=3; and above 97<sup>th</sup> percentile of growth curve=4; and also below the third percentile was calculated as growth retardation and above 97<sup>th</sup> percentile as unusual growth. After segmentation, data was analyzed using SPSS version 17 software; and the impact of maternal training on the nutritional status of 2-5 years children was investigated and intervened in Zanjan. At the end, according to a survey, 99% of parents were completely satisfied and wanted to continue their training.

### Findings

At first, the two test groups, control and experimental, were matched in terms of underlying independent variables that their initial difference may affect the final results. Data analysis indicates that in the control group 50% were boys and in the experimental group 50% were boys in terms of child's gender. In terms of mothers' age, the research units in the control group 90.7% and in the experimental group 89.5% were aged 21-39 years. In terms of mothers' educational level, research units in the control group 41.5% and in the experimental group 43.9% had a diploma. In terms of mothers' occupation, research units in the control group 75% and in the experimental group 74.3% were housewives. In terms of economic condition, research units, 78.4% in the control group and 77.4% in the experimental group had moderate economic condition in terms of monthly net income and ownership. In terms of number of people living together, in research units 72.8% in the control group and 72.5% in the experimental group were in 2-5-person families. In terms of wanting the child in research units, 76.3% in the control group and 78.5% in the experimental group were wanted children. In terms of rank in the family in research units, 58.5% in the control group and 62.3% in the experimental group

were the first child in the family. Then the chi-square test between the two control and experimental groups demonstrated that there is no significant difference in terms of research criteria between the control and experimental groups.

In order to prevent from the error, the two control and experimental groups were also matched in terms of research variables (weight and height) and independent statistical t-test indicated that there is no significant difference between the two control and experimental groups.

In table 1, using numerical descriptors (central indices and dispersion indices), research variables such as height and weight were examined in testing groups before the intervention and control. As it has been shown in table 1, the majority of children in the control and experimental groups have scores between 2-3 in terms of research variables; that is, they are between 50<sup>th</sup> and 97<sup>th</sup> percentile of growth curve; and independent t-test also demonstrated that there is no significant difference between the two control and experimental groups in terms of weight and height before intervention.

According to table 2, in the experimental group after intervention, in order to examine the impact of training on variables affecting the nutrition, Mc Nemar non-parametric test was used. According to the results obtained from this study, training was effective on overcoming problems due to nutrition

such as eating, appetite problem, and food hatred, rejecting new foods, bowel problem and soil-eating problem.

Table 3- in relation to research objectives; that is, the impact of mothers' training program on improving children's nutrition, the results obtained from dependent t-test of experimental group indicate that the mean of height and weight had a significant increase after intervention; and also results obtained from dependent t-test of control group indicate that mean of height and weight didn't have significant increase without intervention with 160 days interval.

Table 4- in relation to research objectives; that is, the impact of mothers' training program on improving children's nutrition, the results obtained from independent t-test of experimental and control groups indicate that mean of height and weight had a significant increase after intervention in the experimental group and without intervention with 160 days interval in the control group.

Table 1. Frequency distribution of numerical indices of control and experimental groups

Experimental group	Control group	Numerical indices	
		2/28	2/30
2/31	2/34	Current weight	
2/24	2/25	Height at birth	mean
2/23	2/26	Current height	

Table 2. Comparison of experimental group in responding to nutrition questions before and after intervention

Mc Nemar test	After intervention		Before intervention		Nutrition questions
	percentage	Number	percentage	number	
	<b>12/2</b>	<b>7</b>	<b>29/5</b>	<b>15</b>	<b>Eating problem</b>
	26/5	12	48/6	25	Appetite problem
	12/2	7	26/6	13	Food hatred
	14/3	8	30/5	16	Rejecting new food
	12/3	6	5/17	9	Soil-eating problem
<b>P-value = 0.040 &lt; 0.05</b>					14/3 5 22/8 11 Bowel problem

Table 3. Comparison of descriptive indices of children's height and weight in control and experimental groups

dependent t-test	mean	Control group	dependent t-test	mean	Experimental group	Variable
	2/26	First sampling		2/23	Before intervention	height
P-value=0/131	2/30	Last sampling	P-value=0/000	2/76	After intervention	
P-value=0/185	2/34	First sampling	P-value=0/000	2/31	Before intervention	weight
	2/36	Last sampling		2/78	After intervention	

Table 4. Comparison of descriptive indices of children's height and weight in the two experimental and control groups

Independent t-test	Mean	group	Variable
	2/76	Experimental group	height
P-value=0/00	2/30	Control group	
P-value=0/00	2/78	Experimental group	weight
	2/36	Control group	

## Discussion

The research findings indicated that by increasing mothers' awareness in relation to the child's nutritional needs, the quality of children's nutrition is increased and leads to increase in growth indices such as weight and height and their nutrition problems was minimized as far as possible this study proved to mothers of experimental group that without additional cost and need of medicine, their children can have a better nutrition quality and thus better

growth. Also 92% of parents welcomed the proposed nutrition behavior. National association of child growth and development in the United States (2010) believed that training affects all aspects of life (11). According to the statement by WHO on child's growth standard, training increases quality of children's nutrition (10, 12). Blank wrote in 2003: nutrition education is considered as an important factor for increasing children's growth and continued that the three corners of the triangle affecting child's growth and development are environment, nutrition and genetic and among the three sides, the nutrition issue appears to be more bold because it can be modified and manipulated (13). Results of the present study in comparison with studies conducted in the country such as qualitative study by Akbarian and Diagnat in Booshehr (14), and Rostamnejad and Amani in Ardebil (15) and Ebrahimi (16) indicated that parents' awareness is an effective factor in child's nutrition and breast feeding. Also similar results obtained from Ramos's study that examined factors affecting child's nutrition and breast feeding, parents' training is essential in successful implementation of child's nutrition and breast feeding. Kalantari et al. (1388) conducted a study aimed at investigating the relationship between obesity and overweight of first-grade primary school students in Shiraz and the pattern of breast feeding, weight at birth and socio-economic condition in Shiraz, and have stated their findings as follows: obesity and overweight of first-grade primary school students in Shiraz is related to the pattern of breast feeding and mother's awareness about nutrition; although this relation may not be an independent one (19). In a qualitative study by Saka in Turkey, mothers with low education level often imagine that growth increase or lack of child's increase is only due to genetic; therefore no attempts are done to increase child's growth (22). Based on WHO classification, Iran is among countries with low prevalence in terms of underweight, stunting and thinness. High prevalence of overweight must be taken into consideration seriously and the simultaneous attention to the two head of malnutrition spectrum is essential. One of the Millennium Development Goal in order to eliminate poverty and hunger in the world is to reduce malnutrition in children less than 5 years. Tracking the Millennium Development Goals in various countries requires access to reliable data on the growth status of children at the national level and in the next step is all-round education (12). Results of Salarkia's (1389) studies revealed that parents' awareness is considered an effective key factor in the mental image and child's nutrition quality (18). Results of Esfarjani's (1386) studies demonstrated that parents' training is effective on children's growth

(23). Results of Klasen's (2008) studies showed that children having parents with high awareness have a better growth than children at the same age (24). Results of Franca's studies (2007) indicated that training is one of the most important factors for improving children's nutrition (25). National association of nutrition in the U.S reported that proper nutrition and children's growth improvement depend on various factors that the most prominent one is parents' training (12). Results of Rezazadeh's (1388) studies showed that parents' awareness increase increases nutrition quality and proper nutrition is related to proper growth (26). Results of Saka's (2005) studies indicated that nutrition is an important factor in children's life quality (22). Wong believes that in order to enhance the most important index of children's life that is life's quality, is the urgent need to increase parents' awareness about children's nutrition in order to prevent growth reduction and reduce diseases, etc. (27).

### Conclusion

The results of the present studies indicated that by improving nutrition, children's growth and development are increased. But in order to increase children's growth and prevent complications due to malnutrition either as thinness and stunting or obesity, parent must be trained continuously. The training must be so strong, reasonable and scientific that meets nutritional problem caused by cultural, social, economic, superstition and other interventions in order to achieve this matter, a comprehensive cooperation of media, cultural groups, ministry of Health and government policies is required.

### Acknowledgement:

This article is part of a thesis, Islamic Azad University of Zanjan, contract No: 10017/89, Date: 4 July 2010. Hereby, we sincerely thank to President of the University, Head of College of Science and Medicine, Head of Research, Research Deputy Director of Nursing, in order to provide funding and support to the research participants and all colleagues who have helped me in this project.

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## AGRICULTURAL WASTES AND ACTIVATED CARBON FROM THEM FOR FURFURAL REMOVAL FROM WATER SOLUTIONS

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**Abstract.** In this paper it has been introduced furfural reduction from water solutions as more important substances for chemical synthesis and as solvent extraction in petroleum refineries. This organic compound entering in soil and water system are considered such a serious problem is that all have some acute and long term toxic effects. The results of research in the field of using of activated carbon produced from agricultural wastes, as sorbents and as promising materials for wastewater treatment from furfural. The advantages of activated carbon produced from agricultural wastes in comparison with other sorbents are their low cost, availability of extraction and others. Apricot stones based acid-activated carbon has higher sorptive activity. The sorption activity of this sorbent as well as comparable with the commercial carbon.

[Ghazi Aidan. **AGRICULTURAL WASTES AND ACTIVATED CARBON FROM THEM FOR FURFURAL REMOVAL FROM WATER SOLUTIONS.** *Life Sci J* 2012;9(3):2501-2505] (ISSN:1097-8135).  
<http://www.lifesciencesite.com>.362

**Keywords:** furfural, agricultural waste, fruit stones, activated carbon, reduction, wastewater treatment.

### 1. Introduction

To day water pollution is one of the most important environmental problems in the world. There are many sources of toxic chemicals in the environment, such as industrial pollution and pesticides runoff. However, industrial pollution wastewater is an important point source of water pollution. Most of industrial wastewater contains organics which are difficult or impossible to remove by conventional biological treatment processes, which are used in the most industries in the world [1]. Many technologies have been developed over the years to treat industrial wastewater contain material which are refractive or potentially toxic to biological growth [2].

One of the best methods for wastewater treatment and water purification from organic and inorganic pollutant is an application of suitable adsorbent. Activated carbon (AC) because of its high adsorptive capacity has become one of the most technically important and most widely used adsorbents[3,4]. The increasing demand for sorptive materials as ecological problems simulated the intensive study of agricultural by-products waste precursor, because they are considered to be cheap sorbent and also good source for AC production[5]. AC is obtained from carefully controlled process of dehydration, carbonization and oxidation of organic substances. It can be prepared for research in laboratory from a large number of materials. However, the most commonly used ones in commercial practice are peat, coal, lignite, wood and agricultural by-products such as rice husks, bagass, fruit stones and shell of coconut, almond, etc.[6].

The usage of carbon adsorbents depend on their surface area, pore size distribution and chemical characteristics. The mentioned quality of AC are directly related to the nature of starting material, the type of the production method and the temperature of production[6]. In general, an AC which is used in any of the most common application must have adequate adsorptive capacity, chemical purity, mechanical strength and etc.[7,8].

Depending on the starting material AC may contain some impurities. Therefore, the adsorption characteristics of AC for certain uses are influenced by the ash content. So the raw material should contain as small ash as possible and also the raw material must have relatively low cost. Although agricultural wastes are the major raw materials used, they have very high volatile content and hence give low yields of AC, but they are relatively inexpensive and economical starting materials [8].

Furfural (FF) is an aromatic aldehyde with the chemical formula  $C_4H_3OCHO$ . The main use of furfural is in the form of feed stock for furfural alcohol (FFA) (accounting for 75 % of FF sales), which in turn, is used as input for furan resin, which are used for foundry binders [9]. Guillermo Rodriguez et al., 2008 reported that world market for FF and FFA is around 300,000 tones / year with annual growth of about 2 % per year. It is consumed by the chemical industries as intermediate products such as nylons, lubricants and solvents, adhesive, medicines, and plastics. Major use (perhaps 65 % or more of world consumption) is for urea furan resin synthesis; a binding material in metallurgy, precision casts and dies [10].

Furfural is also used as solvent in petrochemical refining to extract dines and aromatics from other hydrocarbons. 13% of furfural is used as additional processing solvent, generally in petrol chemistry – for butadiene separation from oil cracking gases, for refining of plant oils and lubricating oils. Furfural is also an intermediate in the production of the solvents [10].

In short – term exposure, furfural may cause irritation of the skin, eyes and respiratory tract. It may also cause a person to become unconscious. In long-term exposure, it may cause sensitization of skin, loss of taste, and numbness of tongue, furfural vapor is irritating to the eyes. Its odor threshold is 0.25-0.38 ppm[11]. Furfural acute exposure can also damage the liver and kidneys and to tumors and mutations. The Permissible Exposure Limit (PEL) and the threshold limit value (TLV) for furfural was reported 5.0µg/ml and 2.0µg/ml, respectively ([12 and 13].

Acute toxicity: The oral LD<sub>50</sub> for furfural was reported 127mg/kgbw in rats ([14]and 333 mg/kgbw in mice [15].

Presence of furfural, increase the toxicity of wastewater and makes biological treatment very difficult. Removal of this substance will require modifications or alternatives of the existing systems [16]. This compound if discharge in open rivers, it can destroy the micro flora and has negative effect on human health. In order to eliminate or lowering the concentration of wide range of dissolved pollutants (organic and inorganic) in an effluent, adsorption is widely used as an effective physical method of separation. Activated carbon (AC) is a well known adsorbent that can be used efficiently for removal of broad spectrum of pollutants from air, soil, and liquids. Adsorbents are usually porous solids, and adsorption occurs mainly on the pore walls inside particles. AC is effectively eliminated many pollutants (organic, inorganic and biological) in water and wastewater treatment. [17]. In present paper it has been investigated an adsorptive abilities of activated carbon produced from agricultural wastes in relation to furfural pollutants. The major way to diminish the discharge of furfural dissolved in water is stronger purification. The objective of the present study is to describe, experimentally, the potential of activated carbon produced from agricultural waste to adsorb organic pollutants using furfural as model component.

## MATERIALS AND METHODS

The abundance and availability of agricultural waste as apricot, peach stones and based on them activated carbon; make them good candidates as precursors for activated carbons. It has been exist rare literature on the use of agricultural waste and base on

them activated carbon for furfural adsorption from water and wastewater treatment processes.

The sample used in this study consisted of:

- (A) Two experimental carbons, namely
1. Peach stones based activated carbon
  2. Apricot stones based activated carbon
- (B) One commercial activated carbon, namely Carbonsorb-AB

This carbon was selected as control for this experiment as they have found to poss the desirable physical and chemical characteristics and was extensively used in municipal wastewater treatment facilities.

A process for treating wastewater realized through the use of powdered activated carbon, which is can be responsible;

1. for physically removing of colloidal and suspended volatile solids through adsorption;
2. for adsorbing of organic substances and elements that interfere with biological processes, thus serving to reduce their contact with and exposure to activated sludge organisms effecting wastewater treatment functions;
3. for providing fixed surface in activated sludge wastewater treatment bioreactors for bacteria and other organisms.

## Bulk density

Bulk density is an important criterion for consideration in the designing of adsorption towers for use in pilot plant studies as well as large commercial applications. For activated carbon, for instance, the adsorption rate is influenced by carbon particle size, which again depends on the bulk density of the granular activated carbon. During municipal wastewater treatment the residence time of the wastewater in the column containing granular activated carbon is affected by the bulk density(  $\rho$  ) as shown by the equation:

$$R_s = \frac{\rho A V r}{7.48 T}$$

Where,  $R_s$  – carbon usage rate (lb/ft<sup>2</sup>min)

$\rho$  - Bulk density of the GAC (lb/ft<sup>3</sup>)

A – Adsorber cross-section area (lb/ft<sup>2</sup>)

V – Linear flow rate (gallons/min/ft)

r – Residence time (min), and

T- Processing time (perrich, 1981)

Attrition or hardness measures the mechanical strength and determines activated carbon and agricultural by-products ability to withstand normal handling operations.

### Measurement of physical properties of sorbents total surface area (m<sup>2</sup>/g)

The total surface area of the activated carbons was determined by the method pendyal [3], using Micromeritics Gemini 2375 surface area analyzer.

The total surface area was measured by nitrogen adsorption at 77<sup>0</sup>K using 15 point BET.

Determination of Bulk Density (g/m<sup>3</sup>)

$$\text{Bulk density (g/cm}^3\text{)} = \frac{\text{weight of dry sample (g)}}{\text{Volume of packed dry sample (cm}^3\text{)}}$$

### Determination of Attrition/ Hardness (%)

The attrition of the samples was measured using wet attrition method described [3]. One gram of granular activated carbon of 10-30 mesh was added to 100 ml of acetate buffer (0.07 M sodium acetate and 0.03 M acetic acid, pH 4.8) in a 150 ml

For agricultural by-products and activated carbon from them bulk density was measured using the method[3], which consisted of placing a known weight of granular activated carbon of 10-30 mesh size carbon in a 25 ml cylinder to a specified volume and tapping the cylinder fo at least 1-2 min and measuring the volume of carbon. The bulk density was measured as:

beaker. The solution was stirred at 500 rpm for 24 h, with a ½ inch stir bar for agitation. The solution was then filtered through 50-mesh screen and the retained carbon was thoroughly washed and dried at 90<sup>0</sup>c under vacuum for 4 h and weighed. The % attrition was measured as:

$$\text{Attrition (\%)} = \frac{\text{Initial weight(g)} - \text{Final weight(g)}}{\text{Initial weight(g)}} * 100$$

### 3.11. Determination of ash content

Ash content (% ash) was determined by the method of Ahmedna et al. (1997). Approximately 2 g of powdered activated carbon was placed into weighed ceramic crucibles. Carbon and crucibles were dried overnight at 80<sup>0</sup>C and reweighed to obtain the dry carbon weight.

The samples were heated in a muffle furnace at 575<sup>0</sup> C for 12 hours or overnight. The crucibles were cooled in a desiccator, and remaining solids (ash) were weighed. Percent ash was calculated by:

$$\% \text{ ash} = [\text{remaining solids wt (g)} / \text{original carbon wt (g)}] \times 100$$

### Result and Discussion

**Adsorption of furfural from water solutions: The furfural measurements were carried out in concentration 0.01 M.** One gram of sorbent added on 100 ml solutions of furfural in water. The mix was carefully shaken up within 4 hours. The measurements of molar refraction of a solution were carried out before and after sorption, on a difference of concentration of adsorbed furfural. Furfural concentration was measured using UV adsorption-spectrum at 270 nm (Shimadzu). Residual quantities of furfural were determined by liquid chromatography and UV spectrum also. It is necessary to note that partial sorption of water /1-2 ml from 10 ml of solution takes place for 4 hours sorption of a solution on sorbents. The results are similarly, apricot stones based acid-activated carbon has higher sportive activity. It also followed expect, as this sorbent has higher physical indicators. The sorption activity of mentioned sorbent as well as comparable with the commercial carbon – Carbonsrb-AB. The results are given in the Table 1.

### Properties of peach and apricot stones

The both of them were obtained from the garden in Ararat valley. Elemental analysis of stones and activated carbon from them were determined using an “Elemental analyzer”, physical properties and chemical composition of the using materials is given in Table 2. Activated carbon can contain some impurities depending on the type of using stones. In this case it should be clean before the using, it make here. Also, the row materials and the activated carbon should contain as small ash as possible. Adsorption by activated carbon produced from agricultural wastes is preferred, because of its have low sensitivity to flow fluctuations and exhibits greater flexibility. The advantages of powdered activated carbon produced from agricultural waste in comparison with other sorbents are their low cost, availability of extraction, operational flexibility, control, etc. The effectiveness of agricultural by-products adsorption also is enhanced made activated carbon for the removal of



organics by its large surface area resulting in higher separation efficiency by activated carbon.

Activated carbon surface area has nonpolar nature, but during the treatment process with some chemicals, as acids for instance, this sorbents surface took slightly polar character, which is in future can be responsible for hydrophobic influence of this surface. In this case, as raw stone materials and more activated carbon can be used for organic molecule sorbents [4]. It should be noted also it's known, that activated carbon obtained from fruit stones can favorably compared with other activated carbons used in industry with respect of their properties.

Here, as it is possible is take place the physical adsorption which is held on the surface of stones or activated carbon, which have not active sites on the surface, by weak van der Waals forces.

Table 1. Reduction of furfural 100 ml 0.01 M furfural on activated carbon /1g, temperature 20<sup>0</sup>C, duration 4 hours

N	Sorbent	The adsorption mg/g
1	Peach seeds based activated carbon	0.29
2	Apricot seeds based acid-activated	0.32
3	Carbonsorb - AB	0.36

Table 2. Physical and chemical properties of experimental sorbents

Physical properties	Row peach stones breaking	Row apricot stones breaking	Peach stones activated carbon	Apricot stones activated carbon
Surface area (m <sup>2</sup> /g)	220	250	620	710
Bulk density (g/m <sup>3</sup> )	-	-	0.41	0.46
Attrition (%)	-	-	11.3	8.60
Elemental analysis Result (%)				
C	48.0	50.0	74.0	85.0
H	6.0	5.0	2.5	2.0
O	46.0	45.0	18.0	8.0
Ash	-	-	5.5	5.0

## Conclusion

It has been found advantageous to go on with the researches in organic pollutants sorption by agricultural wastes and based them activated carbons. It has been offered the convenient method for successfully sorption furfural and probably other organic substances as BTEX/ benzene, ethyl benzene, toluene and xylenes, pesticides from petroleum and petroleum industry having countries for wastewater treatment from furfural.

## Acknowledgement

I am grateful to my adviser Prof. Gagik Torosyan for helpful suggestions.

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9/5/2012

**Indicators to determine the usefulness of mixed and pure culture systems of triticale (*X Triticosecale*. Wittmack) and green pea (*Lathyrus sativus* L.) in rainfed conditions of Iran**

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**Abstract:** To evaluate the yield quality and quantity of forage cultivation and green pea mixture Triticale Experimental Agricultural Research Station, University of Lorestan in agricultural 2007-2008 (November 23) as a randomized complete block design (RCBD) in dry conditions with four replications and five levels (seed ratio) pure stand and mixture of triticale: green pea (100:0), (0:100), (80:20) (60:40) and (40:60) was executed. Initial results of analysis of variance showed superior component mixture 60:40 (Triticale:green pea) on forage production and utilization of environmental resources (LER) was such that this treatment (combination of seed) in the Partial Land Equivalent Ratio and Total Land Equivalent Ratio dominant the other treatments were. In Relative Crowding Coefficient (RCC) top treatments, seed ratio was 80:20, as well as seed mix 60:40 (Triticale: green pea) in terms of system productivity index (SPI) superior to other combinations was the seed.

[Khosro Azizi, Saeed Heidari and Amir Akbari. **Indicators to determine the usefulness of mixed and pure culture systems of triticale (*X Triticosecale*. Wittmack) and green pea (*Lathyrus sativus* L.) in rainfed conditions of Iran.** *Life Sci J* 2012;9(3):2506-2511] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 363

**Keywords:** Pure and mixed culture, Usefulness, Triticale, Green pea, Rainfed

### Introduction

Multiculture techniques rooted in the history of human civilization, and are considered the traditional methods, using such methods in optimal production factors have a fundamental role, and today many researchers have been considered, this definition is as follows Planting more than one plant in one year and a piece of farm land. Advantages of mixed cultures can increase productivity and efficiency yield compared with pure stand cited. In addition, mixed cultures led to a balance of food soil, risk of cultivation, due to the loss of a product by improved use of limited resources and reduce soil erosion and increase yield is stability (Anil *etal.*, 1998 and Dapaah., *etal.* 2003). Cultivated cereal and scrambled Legume often high efficiency compared to pure stand it is (Ofori and Stern, 1987), because each of the plants in mixed culture with many different types of food needs are (Willey, 1979). The mixed culture legume with non Legume, due to the use of different sources of nitrogen is very valuable (Cho and colleagues, 2004) because the grains may get more minerals from the soil, but must compete Legumes If there are bacteria capable of stabilizing Rhizobium are nitrogen. Assefa and Ledin (2001) showed that mixed cultures with vetch and oat and Triticale in seed different ratios, growth rates and forage quantity and quality will affect, so that in normal mixed cultures vetch:oat, in comparison 35:65 Rate exploited seed

environmental conditions and increased forage yield little more than seed ratio 35:65 vetch:triticale, but the yield of crude protein (CP) in all seed ratios in mixtures vetch-oat and triticale increased. Jones and Arous (1999) showed that monoculture system may cause soil nutrient depletion, increased pest and weed populations will be. Thus, monoculture system, leading to reduced yield and farmer's income is. Therefore, a stable and profitable option should be replaced by a single system, which through the cultivation of Legume with the grain in many semi-arid regions of the world benefit has been introduced (Vasilakoglou *etal.* 2005). Hossein *etal* (2003) to evaluate the different planting pattern of cultures on bean and pearl millet yield in mixed cultures in concluded that pearl millet yield to treatment increased 20% belong to mixed results and in front of the beans plant has been defeated in the mixture, the land Equivalent Ratio (LER) of equal in mixed cultures showed that 20% increase in yield 32% more than a pure stand. Majnoun Hosseini *etal* (2003) showed that different ratios mixed cultures of sorghum with Legumes significantly increased forage dry and fresh weight, especially in two rows of sorghum- one row Legume, but Legume type had no significant effect on forage yield but not on all the properties have significant effects on forage quality. Since nowadays need for forage (animal food) and indirect role in human nutrition more than ever before in our country (Iran) are

feeling, with the aim of this study using various combinations to achieve maximum forage cutting and a very valuable role in the mixed system in soil conservation and creating sustainable agriculture systems in product manufacturing climate Khorramabad was executed.

### Materials and methods

Field experiment in cropping year 2007-2008 (November 23) in Agricultural Research Station, University of Lorestan, a randomized complete block design (RCBD) in four replications and five levels (ratio of seed) including single culture and mixed of triticale:green pea (100:0), (0:100), (80:20) (60:40) and (40:60) as mixed cultures with maximum density of triticale and green pea equal to 400 and 150 plant per m<sup>2</sup> implement in rainfed conditions. After land preparation operations using machinery tillage, planting operations at once, as dry sown took place during this experiment, length of each plot 4.50 meters, 2 meters wide (6 lines each plot with planting distance 25 cm from each other) and distance of plots from each 1m and 3m between blocks were considered, for sampling interval was 14 days. This test to determine the usefulness of mixed cultures compared to pure cultures of the following indicators, using existing relationships were used. One of the most common ways to evaluate the usefulness of yield in mixed cultures were used, LER or the Land Equivalent Ratio was equal to the total land surface required under pure crop system (Single Cropping) compared with the mixed farm system for obtaining maximum yield is defined.

$$LER = \frac{y_{ij}}{y_{ii}} + \frac{y_{ji}}{y_{jj}}$$

$y_{ij}$  and in this regard specific yield of any product  $y_{ij}$  in pure stand system,  $y_{ij}$  and  $y_{ji}$  yield per unit area, respectively, in mixed cultures is the first and second product. If

$LER > 1$  mixed cultures is beneficial to represent pure culture. Or other words indicating optimum growth and yield components using mixing periods for plant growth is environmental factors. If  $LER = 1$  is the index indicating critical state, and if  $LER < 1$  is negative effects on growth and yield of plants grown in mixed cultures can express words and resource use efficiency by more than pure cultures mixed cultures is the same plant (Hauggaard *et al.*, 2005). Two other indicators that express the relationship of two competitive product mix are calculated (Willey, 1979) including: Relative Crowding Coefficient and dominance or superiority index (Aggressivity), indicating that these indices measure of dominance of a component to other components of the mixture is or in other words indicates that the amount of competition between plants using a replacement culture have been mixed (Ghosh, 2004).

Relative Crowding Coefficient for mixed crop and green pea Triticale was calculated as follows.

For green pea:

$$RCC(k_{ab}) = \frac{Y_{ab} \times Z_{ba}}{(Y_{aa} - Y_{ab}) \times Z_{ab}}$$

For Triticale:

$$RCC(k_{ba}) = \frac{Y_{ba} \times Z_{ab}}{(Y_{bb} - Y_{ba}) \times Z_{ba}}$$

If  $K > 1$  there is utility function, if  $K = 1$  in the mixed farming any increase or decrease in farm products than Pure stand not see the end if  $K < 1$  is inadvisable to be mixed cultures can express and the amount of product obtained from farm product mix than a pure stand.

Green pea:

$$Aggressivity(A_{ab}) = \frac{Y_{ab}}{Y_{aa} \times Z_{ab}} - \frac{Y_{ba}}{Y_{bb} \times Z_{ba}}$$

Triticale:

$$Aggressivity(A_{ba}) = \frac{Y_{ba}}{Y_{aa} \times Z_{ba}} - \frac{Y_{ab}}{Y_{bb} \times Z_{ab}}$$

$Y_{aa}$  and that  $Y_{bb}$  average net yield on the Pure stand green pea and triticale for replications,  $Y_{ab}$  and green pea mixture  $Y_{ba}$  cultivation and average yield for replications are triticale and green pea,  $Z_{ab}$  and  $Z_{ba}$  respectively represent the yield yield ratio of green pea and triticale is mixture cultivation. System productivity index through the formula provided by the odo (1991) was calculated as follows.

$$SPI = \frac{S_a}{S_b} Y_b + Y_a$$

$S_a$  and  $S_b$ , respectively, for green pea and triticale yield average in pure culture and  $Y_a$  and  $Y_b$  are represent the yield average in mixed culture of green pea and triticale.

### Results and discussion

Normality test data after confirming normal and data obtained from test results showed that different treatments, including the mixed culture and pure stand significant difference between dry forage crop (triticale:green pea) respectively at the time that spike formation and flowering were harvested, there are (Table 1). In green pea plant treatments were significantly different between mixed and pure stand was treated as 40:60 (Triticale:green pea) in the first yield was out, but a significant difference with single cultures and showed no evidence of this self-cultivation mixture was superior high yield culture than are single. In other words, this result showed that treatment 40:60 (Triticale: green pea) the amount of yield obtained from this treatment in addition to the yield of a single green pea cultivation was achieved, the amount of forage obtained from cultivation triticale that this surplus

function treatment, respectively. The results of analysis of variance for dry matter yield data from a pure stand and mixed triticale showed a significant difference between treatments exists, so this adjective 60:40 treatment (triticale: green pea) best treatment, even to a single culture triticale for was to get maximum yield. Initial results of analysis of variance showed superior treatment combines 60:40 (Triticale: green pea) for both plants in the seed yield of forage was dry. triticale treatment plant in 60:40 (triticale:green pea), traits such as leaf fresh weight, forage yield in flowering time, stem number, stem height, stem fresh and dry weight most values allocated to these traits were (Table 2). As shown in bottom diameter of Table 3 is highly correlated with these traits are that the dry matter yield traits as superior traits to select superior treatment were selected. So the first point of view and best treatments for common variance to get the maximum yield treatments Triticale 60:40 (triticale:green pea) was proposed. Green pea treatments for 40:60 (triticale:green pea) for most traits was best known treatment. Table 3 also top diameter correlation between the of different traits with each other has been shown that these traits showed a high correlation with each other and this suggests that these traits, it was a determining role in increasing the yield. In table 1 LER index values for each mixture treatments has shown that if the index values of more than one treatment superior to pure stand would have made that much in green pea plant in the treatment 60:40 (triticale:green pea) More than one and mix in other treatments was less than 1. In the triticale 60:40 (Triticale : green pea) Best treatment of LER, was recognized. Total Land Equivalent Ratio for the two plants showed that treatment 60:40 (triticale:green pea) best treatment for maximum yield. Other indices calculated results for mixed cultures, is given in Table 4. Using index K, the maximum k for green pea treated 60 : 40 (triticale : green pea) and lowest for the index treatment 40 : 60 (Triticale:green pea) were obtained, which showed best treatment in terms of competition for most treatment yield 60:40 (triticale:green pea, respectively). Also, top level competition treatment Triticale 20:80 (triticale:green pea) than other treatments that yield had relatively highest. In general, using this index best treatments for both plants, treated 20:80 (triticale:green pea) were recognized. A index for the two plants in mixed cultures showed that the tendency green pea to regain Triticale is more mixed cultivation and between the mixture treatments best treatment, treatment 60:40 (triticale:green pea) were recognized. SPI index that

shows the aspect of maximum productivity, 60:40 treatment (triticale:green pea) as a superior treatment introduced. Since most of the traits highly correlated with dry matter yield was, therefore use any of the indices for the interpretation of mixed cultures regardless of other attributes was because the treatment was superior to that by dry matter yield trait has been introduced (Table 4). Analysis using various indicators, mixed culture than single culture was accompanied by greater usefulness. Reasons for this can be optimized using two plant nutrients at different levels of soil, competition with weeds and lack of adequate opportunities for the growth of weeds, allelopathic discharge of two plants (cereal and Legume) to relation, possibly resulting in increased yield is and characteristics of nitrogen fixation by Legumes, cited. In fact, a mixture of plants with different root systems cause water and nutrient absorption maximum is (yazdi samadi and poustini, 1994). Oswald *etal* (2002) experiment conducted in Kenya to evaluate corn and soybean mixed cultures simultaneously and delayed and 40% yield increase in corn cultivation announced the delay, they increased to the optimal use of resources in the mixed cultures were also compared sanderson *etal* (2005) showed that mixed cultures Legume plants with grain silage for forage production is caused pasture management system stability and sustainable agriculture. Therefore, the results showed that mixed cultures of legume with grass, can a good forage during dry years to produce, and also in addition to strengthening the soil causes being less invasive weeds will be for several years. Kandel *etal* (2000) showed that mixed cultures Legume (hairy vetch, yellow sweet clover and alfalfa) with sunflower increased soil cover, reduce erosion and increase soil carbon and nitrogen are also secondary effects of this type agriculture led to increased yield and protein content of hard red spring wheat (HRSW) has been. In general, using from the results different indicators and mean comparisons were best treatment in order to increase the hay yield, treatments 60:40 (triticale : green pea) and 40:60 (triticale : green pea). Although it is better that this test will be tested in different areas, but the obvious superiority of treatments introduced, these results can be generalized to other regions is the country (Iran) that are similar climate.

**Table 1.** Mean comparisons of final dry matter yield for the two plants green pea, triticale and index LER values

LER			Hay yield		Treatment
Total	Triticale	Green pea	Triticale	Green pea	
1	0	1	0	1327.45 <sup>a</sup>	Green pea 100%
1	1	0	2100.97 <sup>a</sup>	0	Triticale 100%
1.57	0.67	0.89	1412.66 <sup>b</sup>	1185.27 <sup>b</sup>	Triticale:green pea(20:80)
1.6	0.58	1.03	1208.23 <sup>c</sup>	1363.25 <sup>a</sup>	Triticale:green pea(40:60)
1.73	1.04	0.69	2188.54 <sup>a</sup>	925.66 <sup>c</sup>	Triticale:green pea(60:40)
1.38	0.82	0.9	1727.6	1197.16	Mean
			110.65	46.72	S.E

**Table 2.** The mean comparisons for all traits measured in different treatments

Fresh forage yield (flowering and spike formation stage)		Leaf dry weight		Leaf fresh weight		Trait
Triticale	Green pea	Triticale	Green pea	Triticale	Green pea	
5545.2 <sup>b</sup>	5022.22 <sup>a</sup>	349.76 <sup>a</sup>	612.35 <sup>a</sup>	761.83 <sup>b</sup>	2405.27 <sup>a</sup>	Pure stand
4010.66 <sup>c</sup>	3933.1 <sup>c</sup>	306.21 <sup>b</sup>	500.16 <sup>b</sup>	701.03 <sup>c</sup>	1654.76 <sup>c</sup>	Triticale:green pea(20:80)
3636.91 <sup>d</sup>	4657.95 <sup>b</sup>	166.7 <sup>c</sup>	599.73 <sup>b</sup>	553.03 <sup>d</sup>	2128 <sup>b</sup>	Triticale:green pea(40:60)
6856.11 <sup>a</sup>	3715.17 <sup>d</sup>	312.32 <sup>b</sup>	402.08 <sup>c</sup>	988.99 <sup>a</sup>	1726.24 <sup>c</sup>	Triticale:green pea(60:40)
334.39	139.26	18.35	23.66	40.59	80.86	S.E

**Table 2 continued.** The mean comparisons for all traits measured in different treatments

Dry stem weight		Fresh stem weight		Stem height		Stem number		Trait
Triticale	Green pea	Triticale	Green pea	Triticale	Green pea	Triticale	Green pea	
1751.21 <sup>b</sup>	715.11 <sup>b</sup>	4783.37 <sup>b</sup>	2616.95 <sup>a</sup>	57.18 <sup>c</sup>	37.71 <sup>a</sup>	5.14 <sup>a</sup>	4.3 <sup>a</sup>	Pure stand
1106.45 <sup>c</sup>	685.12 <sup>b</sup>	3309.64 <sup>c</sup>	2278.34 <sup>b</sup>	61.60 <sup>b</sup>	34.47 <sup>b</sup>	4.36 <sup>b</sup>	4.06 <sup>b</sup>	Triticale:green pea(20:80)
1041.53 <sup>c</sup>	763.52 <sup>a</sup>	8960.83 <sup>c</sup>	2530 <sup>a</sup>	60.20 <sup>b</sup>	37.37 <sup>a</sup>	3 <sup>c</sup>	4.76 <sup>a</sup>	Triticale:green pea(40:60)
1876.23 <sup>a</sup>	510.59 <sup>c</sup>	5867.13 <sup>a</sup>	1988.93 <sup>c</sup>	67.18 <sup>a</sup>	37.74 <sup>a</sup>	4.94 <sup>ab</sup>	3.5 <sup>c</sup>	Triticale:green pea(60:40)
97.30	25.39	296.4	65.07	0.97	0.4	0.24	0.14	S.E

**Table 3.** Correlation between different traits measured for each of the plants in mixed cultures. Top diameter table for traits related to triticale and bottom diameter to is the correlation of traits in green pea.

	Hay yield	Fresh yield	forage	Leaf weight	dry	Leaf fresh weight	Stem weight	dry	Stem fresh weight	Stem height	Stem number
Hay yield		**0.92		**0.77		**0.86	**0.99		**0.92	<sup>ns</sup> 0.25	**0.78
Fresh forage yield	**0.84			*0.60		**0.94	**0.94		**0.99	<sup>ns</sup> 0.49	**0.70
Leaf dry weight	**0.94	**0.87				**0.65	**0.68		*0.59	<sup>ns</sup> 0.03	**0.80
Leaf fresh weight	**0.70	**0.96		**0.77			**0.85		**0.92	*0.66	**0.72
Stem dry weight	**0.95	**0.74		**0.81		*0.57			**0.94	<sup>ns</sup> 0.30	**0.73
Stem fresh weight	**0.94	**0.94		**0.92		**0.82	**0.86			<sup>ns</sup> 0.46	**0.72
Stem height	<sup>ns</sup> 0.00	<sup>ns</sup> 0.37		<sup>ns</sup> 0.13		*0.56	<sup>ns</sup> 0.12-		<sup>ns</sup> 0.08		0.10 <sup>ns</sup>
Stem number	**0.82	**0.67		**0.78		*0.53	**0.79		*0.77	<sup>ns</sup> 0.02	

<sup>ns</sup>, \* and \*\* respectively significant and not significant at 0.05 and 0.01 can be.

**Table 4.** Index values of A, K, and SPI for different treatments in mixed cultivation of green pea and triticale

SPI	A value		K	K value		Index
	Green pea	Triticale		Triticale	Green pea	
2077.83	0.72	-0.72	17.11	8.21	2.08	Triticale:green pea(20:80)
2126.64	0.71	-0.71	-51.54	2.03	-25.42	Triticale:green pea(40:60)
2295.44	0.86	-0.86	-54.99	-16.66	3.3	Triticale:green pea(60:40)
2166.64	0.76	-0.76	14.29	-2.14	-6.68	Mean

A reflect or Aggressivity index comparative advantage, K represent the Relative Crowding Coefficient and SPI represent the productivity index

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10/26/2012



## Comparison of competences between Problem-Based Learning (PBL) and Non-Problem-Based graduate nurses in a Provincial Hospital in South Africa

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**Abstract:** The study sought to compare the competences between PBL and Non-problem based graduate nurses in a Provincial Hospital in South Africa. This was a comparative descriptive and cross-sectional design. Data was collected with self constructed questionnaires which were handed out during duty hours to graduate nurses who were present at the time of data collection. The findings revealed the top 5 most ranked competences by both groups as critical thinking, problem solving, long-life learning, collaboration with other medical team and holistic approach to health care. 13 nurses out of 20 participants of PBL group ranked critical thinking in the 1<sup>st</sup> position compared to the Non-PBL graduates who ranked it at 11<sup>th</sup>. Problem solving was ranked at 2<sup>nd</sup> position by 45.0% of PBL group while about 21.4% the Non-PBL ranked it at 5<sup>th</sup> position. The PBL group (25.0%) ranked long-life learning as at the 3<sup>rd</sup> position as compared to Non-PBL group (28.6%) who ranked it at 13<sup>th</sup> position. Graduates of the PBL approach ranked critical thinking, problem solving, and lifelong learning highly as compared to the Non-PBL graduates. PBL graduates also indicated that they continue with updating their professional knowledge through the use of information technology.

[Useh U, Mosebudi D, Tsolo G, Kgwakgwa D.K. **Comparison of competences between Problem-Based Learning (PBL) and Non-Problem-Based graduate nurses in a Provincial Hospital in South Africa.** *Life Sci J* 2012;9(3):2512-2517] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 364

**Key words:** Problem Based Learning, Problem solving, critical thinking, collaboration

### 1. Introduction

The nursing profession has advanced dramatically over the past 50 years. In this modern age people are living longer; technology is advancing at a rapid rate, and patients are presenting with more critical ailment. An estimated 35 million nurses and midwives make up the greater part of the global health-care workforce. Nurses and midwives make a substantial contribution to health-delivery systems in primary care, acute care and community care settings (WHO, 2006). While nursing and midwifery are unique health-care professions, the desire to build the workforce capacity with competent practitioners is a common goal that is reflected in the WHO strategic directions for nursing and midwifery (WHO, 2006).

As more and more developments take place in the nursing profession, the need to identify competency and its role in maintaining optimal health care practices is increasingly demanded and appreciated. Not only is the government and the hospital management responsible for maintaining competency, but also the nursing staff at team level as well as at professional level are responsible to maintain the standards (Smith, 2006). It has been reported that budgetary constraints and a shrinking nursing workforce have added an additional strain on the ability of nurses to remain clinically competent in this fast-paced healthcare environment (Distler, 2006).

These changes have compelled nursing schools worldwide to revise their approach to nursing education to keep up with the challenges faced in nursing practice. This led to the emergence of such terms as problem-based learning, critical thinking, an evidence-based practice, and student-centered teaching strategies have replaced traditional terminology typically linked with nursing education and practice (Woodward & Ferrier, 1983).

Gabr and Mohamed (2011), describes problem based learning (PBL), as a student-centered instructional approach in which students collaboratively solve problems and reflect on their experiences. The PBL approach encourages students to be active and independent, to take more responsibility for their learning (Staun et al, 2009). Students graduating from problem-based medical schools are, for instance, expected to be more skilled in interpersonal communication, are thought to be better problem-solvers and to be better prepared for self-directed, lifelong learning.

These expectations are based on the particular characteristics of PBL: students collaborate in small groups, their learning is centered on problems relevant to their domain of study, and they spend much time on self-directed learning (Yuan, 2009). PBL aims to developing scientific understanding through real-world cases, developing reasoning

strategies, and developing self-directed learning strategies (Lee, Karen and Frank, 2010).

Traditional approach is the method of teaching normally referred to as the lecture method, where a teacher or lecturer would be the disseminator of information and a student becomes a passive absorber of facts (Major and palmer, 2001). Major and Palmer (2001) argues that, this type of instruction has often allowed students to be passive learners in the classroom. They also revealed that in PBL classes students work in teams to solve one or more complex and compelling "real world" problems such as clinical situation. A deduction can therefore be made that the difference between PBL and traditional teaching is chiefly in the method of imparting knowledge. Therefore a PBL approach is learner centered whereas the traditional lecturing method it is teacher centered.

According to Wood (2003), in problem based learning (PBL) students do independent, self directed study before returning to the group or class to discuss and refine their acquired knowledge. Wood (2003) further elaborates that PBL is not all about solving problems but it directs students to use appropriate examples of problems to enrich their knowledge and understanding.

Smith (2009) also describes Problem-based learning (PBL) as learning based on solving problems that occur in the real world of practice. Instead of assigning research papers, reading assignments, or traditional lecturing and teaching methods, students are given problems to solve. This type of learning is highly sophisticated. It makes a shift from a focus on teaching to a focus on learning. The process is aimed at using the power of authentic problem solving to engage students and enhance their learning and motivation. Problem based learning aims to developing scientific understanding through real-world cases, developing reasoning strategies, and developing self-directed learning strategies (Ali, 2010).

According to Wood (2003), generic skills and attitude that the students acquire through PBL are; chairing a group, listening, recording, cooperation, respect for colleagues' views, critical thinking and evaluation of literature, self directed learning and presentation skills.

Those who support problem-based learning (PBL) as an approach to learning and instruction articulate high expectations of the professional competencies of the graduates produced by such programmes, (Gabr et al, 2011). Competency in nursing literature has being characterized by a variety of interpretations (Harrison et al, 2010). Competency has come to refer to a specified attributes that may be possessed by someone, perhaps within a series of

related competence, connoting both a concrete category on which a person's adequacy or sufficiency may be judged and that quality or state of being which characterizes a person as being competent, able, adequate or sufficient within a category (Short, 1984). Short (1984) defines competency as a cluster of related knowledge, skills, and attitudes that affect a major part of one's job (a role or responsibility), that correlates with performance on the job, that can be measured against well accepted standards, and can be improved via training and development.

Competency is comprised of integrated skills and individual attributes and one can conclude that the concept competency is based on education or training. Woodruffe (1993) defined competence as aspects of the job that an individual can perform, and competency as individual's behavior underpinning competence performance. He also suggested that a job includes set of deliverables, output or roles, each of which require some competencies but competencies are not aspects of the job. Xu, Xu and Zhang (2001) regards nursing competencies as a set of knowledge, skills, traits, motives and attitudes that are required for effective performance in a wide range of nursing jobs and various clinical setting. The above idea is supported by Applin et al, 2011 who describes graduate competence as a measure of quality assurance that indicates that professional nurses are prepared to engage in safe, ethical and legal nursing practice in rapidly changing environments.

Gabr et al (2011) describes the nursing environment as a constantly changing environment where self directed learning is essential for enabling nursing students to develop independent learning skills, a sense of accountability, responsibility and assertiveness as they are the essential attributes throughout the nursing career. Gabr et al continues to argue that a deep approach to learning is associated with the development of desirable lifelong, self-directed learning traits beyond tertiary education. This would mean that since health professionals have to keep abreast with rapidly changing technologies and the fast expansion of specialized knowledge, the possession of self direction in learning is essential so that they can seek out the required knowledge when the need arises.

Not all schools of nursing education have embraced the need to change to new methods of teaching and continue to teach as they were taught. The nursing educational institutions in the North West Province of South Africa continue to use both problem based learning and non problem based learning strategies to equip their student nurses with nursing competences required for the professional role.

Graduate competence is a measure of quality assurance that indicates that professional nurses are prepared to engage in safe, ethical and legal nursing practice in rapidly changing environments (Applin, 2011). Despite advances made in the provision of improved nursing education to graduate nurses in order to be in par with the constantly changing lifestyle, it is still not known which curriculum between Problem Based- and non-Problem Based learning could best equip graduate nurses with required competencies to take up professional role (Iwasiw et al, 2005).

A dearth of information in the North West training of nurses was observed. This study therefore sought to compare the competences between PBL and Non-problem based graduate nurses in a Provincial Hospital in North West Province of South Africa.

## 2. Research Methodology

The study design was comparative descriptive and cross-sectional. It was comparative descriptive because the research study compared and described the competences between problem-based learning and non-problem based graduate nurses.

The study was conducted in a hospital in Mafikeng. Mafikeng is Provincial capital of North West Province of South Africa. The study setting was chosen on the basis of the population of nurses that used problem based learning and non-problem based learning as different learning approaches.

The population of this study was all nurses in the chosen hospital. The research study involved 50 graduate nurses working at the chosen hospital who were conveniently chosen. 20 of the participants were trained with the PBL approach, while 28 used the non-PBL approach (traditional lecture method); the remaining 2 participants had used both learning approaches.

### Instrument for Data collection

A self-constructed questionnaire was used to collect data in this study. The questionnaire consisted of three parts. The first part consisted of demographical information, the second part of nursing competences and the third part professional development. The questionnaire was prepared and distributed to nurses in the different wards.

Content validity of the instrument was done by utilizing literature and contents from other tools in similar studies. While inter-rater reliability was ensured through a random selection of 6 respondents to check responses using three different interviewers who interviewed the same respondents at different times using the same instrument. Responses were compared across participants in the pilot study. These were however found to be similar.

### Procedure for Data Collection

Permission to conduct this study was sought from hospital management. After this, the project was then introduced to the participants and their individual consent was sought to participate in this study. The questionnaires were handed out during duty hours to nurses who were present at the time of data collection.

### Data management and Analysis

Statistical Package for Social Sciences (SPSS) version 20 was used to analyze data. Demographic information were analyzed with descriptive statistics of percentages, mean and graphs. Chi-square statistic was used to answer the set hypothesis, with the level of significance set at 0.05.

### Ethical consideration

Permission was obtained in advance from the Ethical Review Board of the Department of Nursing in North West University-Mafikeng campus and from North West Provincial Department of health and Mafikeng Provincial hospital where the research was conducted. The aim of the study was explained as well as the comprehensive and clear information regarding participation in the study was given to nurses. Participation was entirely voluntary with the right of withdrawal from the study without giving reasons at any time of the study. A written informed consent from the participants was obtained voluntarily. In maintaining the privacy and confidentiality the participant's personal data was not included in the questionnaire.

## 3. Results

Fifty nurses participated in this study, 20 were trained with the PBL approach, 28 used the Non-PBL or traditional lecture method, 2 participants used both approaches.

### Age and gender

The mean age of participants was 34 years for both PBL and non-PBL graduate nurses with the age ranges of 23 to 55 years. The mode age was 28 years, with 7 of them as 28 years old. Gender distribution was as follows: For the PBL group, 85% were females and 15% were males. While in the Non-PBL approach 39% were females and the remaining 61% were males.

### Qualifications

56% had college diploma while the remaining 44% had university degree.

### Competences ranked by the PBL and Non-PBL groups

The top 5 most ranked competences by both groups were critical thinking, problem solving, long-life learning, collaboration with other medical team and holistic approach to health care. 13 graduate

nurses out of 20 participants of PBL ranked critical thinking as the 1<sup>st</sup>. Detail of ranking is presented in Table 1

Table 1: Comparison of competences of PBL and NON-PBL graduate nurses

Competences	Group	Rank	N (%)	p-value
Critical thinking	PBL	1 <sup>st</sup>	13 (65)	.649
	N-PBL	11 <sup>th</sup> , 12 <sup>th</sup>	5 (18)	
Problem solving	PBL	2 <sup>nd</sup>	9 (45)	.270
	N-PBL	5 <sup>th</sup>	6 (21)	
Long-life learning	PBL	3 <sup>rd</sup>	5 (25)	.014
	N-PBL	13	8 (28.6)	
Collaboration with other medical team	PBL	7	4 (20)	.313
	N-PBL	4	8 (28.6)	
Responsibility	PBL	4	4 (20)	.465
	Non-PBL	4	5 (17.9)	
Communication	PBL	9 <sup>th</sup> , 12 <sup>th</sup>	3 (15)	.870
	N-PBL	9 <sup>th</sup>	5 (17.9)	
Respect for colleagues	PBL	10 <sup>th</sup>	5 (25)	.001
	N-PBL	6 <sup>th</sup>	5 (17.9)	
Sharing information	PBL	8 <sup>th</sup> & 9 <sup>th</sup>	5 (25)	.000
	N-PBL	13 <sup>th</sup>	6 (21)	
Leadership abilities	PBL	10 <sup>th</sup>	5 (25)	.663
	N-PBL	11 <sup>th</sup>	5 (18)	
Management decision making	PBL	5 <sup>th</sup>	4 (20)	.055
	N-PBL	6 <sup>th</sup>	5 (18)	
Teamwork	PBL	4 <sup>th</sup> & 12 <sup>th</sup>	4 (20)	.696
	N-PBL	5 <sup>th</sup>	6 (21)	
Holistic approach	PBL	13 <sup>th</sup>	4 (20)	.159
	N-PBL	1 <sup>st</sup>	8 (28.6)	
Professional accountability	PBL	13 <sup>th</sup>	5 (25)	.300
	N-PBL	2 <sup>th</sup>	6 (21)	

### Continuation with Lifelong learning

Most (65.0%) of the PBL graduate nurses stated they would continue with lifelong.

### The development of competences

Compared with the Non-PBL graduates, most PBL graduate nurses (13 participants out of 20), (65.0%) indicated that their competences were developed during training. The remaining 35.0% developed their competencies after training. The Non-PBL graduates (6 participants out of 28); about 21.4% indicated that their competences were developed during training while the remaining 53.6% developed them after training.

#### Professional Development

Most (90.0%) of the PBL trained nurses stated that they would continue with professional development, compared with 71.4% of Non-PBL, group. The percentage of graduate nurses who admitted to maintaining and updating professional

knowledge was 90% and 46% for PBL and PBL groups respectively.

Information technology usage and learning approach

About 75.0% PBL graduates indicated that they used information technology for accessing new knowledge. While 68% of the Non-PBL nurses indicated that they do not use information technology to access new information.

Acknowledgement of limitations and learning approach

About 60% of both PBL trained nurses and Non-PBL graduates indicated that there are no limitations in their own competences. There was no significant association between mode of learning and acknowledging limitation in own competencies (p=0.537)

Association between researching and learning approach

About 80 % of PBL and 61.% of Non-PBL would take part and contribute to research to develop their own knowledge and the knowledge of the others. There was however no significant association between the mode of study and taking part and contribution to research ( p=0.398)

### Competences

The association between competences and learning approach is presented in table 3.

Table 3: Association between learning approach and competences

Competencies	P-value	Significant or not Significant
Critical thinking	.649	Not significant
Problem solving ability	.270	Not significant
Lifelong learning	.014	Significant
Collaboration with other medical teams	.313	Not significant
Responsibility	.465	Not significant
Communication skills	.870	Not significant
Respect for colleagues' views	.001	Significant
Sharing information	.000	Significant
Leadership abilities	.665	Not significant
Management decision making abilities	.055	Marginal
Teamwork	.696	Not significant
Holistic approach or health care delivery	.159	Not significant
Professional accountability	.300	Not significant

#### 4. Discussions

This study compared competences between nurses who used the PBL and non-PBL approaches in training.

The main themes that emerged from the PBL rankings were: critical thinking, problem-solving skills, lifelong learning, responsibility, and teamwork and management decision making. In this study critical thinking was ranked at the 1<sup>st</sup> position by 13 PBL participants out of 20 which are 65.0% as compared to 4 Non-PBL participants out of 28 who ranked it as 1<sup>st</sup> which is 14.3% position. The majority of Non-PBL ranked critical thinking as the 11<sup>th</sup> and 12<sup>th</sup> position. The 1<sup>st</sup> position indicates the competency that the participants possess most while 11<sup>th</sup> and 12<sup>th</sup> indicates the least they possess. It was revealed that most PBL participants possess critical thinking skills as compared to the Non-PBL graduates. Despite high percentages and rankings there was no significant difference between the two groups. This finding was at variance with those of Ozturk et al (2008) which compared the critical thinking disposition between PBL and Non-PBL nursing students and revealed a significant difference between the learning approaches. High critical thinking disposition scores were reported in the PBL group than the Non-PBL group. The reason for the differences might be linked to the differences in sample sizes and methodologies. The outcome of this study also agrees with those of Applin et al (2011) who reported that majority of PBL graduates nurses acquired critical thinking skills during.

Our study found no statistical significant differences between those of PBL and Non-PBL: groups in problem solving skills, collaboration with other medical team, responsibility, leadership abilities, teamwork, holistic approach and professional accountability. There was however differences in rankings in problem solving skills, responsibility, teamwork between the two groups (higher in the PBL than in Non-PBL trained nurses).

Collaboration with other medical team, communication, leadership abilities, holistic approach and professional accountability were ranked high by the Non-PBL graduates as compared to the PBL group. From these results it would appear that PBL enhances certain competences that are not found in the Non-PBL groups. Gabr et al (2011) found significance differences between students' problem-solving skills and ability to work in a team in PBL than in the Non-PBL group. This was corroborated by Koh et al, (2008).

#### Development of competences

Most PBL graduates indicated that competencies are mainly acquired during training,

while the majority of the Non-PBL graduates indicated that the competencies were developed after training while working.

There was also a significant difference between the learning approach and the development of competences.

The findings of this study are in agreement with the findings of the study conducted by Prince et al (2005) who found that PBL group acquired some competences at the medical school than the Non-PBL group. It is expected that Non PBL group will begin to acquire these competences during training as compared with PBL. This is because the training of PBL group mimics real life situation and attempting to solve real life problem during training.

In conclusion, PBL enhances nursing competences than the Non-PBL learning approach.. Graduates of the PBL approach ranked critical thinking, problem solving, and lifelong learning high as compared to the Non-PBL graduates. They also indicated that they continue with updating their professional knowledge through the use of information technology.

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9/10/2012

## The effects of an eight-week aerobic exercise training program on serum leptin and cardiovascular risk factors among obese men with type II diabetes

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**Abstract:** Most diabetics suffer from obesity and one of the factors related to obesity is leptin hormone metabolism disorder. Reducing abnormal levels of this substance in the blood can prevent cardiovascular diseases. Thus, the aim of this study was to examine the effects of aerobic exercise training on serum leptin and cardiovascular risk factors among obese men with type 2 diabetes. In this clinical study, 53 patients in the age of 45±6 who had type 2 diabetes mellitus were selected purposely and classified randomly into two groups, i.e., an aerobic exercise group (27 patients) and a control group (26 patients). The former participated in an eight-week training program three times a week that included 45 to 60 minutes with the intensity of 60 to 80% of maximum heart rate. The subjects' blood samples, physical aspects, and oxygen consumption were taken before and after aerobic exercise training in the exercise group and in the control group. Aerobic exercise training caused a significant reduction in fat percentage ( $p = 0.02$ ) and serum leptin of the patients ( $p = 0.000$ ), and it also significantly increased the HDL-c average ( $p = 0.048$ ) and the maximal oxygen consumption ( $p = 0.000$ ). It caused no significant changes in body weight, body mass index, waist-to-hip ratio (WHR), cholesterol, triglycerides, or LDL-C. This study indicated that metabolic disorders, which are considered to be the most important syndromes of type II diabetes, can be decreased by regular aerobic exercise training. Physical activities mixed with aerobic exercise training can decrease metabolic disorders by reducing the percentage of fatty tissue and serum leptin.

[Mohammad Ali Sardar, Seyyed Mahmud Hejazi, Ramineh Abedini. **The effects of an eight-week aerobic exercise training program on serum leptin and cardiovascular risk factors among obese men with type II diabetes.** *Life Sci J* 2012;9(3):2518-2523] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 365

**Keywords:** Aerobic exercise training, Type 2 diabetes, Leptin, Cardiovascular risk factors, Obesity

### 1. Introduction

Most patients with type 2 diabetes suffer from obesity, and one of the factors related to obesity is leptin hormone metabolism disorder. Leptin is a hormone derived from fatty tissues, and it exists in the bound and free structures of human serum. The concentration of serum leptin demonstrates the stored energy level in fatty tissue. Leptin production can be increased by raising the mass of fat. The amount of leptin is indicative of the level of stored fat inside the human body, and it can indicate the existence of an imbalance in the energy condition in the human body (1). Leptin and other molecules secreted from fatty tissue can affect the body's sensitivity to insulin. Also, it has been demonstrated experimentally that leptin plays an important role in the formation of diseases related to obesity disorders, such as atherosclerosis and other cardiovascular problems (2). Thus, leptin can be considered as one of the major factors concerning obesity and heart coronary, and each process that helps reduce abnormal levels of

this substance could help prevent cardiovascular diseases (3).

Lehmann et al. (2001), in an article entitled "Abdominal Fat Reduction and Improvement of Cardiovascular Risk Factors in Patients with Non-Insulin-Dependent Diabetes Mellitus" (NIDDM) reported that a three-month regular aerobic exercise training with the intensity of 50 to 70% of  $Vo_{2max}$  resulted in a 20% reduction in plasma triglyceride concentration (TGC) in the fasting state and an increase in the low density lipoprotein (LDL) level. Also, physical exercises with moderate intensity caused an increase in lipolytic enzymes and an increase in HDL in the plasma (4). Maiorana et al. (200) examined the effects of long-term aerobic exercises (eight weeks) using ergometer bikes and treadmills with the intensity of 70 to 85% of  $Vo_{2max}$  for male patients with type II diabetes. They reported that  $Vo_{2max}$  was increased after such exercises for eight weeks, but they found no changes in LDL, HDL, TG, or body mass index (BMI). However, fat percentage and weight height ratio (WHR) decreased

significantly (5). Bruce et al. (2004) reported the effects of aerobic exercise training on triglyceride content and insulin sensitivity among male patients with type II diabetes. They reported that the percentage of energy consumed, triglycerides, and Vo<sub>2</sub>max increased after the eight-week, aerobic exercise training program at the intensity of 70 to 85% of maximum heart rate, while LDL, HDL, and total cholesterol levels were not changed (6). Ozcelik et al. (2005) reported that 12-week aerobic exercise training using ergometer bikes can reduce weight, percentage of fat, and the density of leptin in obese women (7). Sary et al. (2007) reported that a four-week walking program decreased insulin resistance and leptin density among obese women (8).

Unfortunately, insufficient studies have been conducted concerning the effects of sports activities on leptin levels in diabetic and non-diabetic people in Iran. Taghiyan et al. (2005) examined the effects of a 12-week, aerobic exercise training (running on a treadmill with the intensity of 70 to 80% of maximum heart rate three times a week for 20 minutes during each training session) on plasma leptin level among obese, healthy women. The results indicated that aerobic exercise training reduces the measured percentage of fat; insulin level and plasma leptin can play important roles in controlling the weight of these obese women (9). Haghghi and Hamedinia (2008) examined the effect of a 13-week aerobic exercise training program on the serum of obese, healthy men and reported that such exercises can decrease the leptin level in obese men significantly and cause a positive and significant cohesion between leptin, insulin levels, and fat percentage (10).

Therefore, long-term (more than 12 weeks) and short-term (less than 12 weeks) effects of sports activities on leptin serum levels and on

cardiovascular risk factors among obese people and patients with type II diabetes currently are taken into consideration (11, 13). But it seems that the patients with type II diabetes are more adaptable to leptin reactions and sports activities than other people (14). Thus, the goal of this study was to examine the effect of short-term aerobic exercise training (eight weeks) on serum leptin and cardiovascular risk factors among obese men with type II diabetes.

## 2. Material and Methods

### 2.1. Study Design

Study method was a clinical trial in which pre-test and post-test designs were used on both experimental and control group. The statistical population of this study was 700 male patients with type 2 diabetes who were referred to specific diabetic clinics in Mashhad. These patients volunteered to participate in this research. A screening method was developed for use in selecting participants, and the screening process involved interviews, assessment of medical records, and the types of medicines being used. Ultimately, 53 patients were chosen, and those chosen were 40 to 50 years old and had serum glucose levels that ranged from 150 to 250 mg/dl. The participants were classified randomly into two groups, i.e., the control group and the experimental group. The patients in the control group did not have diabetes complications and they had no medical records in the mentioned clinics. The subjects received letter of informed consent that they were to sign, and they also received the necessary information about the method, the manner of implementing the study, and the possible risks were provided. This study was approved by Moral Committee of Medical Sciences University of Mashhad.

**Table 1.** Eight-week Training Program with Sessions Three Times a Week

week	Warm-up (min)	activity	15-30min HRmax 60-70%	Active rest	15-30min HRmax 40-50%	Cool-down (min)
1-3	10	15min (3×5min)		15min (3×5min)		10
4-6	10	21min (3×7min)		21min (3×7min)		10
7 and 8	5	30min (3×10min)		30min (3×10min)		5

### 2.2. Exercise Protocol

The exercise protocol was an eight-week program with an exercise training program three times each week (Table 1), with each training session lasting 45 to 60 minutes. Each session included warm-up exercises (5 to 10 minutes), the main exercises (30 to 60 minutes), and cool-down exercises (5 to 10 minutes). Warm-up exercises included walking, a general warm-up of the joints, and stretching movements. Exercises on the treadmill

were designed based on a regular duration and intensity so that the subjects did the related exercises during three training sets so that their heart rates detected and stored while they were on the treadmill. In addition to controlling their heart rates, we used the Borg Scale to assess the participants' rate of perceived exertion (RPE) for use in controlling the intensity of the aerobic exercise training, as well as active resting. The subjects did their exercises on the fixed bike and the elliptical trainer according to an



active rest with a pre-determined intensity and duration. At the end of each training session, the subjects did some movements to cool down, including walking with a very low intensity and stretching movements. They did such exercises before and after dinner. The both temperature in the gym was 15 °C. During the first stage of the study, the questionnaire activity coefficient (QAC) was used to control the daily activities of the subjects (15).

### 2.3. Diet and Blood Glucose Control

A 24-hour dietary recall questionnaire was used for controlling the participants' diets at different stages of the training sets. Also, Glucocard II Digital Glucometers (Tanila, 2001) were used to measure blood glucose during the aerobic exercise training sessions.

### 2.4. Measurement of Blood samples

The measurements of leptin concentrations were performed by the radio-immunoassay (RIA) method, using a diagnostic Biochem kit made in Hungary. For measuring total fasting cholesterol, HDL, and LDL levels, a Gama counter device was used together with the Immuno Tech Company's IM3210 kit, made in the Czech Republic. The measurement of TG levels was conducted through an auto analyzer biochemistry Selectra device, built by the Mann Company, which used the enzymatic method.

### 2.5. Measurements of Other Factors

BMI and the subjects' percentages of body fat were measured by the representatives from the Nutrition Department of Mashhad Medical Sciences University using a body composition analyzer (Tanita B\_C418 Model). The  $\text{Vo}_2\text{max}$  was measured by Rockport Walking Test by using a polar heart-rate monitoring device (s 625x), and the following equation was given ( $R = 0.88$ ;  $SE \pm 5$  ml/kg/min).

$$\text{Vo}_2\text{max} = 6965.2 = [20/20 \times (\text{body weight, kg})] - [25.7 \times (\text{age in years})] + [595.5 \times (\text{gender})] - [224 \times \text{test time /minute}] - [11.5 \times (\text{heart rate, in beats/minute})] / (\text{body weight, kg})$$

### 2.6. Statistical Analysis

The research data were processed with the help of SPSS software, version 18 (SPSS, Inc., Chicago, Illinois, United States). The central trend indices and dispersion indices were shown through descriptive statistics. The Kolmogorov-Smirnov test was used to review the data distribution types. To compare pre-test and post-test data means in each test

group, the statistically correlated t test was used. All the statistical tests were performed at the 95% confidence level ( $p < 0.05$ ).

### 3. Results

Table 2 shows the Features of all the subjects in groups, e.g., age, medical record, and body weight, before performing the tests. The results showed no significant difference between the two groups. Table 3 indicates that the serum leptin level and body fat percentage decreased significantly in the experimental group ( $p = 0.02$ ), while there were no changes in the control group. The effects of aerobic exercise training on BMI and WHR were not significant in either group. Also, according to the information provided in Table 3, the experimental group had a significant increase in maximal oxygen consumption ( $p = 0.000$ ), while there was no statistically significant difference in the control group. The average of HDL in the two groups showed a significant increase after finishing the training sets ( $p = 0.048$ ). LDL and total cholesterol levels decreased in the experimental group, but the decrease was not statistically significant ( $p = 0.884$  and  $p = 0.549$ , respectively). Similarly, the triglyceride levels showed no significant change ( $p = 0.723$ ).

### 4. Discussions

The level of serum leptin after the eight-week physical exercise program indicated a favorable decrease ( $p = 0.02$ ). Some researchers have reported that short-term aerobic exercise training cannot change leptin concentration (18, 20). Kraemer pointed out through a review that short-term exercises (less than 60 minutes) and exercises that consume less than 800 calories of energy cannot alter the leptin concentration (14). After implementing a 12-week aerobic exercise training program, Ryan and Elahi (1996) found 28% decrease at serum leptin levels among male patients with type II diabetes (21). Hichkey et al. (1997) examined the effects of aerobic exercise training with the intensity of 60% of maximal heart rate on male and female subjects who had type 2 diabetes. They found no changes in the leptin level in the serum of males, while in spite of females (22). Halle et al. (1999) examined obese male patients with type 2 diabetes after one month of exercise on bicycles and reported that body weights and leptin concentrations were decreased significantly, which led to concomitant reductions in total cholesterol and glucose levels (23).

**Table 2.** Characteristics of Patients with Type 2 Diabetes in the Experimental and Control Groups

Index	Experimental group Mean $\pm$ SD	Control group Mean $\pm$ SD	S or NS
n	27	26	----
Drug treatment before training	2 (metphormin+cloropropamid)	2 (metphormin+cloropropamid)	-----
Age(yr)	44.93 $\pm$ 5.35	45.56 $\pm$ 5.41	Ns
Diabetes history(yr)	5.2 $\pm$ 2.4	5.38 $\pm$ 3.4	Ns
High (cm)	172.36 $\pm$ 5.17	173.09 $\pm$ 7.30	Ns
Weight (kg)	84.86 $\pm$ 5.54	86.03 $\pm$ 4.96	Ns
Fat%	29.94 $\pm$ 6.35	31.14 $\pm$ 6.07	Ns

S: Significant at ( $p < 0.05$ ); Ns: Not significant at ( $p < 0.05$ )

**Table 3.** Measurement indices in the experimental and control groups before and after the eight-week aerobic exercise training program

Index	control		experimental		sig
	Pre-test	Post-test	Pre-test	Post-test	
Weight	11.7 $\pm$ 84.8	11.5 $\pm$ 84.9	18.8 $\pm$ 86	17.5 $\pm$ 85.8	0.35
Body mass index	3.9 $\pm$ 28.6	4 $\pm$ 28.7	5 $\pm$ 28.2	4.9 $\pm$ 28	0.089
WHR	0.07 $\pm$ 1	0.07 $\pm$ 0.99	0.05 $\pm$ 0.96	0.07 $\pm$ 0.95	0.998
Fat%	6.1 $\pm$ 31.1	5.4 $\pm$ 31.5	6.4 $\pm$ 29.9	5.1 $\pm$ 27.9	0.014*
VO2 max	4.3 $\pm$ 31.5	3.5 $\pm$ 30.5	6.4 $\pm$ 31.4	5.9 $\pm$ 34.9	0.000*
Cholesterol	47.4 $\pm$ 194.4	51.4 $\pm$ 193.6	39.8 $\pm$ 192.8	41.9 $\pm$ 186.5	0.549
TG	97.4 $\pm$ 177.2	64.4 $\pm$ 171.7	88.4 $\pm$ 196.3	102.9 $\pm$ 202.7	0.723
HDL	7.6 $\pm$ 39.8	10.5 $\pm$ 45.1	6.1 $\pm$ 36.1	9.8 $\pm$ 46.8	0.048*
LDL	40.5 $\pm$ 117.1	32.1 $\pm$ 105.6	29.7 $\pm$ 113.96	26.1 $\pm$ 101	0.884
leptin	1.1 $\pm$ 4.8	1.1 $\pm$ 4.1	1.6 $\pm$ 4.8	1.02 $\pm$ 2.5	0.02*

\*: significant at ( $p < 0.05$ )

Some studies indicated that, if the mentioned exercises result in the reduction of fatty tissue, this process can decrease plasma level (14, 24, and 25). According to Kohrt et al. (1996), the reduction of the leptin concentration is the indirect result of such physical exercises. Thus, the reduction of BMI reduction is related to the reduction of leptin (26), although this finding is incompatible with the results provided by Pasman et al. in 1998. They declared that endurance training can decrease insulin, body fat percentage, and leptin levels (27). The obvious differences between the subjects and the exercise protocols can probably explain the differences related to the exercise and leptin levels in different studies. Studies conducted by Perusse et al. (1997) and Ostlund et al. (1996) emphasized the relationship between leptin and physical exercise through fat changes inside the human body (28, 29). In this study, the eight-week, aerobic exercise training program resulted in a 67% reduction in the body fat of the subjects, while no changes were found in abdominal obesity (which was measured indirectly through WHR) in either group. Thang et al. (2002) examined the effects of aerobic exercise training on men with upper-torso obesity. After a 12-week training program, they found that obesity changes and the reduction of the leptin were in accordance with under-skin fat tissue (30). Hence, we concluded that the subjects' reductions in fat percentage (6.7%) indicated the differences in the under-skin fatty strata

in the control group. Thus, it was considered that under-skin fat is the main source of leptin secretion compared to visceral fat (31) and that under-skin fat tissue secretes more leptin than visceral fats (3); thus, the reduction of under-skin fat inside the body can moderate the reduction of the leptin level as the result of aerobic exercise training. On the other hand, the lack of changes in BMI and WHR, the reduction of the percentage of body fat, the reduction of the leptin concentration, and the increase in the maximal consumption of oxygen indicate that changes in the concentration of leptin may result from other factors, such as:

1. Aerobic exercise training, which produces some changes due to leptin clearance
2. Aerobic exercise training, which produces some changes in the ratio of free or binding leptin to plasma proteins so that it can change the intensity of leptin activity (30)
3. Aerobic exercise training, which may increase the sensitivity of tissue to leptin, with the leptin concentration being adaptable according to this sensitivity
4. Aerobic exercise training, which affects obesity and has an effect on insulin resistance and physical structure. It might be possible that insulin adaptation and leptin depend on each other (4).
5. Leptin level reduction due to weight loss, which can decrease ob gene of under-skin fat cells;

thus, the reduction of the leptin level due to aerobic exercise training may decrease the under-skin fatty tissue of the subjects significantly.

6. Aerobic exercise training, which can increase the lipolysis reaction to the beta adrenergic in under-skin fatty tissue, and, consequently, it can decrease the concentrations of the ob gene and serum leptin (33).
7. Aerobic exercises, during which the capillary density is increased, i.e., more blood and oxygen are transferred to muscular tissue so that the density of mitochondria and the capacities of the oxidative enzymes can be increased in the muscles' mitochondria, increasing oxygen transfer in the chain enzymes and creating effective enzyme activities in fat oxidation, especially for the beta oxidation-cycle enzymes (34). Therefore, the muscles use the metabolism of fat tissues to produce the energy that is required.

The findings of this study indicated that the eight-week, aerobic exercise training program played a vital role in controlling body weight and preventing cardiovascular risk factors by affecting fatty tissue and plasma leptin levels. This process can be useful for preventing and treating type 2 diabetes.

#### Acknowledgements:

This research was sponsored by the Research Department of Mashhad Medical Faculty, Code 85357. The guidelines of scientific writing were also used to prepare the manuscript (35, 36).

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## Development of Height-Age Model and Site Index Curves for *Pinus rigida* Plantations in South Korea

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**Abstract:** A height-age model, using the Chapman-Richard growth function and site index curves, was developed for *Pinus rigida* in South Korea. The study sites were located in the *Pinus rigida* plantations in Yesan-gun, Muju-gun, Jinan-gun, and Sacheong-gun areas, which are regions in the central and southern parts of South Korea. A total of 15 temporary plots were established and 52 sample trees were harvested for disc collection and stem analysis. In order to evaluate the performance of the developed model, the coefficient of determination ( $R^2$ ), root mean square error ( $RMSE$ ), bias ( $\bar{E}$ ), mean percent bias ( $MPB$ ), and absolute mean difference ( $AMD$ ) were used as evaluation statistics. It was estimated that the model explained about 98.18% of the variation in the average value of height. The value of  $\bar{E}$  was 0.003m, whereas the value of the  $AMD$  was 1.027m. The computed  $RMSE$  was 1.381 and the  $MPB$  was 4.252%. A total of eight site indexes, starting from 8m up to 18m with an interval of 2m, were generated to show the different curves in predicting the productivity of *Pinus rigida* stands in South Korea.

[Seo YO, Lumbres RIC, Lee YJ. **Development of Height-Age Model and Site Index Curves for *Pinus rigida* Plantations in South Korea.** *Life Sci J* 2012;9(3):2524-2528] (ISSN:1097-8135). <http://www.lifesciencesite.com>.

366

**Keywords:** Chapman-Richards equation, forest management, pitch pine, site quality

### 1. Introduction

The Korea Forest Service (KFS) reported that the Republic of Korea, popularly known as South Korea, has a total of 6.370 million ha of forest land area covering approximately 64% of the total land area. Coniferous forests dominate approximately 42% or 2.672 million ha of the total forested land. The third most widely distributed coniferous in this country is the *Pinus rigida* (pitch pine), with approximately 0.41 million ha or 15.2% of the total coniferous forested land (Lee, 2010). In order to sustainably manage these forests, accurate estimates on forest productivity is essential (Haywood, 2009).

Forest managers can assess forest productivity, such as timber production, through site quality evaluation (Clutter et al., 1983). This evaluation can be a guide in predicting the growth and yield of forests, which are important factors in making critical decisions for forest stands (Spurr, 1952; Spurr and Barnes, 1980). This can also help managers to classify forests based on their productive capability (Lee, 2002). Moreover, the evaluation can also be considered as an important foundation in forest land use planning (Hocker, 1979). Clutter et al. (1983) stated that site evaluation can also serve as a basis in justifying the investment in plantation projects. Most forest managers consider the site index as one of the best measures in evaluating site quality because it is the most direct and widely used index in forestry (Clutter et al., 1983; Dieguez-Aranda et al., 2006; Fonweban et al., 1995; Onyekwelu, 2005). Site index, defined as the total height of the dominant or

co-dominant trees in a forest stand at an arbitrary index age, is a method used for quantifying site quality for pure even aged forest stands which is essential in growth and yield modeling (Corral-Rivas et al., 2004; Dieguez-Aranda et al., 2006; Lee, 2002). Akindele (1991) described the site index as the oldest and most satisfactory method, whereas Fonweban et al. (1995) described it as the most efficient and objective tool in evaluating the site productivity of a forest.

The graphical method and the mathematical model are two methods that can be used to evaluate site index. Between these two methods, the mathematical model is more preferred because there are difficulties in conducting statistical tests on the goodness of fit of the curve as well as on the involvement of the element of subjectivity in the graphical method (Akindele, 1991; Onyekwelu, 2005; Onyekwelu and Fuwape, 1998). Mathematical methods utilize different techniques to fit site index curves. These methods could be classified as special cases of three general equation development methods, which are the guide curve, difference equation, and parameter prediction methods (Clutter et al., 1983). Nanang and Nunifum (1999) reported that the guide curve is considered as one of the most popular methods in recent times, particularly on even-aged single species. Furthermore, this technique is very suitable for stands with temporary sampling plots (Akindele, 1991). Site index curves are often based on stem analysis data because it can provide significant information on potential site productivity

and moreover, they are more preferred for the development of reasonable and valid height models (Corral-Rivas et al., 2004). Furthermore, the past growth of trees is reconstructed based on the annual growth ring patterns using the stem analysis (Diegues-Aranda et al., 2006).

Different studies have been conducted in order to develop site index curves for various species in different areas. Site index prediction equations were developed for pine plantations grown under various conditions in the different locations in the southern United States (Avery and Burkhart, 1994; Lee and Hong, 1999; Pienaar and Shiver, 1980). In South Korea, studies were conducted in order to develop site index curves for *Cryptomeria japonica* (Lee, 2002), *Quercus variabilis* (Chung et al., 2002), *Pinus thunbergii* (Shin et al., 2007), *Chamaecyparis obtusa* (Kim et al., 2008), and *Larix kaempferi* and *Pinus densiflora* (Pyo et al., 2009; Shin et al., 2007; Son and Lee, 2003). However, no site index curves have been developed for *Pinus rigida* in South Korea. The development of site index equations as well as studies on the height growth patterns of this species will help forest managers to classify the quality of the different stands of *Pinus rigida* in South Korea. Thus, the objectives of this study is to develop a height-age model using the Chapman-Richards growth function (Chapman, 1961; Richards, 1959) and the anamorphic site index curves for *Pinus rigida* stands.

## 2. Material and Methods

### Study sites

This study was conducted in the *Pinus rigida* plantations in Yesan-gun (92,000ha), Muju-gun, Jinan-gun (60,000ha), and Sancheong-gun (25,000ha) areas, which are located in the central and southern parts of South Korea. Data collection was conducted from 2006 to 2011. The mean annual precipitation in Muju-gun and Jinan-gun was 1,442.1mm, whereas in Yesan-gun and Sancheong-gun, it was 1,228.9mm and 1,479.1mm, respectively. On the other hand, the recorded mean annual temperature in Yesan-gun was 11.6°C. In Muju-gun and Jinan-gun, the mean annual temperature was 10.4°C, whereas in Sancheong-gun, the recorded mean annual temperature was 12.7 °C (based on the years from 1971-2000) (Korea Meteorological Administration, 2010).

### Data collection and analysis

A total of 15 temporary plots were established; eight plots were located in Yesan-gun with a size of 10m × 10m plot, while seven plots with a size of 20m × 20m were established in the regions of Muju-gun, Jinan-gun, and Sancheong-gun. A total of 52 trees were felled from 0.2m above the ground,

and discs with a thickness of 5cm were collected for every 2m log section (for example, 1.2m, 3.2m, 5.2m, etc.). Yet, the first and the last disc were collected from the first and the last 1m of the log. These discs were used for the stem analysis. The age at each section height was determined at the laboratory. The height values were estimated at five year increments from the 2006-2008 data, whereas the height values were estimated at one year increments from the 2009-2011 data using DTRS-2000. The average age of the sampled trees was 21y and the average height was 9m (Table 1).

Table 1. Summary of the observed statistics for the height and age of *Pinus rigida* in South Korea

Variables	n	Mean	SD	Minimum	Maximum
Age (year)	1,056	21	11	3	44
Height (m)	1,056	8.9	5.2	0.3	19

The Chapman-Richards growth function was used in this study (Chapman, 1961; Richards, 1959), which is the extension of Von Bertalanffy's (1957) quantitative laws of the growth of organism. The form of this function is:

$$H = b_1(1 - \exp(-b_2A))^{b_3}$$

where:  $H$  = total height of the tree; (in meter)

$A$  = age; (in year)

$b_1$  = the asymptote;

$b_2$  = the rate parameter; and

$b_3$  = the shape parameter.

This growth function has been widely used because it defines sigmoid curves as having three parameters that characterize the different growth stages, which are influenced by biological processes and behaviors (Peng et al., 2001). Furthermore, this equation has been extensively used in the growth and yield studies of forestry in order to characterize site index curves, height-age, diameter-age, basal area-age, and growth rate-age relationships (Clutter et al., 1983; Payandeh and Wang, 1994; Pienaar and Turnbull, 1973; Somers and Farrar, 1991). To evaluate the model, the following evaluation criteria were utilized: coefficient of determination ( $R^2$ ), root mean square error ( $RMSE$ ), bias ( $\bar{E}$ ), absolute mean difference ( $AMD$ ), and mean percent bias ( $MPB$ ).

## 3. Results and Discussion

### Model fitting

Using the PROC NLIN procedure in SAS (SAS Institute Inc., 2004), a non-linear regression was applied to fit the height-age data using the Chapman-Richards height growth function (Figure 1).

The parameter estimates and associated standard errors were shown in Table 2. For each parameter estimate, the results indicated that none of the asymptotic 95% confidence intervals contained a zero. Therefore, it was concluded that the equation parameters are significant.

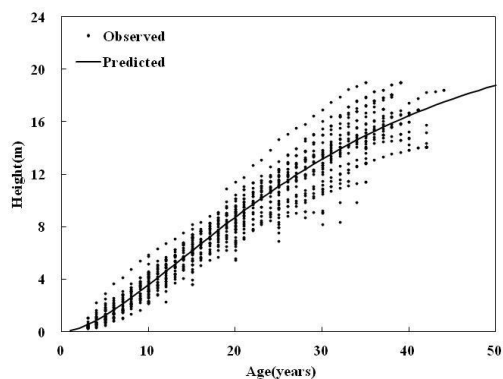


Figure 1. Comparison of the observed and predicted height using the developed height-age model for *Pinus rigida* in South Korea

Table 2. Parameter estimates, approximate standard error, and confidence intervals of the height-age model for *Pinus rigida* in South Korea

Parameter	Estimation	Standard Error	Lower 95% Confidence Level	Upper 95% Confidence Level
$b_1$	23.6177	1.0943	21.4644	25.7590
$b_2$	0.0422	0.0036	0.0351	0.0493
$b_3$	1.7682	0.00869	1.5978	1.9387

The performance of the developed model was evaluated by using the evaluation criteria, which are shown in Table 3. The  $R^2$  was 0.9818, which means that the model explained about 98.18% of the variation in the estimate of total height. In addition, Peng et al. (2001) stated that a larger  $R^2$  or a value near to one is better, meaning that the result of the created model is well fitted. Moreover, the computed  $RMSE$  was 1.381, whereas the  $MPB$  was 4.252%. The value of  $\bar{E}$  was 0.003 m, while the value of the  $AMD$  was 1.027 m. Peng et al. (2001) explained that a negative value of  $\bar{E}$  indicates that the developed model gave an over prediction while a positive value gave an under prediction. Moreover, the explanation defines that if the computed  $\bar{E}$  value is near to zero, the created model is better. A lower  $AMD$  value means that the model is more accurate. To further evaluate the developed model, the bias in the different age classes were determined (Figure 2). The results illustrated that the highest under prediction

was found in the 36-40 age class with 0.533 m; the highest over prediction was found in the 41-45 age class with 1.096 m.

Table 3. Fit statistics and evaluation statistics of the fitted Chapman-Richards model for *Pinus rigida* in South Korea

$R^2$	$RMSE$	$\bar{E}$	$AMD$	$MPB$
0.9818	1.3811	0.003 m (p=0.9460)	1.027 m (p=0.0001)	4.252 (p=0.0001)

\*Coefficient of determination ( $R^2$ ), Root Mean Square Error ( $RMSE$ ), bias ( $\bar{E}$ ), Absolute Mean Difference ( $AMD$ ), and Mean Percent Bias ( $MPB$ )

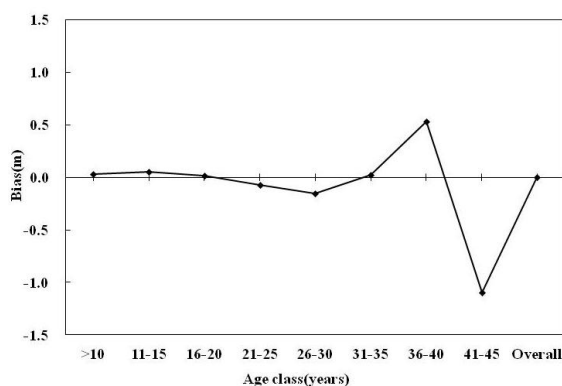


Figure 2. Bias of the developed model in height estimation by age classes for *Pinus rigida* in South Korea

### Site index curves

The guide curve method, described by Clutter et al. (1983), was utilized in this study for the development of anamorphic site index prediction equation in order to estimate the site index ( $SI$ ) for any given index age of *Pinus rigida*. The equation for the guide curve is:

$$H = 23.6177(1 - \exp(-0.0422A))^{1.7682}$$

The index or base age ( $IA$ ) for *Pinus rigida* used in this study was 30 as recommended by the Korea Forest Service (2009). Furthermore, Goelz and Burk (1992) stated that the index age is commonly selected less than the rotation age. The procedure described by Clutter et al. (1983) was also used to derive the curves for the other site index values. In this method, the rate parameter ( $b_2$ ) and the shape parameter ( $b_3$ ) of the equation (2) were constant, whereas the asymptote parameter ( $b_1$ ) varied in determining the height ( $H$ ) where age ( $A$ ) is equivalent to the index or the base age ( $IA$ ). The equation created to estimate the site index for any given age was:

$$SI = H \left( \frac{1 - \exp(-0.0422IA)}{1 - \exp(-0.0422A)} \right)^{1.7632}$$

Equation (3) can be rearranged algebraically to estimate the  $H$  at a given site index as follows:

$$H = SI \left( \frac{1 - \exp(-0.0422A)}{0.7180} \right)^{1.7632}$$

Site index curves were generated using equation (4) for *Pinus rigida* stands ranging from 3 years to 50 years of age, as shown in Figure 3. A total of six  $SI$ , starting from 8m to 18m with an interval of 2m, were generated in order to show the different curves in predicting the yield of a forest stand.

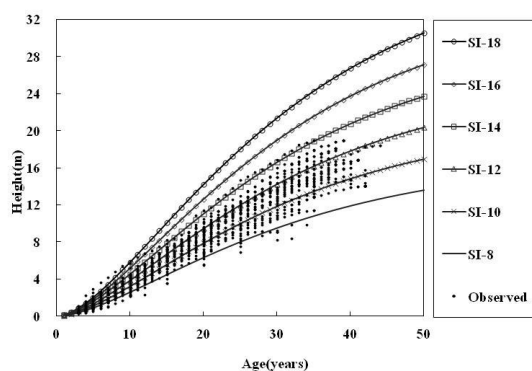


Figure 3. Site index curves developed for *Pinus rigida* in South Korea

#### 4. Conclusion

Site index curves had been developed for the different major species in South Korea except for *Pinus rigida*. The results of this study, in particular, the site index curves, will help forest managers to evaluate and classify pure stands of *Pinus rigida* in South Korea according to their potential productivity. The site index model, which was developed in this study, is a significant management tool in providing simple numerical values that can be easily measured and understood. For future study, it is recommended that site index curves that have more desirable attributes, such as polymorphism and multiple asymptotes, must be developed as suggested by Corral-Rivas et al. (2004).

#### Acknowledgements:

This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF), funded by the Ministry of Education, Science and Technology (2012.0004519).

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9/14/2012

## Effects of Moderate-intensity Exercise on Serum Proinflammatory Cytokine Levels in Obese and Non-obese Men

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**Abstract:** To date, limited and often controversial data concerning modulation of pro-inflammatory cytokines by exercise in obese individuals. In order to assess this possibility, 37 healthy untrained volunteers were selected and divided in two groups, obese and non-obese. Before and after three months of an aerobic training program, the plasma concentrations of leptin, IL-1 $\alpha$ , IL-2, TNF- $\alpha$ , IL-1 $\beta$ , IFN- $\alpha$  and IL-6 by an enzyme-linked immunosorbent assay. Before exercise, obese volunteers exhibited higher concentrations of IL-6 ( $p=0.07$ ), leptin ( $p<0.005$ ) and lower IL-1 $\alpha$  ( $p<0.05$ ) than non-obese group. Following exercise, a significant decrease in IL-2, IL-6, IL-1 $\alpha$ , IL-1 $\beta$  and leptin levels were observed in non-obese individuals ( $p<0.05$ ). Obese volunteers showed a significant reduction only in IL-1 $\alpha$ , IL-1 $\beta$  and leptin after exercise ( $p<0.05$ ). Our results indicate moderate long term exercise induce a major reduction in pro-inflammatory cytokines in obese and non-obese individual, however, adipose tissues probably refines and modulates these alterations.

[Vahdat Boghrabadi, Seyyed Mahmud Hejazi, Hasan Sanian, Ali Hoseinzadeh Gonabadi, Reza motejad. **Effects of Moderate-intensity Exercise on Serum Proinflammatory Cytokine Levels in Obese and Non-obese Men.**

*Life Sci J* 2012;9(3):2529-2532] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 367

**Keywords:** Proinflammatory cytokines, Obese, Moderate exercise

### 1. Introduction

To date, It is becoming increasingly evident that moderate exercise enhances the immune system, whereas intense or strenuous exercise may suppress host defense functions. (Gabriel and Kindermann 1997; Simonson 2001; Starkie and others 2005). There are also some evidences indicating that moderate exercise decrease the risk of infectious disease (Drela and others 2004; Gleeson 2007). Several studies have demonstrated exercise promotes release of pro-inflammatory and anti-inflammatory cytokines (Petersen and Pedersen 2005) and results in catecholamines, corticotropin-releasing hormone (CRH), adrenocorticotropic hormone (ACTH) and cortisol release. The hormones from the HPA axis, in particular cortisol, return to pre-exercise resting baseline within several hours to days. Contrary to this, catecholamines rapidly declines to the normal value (Santos and others 2007). In this context, many studies showed that exercise without any muscle damage induces IL-6 gene transcription in contracting muscle (Keller and others 2003). It appears that adrenaline has minor impact on the exercise-induced increase of IL-6 gene expression (Steensberg and others 2001b). Likewise, Steensberg and co-workers pointed out that low level of muscle glycogen enhances elevation of plasma IL-6 and thus indirectly stimulates the hepatic synthesis of glucose. Taken together, it assumed that IL-6 release may be playing a

glucose modulator role during prolonged exercise. Other data also introduced IL-6 as a potent modulator of fat metabolism in man, increasing lipolysis and fat oxidation without causing hypertriglycerolaemia (Pedersen and others 2001). Exercise also induce production of both IL-1 receptor antagonist and IL-10 and inhibit TNF production. Other proinflammatory cytokines, IL- $\beta$  and IL-1 $\alpha$ , in general do not increase with exercise (Ostrowski and others 1999).

In accompany with the elevation of serum IL-6, IL-10 and IL1ra levels, increase of cortisol and epinephrine, as well as prostaglandin E2, may all contribute to immune deviation to a predominance of Th<sub>2</sub> response. A Th<sub>2</sub> cell response leads to suppression of cell-mediated immunity, rendering the athlete susceptible to infection (Lakier Smith 2003). In the other hand, moderate exercise training could improve Th cell-mediated immune functions and result in a reduction in the risk of infections and autoimmune diseases in elderly people (Shimizu and others 2008). There is a variety of factors involved in the influence of exercise on immune responses include changes in circulating levels of cytokines, nutritional status, intensity, duration and obesity (O'Kennedy 2000). In the later case, several studies confirm the association of immune functions with adipose tissue. Recent investigations demonstrated that adipose tissue is not only an energy store, but also an active endocrine organ which produce a number of hormones and

cytokines. Adipose-secreted proteins include a variety of immune-related proteins such as leptin, TNF- $\alpha$ , IL-6, acylation stimulation protein that are collectively referred to as adipocytokines. In addition, It is known that obesity induces decreases in both T and B-lymphocyte responses (Berggren and others 2005). Although many studies focus on exercise-induced alterations in pro-inflammatory cytokines, however, limited and often controversial data concerning modulation of pro-inflammatory cytokines by exercise in obese and non-obese objects, which is considered as the main purpose of this paper.

## 2. Material and Methods

The volunteers were selected from volunteers recruited through a poster advertising campaign at the Mashhad Azad University. Body mass index of volunteers were measured using the body composition analyzer and 37 healthy untrained volunteers were selected and divided in two groups: 19 participants (weight  $96.8 \pm 15.9$ kg, height  $171.5 \pm 12.3$ cm, age  $30 \pm 5$ years, BMI  $32.3 \pm 2.1$  kg/m<sup>2</sup>) in obese group and 18 participants (weight  $57 \pm 3.3$ kg, height  $177 \pm 4.47$ cm, age  $30 \pm 5$ years, BMI  $18.1 \pm 0.58$  kg/m<sup>2</sup>) in non-obese group. None of the volunteers had a smoking history, medication or an illness or infection in the preceding months. All volunteers gave written informed consent after being provided with a description and explanation of the testing procedures. Approval for the study was obtained from the Ethics Committee of the Mashhad Azad University.

During three months of this study, each groups performed an aerobic training program consisted of running with 65-75% of individual maximum heart rate on treadmill (SportsArt® 6300, Taiwan) for three 30-min bouts per week. Blood samples were taken before and 37 hours after exercise to determine plasma cytokine concentrations. Serum and plasma samples were stored in aliquots at  $-70^{\circ}\text{C}$  until use. The plasma concentrations of IL-1, IL-2, TNF- $\alpha$ , IL-1 $\beta$ , IFN- $\alpha$  and IL-6 were measured by a high sensitivity enzyme-linked immunosorbent assay (Diacclone, Cedex, France). Leptin level was also determined using ELISA (Diagnostic Biochem Canada Ontario, Canada) according to the manufacturer's instructions. All measurements were performed in duplicate and the means of the two values were used in all analyses. Because data were not normally distributed, Non-parametric tests were used for statistical analyses using GraphPad Prism 5 for Windows (GraphPad Software Inc). Comparisons between two groups were carried out by Mann Whitney test. The Wilcoxon signed-rank test was used for paired values of cytokine before and after exercise. Correlations were performed by using Pearson's correlation coefficient. All results are given as mean  $\pm$  SEM. Significance was set at  $P < 0.05$ .

## 3. Results

Table 1 summarized cytokine concentrations in non-obese and obese groups before and after exercise. Using Mann Whitney analysis, we found no significant differences between two groups on IL-1 $\beta$ , IL-2, TNF- $\alpha$ , IL-6 and IFN- $\alpha$  concentrations before exercise. However, volunteers in obese exhibited slightly higher concentrations of IL-6 ( $p=0.07$ ). Obese group also had a significant higher leptin ( $p < 0.005$ ) and lower IL-1 $\alpha$  ( $p < 0.05$ ) than non-obese group before exercise (Figure 1). Following exercise, a significant decrease in IL-2, IL-6, IL-1 $\alpha$ , IL-1 $\beta$  and leptin levels were observed in non-obese individuals ( $p < 0.05$ ). Obese volunteers also showed a significant reduction in IL-1 $\alpha$ , IL-1 $\beta$  and leptin after exercise ( $p < 0.05$ ), while IL-6 and IL-2 demonstrated no different after exercise ( $p=0.37$ ,  $p=0.27$ , respectively).

In both obese and non-obese volunteers, plasma concentration of TNF- $\alpha$  and IFN- $\alpha$  indicated no significant changes following exercise.

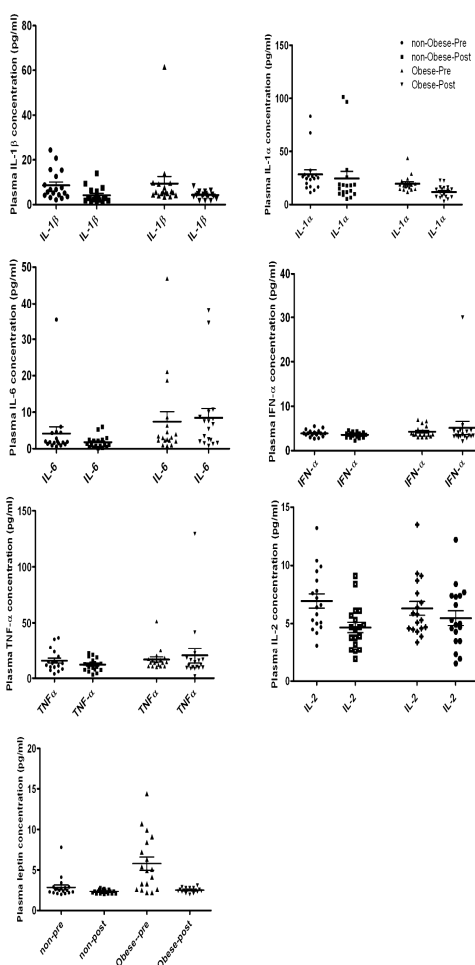
In comparison of post-exercise cytokine in obese and non-obese groups, only plasma concentration of IL-6 was significantly different between two groups that tended to be higher in obese group after exercise. In addition, the ratio of IL-6 to TNF- $\alpha$ , as an anti-inflammatory index (Timmons 2006), was significantly higher in obese group than non-obese group ( $p=0.007$ ). In contrast to baseline (pre-exercise) levels of Leptin and IL-1 $\alpha$ , there were no significant difference between obese and non-obese groups in the plasma levels of leptin and IL-1 $\alpha$  after exercise ( $p=0.1$  and  $p=0.066$ , respectively).

The correlation coefficient between post-exercise plasma levels of TNF- $\alpha$  and IL-2 were 0.68 ( $p=0.002$ ) in the non-obese and 0.48 ( $p=0.042$ ) in obese groups. There was a positive correlation between post-exercise plasma levels of TNF- $\alpha$  and IFN- $\alpha$  in non-obese ( $r=0.57$ ,  $p=0.013$ ) and obese groups ( $r=0.5$ ,  $p=0.035$ ). In obese group, post-exercise plasma level of IL-1 $\alpha$  was correlated with the plasma levels of IL-2 ( $r=0.62$ ,  $p=0.006$ ) and IFN- $\alpha$  ( $r=0.59$ ,  $p=0.01$ ).

## 4. Discussions

Several studies within the past few years have demonstrated that pro and anti-inflammatory cytokine balance could be altered by exercise. It became of interest to determine the role other factors that might be involving influence of exercise on the cytokine balance, which may mediate some of the health benefits of regular exercise. Although several researchers examined the role of exercise duration and intensity on systemic release of pro and anti-inflammatory cytokines, much less is known about the effects of obesity on cytokine balance after exercise. This concept is based on the fact that several important mediators and cytokines are synthesized in adipose

tissue of obese and non-obese individuals including IL-1 $\beta$ , IL-6, TNF- $\alpha$  leptin, complement system components and macrophage colony-stimulating factor and TGF- $\beta$ , (Berggren and others 2005; Coppack 2001; Sopasakis and others 2005; Starr and others 2009). In consistent with this viewpoint, obese group showed a higher concentrations of leptin and IL-6 and a lower concentration of IL-1 $\alpha$  than non-obese group before exercise.



**Figure 1:** Mean plasma concentrations of leptin, IL-1 $\alpha$ , IL-2, TNF- $\alpha$ , IL-1 $\beta$ , IFN- $\alpha$  and IL-6 in non-obese and obese groups before and after exercise. Values are expressed as the mean  $\pm$  SEM.

After exercise, both groups showed a significant reduction in the plasma level of leptin. This could be related to the increase of noradrenaline and adrenaline (Trayhurn and others 1996) that occurs during exercise. These catecholamines have a major suppressive effect on leptin production. It has been reported that leptin increases the production of proinflammatory lymphokines such as IL-2 and

interferon- $\gamma$ , while it inhibits the secretion of IL-4 from the lymphoid cells (Marti and others 2001). In consistent with this notion, both groups indicated a decrease in the plasma level of leptin and IL-2. After a long-term moderate exercise that applied in our study, IL-1 $\alpha$  and IL-1 $\beta$  plasma levels markedly reduced in both group in comparison with pre-exercise levels, while decrease in IL-2 and IL-6 plasma levels were observed only in non-obese group. Although, it has been well documented that acute exercise increases plasma levels of IL-6 (Fischer 2006; Keller and others 2003; Steensberg and others 2001a), several studies found a negative association between the amount of physical training and basal plasma IL-6 concentration (Fischer 2006). The reduction of this cytokine at rest as well as in response to exercise seems to be associated with the normal training adaptation. Our finding showed a post-exercise reduction of IL-6 plasma level in non-obese volunteers which was associated with a significant decrease in the ratio of IL-6 to TNF- $\alpha$  plasma levels. This ratio has been suggested as an anti-inflammatory index (Timmons 2006). TNF- $\alpha$  is a proinflammatory cytokine secreted from a variety of cells including macrophages, monocytes, neutrophils, T-cells and nonfat cells present in adipose tissue (Fain and others 2004). In consistent with our results, several studies demonstrated that TNF- $\alpha$  is unchanged after prolonged (Saghizadeh and others 1996; Steensberg and others 2002). Contrary to this, other previous claim that TNF- $\alpha$  increase immediately after the end of exercise or later on, after a recovery period (Moldoveanu and others 2001). This discrepancy could be due to differences in exercise intensity, gender and fitness, nutritional state of the volunteers and time interval between the last exercise and blood sample collection.

Our results indicate moderate long term exercise induce a major reduction in pro-inflammatory cytokines in obese and non-obese individual, however, adipose tissues probably refines and modulates these alterations.

#### Acknowledgements:

The authors thank Dr sankian for technical assistance and for constructing the human model. We also thank the Dr Mehrdad Jalalian for scientific writing guidance (29, 30).

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## Heavy metal poisoning as a possible cause of massive fish mortality and mongoose in the gold mining area around Khutsong, North west province , South Africa.

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**Abstract:** Ten composite samples each of water, sediment, fish and organs samples of mongoose from the Wonderfontein area were analysed for the presence of As, Pb, Cd and Cr using atomic absorption spectrophotometry in order to investigate the massive fish mortality in the Wonderfontein stream. Follow up samples of water and sediment were similarly analysed a year later. Abundance of metals followed the trend  $As > Pb > Cd > Cr$ ,  $Cr > As > Pb > Cd$  and  $As > Cd > Pb > Cr$  in water, fish and mongoose respectively. The concentrations of As, Pb, Cd and Cr in the initial water samples were 510, 121, 90 and 73 ppm respectively. Water samples collected 12 months later had lower levels of metals at 256, 60, 60, and 50 ppm respectively. Cr was highest in fish samples at 56 ppm, while As was highest in mongoose kidney at 25.7 ppm. Water concentrations of As, Pb, Cd and Cr were 10 205, 8 020, 2 425 and 733 times higher than the EC/WHO/EPA recommended threshold for potable water while those of Cd and Pb were 36 and 11.2 times higher than those recommended for fish. Levels of metals in sediments were generally higher than those in water. Severe heavy metal pollution with As, Pb, Cd and Cr was revealed in this study, and was also most linked to the mortality of fish and mongoose in the stream. Frequent biomonitoring is therefore recommended in order to safeguard public and animal health in the area.

[Nyirenda M, Thekiso V.V, Dzoma B.M, Motsei L.E, Ndou R.V, Bakunzi F.R. **Heavy metal poisoning as a possible cause of massive fish mortality and mongoose in the gold mining area around Khutsong, North west province, South Africa.** *Life Sci J* 2012;9(3):2533-2537]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 368

**Key words:** dynamic simulation; model; composting; domestic solid waste

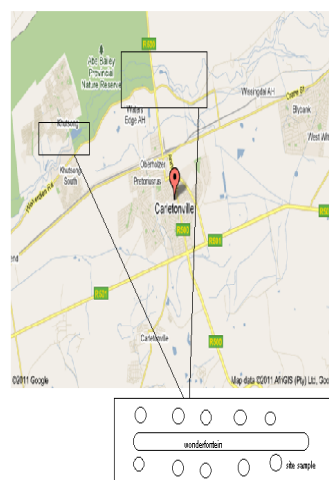
### 1. Introduction

Contamination of freshwater bodies with a wide range of pollutants has turned out to be a matter of great concern over the past few decades (Vutukuru, 2005; Canli *et al.*, 1998). Among the pollutants are toxic metals, which themselves are natural components of the environment. Anthropogenic activities that include industrial and mining processes however lead to a wider diffusion of these elements in the environment (Miranda *et al.*, 2004). Toxic metals accumulate in water, sediments, soil, plants, and organisms along the food chain (Miranda *et al.*, 2004). Heavy metal contamination may therefore have shocking effects on the ecological balance of the recipient environment (Farombi *et al.*, 2007).

Among animal species, fishes as inhabitants of the more vulnerable aquatic environments, cannot escape the detrimental effects of these pollutants (Olifa *et al.*, 2004). Fishes are therefore commonly used as bio-indicators of aquatic environment pollution in many bio-monitoring schemes (Rashed, 2001; Farkas *et al.*, 2002; Birungi *et al.*, 2007). On the other hand, fishes are an important sources of high-quality protein and beneficial omega-3 polyunsaturated fatty acids (Kucuksezgin *et al.*, 2001).

The study was conducted using samples from the Wonderfontein stream as it passes through Khutsong in

the North west province, South Africa. This was after a mass fish mortality during August, 2009. The headwater of the Wonderfontein originates around the mine residue deposits of several active, old and abandoned mines.



**Fig 1:** Location map and sampling map of the study area.

### 2. Materials and Method

#### 2.1 Study area

The study was carried out near Khutsong, a settlement on the outskirts of Carletonville (26°21'S 27°24'E 26.35°S 27.4°E). Carletonville itself is a gold-mining town in western Gauteng, South Africa, and is one of the richest gold-producing areas in the world.

### Dam water parameters

The first step in analysing the temporal dynamic of hydrochemical parameters in the Wonderfontein was focused on their variation over the sampling sites. This gives an overview of the range of possible hydrochemical conditions at the time of sample collection. The number of measurements (counts) and selected statistical parameters are compiled in Table 1.

**Table 1:** Stream water parameters measured in the Wonderfontein in 5 – 10 minutes interval between sampling sites.

Parameter	Temperature	pH
Unit	°C	
Count	5	5
Average	19.1	7.5

### Sample collection

#### Water and sediment

Ten samples each of sediment and water were collected from a 1 km stretch along the stream from the bridge. 500g sediment samples were collected 50cm from the banks of the stream, at a depth of about 10cm. The samples were transported to the laboratory in clean plastic bags. In the laboratory, these samples were combined to make a composite sample that was then well mixed and made into ten 1kg duplicate samples. 500 ml each of water were collected from similar points as sediment, and made into similar composite samples to produce ten 1L duplicate samples.

#### Fish and mongoose samples

Dead fish and mongoose specimens were collected from the Wonderfontein stream near the Krugersdorp-Carletonville road bridge. These were brought to the laboratory on ice immediately and then frozen at -25 °C until processing for analysis.

### Sample preparation

#### Water

Each water sample was filtered through a 0.45 micron microspore membrane filter in order to avoid clogging of the burner capillary.

#### Sediment

Sediment samples were put in aluminum plates and left to air dry for 7 days. They were then refined through a 2 mm screen prior to digestion.

#### Fish and mongoose specimens

About 50g of composite samples was collected from 15 fish, while the same weight was collected from mongoose liver, kidney and muscle tissue. These were dried to constant weight at 85°C in preparation for acid digestion.

### Digestion of samples

#### Equipment preparation

All laboratory equipments used for sample digestion and analysis were soaked in 32% HCl overnight. They were rinsed with distilled water 3 times and dried in a hot air oven for 16 hours at 106° C. A desiccator was used for 6 hours to cool crucibles.

#### Sediment

Five grams (5g) each of sieved soil and sediments were mixed with 10 ml of distilled water and shaken for 30 minutes. The aqua regia digestion method (Mapanda *et al.*, 2007) was performed for complete dissolution of soil samples. The solution was filtered through Whatman filter paper no 42 into a suitable container. The extracts were used for analysis.

#### Water

Digestion was performed to ensure the removal of organic impurities from the samples and thus prevent interference (Momodu and Anyakora, 2010). The samples were digested with concentrated nitric acid (where 10ml of nitric acid was added to 50ml of water in a 250ml conical flask). The mixture was evaporated to half its original volume on a hot plate after which it was allowed to cool and then filtered through Whatman filter paper No.42.

#### Tissue samples

5 ml of HNO<sub>3</sub> and 5ml of H<sub>2</sub>SO<sub>4</sub> were added to 5g of tissue samples (dry weight). When the reaction slowed, the tubes were placed in a hotblock digestion apparatus and heated at 60°C for 30 min. After cooling, 10ml of HNO<sub>3</sub> were added, and heated slowly to 120°C, then to 150°C until the samples tubes turned black. After cooling, 1ml of H<sub>2</sub>O<sub>2</sub> was added, resulting in a vigorous reaction. Further heating and addition of H<sub>2</sub>O<sub>2</sub> were carried out, after which the tubes were removed and filled up to 50ml with distilled water. 40ml of the digest was taken and filled up to 50ml using 5ml of APDC and 5ml of MIBK phase. The samples were shaken vigorously for 5 min after which metals were determined in the MIBK phase (Agemian *et al.*, 1980).

### Estimation of heavy metals in acid digested samples

All the acid digested samples water, sediments, fishes and birds were analyzed for Cd, Cu, Pb and Zn using the Atomic Absorption Spectrophotometer (AAS) with the approved methods from the Perkin Elmer

release Version E (2000). Values were expressed as parts per million (ppm).

### 3. Results

Ten composite samples each of water, sediment, fish and mongoose from the Wonderfontein area were analysed for the presence of As, Pb, Cd and Cr. Follow up samples of water and sediment were similarly analysed a year later. Abundance of metals followed the trend; As>Pb>Cd>Cr, Cr>As>Pb>Cd and As>Cd>Pb>Cr in water, fish and mongoose respectively. The concentrations of As, Pb, Cd and Cr in the initial water samples were 510, 121, 90 and 73 ppm respectively (Table 2). Water samples collected 12 months later had lower levels of metals at 256, 60, 60, and 50ppm respectively. The metals occurred at various levels in fish and mongoose samples, with Cr being highest in composite fish samples at 56 ppm, and lowest in mongoose muscle at 0.22 ppm. On the contrary, as was highest in mongoose kidney at 25.7 ppm. Levels of metals in sediments were generally higher than those in water, except for Cd.

**Table 2:** Trace heavy metal levels (ppm) in water, sediment, fish, and mongoose specimens from and around the Wonderfontein stream at Carltonville

SAMPLE	ARSENIC	CHROMIUM	CADMIUM	LEAD
WATER 2009	510.25	73.25	90.10	121.25
WATER 2010	305.2	65.61	86.73	65.37
SEDIMENT 2009	581.81	86.01	51.63	943.76
SEDIMENT 2010	348.2	77.07	49.7	812.85
FISH 2009	5.65	56	1.8	2.24
FISH 2010	3.33	54.02	1.63	2.08
MONGOOSE 2009				
Kidney	25.66	0.46	2.65	3.26
Liver	15.16	0.63	6.33	2.33
Muscle	3.25	0.22	0.12	0.65

### 4. Discussion

The current study revealed massive pollution of the Wonderfontein stream by trace metals As, Pb, Cd and Cr. This pollution can be attributed mining activities in the surrounding gold mines. In the North West Province of South Africa, gold mining activities have been associated with varying levels of heavy metal contamination that has posed potential risks to inhabitants of surrounding informal settlements (Winde, 2002; Winde and van der Walt, 2004; Winde *et al.*, 2004). Biomonitoring of the environment therefore becomes mandatory.

As, Pb, Cd and Cr trace metals in 2009 showed a trend of decreasing in 2010 and this could be attributed to the fact that the mines could have implemented the recommendations of Winde *et al.* report of 2004.

The heavy contamination of fish and mongoose specimens strongly points to heavy metal toxicity as the cause of mortality. A complete post mortem, including histopathology and microbiology were hugely hampered by post mortem time, which led to specimen deterioration for the respective protocols. However, based on the levels of water contamination and tissue levels, chances are high that death was related to environmental pollution. The turbidity of the water at the time of fish deaths further corroborates the findings of high pollution. Exposure of animals to high levels of toxic metals puts them at risk of adverse effects that include reproductive impairment, physiological abnormalities, behavioral modification, or even death (Sarkar *et al.*, 2003, 2008).

The heavy contamination of the specimens also bear testimony to the mobility of heavy metals up the food chain, and the risks it poses to public health. The concentrations of the concerned heavy metals were above the recommended thresholds for water and fish (EC, 2005) (Table 3).

**Table 3:** Recommended safe metal concentrations (ppm) as stipulated by the EC Regulation (2005)

METAL	Recommended threshold in water	No of Times greater in study water	Recommended threshold in fish	No of Times greater study fish
Cadmium	0.005	18020	0.05	36
Lead	0.05	2425	0.2	11.2
Arsenic	0.05	10205	*2	2.8
Chromium	0.1	733	NA	-

\*in meat in general NA- not available

Both sets of water samples, the one at the time of fish deaths and the one 12 months later were huge magnitudes higher than the recommended levels, although the latter ones had lower levels. The finding of excessive contamination of the environment with heavy metals puts the surrounding communities at risk (Winde, 2002; Winde and van der Walt, 2004; Winde *et al.*, 2004), more so because of the fishing, swimming and livestock grazing and watering activities in the area. Arsenic is one of the most toxic and carcinogenic metals derived from the natural environment (Yu *et al.*, 2006). Chronic exposure to inorganic arsenic compounds may result in neurotoxicity of the peripheral and central nervous systems (Goyer and Clarksom, 2001). The main signs of acute toxicity are an acute onset of profuse vomiting, fever, and disturbances of the cardiovascular and central nervous systems which may lead to death (Jarup, 2003). Arsenic has also been associated with cancer in the lung, kidney, bladder, and skin (ATSDR, 2003).

In cattle, clinical signs include depression, prostration, weight loss, weakness, dehydration, anaemia, anorexia, bloody diarrhea, ruminal stasis,



lethargy, dermatosis, reddish urine, dry dull rough, epilated hair coat and anoestrus (Rana *et al.*, 2008).

Pb is associated with a wide range of signs and symptoms that include impaired hearing ability, anaemia, renal failure, reduced immune system, low birth weights, still births and miscarriages, premature births, and elevated blood and urine lead levels in humans (Ati-Hellal *et al.*, 2007; Shahtaheri *et al.*, 2007; Gulser and Erdogan, 2008.).

Cadmium adversely affects a number of organs and tissues such as kidney (induces renal tubular dysfunction, proteinuria and chronic renal insufficiency), heart (aortic and coronary arteriosclerosis, increases cholesterol and free fatty acids), lung (fibrosis), skeletal system, testes, placenta, brain and the central nervous system (Houston, 2007). Its compounds also induce kidney, prostate and testicular tumors in animals, and lung, kidney and prostate cancers in humans (Waalkes, 2003; Satarug *et al.*, 2003). The short-term effects of high Cd concentrations include diarrhoea, nausea, vomiting, renal failure, muscle cramps, salivation, sensory disturbances, convulsions, shock and liver injury (Drastichova, 2004).

Chromium can affect developing fetuses, and can lead to DNA damage, which may result in cancer causing gene mutations (Dingbang *et al.*, 1995). The massive pollution of the Wonderfontein stream exposes the general populace to any of the effects described above.

### Conclusion

Heavy pollution of the Wonderfontein stream with As, Pb, Cd and Cr was revealed in this study, which was also linked to the death of fish and mongoose in the stream. More bio-monitoring, public and animal health studies are strongly indicated in this area. Policy regarding point source environmental pollution in the area need to be reviewed and enforced in order to avert a possible future public health crisis.

### Acknowledgement:

Authors would like thank the Department of Animal Health, North West University (South Africa) for the financial support to carry out this work.

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9/10/2012

## The awareness of the HPV's association with cervical cancer and the HPV vaccine among Saudi females

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**Abstract: Introduction:** Cytological screening, the Papanicolaou smear (Pap smear) has been one of the most successful public health measures available for cancer screening and prevention. The aim of our study was to assess the knowledge and the attitude toward the cervical cancer screening (the Pap smear) among women in Saudi Arabia. **Methodology:** a cross-sectional study, self-administered questionnaires were sent out to school teachers, relative, friends between the period November to December 2011, a random sample of 1023 women most of them aged between 16 and 45 years old were recruited. **Result:** We found 37% of the population never heard about the Pap smear test, and of those who heard about the test; 36% knew through the media. The majority of the married population (95%) does not perform the Pap smear test regularly and most of them never had PAP smear done. The main reason for not having a Pap smear was the lack of awareness. **Conclusion:** There is a need to educate and promote awareness of cervical cancer in this population in a different ways including the media, medical educational campaigns, brochures...etc. [Abdulrahim Gari; Ahmed Asiri; Amr Mohammed; Fahad Al-Malki; Mohammad Melibari; Mohammed AlSheikh; Moayad Kalantan; Nader Al Qethami; Shaddy Futtiny; Sultan Al-Essi; Yasser Al Shomrany and Ziyad Alihiby. **The awareness of the HPV's association with cervical cancer and the HPV vaccine among Saudi females.** *Life Sci J* 2012;9(3):2538-2546]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 369

**Keywords:** Human papillomavirus, HPV, Adult vaccination, Cervical cancer, HPV Vaccine

### 1. Introduction

Cervical cancer is one of the commonest cancer affecting women [9], it is considered the third most common cause of cancer related death among female population [10]. Over 500,000 new cases are diagnosed each year. Approximately 80 percent of cervical cancer cases occur in low-income countries where it is the most common form of cancer [14]. The association between cervical cancer and Human Papilloma virus (HPV) has been clearly documented [11]. Since most of the cases are attributed to HPV, prevention of this infection means the prevention of cervical cancer, which was already confirmed by the introduction of HPV vaccine [12]. Recently, the HPV vaccine in Saudi Arabia has been available but the awareness of its availability, importance and administration remains poor [13]. The human papilloma virus (HPV) vaccine prevents infection with certain strains of the virus associated with cervical cancer, genitalwarts and some less common cancers [15]. Two HPV vaccines are currently on the market: the bivalent and quadrivalent [15].

Both vaccines protect against the oncogenic strains (HPV-16 and HPV-18) that cause 70% of cervical cancers, 80% of anal cancers, 60% of vaginal cancers and 40% of vulvar cancers [15]. These HPV types also cause most HPV induced oral cancers and some other rare genital cancers [15]. The Quadrivalent vaccine also protects against (HPV-6 and HPV-11) that cause 90% of genital warts[15].

### 2. Methodology:

This is a cross-sectional study. One thousand and twenty three randomly chosen women were included in the study, excluding those who are involved in the medical field. Using self-administered questionnaires, that were sent out to school teachers, relative and friends.

The phase of "data collection" was between the first of November and the 7<sup>th</sup> of December.

Data analysis done by using the SPSS program in particular (chi square), statistical significance is considered if the  $p$  value is  $<0.05$ .

### 3. Results:

One thousand and twenty three females in the western region where included in the study.

Almost half of our study population aged between 26-45 years which represented (50.9 %), those who aged between 16-25 years represented (38.8%) of the study population followed by those aged 45 years and older which represented (9.5%). The minority aged 15 years or less which represented only (0.8 %) of the study group. (Figure. 1).

Those who were married represented (62%) of the study population, while (38%) were single.(Figure. 2). Among the married women; 27.1% have been married for less than 5 years, 20.2% have been married for a period ranges between 6 to 10 years and 20.2% have been married for a period ranges between 11 to 15 years. Only 16.5% married for a period between 16 to 20 years and 21.4% were married for more than 20 years. (Table1). We found that there is no statistical significant relationship between "marital status " and " awareness of HPV vaccine" ( $P$ -value = 0.954).

Only 1.5% of the population are illiterate and 41.5% of the population were at the elementary to high school level. The university graduates represented 57% of the study population. (Graph.3).

We found that only 13.4% of study populations are smokers while 86.6% are nonsmokers. (Table. 2).

The majority of the population represented by 84.6% did not know about Human Papilloma Virus and only 15.4% did know about it. (Graph. 4). There is no statistical significant relationship between "educational background" and "awareness of the HPV vaccine " ( $P$ -value = .661).

Up on asking the women about their reproductive organs; only 34.8% of them knew the exact location of the cervix (Figure. 5). The majority did not know the association between the HPV and Cervical Cancer which is represented by 82.2% and only 17.8% of the women knew the association. (Graph.6).

among the study group; 5.8% have a family member diagnosed with cervical cancer, while 94.2% don't have a family member diagnosed with cervical cancer. (Table. 3). There is statistical significant relationship between " awareness of the vaccine " and "family history of cervical cancer" ( $P$ -value = 0.001).

Almost half of the women have no idea about the prevalence of cervical cancer in our community and they represented 56.1% while only 16.9% think that cervical cancer isn't prevalent, however 26% of the study group thinks it is prevalent. (Table. 4). Only 20.8% of the study group did know the existence of the HPV vaccine, of which 1% was illiterates, 43.8% have a general education and 55.3% have Bachelor degree or Higher. (Table. 9). Most of those knew about HPV vaccine through the Media (38%). (Table. 5). However only 1.4% of the study group received the vaccine. (Table. 6). Seventy six percent of the females who think that cervical cancer is prevalent in the Kingdom are willing to receive the vaccine. Among women with family history of cervical cancer; 37.3% know about the presence of HPV vaccine. (Table. 12). Most of the study group are willing to receive the vaccine (63.3%) while the reminder (36.7%) aren't willing to receive it. (Graph.8). Knowing the association between the HPV and cervical cancer did not change the acceptability of the vaccine (62.7% vs 66.9%) (Table.13). Women who believe that cervical cancer is common are willing to get the vaccine more than others. ( $P$ -value = 0.001), it was also applicable on women who knew the association between the HPV and cervical cancer.

There were different reasons not to receive the vaccine (Graph. 9), that included; Lack of knowledge (43.6%), fear of side effect (29.7%), lack of trust (11.9%), thinking it is not important (8.2%), costs (2.9%), other reasons (4%). About a quarter (24.3%) of our population have some hesitation to recommend the

vaccine to a family member, but still most of them do recommend the vaccine to the other (63.2%), however only 12.5% of them don't recommend it to others. (Graph. 10).

#### 4. Discussion:

Cervical cancer is a preventable disease and the corner stone of prevention (primary prevention) is the HPV vaccine, however only 1.5% of the study population were vaccinated. This low percentage of vaccinated women is mostly due to low level of awareness about the presence of such a vaccine; we found that; only 20.8% of the study group has heard about it. Which can be attributed to low level of Knowledge about the virus itself, since only 15.4% of the population Knew about the virus. The same number was found by a study conducted by **Saitet al.** in study conducted in Jeddah –Saudi Arabia. They found only 9.8% of the population have heard about the vaccine [6]. A higher level of awareness was reported in a study conducted by **Mareket al.** in Hungary; they reported that, 35% of the population have heard about the vaccine [4]. **Ford et al.** conducted a study in Ohio-USA in 2011, the level of awareness of HPV infection and the vaccine among Hispanic and non-Hispanic women was high, it was 90% and 80% respectively, however; the HPV vaccination rates were low among this national population of young adult women.[ 7 ]. In 2007; **Jain et al.** conducted a study on the awareness of human papillomavirus (HPV) and HPV vaccine among women in the united states, he reported in his study the level of awareness of HPV was (84.3%) and (78.9%) of HPV vaccine. [8]

In our study; neither the marital status nor educational levels have any effect on the level of awareness. This point was not addressed in other studies. As expected a diagnosis of cervical cancer in a family member apparently will increase the level of awareness and this is common in most the cancers. **Durusoyet al.** Confirmed that in his study conducted in Turkey, genital cancer history in the family significantly increased the awareness [5]. The most common tools through which females in our study knew about the HPV vaccine was the newspapers (20.8%), however the minority heard about it through their physician (13.2%). **Marek et al.** found that the majority of his study population knew about the vaccine through school health and health professionals [ 4 ]. Lack of knowledge about reproductive anatomy might point to a problem in our educational curricula that needs more attention and this is never been addressed before in studies conducted in the developed world since they do not face such a problem. Most of the study population are willing to receive the vaccine (63%).

Table 1

SINCE HOW LONG HAVE YOU BEEN MARRIED					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	140	13.7	21.7	21.7
	Between (6 – 10) years	130	12.7	20.2	41.9
	Between (11 – 15) years	130	12.7	20.2	62.1
	Between (16 – 20) years	106	10.4	16.5	78.6
	Over 20 Years	138	13.5	21.4	100.0
	Total	644	63.0	100.0	
Missing	6	379	37.0		
	Total	1023	100.0		

Table 2

HAVE YOU EVER BEEN CONSIDERED AS A SMOKER IN YOUR LIFE ( CIGARETTE, SHISHA, HUBLY BUBLY)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	135	13.2	13.4	13.4
	No	870	85.0	86.6	100.0
	Total	1005	98.2	100.0	
Missing	3	18	1.8		
	Total	1023	100.0		

Table 3

DO YOU HAVE ANY OF YOUR FAMILY MEMBER WAS DIAGNOSED WITH A CERVICAL CANCER					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	59	5.8	5.8	5.8
	No	955	93.4	94.2	100.0
	Total	1014	99.1	100.0	
Missing	3	9	.9		
	Total	1023	100.0		

Table 4

DO YOU THINK THAT CERVICAL CANCER IS WIDELY PREVALENT OVER THE KINGDOM					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	266	26.0	26.3	26.3
	No	173	16.9	17.1	43.3
	I have no idea	574	56.1	56.7	100.0
	Total	1013	99.0	100.0	
Missing	4	10	1.0		
	Total	1023	100.0		

Table 5

IF YOU ANSWERED "YES", WHERE DID YOU HEAR ABOUT IT					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Your Physician	33	3.2	13.2	13.2
	Through the Media	95	9.3	38.0	51.2
	Relative	43	4.2	17.2	68.4
	Papers	52	5.1	20.8	89.2
	Others	27	2.6	10.8	100.0
	Total	250	24.4	100.0	
Missing	6	773	75.6		
	Total	1023	100.0		

Table 6

HAVE YOU EVER BEEN VACCINATED BEFORE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	14	1.4	1.5	1.5
	No	914	89.3	95.0	96.5
	I don't remember	34	3.3	3.5	100.0
	Total	962	94.0	100.0	
Missing	4	61	6.0		
	Total	1023	100.0		

Table 7

IF YOU ANSWERED "YES" , WHICH TYPE OF VACCINE DID YOU TAKE ?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Divalent	7	.7	5.5	5.5
	Quadrivalent	6	.6	4.7	10.2
	I don't remember	115	11.2	89.8	100.0
	Total	128	12.5	100.0	
Missing		895	87.5		
	Total	1023	100.0		

Table 8

ARE YOU MARRIED (OR PREVIOUSLY MARRIED) * DO YOU KNOW THAT THERE IS A VACCINE AGAINST "HPV RELATED CERVICAL CANCER" CROSSTABULATION					
			Do you know that there is a vaccine against "HPV related cervical cancer"		Total
			Yes	No	
Are you married (or previously married)	Yes	Count	128	489	617
		% within Are you married (or previously married)	20.7%	79.3%	100.0%
	No	Count	79	299	378
		% within Are you married (or previously married)	20.9%	79.1%	100.0%
Total		Count	207	788	995
		% within Are you married (or previously married)	20.8%	79.2%	100.0%

Table 9

<b>EDUCATIONAL BACKGROUND * DO YOU KNOW THAT THERE IS A VACCINE AGAINST "HPV RELATED CERVICAL CANCER" CROSSTABULATION</b>					
			<b>Do you know that there is a vaccine against "HPV related cervical cancer"</b>		<b>Total</b>
			<b>Yes</b>	<b>No</b>	
<b>Educational background</b>	<b>Illiterate</b>	<b>Count</b>	<b>2</b>	<b>12</b>	<b>14</b>
		<b>% within Do you know that there is a vaccine against "HPV related cervical cancer"</b>	<b>1.0%</b>	<b>1.5%</b>	<b>1.4%</b>
	<b>B )General Education (Elementary, Intermediate, or Secondary)</b>	<b>Count</b>	<b>91</b>	<b>323</b>	<b>414</b>
		<b>% within Do you know that there is a vaccine against "HPV related cervical cancer"</b>	<b>43.8%</b>	<b>40.9%</b>	<b>41.5%</b>
	<b>Bachelor degree or Higher</b>	<b>Count</b>	<b>115</b>	<b>454</b>	<b>569</b>
		<b>% within Do you know that there is a vaccine against "HPV related cervical cancer"</b>	<b>55.3%</b>	<b>57.5%</b>	<b>57.1%</b>
<b>Total</b>		<b>Count</b>	<b>208</b>	<b>789</b>	<b>997</b>
		<b>% within Do you know that there is a vaccine against "HPV related cervical cancer"</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Table 10

<b>DO YOU KNOW THAT HUMAN PAPILLOMA VIRUS CAN CAUSE MORE THAN 99% OF CERVICAL CANCER? * DO YOU KNOW THAT THERE IS A VACCINE AGAINST "HPV RELATED CERVICAL CANCER" CROSSTABULATION</b>						
			<b>Do you know that there is a vaccine against "HPV related cervical cancer"</b>		<b>Total</b>	
			<b>Yes</b>	<b>No</b>		
<b>Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?</b>	<b>Yes</b>	<b>Count</b>	<b>76</b>	<b>100</b>	<b>176</b>	
		<b>% within Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?</b>	<b>43.2%</b>	<b>56.8%</b>	<b>100.0%</b>	
	<b>No</b>	<b>Count</b>	<b>131</b>	<b>694</b>	<b>825</b>	
		<b>% within Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?</b>	<b>15.9%</b>	<b>84.1%</b>	<b>100.0%</b>	
	<b>Total</b>		<b>Count</b>	<b>207</b>	<b>794</b>	<b>1001</b>
			<b>% within Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?</b>	<b>20.7%</b>	<b>79.3%</b>	<b>100.0%</b>

Table 11

<b>DO YOU THINK THAT CERVICAL CANCER IS WIDELY PREVALENT OVER THE KINGDOM * DO YOU KNOW THAT THERE IS A VACCINE AGAINST "HPV RELATED CERVICAL CANCER" CROSSTABULATION</b>					
			Do you know that there is a vaccine against "HPV related cervical cancer"		Total
			Yes	No	
Do you think that Cervical cancer is widely prevalent over the Kingdom	Yes	Count	90	174	264
		% within Do you think that Cervical cancer is widely prevalent over the Kingdom	34.1%	65.9%	100.0%
	No	Count	34	135	169
		% within Do you think that Cervical cancer is widely prevalent over the Kingdom	20.1%	79.9%	100.0%
	I have no idea	Count	82	490	572
		% within Do you think that Cervical cancer is widely prevalent over the Kingdom	14.3%	85.7%	100.0%
Total	Count		206	799	1005
	% within Do you think that Cervical cancer is widely prevalent over the Kingdom		20.5%	79.5%	100.0%

Table12

<b>DO YOU HAVE ANY OF YOUR FAMILY MEMBER WAS DIAGNOSED WITH A CERVICAL CANCER * DO YOU KNOW THAT THERE IS A VACCINE AGAINST "HPV RELATED CERVICAL CANCER" CROSSTABULATION</b>					
			Do you know that there is a vaccine against "HPV related cervical cancer"		Total
			Yes	No	
Do you have any of your family member was diagnosed with a Cervical Cancer	Yes	Count	22	37	59
		% within Do you have any of your family member was diagnosed with a Cervical Cancer	37.3%	62.7%	100.0%
	No	Count	185	764	949
		% within Do you have any of your family member was diagnosed with a Cervical Cancer	19.5%	80.5%	100.0%
Total	Count		207	801	1008
	% within Do you have any of your family member was diagnosed with a Cervical Cancer		20.5%	79.5%	100.0%

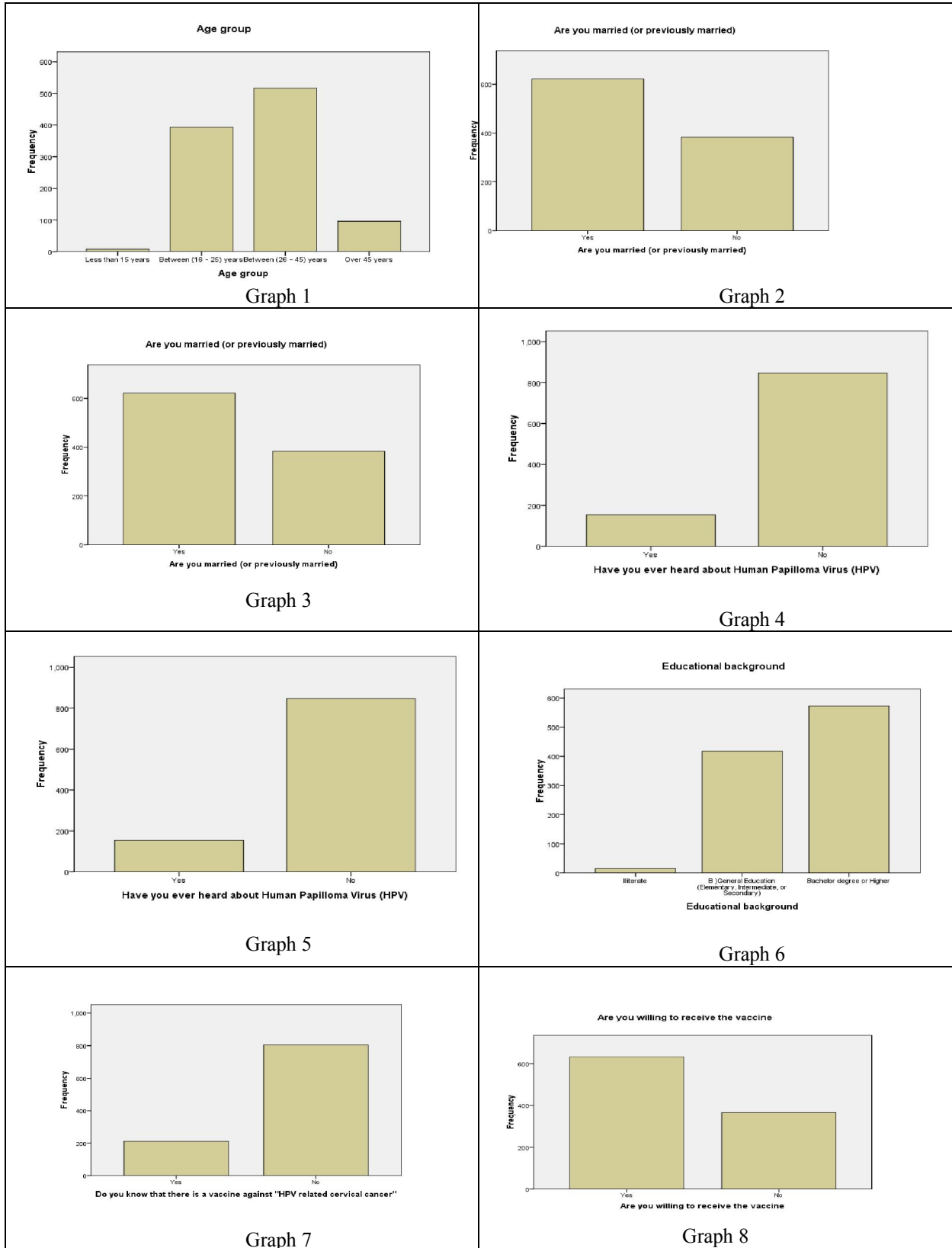


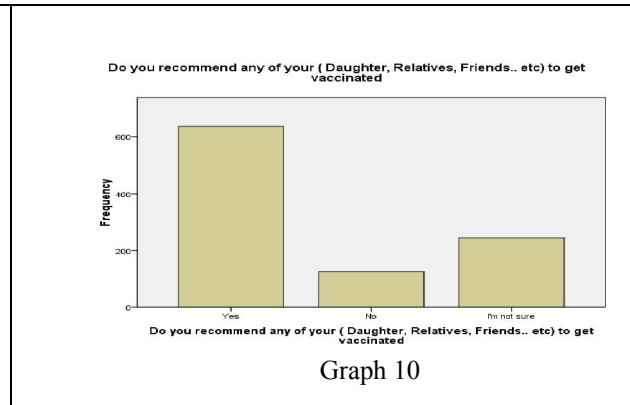
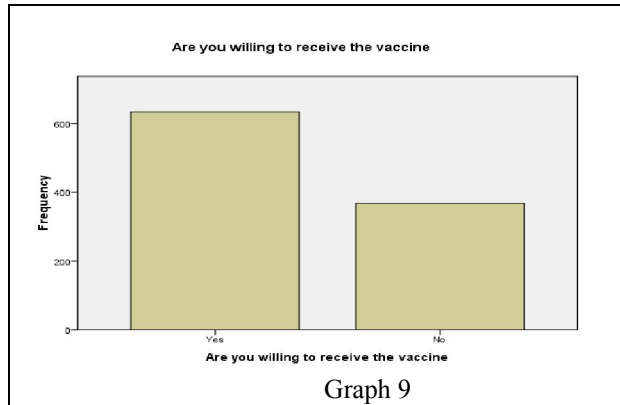
Table 13

<b>DO YOU THINK THAT CERVICAL CANCER IS WIDELY PREVALENT OVER THE KINGDOM * ARE YOU WILLING TO RECEIVE THE VACCINE CROSSTABULATION</b>					
			Are you willing to receive the vaccine		Total
			Yes	No	
Do you think that Cervical cancer is widely prevalent over the Kingdom	Yes	Count	200	62	262
		% within Do you think that Cervical cancer is widely prevalent over the Kingdom	76.3%	23.7%	100.0%
	No	Count	106	61	167
		% within Do you think that Cervical cancer is widely prevalent over the Kingdom	63.5%	36.5%	100.0%
	I have no idea	Count	324	240	564
		% within Do you think that Cervical cancer is widely prevalent over the Kingdom	57.4%	42.6%	100.0%
Total	Count	630	363	993	
	% within Do you think that Cervical cancer is widely prevalent over the Kingdom	63.4%	36.6%	100.0%	

Table 14

<b>DO YOU KNOW THAT HUMAN PAPILLOMA VIRUS CAN CAUSE MORE THAN 99% OF CERVICAL CANCER? * ARE YOU WILLING TO RECEIVE THE VACCINE CROSSTABULATION</b>					
			Are you willing to receive the vaccine		Total
			Yes	No	
Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?	Yes	Count	117	58	175
		% within Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?	66.9%	33.1%	100.0%
	No	Count	510	303	813
		% within Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?	62.7%	37.3%	100.0%
Total	Count	627	361	988	
	% within Do you know that Human Papilloma Virus can cause more than 99% of cervical cancer?	63.5%	36.5%	100.0%	





The more the awareness of the prevalence of cervical cancer, the more they are willing to receive the vaccine. The cost might be a major factor in the vaccination process; In Hungary Marek E et al. found that; if the vaccine was available free of charge, almost 80% of respondents would request it, but in case they had to pay for it, this number would significantly decrease[ 4 ]. The cost was not the main reason for low vaccination rate, only 3% did not take it because of the cost but the low vaccination rate was mainly because of the lack of knowledge followed by worries about the side effect.

#### Conclusion:

The level of awareness about HPV, its association with cervical cancer, and HPV vaccine in the kingdom is very low compared to the developed countries. Further researches exploring the HPV awareness and vaccination barriers across our population are needed. Educational campaign regarding HPV, its association with cervical cancer, and HPV vaccine should be established.

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9/1/2012

## Changes in socioeconomic status, community health and environmental conditions of fishermen by transmigration (*transmigrasi*) in Lampung Timur, Indonesia

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**Abstract:** Indonesia is characterized by an uneven population distribution, i.e., approximately 60 percent of the population is concentrated on Java Island (7 percent of Indonesia's land areas), and others live on the islands of Kalimantan, Sumatra, Sulawesi and Papua. In order to mitigate the overpopulation problem in Java, the Indonesian government created a transmigration program (*transmigrasi*) in the early 20th century to move people from densely populated areas (mainly Java) to more sparse areas. The Lampung Province in Sumatra has been one well-known destination of transmigration since the first migration in 1905. Focusing on the fishermen that migrated into the coastal area of Lampung Timur in the mid-1980s, this study aims described the transmigration-induced changes in their socioeconomic status (SES), community health, environmental conditions and quality of life. Focus group discussion with selected people and interviews with 179 heads of households (all are first generation) revealed that their SES and community health conditions generally improved after transmigration. However, certain kinds of environmental degradations happened after they settled in the area. In 1996 some people moved out to the elephant-conservation area to seek for more fish, but they were forced to come back to the transmigration area after having social conflicts with the government. The perception of community health and environmental conditions, and QOL score with social conflict experience was worse than without social conflict experience, and the desire for further migration was higher in the former.

[Nugroho, AS, Tsukasa, I. **Changes in socioeconomic status, community health and environmental conditions of fishermen by transmigration (*transmigrasi*) in Lampung Timur, Indonesia.** *Life Sci J* 2012;9(3):2547-2556] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 370

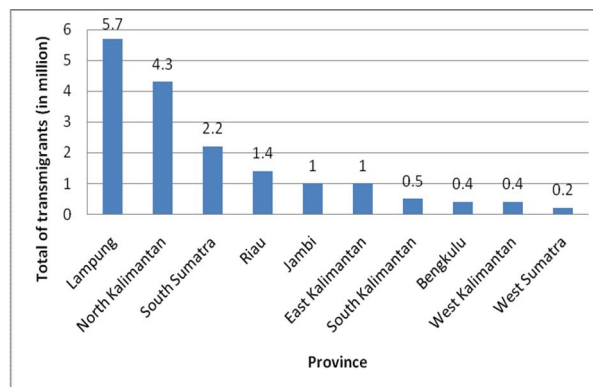
**Keywords:** Transmigration; fishermen; socioeconomic status (SES); community health; environmental conditions

### 1. Introduction

Human migration is natural, and academic papers have proposed several theories and models. A recent Human Development Report [1] stressed improvement in the quality of life (QOL), such as occupation, education, civil and political rights, and security and health care, but it is also true that immigrants have caused significant conflict with the indigenous population. Indonesia has a long history of migration programs (called *transmigrasi* in Indonesia) in the country. These programs were started during Dutch colonial rule in 1905 [2-4] to solve the overpopulation problem on Java Island (Java and Madura share only 7 percent of Indonesia's land, but they are inhabited by approximately 60 percent of Indonesia's population) as well as to reduce poverty in the country and to develop food production outside Java [5,6].

After independence in 1945, the Indonesian government continued the transmigration program [7], with various types of implementation. The transmigration in period (1945-1967) was understood as the displacement of families from an inner island (Java Island) to an outer island (Sumatra, Kalimantan, Sulawesi, Maluku and Papua Islands). After 1968, the Indonesian economy gradually developed under the

New Order period (1968-1999), and many people participated in the program to fulfill their dreams. The number of people participating in the transmigration program has decreased since 1999. In fact, the transmigration program stopped for a while in 2000. According to the 2010 census in Fig. 1, roughly 20 million people migrated from the inner islands to the outer islands [4,8,9], making Indonesia's transmigration program the largest voluntary land settlement scheme in the world [10].



**Fig. 1. Distribution of total migrants, families and descendants**

In Sumatra, including Lampung, the transmigrants' manpower was used on various kinds of plantations, and the provinces of South Sumatra and Lampung developed as food-production areas and North Sumatra developed as a plantation area [4,11,12]. However, the transmigration program has created problems such as the accelerated deforestation of sensitive rainforests from the overuse of natural resources and the overgrazing of land [4]. For example, the transmigration area in Central Kalimantan showed that the peat land was unacceptable for rice cultivation, crops were destroyed by rodents, drainage and irrigation systems did not work properly; and the groundwater was highly acidic and inappropriate for drinking [7]. Some transmigration programs fail to improve the living standard of migrants and their quality of life, and instead create unsuitable farming systems, environmental degradation and cultural conflict [13].

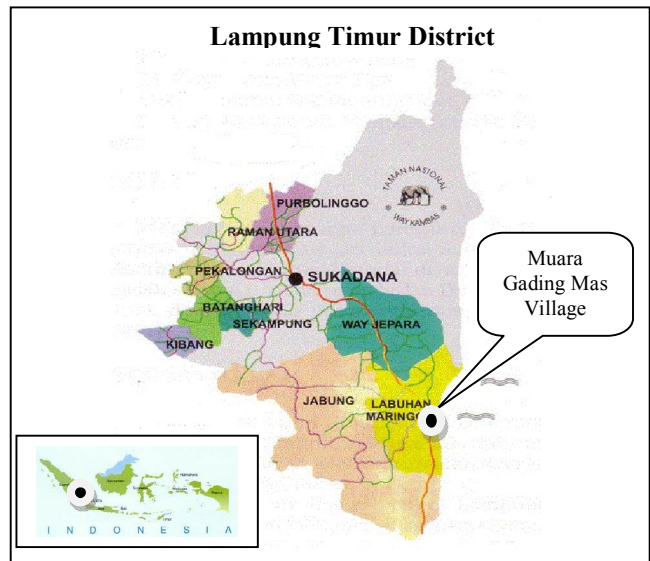
The transmigration program was devoted to farmers and to fishermen to keep the border area and to reduce the density of fishermen on Java Island. In the 1980s, it became difficult for fishermen on Java Island to catch fish; their income decreased and they participated in the transmigration program to fish the outer islands. Fishermen migrants can cause problems for local fishermen in the way of unfair competition for the fishing catch and environmental damage [14]. Fishermen migrants will encourage significant environmental changes and they are more likely to be found in villages with lower environmental quality [14]. The lower environment quality will affect income levels, especially for the small fishermen who depend on the environment [15]. Decreasing the economic level will reduce their quality of life. Lampung Timur is an interesting research area that can describe this condition.

This study aims to describe the changes in socioeconomic status, community health and environmental condition among the people who migrated in Lampung Timur from Java and Sulawesi as fishermen in 1984. People were asked about those conditions before migration (at their original village), immediately following their migration, and at the time of study. Then their perception of community health and environmental quality was compared to theirs and others responses. This study also aims to describe their quality of life (QOL) in the present condition

## 2. Material and Methods

Indonesia's Lampung Province has long history of transmigration from the first migration in 1905, and this province has accepted the most Indonesian migrants [4]. Lampung Timur has been the destination of the transmigration program since the 1970s; therefore it can demonstrate changes in socioeconomic status (SES), community health, and environmental

condition, and evaluate their quality of life (QOL). Research has been carried out in the transmigration area in Muara Mas Gading Village in the Lampung Timur district (Fig. 2). As many as 534 households (2,000 people) have migrated into this area from Java and Sulawesi since 1984. The most interesting thing is that the majority of migrants were fishermen.



**Fig. 2. Research area of Muara Gading Mas Village**

The social conflicts that have happened since then are also interesting. The fundamental conflict happened because the fishermen could not earn enough income fishing. In 1996 it became difficult to get fish around the transmigration area, and some migrants (84 households) moved again to the border of the Lampung National Zoo's conservation area (+10 km from their area), even though settlement was restricted [16]. Migrants had to fight with the forest police—the processes of conflict resolution started in late 2008, and the forest police ordered migrants to leave by the end of January 2009. Nevertheless, they refused to move out. After the negotiations on November 6, 2009, migrants agreed to return to the transmigration areas by November 26, 2009. More than half of the migrants have followed the agreement, but 40 households remain in the Lampung National Zoo's conservation area. The forest police burned their houses on July 15, 2010, and most of them returned to the migration area. Our research was carried out just after they returned to the migration area.

The focus group discussion (FGD) included the head of the village, village secretary and staff, indigenous stakeholders, the head of fishermen's group, midwives, and school principals to share general information about the transmigration history, public health, sanitation and environmental conditions

before migration (at original village), just after migration (1984) and at the time of the study (2010). Participatory research discussion started with a substantial amount of time spent on creative ways to explore the participants' experiences or situations [17]. Pictures, maps and diagrams were used to recall old information [18].

Questionnaires for household respondents were composed of three major questions about socioeconomic status (SES), community health and environmental conditions. The SES included household income, ethnic groups, and experience with social conflict, education history and occupation. Household income is the sum of income from all sources received by all members of the household each month. Income refers to wages, salaries, profits, rents, and any earnings received. Income can also come as unemployment or workers compensation, social security, pensions, interests, government support, and family financial assistance [19]. Free and serial recall was used to collect information. Free recall helped participants remember information with the list data [20], while serial recall helps participants remember events chronologically [21]. Specifically, the questionnaire above directed respondents to recall information before migration (in their original village), just after migration (1984) and at the time of study (2010).

Perception questions differ from other types of survey questions that measure perception because they ask respondents to provide information on how they perceive matters such as their health status, environmental conditions and the effectiveness of programs. The questionnaires mentioned satisfaction level measures of how people evaluate their life as a whole rather than their current feelings. Participants responded using a 5 Likert scale with a given statement. For these questionnaires, respondents only expressed their perceptions before migration and at the time of study (2010).

To determine the level of quality of life between migrants who have experienced conflict and those who have not, we retrieved data on quality of life using the method of WHOQOL-BREF in Indonesian (*Bahasa*) version [22]. WHOQOL-BREF is a multi-dimensional, multi-lingual, generic profile that is standardized for sick and well populations in diverse cultures [23]. It demonstrates psychometric properties of internal consistency, reliability, content validity, and discriminant validity [24] and it is now the best instrument for cross-cultural use [25]. The WHOQOL-BREF sheet is also very efficient and effective, consists of 26 items that keep respondents engaged. In this study, the WHOQOL-BREF questionnaires were used for the respondents to describe their QOL in the second point of study (2012).

In total, 179 people (household heads or representatives, 165 males and 14 females aged 41-91 years) were interviewed August-September 2010. The research used purposive sampling for experience with social conflict (25 from 84 households) because they were living together, as refugees tend to do. Snowball sampling was used for groups without experience with social conflict (154 from 450 households). However, snowball sampling can be vulnerable to sampling error or biases because the randomness of the selection may result in a sample that does not reflect the makeup of the population [26]. Only 45 people out of 179 were interviewed in the second research period in January 2012 because of limited time. We should choose the same sample in the first research period. The low sample number can affect the reliability and validity in QOL level. All the data were analyzed with SPSS version 17 [27].

### 3. Results

#### 3.1 Socioeconomic status of the migrants

As shown in Table 1, the migrants' average income (lowest column) before moving into Lampung was approximately 99,441 IDR/month, less than the minimum national standard at the time. Their income sharply increased after migration (259,776 IDR/month), since the government provided each migrant household a house (5 x 6 m<sup>2</sup>), 800 m<sup>2</sup> of land, a fishpond, food for one and one-half years at the beginning of resettlement in 1984, and agricultural and fishing equipment to every 20 households. Twenty-five years later, their average income increased to 554,469 IDR/month. The migrants' monthly household income average in IDR increased from year to year, but when compared to the currency exchange rate in USD, their income was classified below the standard of the national average income (GNP) [28,29].

When average income was classified by education, it was unexpectedly high among those without education in all three periods. However, this was because the fishermen followed their father's job without going to school. Most of them migrated into the area as fishermen, but their jobs have changed over 25 years. Eleven people who changed from fishermen to small industry owners had a higher average income than fishermen, although those migrants who became fishing port workers or transport service workers had a lower income.

Ethnic group was expected to affect their income level because fishing gear differs (therefore the catch amount varies) by ethnic groups. However, the difference in average income by ethnic group was minor. The difference in average income for those who experienced conflict and those with no experience with social conflict were small before and after transmigration. At present, the average income of

the group with social conflict experience is smaller than the group without social conflict experience, probably because social conflict made their economic situation difficult after coming back to the transmigration area.

or doctors (63.7 percent) before migration. Fishermen drunk traditional medicine or went to traditional birth attendants (TBA) when they had health problems. They preferred TBAs or traditional healers because they did not trust health centers (28.5 percent).

**Table 1. Monthly average income by socioeconomic status (SES) in each period**

	Average income per month		
	Before migration	1985	2010
Education			
Junior High School (2)	65,000 IDR	200,000 IDR	450,000 IDR
Primary School (62)	78,064 IDR	237,903 IDR	530,645 IDR
Illiterate (115)	111,565 IDR	270,260 IDR	569,130 IDR
Occupation			
-Jobless	25,102 IDR (42)	-	366,666 IDR (3)
-Fishing port worker	-	-	487,500 IDR (8)
-Small industry owners	-	200,000 IDR (1)	672,727 IDR (11)
-Farmer	133,333 IDR (6)	-	-
-Transport service worker	-	-	475,000 IDR (4)
-Fishermen	127,177 IDR (124)	258,595 IDR (178)	555,228 IDR (153)
Ethnic			
-Sundanese (56)	97,678 IDR	258,928 IDR	555,357 IDR
-Bugis (69)	102,898 IDR	263,768 IDR	578,985 IDR
-Javanese (54)	96,851 IDR	255,555 IDR	522,222 IDR
With or without conflict			
1. With conflict (25)	109,600 IDR	284,000 IDR	526,000 IDR
2. Without conflict (154)	97,792 IDR	255,844 IDR	559,090 IDR
Average income	99,441 IDR	259,776 IDR	554,469 IDR
International currency (average in year) <sup>a</sup>	1 USD = 1025 IDR	1 USD = 1110 IDR	1 USD = 8683 IDR
GNP per capita	540 USD	510 USD	2500 USD

Note: Figure in parenthesis indicates number of subjects in the category

<sup>a</sup>Sources: Bank Indonesia, 2012 and The World Bank, 2012

### 3.2 Community health

The community health of the migrants can be seen through disease events and health seeking behavior. Disease event data was captured by asking the respondents cross-check questions about the disease events in their household. Respondents were given a checklist of disease events that have happened in their life. The disease event list in the questionnaires used data from the sub-district hospital in the Labuhan Maringgai (Puskesmas) from 2007–2009. As shown in Table 2, the communal pattern of disease events is similar in the three periods (before migration, just after migration and the study period). The most common disease events for transmigrants in 2010 were viral or infection fever (32.4%), common cold or influenza (25.8%), and pertussis (allergy, common cough, dry cough)(25.8%). Other disease events included diarrhea, asthma, scabies, etc.

In this research, health seeking behavior is described as the process from the recognition of symptoms to the use of particular health facilities. This method attempts to identify a logical sequence of steps and looks at social and cultural factors that affect this sequence. This is primarily an anthropological approach, with qualitative methods of investigation [30]. Table 3 shows that there were no health centers

They started going to health centers after migration (30.7 percent), when the government built new health centers in the transmigration area.

**Table 2. Disease events (percent of the people per year) in each period**

Disease events	Before migration	1985	2010
0. None	25.4%	14.6%	2.7%
1. Viral or infection fever	29.5%	30.0%	32.4%
2. Pertussis	16.0%	18.6%	25.8%
3. Common cold or influenza	16.0%	18.6%	25.8%
4. Diarrhea	3.7%	6.4%	4.5%
5. Scabies	3.7%	3.6%	3.0%
6. Asthma	2.0%	2.9%	2.7%
7. Gastritis	1.2%	2.1%	2.4%
8. Malaria	0.8%	-	0.3%
9. Pregnancy disease	0.8%	-	0.3%
10. Typhus	0.8%	0.7%	1.2%
11. Eye diseases	0.4%	1.4%	-
12. Kidney diseases	0.4%	0.4%	-
13. Dengue	0.4%	-	0.3%
14. Hepatitis	-	0.7%	-
15. Diabetes	-	2.1%	0.6%
16. Tuberculosis	-	-	0.9%

Note: Data calculation used multiple responses

In 1985, some people complained that they still found it difficult to go to health centers because they did not have enough money to pay for medical

treatment after migration (25.1 percent). Health insurance systems for the poor have been running since 2004, but they could not cover all medical expenses. The number of migrants who visited the health centers exceeded 58.7 percent, and the percentage that complained about the cost of medical treatment decreased in 2010.

**Table 3. Health seeking behavior**

Reason	Before migration		
	1985	2010	
1. No health center available	63.7%	3.4%	-
2. Don't trust health center	28.5%	17.3%	0.6%
3. Use traditional medicine	4.5%	10.6%	8.9%
4. No have medical treatment fee for hospital	3.4%	25.1%	19.6%
5. Lazy to go to the hospital	-	5.6%	6.1%
6. Purchased medicine at local pharmacy	-	7.3%	6.1%
7. Visited a health center	-	30.7%	58.7%

Note: Data calculation used multiple responses

**3.3 Perception of community health**

The perceptions of community health in the questionnaire were concerned with the level of access to health facilities and public health services before migration and at present. The data analyses were separated into groups of migrants with and without social conflict experience. The results of the t-test show that the variance and means of community health perception were significantly different in transmigrants (both groups) before and after migration ( $p < 0.05$ , Table 4).

**Table 4. Mean differences of community health perception of transmigrants (both groups with and without conflict experience) in before migration and present time (2010)**

Community health perception of transmigrants (both groups)	Paired Differences					
	Mean (Before migration)	Mean (After migration)	SD	P	95% CI	
					Lower	Upper
Time of before present study period	-.68	-.08	1.07	.00*	-.75	-.43

\*Significant different if  $p < 0.05$

Note: Data calculation uses t-Test and N is 179. Likert scale: (-2) Very uncomfortable, (-1) uncomfortable, (0) not different, (1) comfortable, (2) very comfortable

The McNemar test of marginal homogeneity in Table 5 was carried out to examine the difference between the perceptions of the groups before and after migration. The left side of the table shows there was no difference proportion in the perception of community health in the group with social conflict experience before and after migration ( $p > 0.05$ ). The perception of community health in this group was better in the transmigration area. On the contrary, significant differences proportions in community health perception in the group without social conflict

experience before and after migration ( $p < 0.05$ ). The perception of community health in this group was better in the transmigration area.

**Table 5. Perception of community health before and after migration by the experience of social conflict**

Community health perception	Those with experience of social conflicts				Those without experience of social conflicts			
	N	Mean	SD	P	N	Mean	SD	P
Before migration	25	-.24	.92	.06	154	-.75	.54	.00*
After migration	25	-.64	.56		154	.01	.86	

\*Significant different if  $p < 0.05$

Note: Data calculation used Mc Nemar test of marginal homogeneity and N is 179. Likert scale: (-2) Very uncomfortable, (-1) uncomfortable, (0) not different, (1) comfortable, (2) very comfortable

**3.4 Environmental conditions**

**Table 6. Claims for environmental condition (percent of the people per year)**

Environmental degradation	Before migration	1984 - 1995	2010
0. None	28.5%	8.3%	1.0%
1. Risk of tides rise.	28.5%	12.2%	4.3%
2. Nonproductive land.	1.0%	-	-
3. Soil sediment.	28.0%	-	-
4. Poor water quality	3.1%	1.5%	2.9%
5. Mangrove degradation.	-	11.7%	1.4%
6. Household garbage.	4.7%	15.1%	28.0%
7. Loss flora and fauna.	-	2.9%	1.9%
8. Forest clearing.	2.6%	15.1%	0.5%
9. Abrasion	0.5%	14.1%	19.8%
10. Water stagnation.	-	19.1%	40.1%
11. Productive land	3.1%	-	-

Cause of environmental degradation			
0. None	32.4%	10.3%	3.2%
1. Government policy.	-	5.9%	10.2%
2. Resettlement/Transmigration	24.0%	22.1%	3.8%
3. Fisheries activities.	1.1%	-	-
4. Deforestation.	5.0%	6.9%	4.3%
5. Infrastructure	-	4.4%	7.0%
6. Population growth.	1.7%	9.3%	11.8%
7. Abrasion.	-	4.9%	7.5%
8. Natural	29.1%	3.9%	3.2%
9. Harmful human activities	6.7%	31.4%	41.4%
10. Poverty problems	-	1.0%	7.5%

Note: Data calculation used multiple responses

As shown in Table 6, the migrants settled in places with risks of tides rise (28.5 percent), and sediment (28.0 percent) before migration. The risk of tides rise would have happened due to the loss of mangroves trees, and river sedimentation could have been caused by natural sedimentation and resettlement. After migration, environmental problems such as water stagnation (19.1 percent) and deforestation (15.1 percent) became prominent because more mangrove trees were destroyed due to natural exhaustion and humans cutting them down for



firewood and fishing gear/anchors (31.4 percent). The loss of the mangrove trees was fatal because the transmigration area was close to the coast (50 m), and seawater could easily enter into the residential areas.

In 2010, more people claimed water stagnation (40.1 percent) and coastal abrasion (19.8 percent) due to floods and clogged canals, and the village administration built artificial embankments to prevent severe abrasion. In addition, the number of transmigrants throwing their household garbage (28.0 percent) in the canal, yards and public places increased, since there was no garbage disposal system and they did not care about the garbage. It is clear that household garbage can lead to a decline in water quality.

**3.5 Perception of environmental conditions**

The items regarding of environmental conditions in the questionnaire were concerned with the comfort level of environmental qualities before migration and at present. The results of the t-test (Table 7) show that the variance and means of environmental condition perception of transmigrants (both groups) were significantly different before migration and in the present study period (p< 0.05).

**Table 7. Differences of environmental perception of transmigrants (both groups with and without conflict experience) in before migration and present time (2010)**

Environmental perception of transmigrants (both groups)	Paired Differences					
	Mean (Before migration)	Mean (After migration)	SD	P	95% CI	
					Lower	Upper
Time of before and present study period	-.68	.00	1.30	.00*	-.87	-.48

\*Significant different if p < 0.05

Note: Data calculation uses t-Test and N is 179. Likert scale: (-2) Very uncomfortable, (-1) uncomfortable, (0) not different, (1) comfortable, (2) very

The change of perception of environmental condition was examined in both groups (Table 8). The McNemar test of marginal homogeneity also applies to determine the differences in perception of environmental conditions before and after migration, similar to the perception of community health calculation. The right table shows significant differences between the present study period and before migration in the group with social conflict experience (p<0.05). The mean shows changes in the negative direction of the group with conflict experience. On the other hand, the perception of environmental conditions among those without social conflict experience (Table 8, right) was significantly different before migration and at present (p<0.05). The mean shows the positive direction of the group without experience with social conflict.

**Table 8. Perception of environmental condition before and after migration by the experience of social conflict**

Environmental condition perception	Those with experience of social conflicts				Those without experience of social conflicts			
	N	Mean	SD	P	N	Mean	SD	P
Before migration	25	.36	.90	.00*	154	-.85	.58	.00*
After migration	25	-.84	.55		154	.14	.86	

\*Significant different if p < 0.05

Note: Data calculation used Mc Nemar test of marginal homogeneity and N is 179. Likert scale: (-2) Very uncomfortable, (-1) uncomfortable, (0) not different, (1)

**3.6 Impact of perception on the future desire**

People without experience with social conflict seemed to live comfortably in the transmigration area. However, 101 out of 154 (65.6 percent) had thoughts of moving to another location if they could get support from the government, e.g., adequate housing and appropriate environmental capacity to support their livelihood as fishermen, while this percentage was a little less than 84 percent (21/25) for those with experience with social conflict (Table 9). They were willing to move again to find a comfortable place to live or to find a job or a place with a lot of fish stock resources, and to improve their living standard (Table 9).

**Table 9. The desire to move again to another place and their reasons**

Those without experience of social conflicts	Reasons				Those with experience of social conflicts	Reasons			
	0	1	2	3		0	1	2	3
No	42	0	0	0	No	4	0	0	0
Yes	0	38	55	9	Yes	0	5	15	1
No answer	10	0	0	0	No answer	0	0	0	0

Note: Reasons are 0) No reasons, 1) To find a comfortable place, 2) To find a good job, 3) To improve living standard.

The logistic regression in Table 10 is intended to examine in more detail the factors that influence the migrants' desire to move, including their perception of environmental conditions and community health, SES and the presence of social conflict. The logistical regression showed only one factor—a job (2010)—that influenced their desire to move again to another area.

A factor that directly correlates is the difficulty of looking for a good job in the new area. Fishermen migrants have only small-capacity fishing gear in comparison to another newcomer, so the catch is also less than that of immigrant fishermen. Environmental factors and health no longer influence their desire to move, because only those who experience social conflict perceive the environmental degradation and

health (25 respondents), while 154 respondents in the non-conflict group had not been influenced by their perceptions of the environment and health.

Table 11 presents the results of the differences of means in each question and the reliability in four domains.

**Table 10. Logistic regressions of migrant’s desire to move with variables of perceptions at 1985 and 2010, their changes between 1985 and 2010, and SES at 1985 and 2010**

Independent variables		B	S.E.	Wald	df	Sig.	Exp(B)
Perception	Environment condition (1985)	-.136	.483	.079	1	.779	.873
	Environment condition (2010)	-.174	.446	.152	1	.696	.840
	Environmental changes (2010 - 1985)	.056	.400	.020	1	.888	1.058
	Community health condition (1985)	-1.152	1.041	1.225	1	.268	.316
	Community health condition (2010)	1.004	1.020	.970	1	.325	2.730
	Community health changes (2010 – 1985)	-.823	1.014	.660	1	.417	.439
SES	Ethnic	.208	.221	.890	1	.345	1.231
	Education	.159	.128	1.537	1	.215	1.172
	Job (1985)	-.102	.124	.667	1	.414	.903
	Job (2010)	-.155	.075	4.261	1	.039*	.857
	Income (1985)	.000	.000	.164	1	.685	1.000
	Income (2010)	.000	.000	.345	1	.557	1.000
Social conflict	Social conflict	-1.548	.839	3.403	1	.055	.213
Constant		1.890	1.176	2.582	1	.108	6.622

\* Significantly different (p < 0.05)

Note: Variable in the Equation (logistic regression) and dependent is migrant’s desire move (no = 0, yes= 1)

**3.7 Comparison of QOL scores with and without social conflict experience**

Social conflicts should have affected the QOL of the migrants. In the second research period, households (21 with and 24 without social conflict experience) were interviewed to determine the differences in QOL between the two groups.

The highest means of the question items in both groups are at the level of body image and appearance (Q19) and spirituality (Q6). The reliability of the physical domain is below 0.6; therefore it is poor. The low reliability may be caused by a small number of respondents (<100 respondents).

**Table 11. Mean differences and reliability (Cronbrach’s alpha) between the with conflict and without conflict samples by four domains of the WHOQOL-BREF**

Domains	Questions items (Q)	With experience of social conflicts			Without experience of social conflicts		
		α	Md	Mean ± SD	α	Md	Mean ± SD
Physical	Pain and discomfort (Q3)		2.00	1.86 ± .72	2.00	2.00	1.71 ± .75
	Dependence on medication and treatments (Q4)		1.00	1.52 ± .60	1.00	1.00	1.54 ± .72
	Energy and fatigue (Q10)		2.00	2.10 ± .94	2.00	2.00	2.08 ± .65
	Mobility (Q15)	.41	3.00	3.14 ± .72	.59	3.00	3.21 ± .65
	Sleep and rest (Q16)		3.00	2.90 ± 1.04	3.00	3.00	2.96 ± .80
	Activities of daily living (Q17)		3.00	3.05 ± .80	3.00	3.00	2.92 ± .50
	Working capacity (Q18)		3.00	2.90 ± .70	3.50	3.50	3.38 ± .71
Physiological	Positive feelings (Q5)		3.00	2.86 ± .65	3.00	3.00	3.38 ± .49
	Spiritual/religion/personal beliefs (Q6)		4.00	3.62 ± .80	4.00	4.00	3.96 ± .69
	Thinking, learning, memory and concentration (Q7)	.66	3.00	3.19 ± .40	.66	3.00	3.38 ± .49
	Body image and appearance (Q11)		4.00	4.14 ± .94	5.00	5.00	4.46 ± .65
	Self esteem (Q19)		3.00	3.38 ± .86	3.00	3.00	3.50 ± .72
Social Relationship	Negative feelings (Q26)		2.00	2.38 ± .74	2.50	2.50	2.46 ± .58
	Personal relationship (Q20)		3.00	2.76 ± .53	3.50	3.50	3.38 ± .71
	Social support (Q22)	.68	3.00	2.86 ± .65	.66	3.00	3.38 ± .49
	Sexual activity (Q21)		3.00	3.14 ± .65	3.00	3.00	3.33 ± .48
Environmental	Physical safety and security (Q8)		3.00	3.05 ± .49	3.00	3.00	3.33 ± .48
	Physical environment (infrastructures)(Q9)		2.00	2.19 ± .75	3.00	3.00	2.71 ± .95
	Financial resources (Q12)		2.00	2.00 ± .83	3.00	3.00	2.71 ± .69
	Opportunities for acquiring new information and skills (Q13)	.78	2.00	2.00 ± .70	.69	3.00	2.58 ± .58
	Participation and opportunities for recreation (Q14)		1.00	1.43 ± .50	2.00	2.00	1.96 ± .62
	Home environment (Q23)		2.00	2.19 ± .92	3.00	3.00	2.54 ± .77
	Health and social care, availability and quality (Q24)		3.00	2.90 ± .62	3.00	3.00	2.79 ± .83
Transport (Q25)		3.00	2.57 ± .67	3.00	3.00	2.75 ± .94	

Note: Md (median) and α (Cronbrach’s Alpha). Reliability (< 0.6 “poor”, 0.6 to < 0.8 “acceptable”, > 0.8 “good”)

Table 12 presents the results of the discriminant validity analysis by t-test. Significant mean differences were found between the group with and without experience with social conflict for the psychological, social and environmental domains.

**Table 12. Discriminant Validity of the WHOQOL-BREF Assessment**

Domains	With experience of social conflicts (Mean ± Sd)	Without experience of social conflicts (Mean ± Sd)	T value	Sig (2 tailed)
Physical Mean	38.00 ± 8.75	38.25 ± 9.54	.248	.807
Psychological Mean	50.76 ± 11.50	58.67 ± 10.87	1.944	.046*
Social Mean	46.95 ± 11.47	59.13 ± 10.62	4.025	.001*
Environment Mean	34.05 ± 10.75	43.67 ± 11.26	2.115	.047*
<b>Items</b>				
Overall QOL	2.71 ± .72	3.1 ± .13	-.439	.666
General health	2.76 ± .89	2.79 ± .21	1.372	.183

\*Significant difference between with and without social conflict experience ( $p < 0.05$ )  
Note: t-Test with Welch's method

The scores in the psychological, social, and environmental domains were influenced by the group with and without social conflict experience, but areas of the physical and general health and overall QOL were not affected. The physical domain and two items of QOL were not significantly different between the groups. On the other hand, the domains of psychological health, social relationships and environment were significantly lower in the group with social conflict experience than those in the group without social conflict experience. The average of each domain was below 60 (score 0-100), and the overall items of QOL and general health were below standard [31].

## 4. Discussions

### 4.1 Change of Transmigration Program in Indonesia

Millions of people have migrated from populous areas such as Java, Madura and Bali to the less populous areas of Sumatra, Kalimantan, Sulawesi, Maluku and Papua Islands [32-35]. Sumatra Island has turned into big cities, and many migrants, farmers especially, could increase their income by cultivating the land provided or by being employed by plantations in the new area. As for the fishermen, their income is essentially unstable, depending on their skills and the technology of fishing gear.

The transmigration process had potentially tremendous impacts on the areas of migration in terms of resource-use and social relationships. In fact, social conflicts (different types of social conflicts than used in this study) occurred in transmigration areas such as Aceh, Kalimantan, Maluku, Papua and Lampung in 2000-2005 [7]. In 2007, the government reorganized the transmigration program with local resettlement and developed an integrated city with comfortable transmigration areas that account for socio-economic

development and improvement of environmental quality and quality of life.

Fishermen transmigrants have different characteristics than farmer transmigrants that can influence their differences in SES, environment qualities, community health and QOL. Aspects of the environment qualities and community health cannot be separated from SES, which will ultimately determine the level of QOL. A correlation between fishermen in coastal areas and forest composition change, and they also observed interesting changes in the process of adaptation on the coast of East Sumatra [36].

### 4.2 Impact of transmigration on SES of fishermen

The migrants in Sumatra—including Lampung—could raise the quality of education, level of economy and welfare [11]. An improvement of QOL was achieved partly through government support in the transmigration area [12]. An improvement in SES, especially income, is very important because it is their major concern and motivation for migration. Furthermore, their income correlates with community health and the environmental quality of the transmigration area [37-39].

By the time of study in 2010, the income of the fishermen had increased constantly (that means the amount of fish catch increased), although it was still within the low-middle income level [40]. However, it is difficult for them to rapidly increase their while relying on small-scale fishing. Their parents fished as an occupation, and that is all they have done since they were children, so they had a little chance to get an education before they migrated. Low education made difficult for the fishermen that migrated to look for a new occupation, although some people became small business owners and earned more money than fishermen. Later, the government established primary and secondary schools in the transmigration area. However, 10 percent of the households moved into a new area near the border of the conservation area in the 1990s to get more fish. While ethnic difference did not have a significant effect on their income, the Bugis had bigger fishing gear to catch fish farther from the shoreline. The Bugis from Sulawesi have the skills to use static fishing gear, while the ethnic Sundanese and Javanese from the Java Islands use dynamic fishing gear.

### 4.3 Impact on transmigration on community health and environmental conditions

Health facilities and services improved in the transmigration area after migration. Today, a few migrants still find it difficult to go to the health center because of medical treatment fees, even though many migrants go there when they have health problems. However, for the group without experience with social conflicts, the perception of community health increased after migration in transmigration area. On

the contrary, the perception of community health of the group with experience with conflict did not increase after migration. Nevertheless, health seeking behavior in the migration area is better than those in the conservation area.

They realized that some environmental degradation such as water stagnation, abrasion and household garbage had become more serious, but they did not mention that these decreased their fish catch. Therefore, some people moved to the conservation area in 1996 not because of environmental degradation, but because of the will to get more fish. The perception of the environmental condition was also different between those with and without experience with social conflicts. The perception of environmental conditions of the group with experience with conflict did not increase after migration. These "bad feelings" about the environmental conditions in 2010 significantly attributed to the desire for another migration, although the rate of willingness to move again (as far as government supports are provided) did not markedly differ between the two groups.

The WHOQOL-BREF in both groups of transmigrants intended to give an overview of their QOL in the transmigration area. A limited number of respondents that took this test could not give the exact description of their QOL or if there was bias, but at least we can see the difference in the level of QOL between the groups with and without experience with social conflict. It is understood that except for physical domains, scores were by far lower in the group with experience with social conflicts than those without, while the generally low QOL score of each domain may reflect the characteristics of migrants such as low education level, low income and perception of environmental degradation.

## 5. Conclusion

This study subjected transmigrated fishermen, on whom little attention has been paid in the evaluation of transmigration program in Indonesia. In summary, SES of migrants, especially their income, improved by migration. The community health also improved with establishment of health seeking behavior in the transmigration area. While environmental degradations happened after settlement, however it was not the trigger for illegal migration to the conservation area. Perceptions of community health and environmental condition generally become better at present except for the groups with experience of social conflicts in the conservation area. This uncomfortable perception of environmental condition among those with experiment of social conflicts was related to the desire for another migration, but it seemed difficult because government support is hardly obtained at present. As expected, QOL scores of

fishermen were generally low, especially among those experienced social conflicts.

## Acknowledgements:

We would like to express our thanks to the village administrative and community members. The research was not possible without their supports, hard works and endless efforts.

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8/29/2012

## **Ameliorative Role and Antioxidant Effect of Propolis and Ginseng against Reproductive Toxicity of Chlorpyrifos and Profenofos in Male Rats**

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**Abstract:** The present study was aimed to evaluate the toxic effect of both Chlorpyrifos and Profenofos (organophosphorous insecticides) each alone and in their combinations with either propolis or ginseng and as well known that propolis and ginseng have been reported to be effective antioxidant, therefore, the present study sought to elucidate the possible ameliorative role of propolis and ginseng in alleviating the toxicity of both Chlorpyrifos and Profenofos when given to male rats. This was done through studying the effects of both Chlorpyrifos and profenofos on some liver function parameters like testosterone hormone and by measuring reproductive performance parameters as well as histopathological changes in vital organ like testis. Animals were divided into nine groups; The 1<sup>st</sup> (Control group): Animals received 1ml of distilled water orally daily for 8 weeks, The 2<sup>nd</sup> (Chlorpyrifos treated group) Animals were daily received oral doses of Chlorpyrifos (6.75 mg/Kg b.wt.) for 60 days, The 3<sup>rd</sup> (Profenofos treated group) Animals were received orally Profenofos (20 mg/Kg b.wt.) daily for 8 weeks, The 4<sup>th</sup> (Propolis treated group) Animals were received orally Propolis extract (70mg/kg b.wt.) daily for 8 W, The 5<sup>th</sup> (Ginseng treated group) Animal were given orally Ginseng extract (200mg/Kg b.wt.) for 8 weeks daily, The 6<sup>th</sup> (Chlorpyrifos + Propolis treated group) Animals were given orally Chlorpyrifos (6.75 mg/Kg) and then co-administered with Propolis extract (70mg/kg b.wt.) for 8 weeks daily, The 7<sup>th</sup> (Chlorpyrifos+Ginseng treated group) Animals were given orally Chlorpyrifos (6.75 mg/Kg b.wt.) and then co-administered with Ginseng extract (200mg/Kg) for 8 weeks daily, The 8<sup>th</sup> (Profenofos +Propolis treated group) Animals were given orally Profenofos (20 mg/Kg) and then co-administered with Propolis extract (70mg/kg) for 8 weeks daily, The 9<sup>th</sup> (Profenofos +Ginseng treated group) Animals were given orally Profenofos (20 mg/Kg) and then co-administered with Ginseng extract (200mg/Kg) as mentioned above for 8 weeks daily. Results showed that there was a correlation between CPF and PRF administration and the highly significant decrease of the testosterone hormone and deficiency of reproductive performance in male rats. In contrary to these actions, co-administration of propolis and ginseng to CPF and PRF-treated rats recovered almost most of these biochemical parameters to normal levels. On the other hand, CPF and PRF showed histopathological alterations in testis of male rats like spermatogenic arrest and odema and degeneration of spermatids, while administration of both propolis and ginseng highly ameliorate these dangerous reproductive toxicity markers. [Ahmed A. Hendawy, Mansour H. Zahra, E I-Sayed A. Abd El-Aziz, Abd El-Aziz A. Diab and Reham Z. Hamza. **Ameliorative Role and Antioxidant Effect of Propolis and Ginseng against Reproductive Toxicity of Chlorpyrifos and Profenofos in Male Rats.** *Life Sci J* 2012;9(3):2557-2567]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 371

**Keywords:** Chlorpyrifos, Profenofos, Propolis, Ginseng, Testosterone, Reproductive toxicity, Reproductive performance.

**Abbreviations:** CPF, Chlorpyrifos; PRF, Profenofos.

### **1. Introduction**

The testes of humans and other mammals are highly susceptible to damage produced by genetic to chemical or other means. It has been reported that pesticides have been shown to cause overproduction of reactive oxygen species (ROS) in both intra and extra cellular spaces, resulting in a decline of sperm count and infertility in wildlife human [1].

Histological examination revealed that Chlorpyrifos caused testicular lesions characterized by markedly decreased testes weight with moderate to severe widening of interstitial spaces and partial arrest of spermatogenesis at the high level dose of 25 mg/kg.d. Histological epididymal changes were

occurred in the high and middle dose groups characterized by severe oedema and congestion between epididymis tubes and lacking of sperm number. Lesser histological changes were noted at 5 mg/kg-d, where minimal histological evidence of damage was observed [2].

The reduction in fertility index may simply represent the effects of Chlorpyrifos exposure on sperm parameters, and testis histological changes. Spermatogenesis and fertility are critically dependent upon the maintenance of adequate levels of testosterone [3]. Therefore, the effects of Chlorpyrifos on the fertility can be attributed to its ability to reduce serum testosterone levels and sperm

counts. Reduction in male body weight in dose group of 25 mg/kg-d can be attributed to the reduction in feed consumption and systemic toxicity of Chlorpyrifos in male mice.

It has been demonstrated that Propolis provides protection against infertility by improving sperm production, motility, count and quality, and increased the process of steroidogenesis and hence testosterone production [4]. Furthermore, Propolis protects sperm DNA from the oxidative damage caused by thiobarbituric acid-reactive substances (TBARS).

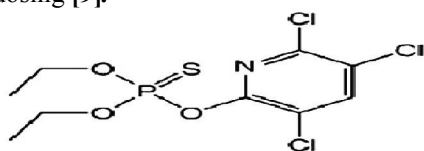
Propolis increased the levels of testosterone, relative weight of testes and epididymis and alleviated the negative effects of triphenyltin chloride (TPTC1) and this is in accordance with Shalmany and Shivazad [5] who suggested that the increase in weight of testes treated with propolis is due to high content of flavonoids.

A 2002 study by the Southern Illinois University School of Medicine (published in the annals of the New York Academy of Sciences) found that in laboratory animals, both Asian and American forms of ginseng enhance libido and copulatory performance. These effects of ginseng may not be due to changes in hormone secretion, but to direct effects of ginseng or its ginsenoside components on the central nervous system and gonadal tissues [6] in males, ginsenosides can facilitate penile erection.[7] This is consistent with traditional Chinese medicine and Korean medicine.

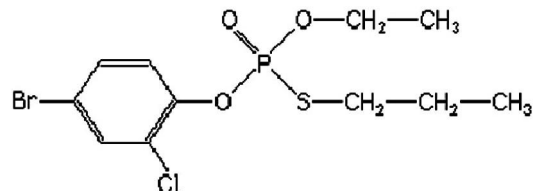
## 2. Materials and Methods

### 2.1. Test insecticide

**2.1.1 Chlorpyrifos** was produced by Misr for Agricultural Development Company, Cairo, Egypt. Under trade name Dursban and was stored at 4°C until stock solution preparation. The insecticide (CPF) was orally administered at a dose level equivalent to 1/20 LD<sub>50</sub> (6.75 mg/kg b.wt.) in distilled water for 60 successive days, this selected dose of the insecticide was based on previous studies in which 1/20 LD<sub>50</sub> of CPF induced biochemical alterations in rats without morbidity [8]. Stock solution was prepared by bringing Chlorpyrifos to room temperature then taking a certain amount by pipette from the Chlorpyrifos bottle and dilute it in distilled water (0.25 ml of Chlorpyrifos was dissolved in 250 ml dist. water) and diluting it in tween 80 to ensure rapid and complete absorption and we prepare 250 ml only to prepare the working solution freshly for each day of dosing [9].



**2.1.2 Profenofos** is a pale yellow liquid; it was produced by Ciba-Geigy, Pharmacological Company, Scientific office Cairo, Egypt. under trade name: Selecron 72% EC , Profenofos was given at a dose of (20mg/Kg b.wt.) which represent 1/10 LD<sub>50</sub>, where the LD<sub>50</sub> value of Profenofos is (200 mg/Kg) according to [10] and this selected dose of the insecticide was based on Weil studies in which 1/10 LD<sub>50</sub> of Profenofos induced biochemical alterations in rats without morbidity. Tap water was used for preparing emulsion of Profenofos immediately before use, Stock solution was prepared by bringing Profenofos to room temperature then taking a certain amount by pipette from the Profenofos bottle and diluting it in distilled water (1.97 ml of Profenofos was diluted in 250 ml dist. water) we prepare 250 ml only of working solution freshly for each day of dosing [11].



## 2.2. Extracts

### 2.2.1 Propolis extract preparation:

In this study, Propolis powder extract (70% ethanolic extract) was obtained from (Dosis IMP & EXP. Co, Ltd) China .Propolis was dissolved in dist. water and administered orally for 60 successive days via gastric tube at dose 70 mg/ Kg b.wt. [4,12].

### 2.2.2 Ginseng extracts preparation:

Red Ginseng powder (Supplied by Tsumura Pharmaceutical Co., Tokyo, Japan) was administered orally at dose (200 mg/Kg) [13] for 60 successive days via a gastric tube. The Ginseng extract was suspended in tap water just before use and the dose was calculated according to the animal's body weight on the week before using.

## 2.3. Animals

The present study was carried out at Zoology Department, Faculty of Science - Zagazig University, using (one hundred and ten) (110) clinically healthy mature adult male albino rats. The animals were obtained from the Animal House of Faculty of Veterinary Medicine, Zagazig University, Their weights ranged from (200-250gm) each. The animals were housed in standard conditions, where the animals were housed in metal cages and bedded with wood shavings and kept under standard laboratory conditions of aeration and room temperature at about 25°C. The animals were allowed to free access of standard diet and water *ad libitum*. The animals were accommodated to the laboratory conditions for two weeks before being experimented.

## 2.4. Experimental design

After the period of acclimation, animals were divided into nine groups with 10 animals in each as :

- I) The 1<sup>st</sup> (Control group):** Animals received 1ml of distilled water orally daily for 8 weeks.
- II) The 2<sup>nd</sup> (Chlorpyrifos treated group):** Animals were daily received oral doses of Chlorpyrifos (6.75 mg/Kg b.wt.) for 8 weeks using metallic stomach tube.
- III) The 3<sup>rd</sup> (Profenofos treated group):** Animals were received orally Profenofos (20 mg/Kg b.wt.) daily for 8 weeks using metallic stomach tube.
- IV) The 4<sup>th</sup> (Propolis treated group):** Animals were received orally *Propolis* extract (70mg/kg b.wt.) daily for 8 weeks using metallic stomach tube.
- V) The 5<sup>th</sup> (Ginseng treated group):** Animals were given orally Ginseng extract (200mg/Kg b.wt.) for 8 weeks daily using metallic stomach tube.
- VI) The 6<sup>th</sup> (Chlorpyrifos + Propolis treated group):** Animals were given orally Chlorpyrifos (6.75 mg/Kg b.wt.) and then co-administered with *Propolis* extract (70mg/kg b.wt.) for 8 weeks daily.
- VII) The 7<sup>th</sup> (Chloropyrifos+Ginseng treated group):** Animals were given orally Chlorpyrifos (6.75 mg/Kg b.wt.) and then co-administered with *Ginseng* extract (200mg/Kg b.wt.) for 8 weeks daily.
- VIII) The 8<sup>th</sup> (Profenofos +Propolis treated group):** Animals were given orally Profenofos (20 mg/Kg b.wt.) and then co-administered with *Propolis* extract (70mg/kg b.wt.) for 8 weeks daily.
- XI) The 9<sup>th</sup> (Profenofos +Ginseng treated group):** Animals were given orally Profenofos (20 mg/Kg) and then co-administered with *Ginseng* extract (200mg/Kg b.wt.) as mentioned above for 8 weeks daily.

## 2.5 Semen analysis:

(Sperm count and motility) were performed by dissecting out the Cauda epididymus and teasing it in a known volume of normal saline at 37°C. Sperm counting was done using a haemocytometer according to the method of Gerberding *et al.* [14]

. The right testes were kept in a deep freezer (-40°C) for biochemical estimations and microelements detection. Left testes were removed and fixed in 10 % formalin for routine histopathology.

## 2.6 Evaluation of sperm motility and morphology:-

The testis and epididymis were excised immediately, cleaned of the adhering tissues and weighed. The right caudal epididymis was used for collecting semen for sperm counting and the left one for studying fertility –related parameters (Sperm count, motility and abnormal forms) and morphology analysis.

The total number of sperm in the ejaculate= Calculation the mean number of sperm.

Total count = the mean no. of sperm X 10<sup>4</sup> = /ml.

The total count X dilution factor (100) = /ml.

## 2.7 Biochemical Assays

Blood samples were collected after the end of the experiment from the retro-orbital vein, which is a simple, convenient and successful procedure that allows bleeding of the same animal more than one time with minimal stress [15]. After the last administration of the drug at the end of 8<sup>th</sup> week, individual blood samples were drawn by orbital puncture (from eye plexus) using microhematocrit capillary tubes (Lancer, Athy, County-Kildare, Republic of Ireland), Serum was harvested from blood without EDTA and then blood samples were transferred into Eppendorf tubes and subsequently used for the determination of Testosterone hormone. The biochemical measurements were performed according to the details given in the kit's instructions.

### 2.7.1 Determination of Testosterone hormone:

The assay used for the determination of testosterone hormone in plasma was enzyme linked immunosorbent assay (ELISA), using available kit purchased, from Diagnostic laboratories Inc (England). [16].

## 2.8 Preparation of tissues for histopathological examination

After 8 weeks post drug administration, animals were sacrificed and samples from heart, liver, brain, kidney and testis were fixed in 10% formalin for histopathological studies. Parts of liver were transferred into 10% buffered formalin for histopathological examination, and the remainder tissue was used for the analysis of oxidative stress parameters. Tissue samples were taken from the liver of the necropsied animals and fixed in 10% formalin saline. The trimmed tissues were first washed with tap water followed by dehydration through a graded alcohol series and then passed through xylol and paraffin series before finally blocked in paraffin. The paraffin blocks were cut into 5-6 µm sections using a microtome stained using hematoxylin and eosin and examined under a light microscope [17].

## 2.9 Statistical analysis

Data were collected, arranged and reported as mean ± standard error of mean (S.E.M) of nine groups (Each group was considered as one experimental unit), summarized and then analyzed using the computer program SPSS/ version 15.0) The statistical method was one way analyzes of variance ANOVA test (F-test), and if significant differences between means were found, Duncan's multiple range test (Whose significant level was defined as ( $P < 0.05$ )) was used according to [18] to estimate the effect of different treated groups.



### 3. Results

#### 3.1 Morbidity and mortality:

Male rats orally administered Chlorpyrifos, profenofos in doses of (6.75 mg/kg b.wt.) and (200 mg/Kg b.wt.) respectively for 60 days have shown signs of toxicity (Diarrhea, myosis, increased urination, diaphoresis, nose and eye bleeding and salivation) and no deaths were recorded throughout the experimental groups.

#### 3.2 Effect on serum Testosterone:

(Table1) and (Fig 1) demonstrates that treatment of normal rats with either Chlorpyrifos or Profenofos exhibited a marked decrease ( $P<0.05$ ) in serum testosterone level after the end of the experiment when compared with normal control group. At the mean time, treatment of normal rats with Propolis or ginseng each alone induced a significant increase ( $P<0.05$ ) in serum testosterone after the end of the experiment when compared with normal control group. Whereas, a significant decrease in testosterone level was also recorded in response to combinations of the insecticides with either Propolis or ginseng when compared with normal control group, yet this effect was much better than that produced with each insecticide alone.

#### 3.4 Effect on male fertility and sperm count:

(Table 2) and (Fig. 2) showed that the administration of either propolis or ginseng in their recommended doses for 60 successive days to mature rats afforded a slight and marked increase ( $P<0.05$ ) in total sperm count respectively compared to normal control group. Whereas, the administration of either chlorpyrifos or profenofos each alone and their combinations with either propolis or ginseng elicited a significant decrease ( $P<0.05$ ) in total sperm count when compared with normal control group. But the decrease was more profound with the insecticides used.

#### 3.5 Effect on sperm motility:

It was apparent from (Table 2) and (Fig.2) that the insecticides under investigation elicited a significant decrease ( $P<0.05$ ) in sperm motility % compared with the control group after the end of the study. Whereas, Propolis or ginseng each alone afforded non significant increase in sperm motility % compared with control group as well as a significant increase ( $P<0.05$ ) when compared with the groups treated with each of the insecticides used. The combinations of each of propolis or ginseng with either chlorpyrifos or profenofos elicited a non significant decrease except combination of

Chlorpyrifos with propolis which showed a significant decrease when compared with normal control group.

#### 3.6 Effect on abnormal forms of sperms:

It was apparent from (Table 2) and (Fig. 2) that the administration of either chlorpyrifos or profenofos for 60 successive days in their recommended doses to normal male rats elicited a significant increase ( $P<0.05$ ) in the abnormal forms of spermatozoa. Whereas, non significant changes were reported in other groups when compared with normal control group.

#### 3.7 Effect on viability % of sperms:

It was apparent from (Table 2) and (Fig. 2) that the administration of either chlorpyrifos or profenofos for 60 successive days in their recommended doses to normal male rats elicited a significant decrease ( $P<0.05$ ) in the viability of spermatozoa. Whereas, non significant changes were reported in other groups except groups were given the combinations of propolis with either chlorpyrifos or profenofos which showed a significant decrease when compared with normal control group.

Table (1): Effect of Chlorpyrifos (6.75 mg/kg), Profenofos (20mg/Kg) , Propolis (70 mg/ Kg), Ginseng (200 mg/Kg) and their combinations on Testosterone hormone in male albino rats (mean  $\pm$  SE). (N = 7).

Groups	Testosterone ( $\mu$ IU/ml)
Control group	4.24 $\pm$ 0.08 <sup>c</sup>
Chlorpyrifos	1.68 $\pm$ 0.07 <sup>g</sup>
Profenofos	1.18 $\pm$ 0.05 <sup>h</sup>
Propolis	5.46 $\pm$ 0.10 <sup>a</sup>
Ginseng	4.62 $\pm$ 0.09 <sup>b</sup>
Chlorpyrifos + Propolis	3.16 $\pm$ 0.05 <sup>d</sup>
Chlorpyrifos + Ginseng (mg/Kg)	2.64 $\pm$ 0.05 <sup>c</sup>
Profenofos + Propolis	2.20 $\pm$ 0.07 <sup>f</sup>
Profenofos + Ginseng mg/Kg)	2.20 $\pm$ 0.15 <sup>f</sup>

Means within the same column in each category carrying different litters are significant at ( $P \leq 0.05$ ) using Duncan's multiple range test, where the highest mean value has symbol (a) and decreasing in value were assigned alphabetically.

Table (2): Effect of Chlorpyrifos (6.75 mg/kg), Profenofos (20mg/Kg) , Propolis (70 mg/ Kg), Ginseng (200 mg/Kg) and their combinations on semen characteristics in male albino rats (mean ± SE). (N = 7).

Groups	Total countX106	Motility%	Abnormal forms%	Viability% after 1/2 h
Control group	79.8 ± 3.05 <sup>b</sup>	60 ± 3.25 <sup>ab</sup>	30 ± 6.35 <sup>cd</sup>	75 ± 6.35 <sup>ab</sup>
Chlorpyrifos	40.42 ± 2.05 <sup>e</sup>	40 ± 2.10 <sup>d</sup>	60 ± 2.36 <sup>a</sup>	35 ± 3.32 <sup>d</sup>
Profenofos	35.21 ± 2.03 <sup>e</sup>	30 ± 2.03 <sup>e</sup>	55 ± 5.36 <sup>ab</sup>	30 ± 1.52 <sup>d</sup>
Propolis	85.92 ± 5.96 <sup>ab</sup>	61.21 ± 3.33 <sup>ab</sup>	35 ± 5.32 <sup>cd</sup>	73 ± 1.35 <sup>ab</sup>
Ginseng	108.51 ± 6.78 <sup>a</sup>	70 ± 4.31 <sup>a</sup>	25 ± 3.32 <sup>cd</sup>	80 ± 6.35 <sup>a</sup>
Chlorpyrifos + Propolis	50 ± 2.68 <sup>d</sup>	45.91 ± 2.52 <sup>cd</sup>	40 ± 8.25 <sup>bc</sup>	45 ± 8.75 <sup>cd</sup>
Chlorpyrifos + Ginseng	65 ± 3.01 <sup>bc</sup>	50 ± 2.95 <sup>bc</sup>	39 ± 4.23 <sup>bc</sup>	55 ± 1.20 <sup>bc</sup>
Profenofos + Propolis	60 ± 2.02 <sup>c</sup>	51.52 ± 3.05 <sup>bc</sup>	45 ± 5.36 <sup>bc</sup>	40 ± 2.51 <sup>cd</sup>
Profenofos + Ginseng	49 ± 2.65 <sup>d</sup>	58.43 ± 4.62 <sup>b</sup>	40 ± 8.62 <sup>bc</sup>	49 ± 6.32 <sup>bc</sup>

Means within the same column in each category carrying different letters are significant at (P ≤ 0.05) using Duncan's multiple range test, where the highest mean value has symbol (a) and decreasing in value were assigned alphabetically.

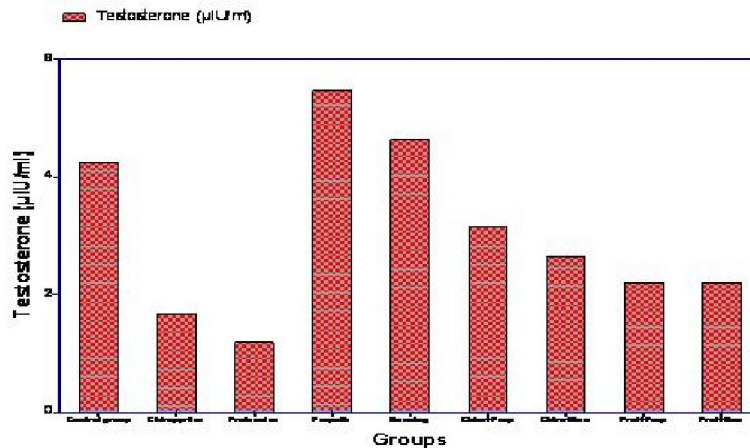


Fig (1): Effect of Chlorpyrifos (6.75 mg/kg), Profenofos (20mg/Kg) , Propolis (70 mg/ Kg), Ginseng (200 mg/Kg) and their combinations on Testosterone hormone in male albino rats.

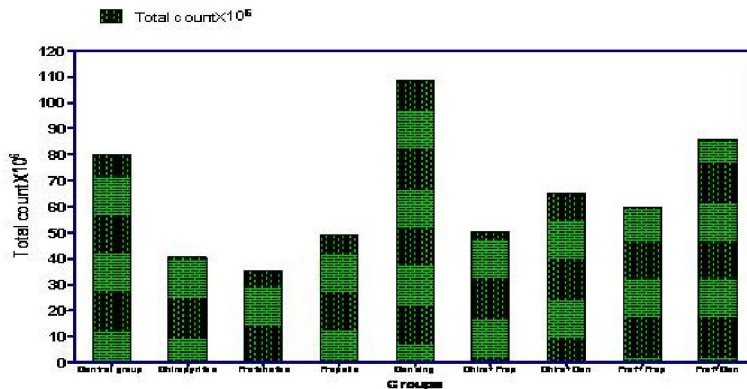


Fig (2): Effect of Chlorpyrifos (6.75 mg/kg), Profenofos (20mg/Kg) , Propolis (70 mg/ Kg), Ginseng (200 mg/Kg) and their combinations on ( total count of sperm X 106) in male albino rats.

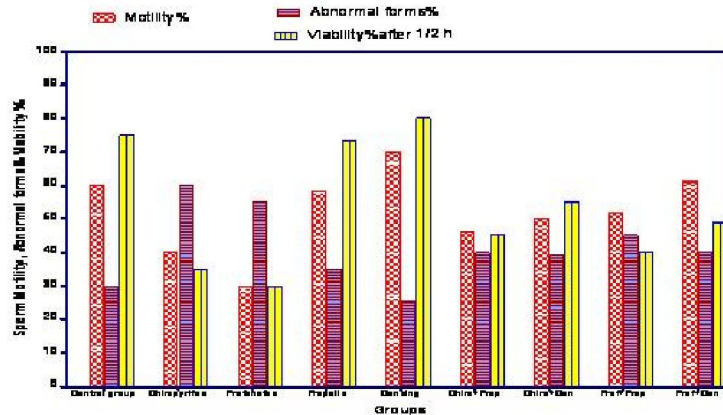


Fig (3): Effect of Chlorpyrifos (6.75 mg/kg), Profenofos (20mg/Kg) , Propolis (70 mg/ Kg), Ginseng (200 mg/Kg) and their combinations on ( Sperm motility , abnormal forms & Viability) in male albino rats.

### 3.7: Histopathology:

#### (Group 1): Control group

*The Testis:* Microscopically: testis of the male control treated rats appears oval in size with normal testicular tissue showing normal seminiferous tubules containing small groups of leydig cells (Fig. 4).

#### (Group 2): Chlorpyrifos treated group

The testis: Microscopically, seminiferous tubules were lined by few layers of spermatogenic cells and few sperms (hypospermatogenesis) (Fig. 5), seminiferous tubules lined by few layers of spermatogenic cells with no sperm formation (Testicular atrophy) were seen in (Fig. 6).

#### (Group 3): Profenofos treated group

The testis: Seminiferous tubules were filled by primary spermatogonia only with no sperm formation (spermatogenic arrest) (Fig. 7) and a seminiferous tubule filled by spermatogenic cells up to spermatid only with no sperm formation (spermatogenic arrest) was shown in (Fig. 8).

#### (Group 4): Propolis treated group

The testis: The seminiferous tubules of this group were lined by layers of spermatogenic cells up to sperm formation and surrounded by thin basement membrane, (Fig.9).

#### (Group 5): Ginseng treated group

The Testis :Seminiferous tubule lined by layers of spermatogenic cells up to formation and surrounded by thin basement membrane (Fig10 ).

#### (Group 6): Chlorpyrifos + Propolis treated group

The Testis: Microscopically, seminiferous tubules lined by few layers of spermatogenic cells and few sperms (Hypopermatogenesis) (Fig. 11).

#### (Group 7): Chlorpyrifos + Ginseng treated group

The Testis: Microscopically, seminiferous tubules lined by several layers of spermatogenic cells up to sperm formation but surrounded by mild edematous stroma (Fig. 12).

#### (Group 8): Profenofos+Propolis treated group

The Testis: Microscopically, testicular tissue showing normal seminiferous tubules surrounded by edematous stroma containing small groups of leydig cells (fig. 13).

#### (Group 9): Profenofos + Ginseng treated group

The Testis: Microscopically, testicular tissues showing normal and some elongated seminiferous tubules surrounded by small edematous stroma (Fig. 14).

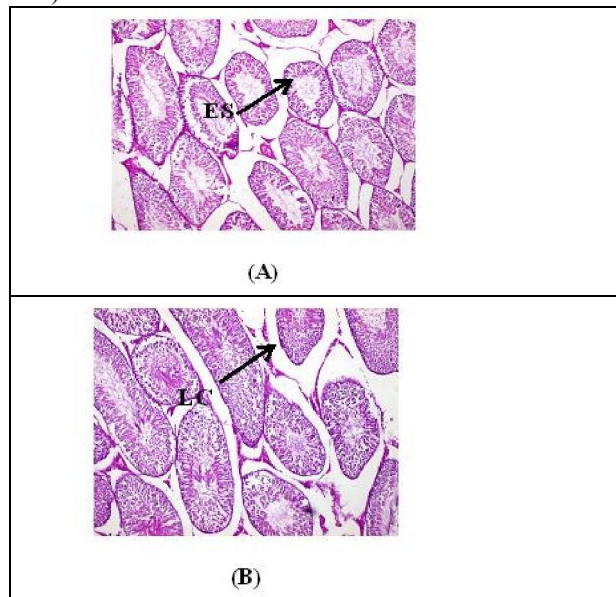
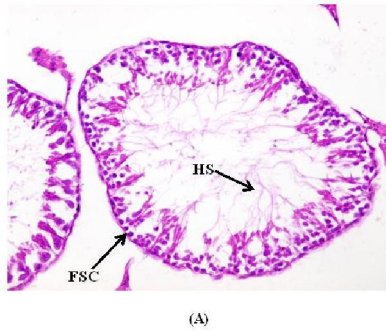
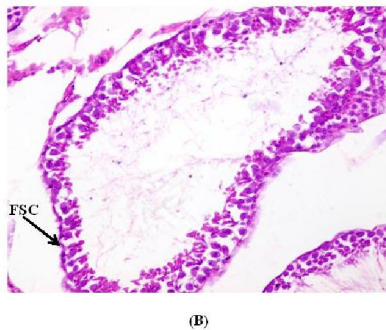


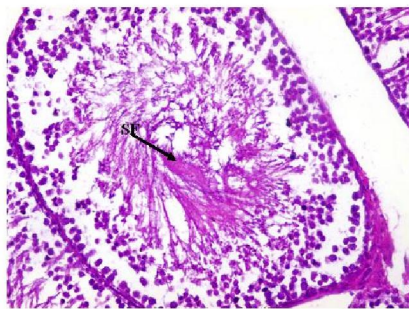
Fig. (4): Cross section of control rat testis of (Group 1) (testicular tissue) showing normal seminiferous tubules surrounded by edematous stroma containing small groups of leydig cells (H and E x 100) (SE: seminiferous tubules, ES: edematous stroma, LC: Leydig cells).



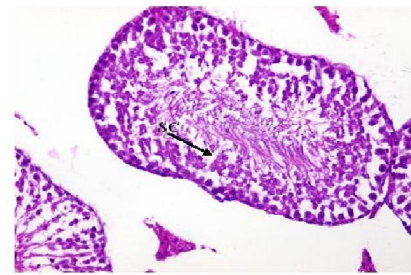
**Fig. (5)** Cross section of rat testis of group (2) treated with chlorpyrifos (6.75 mg/kg) showing seminiferous tubules lined by few layers of spermatogenic cells and few sperms (hypospermatogenesis) (H and E x 400) (FSC: Few spermatogenic cells, HS: Hypospermatogenesis).



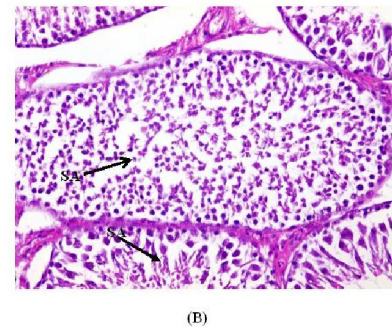
**Fig. (6)** :Cross section of rat testis of group (2) treated with chlorpyrifos (6.75 mg/kg) showing seminiferous tubules lined by few layers of spermatogenic cells with no sperm formation (Testicular atrophy) (H&EX400) (FSC: Few spermatogenic cells).



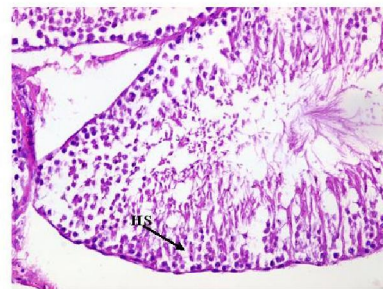
**Fig.(7)**: Cross section of rat testis of group (3) treated with profenofos (20 mg/ Kg) showing seminiferous tubules filled by spermatogenic cells up to spermatid only with no sperm formation (spermatogenic arrest) (H and E x 400)(SA: spermatogenic arrest).



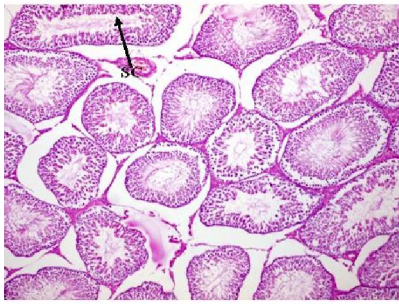
**Fig. (8)** :Cross section of rat testis of group(4) treated with propolis(70 mg/ Kg) showing seminiferous tubules lined by layers of spermatogenic cells up to sperm formation and surrounded by thin basement membrane (H and E x 400) (SC: spermatogenic cells) .



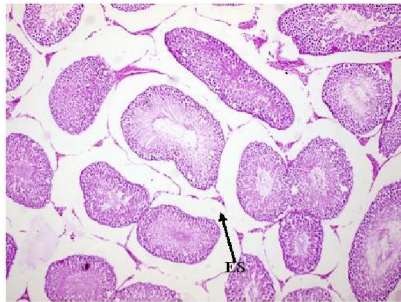
**Fig. (9)**: Cross section of rat testis of group(5) treated with ginseng (200 mg/ Kg) showing seminiferous tubule lined by layers of spermatogenic cells up to sperm formation and surrounded by thin basement membrane (H and E x 400) (SF: sperm formation).



**Fig. (10)**: Cross section of rat testis of group (6) treated with (Chlorpyrifos +Propolis) (6.75 mg/kg) & (70 mg/kg) respectively showing seminiferous tubule lined by few layers of spermatogenic cells and few sperms (Hypospermatogenesis) (H&EX400) (HS: Hypospermatogenesis).

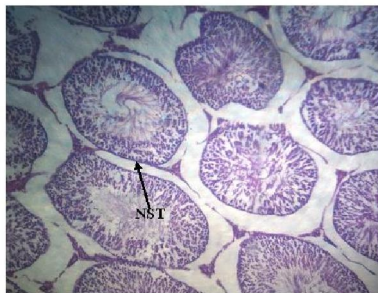


**Fig. (11):** Cross section of rat testis of group (7) treated with (Chlorpyrifos + ginseng) (6.75 mg/kg) & (200 mg/kg) respectively showing seminiferous tubules lined by several layers of spermatogenic cells up to sperm formation but surrounded by mild edematous stroma (H and E x 100) (**SF: Sperm formation, SC: Spermatogenic cells**) .



(B)

**Fig. (12):** Cross section of rat testis of group (8) treated with (profenofos + propolis) (20 mg/kg) & (70 mg/kg) respectively showing testicular tissue with normal seminiferous tubules surrounded by edematous stroma containing small groups of Leydig cells (H&EX400) (**ST: Seminiferous tubules, ES: Edematous stroma**).



**Fig. (13):** Cross section of rat testis of group (9) treated with (profenofos + ginseng) (20 mg/kg) & (200 mg/kg) respectively showing testicular tissues with normal and some elongated seminiferous tubules surrounded by small edematous stroma (H and E x 200) (**NST: Normal seminiferous tubules**).

#### 4. Discussion:

##### Effect on Sex hormone and male fertility:

Our results demonstrated that treatment of normal rats with either Chlorpyrifos or Profenofos exhibited a marked decrease in serum testosterone level after the end of the experiment when compared with normal control group. At the mean time, treatment of normal rats with Propolis or ginseng each alone induced a significant increase in serum testosterone after the end of the experiment when compared with normal control group. Whereas, a significant decrease in testosterone level was also recorded in response to combinations of the insecticides with either Propolis or ginseng when compared with normal control group, yet this effect was much better than that produced with each insecticide alone.

At the meantime, our results showed that the administration of either propolis or ginseng in their recommended doses for 60 successive days to mature rats afforded a slight and marked increase in total sperm count respectively compared to normal control group. Whereas, the administration of either Chlorpyrifos or profenofos each alone and their combinations with either propolis or ginseng elicited a significant decrease in total sperm count when compared with normal control group. But the decrease was more profound with the insecticides used.

It was apparent from our results that the insecticides under investigation elicited a significant decrease in sperm motility % compared with the control group after the end of the study. Whereas, Propolis or ginseng each alone afforded non significant increase in sperm motility % compared with control group as well as a significant increase when compared with the groups treated with each of the insecticides used. While the combinations of each of propolis or ginseng with either Chlorpyrifos or profenofos elicited a non significant decrease except combination of Chlorpyrifos with propolis which showed a significant decrease when compared with normal control group.

It was obvious from our results that the administration of either Chlorpyrifos or profenofos for 60 successive days in their recommended doses to normal male rats elicited a significant increase in the abnormal forms of spermatozoa. Whereas, non significant changes were reported in other groups when compared with normal control group.

It was apparent from our results that the administration of either Chlorpyrifos or profenofos for 60 successive days in their recommended doses to normal male rats elicited a significant decrease in the viability of spermatozoa. Whereas, non significant changes were reported in other groups except groups

given the combinations of propolis with either Chlorpyrifos or profenofos which showed a significant decrease when compared with normal control group.

The testes of humans and other mammals are highly susceptible to damage produced by genetic, to chemical or other means. It has been reported that pesticides have been shown to cause over production of reactive oxygen species (ROS) in both intra and extra cellular spaces, resulting in a decline of sperm count and infertility in wildlife human [1].

Our results are greatly supported by [19]. They concluded that combined exposure of toxic doses of Chlorpyrifos and Malathion induced significant reproductive dysfunction in the offspring of rats.

At the meantime, Chlorpyrifos can induce adverse effects on reproductive performance; it showed fetotoxic and teratogenic effects at a maternal dose of 25 mg/kg-d, a dose that also produced maternal toxicity [20].

Histological examination revealed that Chlorpyrifos caused testicular lesions characterized by markedly decreased testes weight with moderate to severe widening of interstitial spaces and partial arrest of spermatogenesis at the high level dose of 25 mg/kg.d .Histological epididymal changes were occurred in the high and middle dose groups characterized by severe oedema and congestion between epididymis tubes and lacking of sperm number. Lesser histological changes were noted at 5 mg/kg-d, where minimal histological evidence of damage was observed [2].

Testicular spermatide and epididymal sperm counts indicated that spermatogenesis was partially arrested at the middle and high dose groups (15 and 25mg/kg-d). These results are in consistent with the published data reported that Chlorpyrifos at 17.5 mg/kg-d caused adverse reproductive effects in male mice included severe testicular damage and resulted in reduction in sperm count and thus affect the fertility [2] and these results are in full agreement with our results.

Indeed, decreased sperm number and ventral prostate weight of male mice observed are all related indicators for hypothyroidism and lowered testosterone level at 17.5 mg/kg-d. Chlorpyrifos was reported to be a potential endocrine disrupter by depression of sperm T4 level [21].

More recently, [22], reported that the Chlorpyrifos treated group showed that there were necrosis, degeneration, decreasing number of spermatogenic cells in some seminiferous tubules, separating of cells from basal region of seminiferous tubules and edema in interstitial tissue of testis.

Testosterone is produced mostly in the leydig cells of the testis in response to hormonal signals

from the hypothalamus and pituitary. And it was further metabolized to dihydrotestosterone (DTH) by 5 $\alpha$ -reductase, a highly lipophilic enzyme found on intracellular membrane [23]. The reduction in fertility index may simply represent the effects of Chlorpyrifos exposure on sperm parameters, and testis histological changes. Spermatogenesis and fertility are critically dependent upon the maintenance of adequate levels of testosterone [24]. Therefore, the effects of Chlorpyrifos on the fertility can be attributed to its ability to reduce serum testosterone levels and sperm counts. Reduction in male body weight in dose group of 25mg/kg-d can be attributed to the reduction in feed consumption and systemic toxicity of Chlorpyrifos in male mice.

Our results are in full accordance with [25]. They demonstrated that 60 day's exposure of male rats to profenofos at the dose 23.14 mg/kg body weight (4 doses/week) resulted in decreased the testes and epididymus weights, male fertility indices (sperm count and motility).Moreover, the authors showed that the weights of testes and epididymus were significantly lower in the profenofos-treated rats than in the controls. The decrease in testicular weight in treated rats may be due to reduced tubule size, spermatogenic arrest and inhibition of steroid biosynthesis of leydig cells, a site of steroid biosynthesis [26].

The decrease in testicular weight in profenofos-treated rats may indicate impairment at testicular, pituitary, or hypothalamic level [27]. Similar results were recorded by [2], who mentioned that Chlorpyrifos (OPIs) at dose levels of 7.5, 12.5 and 17.5 mg/kg b.wt./day, for 30 days, decreased significantly the weight of testes. The epididymus is androgen-dependant organ, relying on testosterone for its growth and function [28]. They proposed that profenofos probably reduced the activity of testes and epididymus by inhibition of androgen production or its direct action on these organs [29], the reduction in the weights of testes and epididymus in their study may be due to lower bioavailability of androgen [26]. Moreover, the deleterious effects of profenofos on reproductive organ weights might be due to a decrease in the testosterone (T) and thyroid hormone levels after 60 days from the onset of the treatment [30].

Furthermore, [25] confirmed the previous reports of [31] who mentioned that administration of rats with profenofos at 23.14 and 46.30 mg/kg body weight for 28 days and 60 days, respectively, induced significant decrease in thyroid hormone levels. There is ample evidence that thyroid hormone is essential to the normal development of testes in the neonate [32] and these results are a new support for our obtained results.

Sperm count is one of the most sensitive tests for spermatogenesis and it is highly correlated with fertility. Our results go in full agreement with [25]. They revealed that, treatment of rats with profenofos significantly reduced the sperm count and motility. The decreased sperm motility and density (count) after oral administration of profenofos may be due to androgen insufficiency [33] which caused impairment in testicular functions by altering the activities of the enzymes responsible for spermatogenesis [34].

Moreover, histological structure of the testes confirmed the before mentioned results, where it revealed degeneration in some of seminiferous tubules associated with low luminal spermatozoal concentration. It is tempting to speculate that the decreased sperm motility in the present study may /have been related to earlier studies on profenofos.

At the same time, it had been reported that profenofos brought about marked reduction in epididymal and testicular sperm counts in exposed males [2]. Also, testicular atrophy and degenerative changes in the seminiferous tubules had been reported by [35] which are in accordance with our obtained results.

Moustafa *et al.*, [36] reported also that Profenofos is considered as one of the male reproductive toxicants. ALP is primary of testicular and epididymal origin and, therefore, suitable for differentiation of oligo- and azospermia. Similar results were recorded by [37], who mentioned that profenofos produced atrophy, morphological changes and impaired spermatogenesis in testes of experimental animals.

## 5. Conclusions

From the obtained results, we report that both organophosphorous insecticides either Chlorpyrifos or profenofos have very dangerous and toxic effects, since they showed many side effects represented by lower level of testosterone hormone and decreasing total sperm count and increasing abnormal forms. Moreover, the damage in tissues of Testis.

## 6. Recommendations

So we recommend the use of the combination of propolis and ginseng which is known as antioxidants compounds in order to ameliorate the possible side effects caused by insecticides that we exposed to them to avoid the proven hazardous effect of insecticides on biochemical parameters and to overcome the side effects of both Chlorpyrifos and profenofos on liver.

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9/2/2012



## Eye Affection Syndrome Wild and Cultured Fish

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**Abstract:** Fish eyes syndrome is often one of the causes which induce difficulties in the life of both wild and cultured fish. The clinical fish eye syndrome is either local or systemic. The most common syndromes affecting wild fish are exophthalmos (pop-eye) and cataracts while those recorded in cultured one are exophthalmos, cataracts and enophthalmos (sunken-eye). The syndrome is associated with various infectious causes such as parasitic, chemical, mechanical, traumatic and hormonal imbalance. The epidemiology of these syndromes depends on the cause of infection of the eye in both wild and cultured fishes of all species and ages. Also, the diagnosis of these syndromes depends on: case-history, behavioral abnormalities and clinical examination (clinical signs and laboratory diagnosis). Histopathological examinations of eye syndromes affecting wild and cultured fish are graded from inflammation in acute form (traumatic causes) to cataracts and keratitis in chronic form (parasitic causes), retro-retinal gas bubbles (GBD). Prevention and control of fish eyes' syndrome depends on strict hygienic measures including the use of prophylactic treatment of parasitic and biological control. Treatment and removal of the causative agent are considered to be the most important factor in treating these diseases. In conclusion, eye affection syndrome is a group of non specific clinical signs which are associated with various infectious and non infectious diseases and the best approach to ocular disease is the prevention or avoidance through either strict hygienic measures or treatment and removal of the causative agent.

[Noor El Deen, A. I. E and Mona S. Zaki. **Eye Affection Syndrome Wild and Cultured Fish.** *Life Sci J* 2012;9(3):2568-2575]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 372

**Keywords:** Fish; eye; syndrome; clinical examination; laboratory diagnosis

### 1. Introduction

Fish eye is considered a very important organ. It is adapted for the vision in air as well as waters either in wild and cultured fish which do display some differences to the mammalian eyes (Lee, 2002). Wild fish are free living in open water their feeding depends on phyto and zooplankton. While cultured fish are bred and live in aquaculture systems such as cages and ponds and depend on either artificial or sometimes on natural feeding (Woo, 2006). Eye syndrome infection is an important health problem among fish all over the world. Ocular diseases of fish are common and represent a significant problem within the aquaculture industry and ophthalmic diseases that may cause the fish to be off food and leading to retardation growth (Noor El- Deen, 2007). The most common parasitic syndrome affecting fishes are of digenetic trematode (*Diplostomiasis* (cataracta parasitica), copepod *Ommatokoita elongate*, *Myxobolus dermatobia* while, keratitis, sunken eye, absence of eye, small eye and neoplasma of cornea, retina and other parts could be a result of physical, physiological and hormonal deficiency (Bjerkas *et al.*, 2006). The pathogenesis differs according to the route of infection (Austin and Austin, 2007). Hygienic measures, such as sanitation have become important aspect of aquaculture (Bostock, 2002).

The use of antiparasitic, antibacterial and antifungal drugs in the treatment of eye affections are of value (Noga, 2010). Also, traditional medicinal plants and biological control can control some parasitic

pathogens (Noor El -Deen *et al.*, 2010). In Egypt, many studies reported the eye syndrome affections among wild and cultured fish that recorded parasitic and non infectious causes of eye syndrome affection have much lower rates of developmental (El-Seedy *et al.*, 2009).

The present review is disseminating knowledge on fish eyes' syndrome in wild and cultured fish to stimulate further explanatory research that contribute in establishing a new effective strategy for prevention and control.

### Etiology of eye affection syndrome

#### In wild fish:

##### Infectious causes:

##### Parasitic causes.

Many species of metacercariae are found encysted or free in the eyes of fish which are found within the retina, vitreous humour and lens of the eye. Greatest damage is caused by those species occurring in the lens. Possibly the most important species is *Diplostomum spathaceum* or 'eye fluke' which is found in many species of fresh water fish in Europe, Africa and North America (Roberts, 2012). Some copepod parasites may be found attached only superficially and probably cause little harm to the eyes of fish. Others may penetrate deeper into the eye, causing severe damage. Also, the parasitic copepod *Ommatokoita elongata* (Grant) were collected in Arctic waters of Victor Bay, North-west Territories, Canada were firmly attached to the corneas of Greenland sharks, *Somniosus microcephalus* by an

anchoring structure, one per eye (**Borucinska et al., 1998**). Also, metacercariae that isolated from cultured Japanese eel in Taiwan caused swollen, cloudy and white eyes and the causative agent of the disease of eye of the fish, detected in three South American trout's was *Diplostomum compactum* and showed unilateral exophthalmia (**Vazquez-Gamboa et al., 2001**). In Egypt, *Diplostomum* metacercariae infection was found in eyes of wild and cultured catfish causing unilateral corneal opacity and blindness (**Eissa 2006**). In Nile tilapia *Diplostomum* in early stages caused exophthalmia without eye opacity and in chronic stages caused complete eye cataract and white dots around the eye cornea. While, *Myxobolus sp* was isolated from eye of some marine fish in red sea region (**Abd El-Monem et al., 2005**).

#### Non infectious causes:-

##### Physical causes.

Sudden change in water temperature, salinity and gas supersaturation are responsible for developing eye cataract and gas bubble disease in wild fish (**Woo, 2006**). Post capture eye damage to sockeye salmon may be related to supersaturation of the River in adult Columbia River fish's gas bubble disease. Moreover, exophthalmos in West Australian dhufish occurred more frequently in summer season (**Stephens et al., 2002**). Cataract in atlantic salmon (*Salmo solar* L) has been recorded from subzero water temperature (**Ferguson et al., 2004**). Gas supersaturation was observed in the Parana River, Argentina. The gas bubble was observed in fins, eyes and skin (**Domitrovic et al., 2000**).

##### Chemical causes.

Eye lesions and other clinical abnormalities are positively associated with water pollution. Inflammatory lesions of the eyes were interpreted as circumstantial evidence for contamination by wastes from titanium dioxide production (**Delthlefsen, 1984**). Eye lens cataract was common in fish of Elizabeth River, Chesapeake Bay, Virginia due to contamination of water with polycyclic aromatic hydrocarbons (**Williams et al., 1992**). Skeletal deformities, scale disorientation, gill, eye, soft tissue deformities and other kinds of deformities were reported in tilapia and other native fish species from southern Taiwan contaminated rivers (**Sun et al., 1998**). The exposure of larval fishes to sewage plumes off the coast of Sydney, Australia can potentially affect the health of larvae and cause deformities to the eyes (half pigmented eyes) (**Kingsford et al., 1997**).

#### In cultured fishes:-

##### Infectious causes:-

##### Parasitic causes.

The available literature recorded that eye flukes, *Myxosoma sp* and metacestodes were responsible for

affections in various farmed fish. *Myxosoma sarigi* isolated from the orbit and cornea of infected *O. niloticus* fishes were cultured at the kainji Lake research Institute, Nigeria (**Okaeme et al., 1988**).

*Ichthyophthirius multifiliis* causing cataracta in ornamental Golden fish (**Noga, 2010**). In Egypt, the most common parasites were; *Diplostomum spathaceum*, or 'eye fluke' isolated from tilapia sp. at Abbasa fish farm, Sharkia (**El-Bouhy, 1995**); *Myxobolus sp* isolated from *Tilapia zilli* at Giza province causing unilateral eye opacity (**Mohamed et al., 2004**). *Myxobolus dermatobia* from *Oreochromis niloticus*, hybrid tilapia and *Sarotherdon aureus* at Kafr El-Sheikh Governorate causing petechial haemorrhages and focal to large haemorrhages in orbit, exophthalmia and in advanced cases unilateral eye opacity (**Abd El-Aal, 2002**). *Cataracta parasitica*, the most common cause of eye opacity is metacercaria of digenean trematodes (**Eissa, 2006**).

#### Non infectious causes:-

##### Physical causes.

Cold, rapid fluctuations in water temperature, high water temperature, direct of water flow are important physical factors for inducing eye affection in fishes (**Woo, 2006**). Atlantic salmon (*Salmo salar* L) cultured in nets in sea water was appeared in some of them cataract after a period of elevated surface water temperature with simultaneous rapid in water temperature (**Bjerkas and Bjornstad, 1999**). Gas supersaturation, change in breeding techniques, temperature fluctuation and seawater transfer time are capable of development of eye abnormalities and other clinical signs in cultured fish as rapid growth rate and most severe cataracts in Atlantic salmon during the rearing stage (**Bjerkas et al., 2001**).

##### Mechanical causes.

Corneal abrasions and ulcerations are common sequelae of trauma, especially in large individuals. This can result not only from fighting, but also, from bumping into sharp objects, such as rocks or coral, in an aquarium. Ophthalmic trauma, which can eventually lead to phthisis bulb, is common in large aquarium fish (**Noga, 2010**). Phacogenic uveitis is often found in Rainbow trout, *Salmo gairdneri* association with the lenticular lesions, and retinal detachment often occurs as a result of vitreous trauma (**Shariff et al., 1980**). As a result of probable damage of common snook broodstock *Centroponus undecimalis* during netting from Terra Ceia Bay, Florida, USA, the cornea of most fish in captivity began to turn opaque white within 24h of capture, while, the untreated fish became blind (**Kraxberger-Beatty et al., 1990**).

##### Hormonal causes.

Injection of high doses of methyl testosterone and L-thyroxine inhibited growth and was bulging eyes of

Red sea bream, *Pagrosomus major* and cultured *O. niloticus* caused corneal opacity ( **Aml El-Asaly, 2004**).

#### Therapeutic causes.

Incriminated Nugvan used to control sea lice on salmon was found to induce cataract in seabass ( *Dicentrarchus labrax L* ) ( **Bjerkas et al., 2003** ). Corneal opacity was observed with the deficiency of Ascorbic acid ( **NRC, 2011** ) and probiotic in tilapia *O. niloticus* ( **Taoka et al., 2006** ).

#### Physiological causes.

The cataract observed in rapidly growth Atlantic salmon *Salmon salar L.* smolt in Norway might be related to smoltification process ( **Bjerkas et al., 2006** ).

#### Epidemiology of eye affection syndrome

Eye affection syndrome is a group of non specific clinical signs which were associated with various infectious and non infectious diseases. Therefore, the epizootiology of this syndrome is dependent on the cause of eye disorder. This problem is worldwide in distribution affecting both wild and cultured fishes of all species and ages.

#### Incidence of eye affections syndrome:-

##### In wild fish.

The available data showed that prevalence of eye lesions ranged from near negligible level to 100% ( **Eissa, 2006** ). In addition , **Iglesias et al. (2001)** recorded three species of *Myxobolus* (*Myxobolus dermatobia*, *Myxobolus spheroidalis* and *Myxobolus ocularis*) in different locations in the skin, gills and eyes of *Chondrostoma polylepis* in Galicia, New Spain.

Naturally occurring cases of exophthalmos that examined were mostly unilateral and occurred more frequently in summer months during periods of increasing water temperature. Changes varied from a hazy opacity in the interior part of the lens to cataract affecting the whole lens. Severely affected lenses appeared swollen and large vacuoles were visible in the opaque areas. Large vacuoles in the otherwise clear lenses were seen in 1 of 4 adult salmon examined ( **Bjerkas et al., 2003** ).

##### In cultured fish.

Numerous reports have been released concerning the prevalence of eye affection syndrome in aquaculture. They reported that the spreading of the eye problems among cultured fish is worldwide in distribution.

In Egypt, *Myxobolus sp* were isolated from both *Tilapia sp* and *Clarias lazera* at Behera province causing unilateral eye opacity. *Myxobolus spheroidalis* and *Myxobolus ocularis* from *Oreochromis niloticus* were illustrated to cause exophthalmia and in advanced cases unilateral eye opacity ( **Abu El-wafa, 1988** ).

Cataract and other optical changes in traditional pond farms in lower Saxony, Germany was low incidence ( **Schlotfeldt and Wegener, 2000** ). They also added that the cataract problem and more severe eye

changes. Also, present in freshwater fish farming, seen to be less prevalent than the marine production of Atlantic salmon. The prevalence of cataracts in seawater farmed atlantic salmon, *Salmon salar* was 83% in spring entry groups and 79% in autumn entry groups respectively ( **Ersdal et al., 2001** ). Spontaneous exophthalmos was common in cultured West Australian dhufish *Glaucosoma hebraicum* Richardson which is a potentially valuable aquaculture species ( **Stephens et al., 2002** ).

#### Factors influencing the eye affections syndrome:-

The incidence of ocular abnormalities is greatly affected by various factors involving fish type, species, age, environmental temperature and others ( **Woo, 2006** ). Eye disorders are more common among farmed fish because stresses associated with culture (overcrowdness, artificial feeding, unfavorable water quality, rough handling) render them more susceptible than feral fishes. The rate of eye diseases varies from one species to another ( **Woo, 2006** ). Pop - eye which is the main signs of GBD can be seen in winter ( **Isaacson, 1977** ) as well as in summer ( **Stephens et al., 2002** ). The West Australian dhufish, *Glaucosoma hebraicum* Richardson (family Glaucosomatidae) is a potentially valuable aquaculture species, but spontaneous exophthalmos is common in freshly caught and cultured dhufish. Naturally occurring cases of exophthalmos that examined were mostly unilateral and more frequently in summer during periods of increasing water temperature ( **Stephens, et al., 2002** ). Meanwhile, chemical pollution enhances to a great extent the eye disorders incidence of deformities in larval fishes ( **Kingsford et al., 1997** ), in tilapia and other native fish species from Southern Taiwan contaminated rivers ( **Sun et al., 1998** ). Eye lens cataract was reported to be the most common sign in some fish species in Poly cyclic aromatic hydrocarbons heavily contaminated sites of the Elizabeth River, Virginia, USA was reported ( **Williams et al., 1992** ).

#### Epidemiological occurrence of eye affection syndrome:-

Depending on what was mentioned earlier, it is clear that there are several epizootiological patterns of eye affection syndrome due to cause's variation.

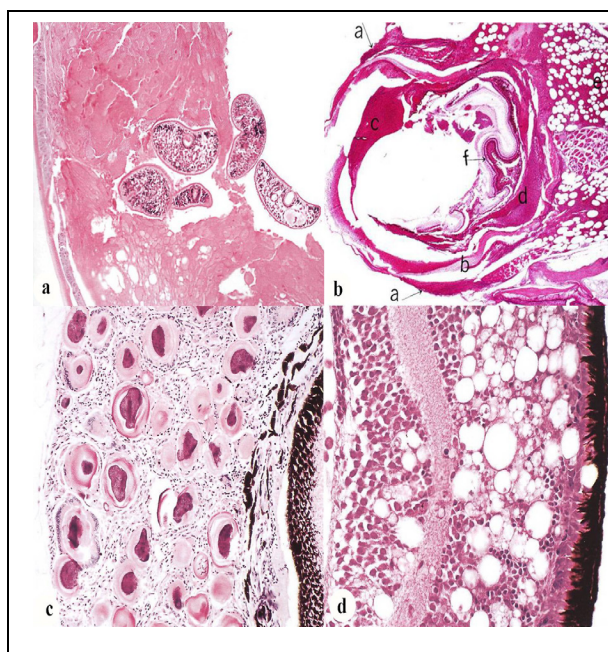
The most common eye affection was *Cataracta parasitica* which caused by metacercaria of digenean trematodes (mostly *Diplostomum sp*) which is found in fishes as second intermediate host ( **Karvonen et al., 2001** ). Several fish-eating aquatic birds are the primary hosts of the fluke. Adult trematode in the birds produced large amount of eggs that shed and passed in feces to the water and fish ( **Eissa, 2006** ).

Gas-bubble disease due to helicopter was transport in young pink salmon ( **Hauck, 1986** ). It has now been observed clinically in a wide variety of farmed species and under a number of different circumstances. Uni or bilateral exophthalmia, another pattern of occurrence

and associated environmental and management factors were detected (Speare, 1998).

#### Pathological changes of eye affection syndrome

The eye affection syndrome is associated with infectious and non-infectious diseases, the different pathogenesis should be considered. Histopathological examination of eye affected by several fluke larvae within the lens revealed localized granulomatous reactions around the dead ones (Saburoh *et al.*, 1982). As shown in **plate,1**. Diplostoma in tissue of cornea causing eye opacity. Corneal epithelial ulceration and heterophilic keratitis was observed (Reborts, 2012). As shown in **plate,2**. Epithelial proliferation is a frequent finding in cataract in fish. The Ocular enucleation, persistent corneal cataracts and panophthalmitis are the dramatic sequel of Gas bubble disease (Woo, 2006). The ocular cataracts happened to yearling salmonids after seawater exposure cause damage of cortical fibers as a result of exposure to hypertonic solution and defective osmoregulation (Bjerkas *et al.*, 2003).



**Plate( 1).** (a) Diplostoma in tissue of cornea , ( b) Infected eye. Bacteria invade the conjunctiva(a), sclera (b), iris(c), choroid(d) and orbital adipose tissue(e) ,the retina(f) is separated,the eye ball is forced out of the orbit. H-E, x 10.,(c) Retinitis in tissue of cornea .(d) . Uveitis and vacuoles are the typical findings which are seen in all layers of the retina (Saburoh *et al.*, 1982).



**Plate (2).** (a) Epithelial proliferation, is a frequent finding in cataract in fish. (b) Massive retro-retinal gas bubbles result in unilateral loss of vision in this aquarium species, largely due to distortion of retina, (Saburoh *et al.*, 1982) .

#### Diagnosis of eye affection syndrome

##### Case History:-

Many factors should be reported such as; recent stress exposure (overcrowdness, transportation, decrease in water flow / exchange, overfeeding) (Noga, 2010), Mechanical injury (netting, grading, fish sampling) (Kraxberger-Beatty *et al.*, 1990) , rapid fluctuation in water temperature, sudden increase (Eissa and Zaki, 2010) or decrease in water temperature (Bjerkas and Bjornestad, 1999) , snails and aquatic birds spreading ( Eissa, 2006) and chemical pollution (Williams *et al.*, 1992) should be considered in diagnosis of eye affections .

##### Clinical examination:

Fish should be examined first for detection of any behaviour changes, then representative fish sample was taken and fish were inspected individually for detecting gross lesions.

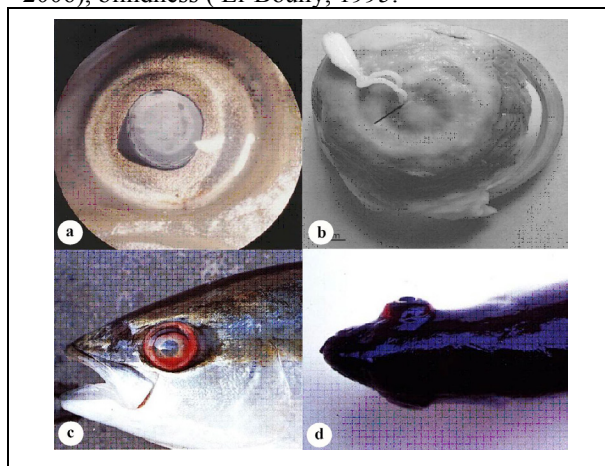
##### Behaviour abnormalities.

Fish floating to water surface and increase in time devoted to feeding (Noor El-Deen, 2007), random swimming into objects (Karlsbakk *et al.*, 2002) and sluggish movement (Ness and Foster, 1999) are considered the most common behavioral abnormalities.

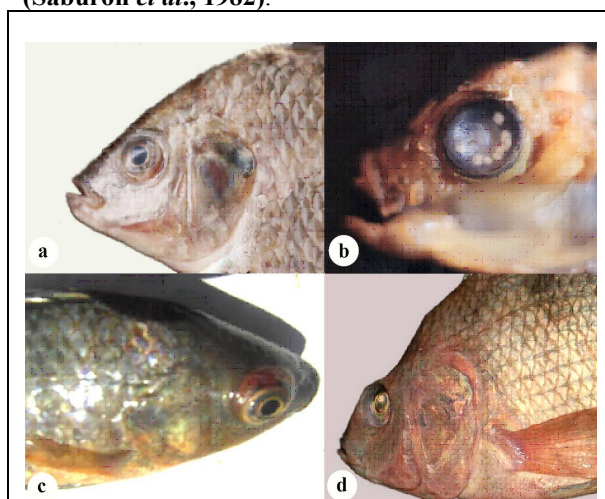
##### Clinical signs.

Most common clinical signs were stunted growth (Ersdal *et al.*, 2001), acute or chronic mortality (Sogma *et al.*, 1999), Diplostomum flukes (Eye flukes) (Crowden and Broom, 1980), adult female Ommatokoita elongata (Borucinska *et al.*, 1998), exophthalmos(Saburoh *et al.*, 1982). **Plate,1(a,b,c and d)**.

*Myxobolus cysts*, endophthalms (Noor El -Deen, 2007), Cataracta parasitica in Tilapia (Eissa, 2002). **Plate,2 (a,d,c and b)** . unilateral or bilateral eye lens opacity cataract (Vasquez-Gomboia *et al.*, 2001 and Austin and Austin, 2007), unilateral or bilateral exophthalmos (Russo *et al.*, 2006), presence of gas emboli ( Domitrovic *et al.*,2000 ). Plate,3(d), Vision impairment ( Bjerkas *et al.*, 2003 ),("pop-eye) (Eissa, 2006), blindness ( El-Bouhy, 1995).

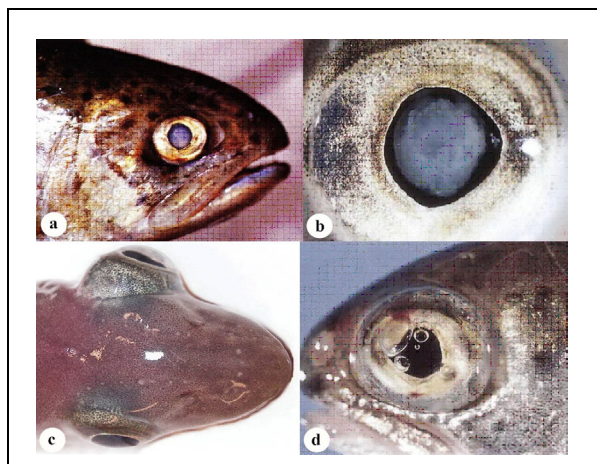


**Plate (1).** (a) Diplostomum flukes ( **Eye flukes**) showed in the cortical layer where there is a concurrent cataract development (Saburoh *et al.*, 1982). (b) The eye of a Greenland shark infected with adult female Ommatokoita elongata (arrow indicates point of parasite attachment) (Borucinska *et al.*, 1998). (c) A yellowtail fish exhibits exophthalmos with hemorrhage of the conjunctiva and iris (Saburoh *et al.*, 1982). (d) This fish exhibits exophthalmos. (Saburoh *et al.*, 1982).



**Plate (2)** . Myxobolus cysts in the eye and slight exophthalmos (Noor EL- Deen,2007). (b): Showing Cataracta parasitica in Tilapia (Eissa,2006). (c ) *Oreochromis niloticus* with exophthalmia eye (Noor EL- Deen, 2007 ).

(d) *Oreochromis niloticus* with sunken eye (Noor EL- Deen,2007).



**Plate(3).** (a) A rainbow trout with cataract and a cloudy lens (Saburoh *et al.*, 1982). (b) Diplostomum flukes ( **Eye flukes**) in the cortical layer (Saburoh *et al.*, 1982). (c ) Retrolubar gas has pushed the eye forwards and out of the orbit, resulting in exophthalmia in this cod (Saburoh *et al.*, 1982). (d ) Small gas bubbles in the anterior chamber of rainbow trout (GBD) (Saburoh *et al.*, 1982).

#### Laboratory diagnosis.

First, freshly prepared fish samples are essential for isolation and identification of parasitic, bacterial, fungal and viral examinations. **Parasitic diagnosis** depends on isolation and identification according to Lukey (1977)

#### Prevention and control of eye affection syndrome

Numerous studies with controlling of eye affection syndrome in wild and cultured fish were concerned.

#### Managerial prevention.

Quarantine of new fish and good sanitation practices should be used at all times (Eissa, 2006). Nutritional deficiency as a cause of eye syndrome affections should be balanced (Noga, 2010). Stress factors must be avoided with added to the feed anti stress substances such as ascorbic acid (Taoka *et al.*, 2006). Also, Aerating the water sources in a reservoir to allow it to equilibrate with air or stripping of excess gas by using vacuum, the excess gas may leave solution in the blood stream, forming emboli in various tissue causing gas bubble disease (Woo,2006).

#### Drug therapy control.

#### In parasitic infections and /or infestations.

Antiparasitic drugs should be used as in case of eye fluke *Diplostomum spathaceum* in Channel catfish

which treated with 2 mg Praziquantel/l in water bath for 2-4 h (**Plumb and Rogers, 1990**). Eye affections associated with parasitic infections and/ or infestations, antiparasitics were recommended for controlling of this condition. An oral praziquantel used as inhibiting attachment of parasites to *O. niloticus* (**Osman et al., 2008**). Recently, electrical currents, ultraviolet radiation and supersonics are used for eradication of cercariae (**Eissa, 2006**).

#### Biological control.

In addition to controlled indirectly through eradication of snails. Several methods were used for snail destruction, but abiological control by black carp is the best (**El- Khatib, 2003**). Avoid exposure of culture waters to the aquatic birds (**Noga, 2010**). Probiotics, live microbes that may serve as dietary supplements to improve fish immune responses, have received some attention in aquaculture (**Kesarcodi-Watson et al., 2008**).

#### Conclusion:

Fish eyes syndrome is a disease that causes many problems to both wild and cultured fish. Treatment of this syndrome in wild fish depend on great extent on getting rid of the causative agent. In cultured fish, prevention and control of fish eyes' syndrome problems could be balance of nutrition.

**Methods used to control ocular diseases are:-** Good farm management, environmental stresses and associated disease, high water quality, applying lime to the ponds, low rearing densities, and excellent nutrition. Quarantine and health certificate form which is a part of the control microbial diseases.- Paying attention for eradication of any parasitic, bacterial, fungal and viral causes in fish farm. Employing some molluscicides chemically or biological and trials for elimination of the aquatic piscivorous birds, dead fish. Application of vaccination programs for fish, or using medicinal plant extracts which are the alternatives to the antibiotics for preventing and controlling the infectious diseases in fish farms. Recently, electrical currents, ultraviolet radiation and supersonics methods are used for eradication of cercariae in cultured fish at water inlet.

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9/2/2012



## Sustainable strategies in Iranian houses

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**Abstract:** Traditional Iranian architecture especially houses have unique characteristics, while considering aesthetic issues and environmental conservation have been responsive to climate requirements for each region. Techniques and rules used in this architecture clearly have in themselves many new concepts in sustainable architecture arena. This paper studies these sustainable concepts in the architecture of Iranian houses. This research is qualitative, descriptive and then analytic in regard to research performing process. Investigating and selecting the bases and concepts are based on library and documentation methods. This research results show that sustainability can be promoted in environmental, economic, social and architectural dimensions considering to indigenous and local sustainable values.

[Shadi Babaei, Nasim Fazeli, Behnam Ghasemzadeh. **Sustainable strategies in Iranian houses.** *Life Sci J* 2012;9(3):2576-2580] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 373

**Keywords:** Sustainable architecture, Iranian houses, Iranian architecture, traditional architecture

### 1. Introduction

A glance at the architecture of Iranian houses at least in past fifty years indicates that the solutions and architectural spaces which over the centuries had permanent presence have been eliminated and supposed to be inefficient. These solutions not only promoted physical and functional aspects of architecture but also equipped with advanced technology of that time by consistency with environmental and climate conditions and utilizing renewable energies and in their lines.

In the discussion of sustainable development and following it sustainable architecture, it is obvious that each building should interact with its surrounded natural environment. The controversial and significant part is how to interact and the type of considered measures. This is exactly something that was exploited years ago by Iranian people with especial skill. They have benefited from it by performing technologies and especial rules in regard to optimal use of energies and natural resources particularly solar and wind energies; and coordinating with regional climate. But unfortunately, today it is forgotten and destroyed. These measures are not only evident in environmental but also in social and economic dimensions (Zandieh and Parvardinejad, 2010).

Therefore, sustainable architecture helps to create a healthy environment based on resource efficiency, conservation of non-renewable resources, reducing consumption of renewable energies and quality promotion of life and human health.

“Evaluation of traditional solutions in local architecture precedes the development of mechanical solutions in order to accept or remedy these

methodologies to preserve from modern sophisticated requirements... This process should be based on new progresses acquired in humanities, physics as well as in sciences such as material technology, physics, aerodynamics, meteorology and physiology” (Hassan Fathi, 1986).

So first, in this research the principles of sustainable architecture and then climate techniques used in architecture of Iranian traditional houses have been specifically studied. The existence of spaces such as particular residential spaces for summer and winter, optimal use of wind and solar energy and soil thermal capacity are significant characteristics of houses in different regions of Iran. In this research, it has been attempted briefly to investigate some elements and techniques used in construction and architecture of Iranian traditional houses.

### 2. Methods

This research is qualitative in regard to performance process, applied in regard to research results, retrospective in time of research conducting, descriptive in research objective and then field study in regard to its analysis (diagram 1). Books, reliable journals and sites have been used for obtaining optimum results and providing appropriate answers to the questions. Finally, it has been attempted to totalize and analyze the obtained materials by field visiting of available facilities and giving case examples of different types of housing.

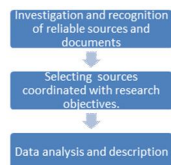
### 3. Research Questions

3.1 To utilize the greatest advantage from sun rotation in different seasons and the existing wind in each climate, how should be climate

indicators of each region and buildings orientation?

- 3.2 What sustainable elements were effective and important for using optimal construction model of Iranian housing?

Diagram 1- Data collection process



#### 4. Research Objectives

- 4.1 Identifying the factors is effective on shaping the architecture of Iranian houses.  
4.2 The elements and techniques have been used in architecture of Iranian traditional houses.

#### 5. Theoretical bases of research

##### 5.1. Principles of sustainable architecture

For classifying a building in the category of sustainable buildings, some principles should be observed as follows:

- The first principle: Energy Conservation
- The second principle: Climate coordination
- The third principle: To reduce use of new resources
- The fourth principle: To meet residents needs
- The fifth principle: Coordination with site
- The sixth principle: Generalization (Ghiasvand, 2006)

##### 5.2 Climate techniques for traditional Iranian houses

###### 5.2.1 House architecture in Iran

Nearly 9000 years pass from the time that human select sedentary in Iranian plateau (Adib et al, 2005). Iran with its cultural and geographical characteristics is among the countries which have been able to create various architectures over history. Even, this diversity is also observable in geographical segmentations of a limited region. For example, a large variety of residential architecture in green areas of Gilan province or residential architecture in Iran desert of Natanz Abyaneh well presents this issue (Memarian, 2008). Various factors such as topography, climate characteristics, economic capabilities, livelihood, water resources and other factors have caused to emerge different residential tissues in Iran in regard to physical formation. This specific geographical and climate position along with the intelligence of the ancients in utilizing natural energies like wind and solar energy whether in scorching desert or in humid areas of the country together have caused to emerge this unique architecture. But it is observed that today people of

this land with negligence and a foreign model are constructing instable buildings (Zandieh and Parvardinejad, 2010).

###### 5.2.2 Four seasons housing

The optimization of energy consumption in residential buildings is the design of four seasons housing, the most obvious form of traditional buildings in consistency with climate which have been made in hot and dry regions as central courtyard and completely introverted.

These buildings have particular residential spaces for summer and winter that are the best forms and possible combinations of components in a building for climate modification. Thus, north and sunny side of courtyard which was warmer, was used in winter and was famous as particular residential space for winter. Vice versa, south side of courtyard and back to the sun was used in summer and known as particular residential space for summer (Ghobadian, 2008).

There were below windcatcher spaces and throne room which had higher elevation and lighter volume than particular residential space for winter. This was because of using wind, air conditioning and better air circulation; and cooling this space in summer. Particular residential space for winter consists of three-door room, five-door room and a space that its coherent is cut off in the corners.

It also settled on the main axis and two communication spaces which can be corridor and the upstairs in two sides of the saloon consist of three-door, sash or Tehrani and two-door room. For more sunlight, the windows were often constructed from large sashes and intricate mirror decorations such as very complex mirror works are seen inside central spaces due to the closed space (Zandieh and Parvardinejad, 2010).

###### 5.2.3 Introspection

Work on the appearance was avoided and instead work on the inside and internal estates has also been drawn in this arena by some acquaintances with architecture, as far as Iranian architecture is not seen from exterior façade something more than mud but inside has a beautiful world; and so it is called introverted architecture.

###### 5.2.4 Characteristics of introverted houses:

- 1- Lack of direct visual connection between the spaces within and outside urban areas.
- 2- The elements such as central courtyard or covered platforms have organized different spaces such that the openings are opened to the side of these elements.

The discussion on lack of direct visual connection with urban areas can be investigated from two cultural and climate views (Memarian, 2002).

###### 5.2.5 Extraversion

Extroverted typology is related to a type of housing architecture with the characteristics such as having direct visual and physical connection with outside space of the house, no courtyard, extending the height and spatial organization than other space like facing porch (Memarial, 2002).

### 5.2.6 House orientation

The use of resources and natural energies is one of construction principles and spatial organization in traditional complexes. For example, old houses in tissues of the desert are located in direction of Mecca (except when there is annoying wind). This orientation has created climate conditions in design of biological spaces to place summer spaces and winter rooms logically in proper position. Proper orientation in addition to protecting residents against direct heat of the sun; prevents from improper winds (Asadpour, 2006).

Three existing orientations in traditional Iranian buildings are: order (northeast-southwest), Esfahan (northwest-southeast) and Kerman (eastern-western) indicated the best establishment orientation in any climate. Order orientation has included central cities like Tehran, Yazd, Jahrom and Tabriz in northwestern of Iran, Isfahan orientation has included Isfahan, Shiraz and finally Kerman orientation has included Kerman, Hamadan, cities in western Azarbijan, Khoy (Pirnia, 2003).

### 5.2.7 Diving in the soil deep

Diving in the soil deep and constructing the spaces in underground to use soil heat capacity in different seasons of the year is another climate techniques. Construction of such spaces is only prohibited in the areas with high soil moisture such as the areas in Caspian Sea margin (Zandieh and Parvardinejad, 2010).

### 5.2.8 Green area

Gardens and low water usage trees while providing shade, playing the role in production and creating beauty compensate lack of humidity in the environment. These green surfaces prevent re-reflection of beams and unwanted increase in heat by absorbing solar radiation beams (Asadpour, 2006). These trees sometimes play the role of windward. Selecting evergreen or deciduous tree is different depending on climate type.

### 5.2.9 Use of appropriate materials

One of the climate tricks in residential architecture of Iran is use of local materials with adequate thermal capacity due to climate. So, not only the materials appropriate to any climate have been used but also side costs such as transportation costs saved. Typical samples are the use of wood in northern area of the country and the use of soil, clay and brick in central and desert areas which are well evident (Zandieh and Parvardinejad, 2010).

### 5.2.10 Insulation in traditional architecture

From ancient times, by insulation and the use of available construction materials and also reducing and increasing walls thickness; Iranians have constructed their houses such that they require the minimum heating and cooling and it is the manifestation of ancient Iranian civilization. Insulation in summer causes less heat enters into the building and in winter prevents heat leaving from and cooling the building. In traditional architecture of Iran, the insulation has a specific importance. So that, in this architecture there is no roof covering whether flat or curved that is not double-layer. In addition to lighten the covering, the transmission of outer heat into the building has been prevented by this method (Pirnia, 2003).

### 5.2.11 The role of water in traditional architecture

One of the important constituent elements of Iranian traditional courtyards is the existence of water and pool (Toofan, 2006). Water pond in the middle of the yard, in the basements and the use of water in the spaces like spring house for softening the air, creating appropriate visual vision and sometimes the sound of water using fountains and waterfalls; and instill sense of calm are the small samples of using water in residential houses. For instance, evaporation in hot and dry climate can reduce temperature. In aspect of architecture and its relationship with water, Zoroastrians marked four sides of an open sacred area which was a land in rectangular shape and was called "Pavy" then read a special prayer for getting out demon's soul and cleansing it with holy water (Nayebi, 2002, 45).

## 6. Results

One of the important and effective factors in shaping the architecture in an area is climate. Synchronizing with new world architecture and applying new energies in the building and constructing in coordination with climate can save energy and reduce environmental pollutions. Besides of these, applying valuable templates of traditional architecture is also very important. Some of these templates have been mentioned in the following:

### 6.1 Use of natural ventilation system

In traditional Iranian architecture, ventilating and cooling the environment particularly in hot and dry climate and rotating the air and leaving moisture out in humid climate has been important. Creating and use of the windwards, a large window facing the courtyard, a hole in small dimension in the ceiling in addition to light entry; have been responsible for leaving hot air out and sometimes in larger dimensions as patios and windows below the ceiling displayed in hot and dry climate. Among the above mentioned, ventilation in humid climate for air

circulation and leaving moisture out in dominant wind direction by non condensation constructing of building, allowing air circulation within buildings and also embedding proper opening have been important.

### **6.2 Correct use and utilization of the wind of any climate in the ventilation**

The rotation of the building in proper winds direction or opposite direction of the annoying winds and making windcatcher one or more ways in proper winds direction and preventing the entry of annoying winds (when winds carrying sand in the deserts) show the correct use of wind by ancients. Therefore, building orientation, proper use of wind and air circulation in many ancient traditional houses have had a useful and effective assistance for ventilation of the house and heating interior spaces in different seasons.

### **6.3 Use of proper materials available in each area**

Use of proper materials available in each area, does not have any reason except their proper functioning in each region's climate. Besides, use of materials available in any climate and area for reducing transportation costs which in its turn requires energy consumption and their availability are very important. Use of wood in forest area, stone in mountain area and brick in desert area is a reason for this claim.

### **6.4 Use of indigenous materials consistent with climate**

Use of indigenous materials consistent with climate in each area not only emphasize on reducing transportation costs and saving energy consumption but also is completely consistent with its climatic environment and is flexible against environmental factors. As it was noted, use of brick in hot and dry climate (due to the considered thermal capacity) and stone in cold climate compare to humid climate and use of wood (due to high-humidity environment) are quite apparent. So that, flexibility of each of these materials against climatic actions and reactions has included proper responds.

### **6.5 Proper use of water and plants**

Proper use of water and plants together for creating a pleasant environment and perspective; is one of the most important principles in Iranian architecture. In addition to making the supposition of like heaven space, these factors are important in having an important role in regulating environmental conditions inside the building and softening environmental and regional air. Planting vegetations appropriate to regional climate, planting evergreen and deciduous trees commitment to shade or sunlight in different seasons and creating diversity and color in the space; prove the intelligent use of plants by ancients.

### **6.6 Proper orientation of buildings according to the sun movement**

One of the construction principles in traditional complexes of Iran is proper orientation of buildings according to the sun movement in the sky and optimal use of solar thermal energy in different seasons of the year. In traditional Iranian buildings, three order orientations (northeast-southwest), Isfahan (northwest-southeast) and Kerman (eastern-western) indicate the best side of building establishment in any climate.

### **6.7 Use of soil thermal capacity in winter and summer**

Since, the earth is almost an unlimited thermal source, soil thermal capacity is used in winter and summer in the spaces such as basements, cellars and shovadans. Its heat storage capacity rate provides this possibility to be used for seasonal heat storage. Soil temperature at depth below 6m., is almost stable and equal to annual average of surface temperature. The existence of summery and wintery spaces, use of earth depth and life in soil depth has had positive consequences.

### **6.8 Use of additional elements**

Use of additional elements such as porches and canopies along with vertical or horizontal sunlight controller blades, curtains, and latticed windows with colored glasses are the ways to control the depth and amount of sunlight into the building in summer and winter based on resident needs to solar energy. While, the proper angle of solar radiation in winter makes the penetration of sunlight possible into the building in the best way.

### **6.9 Use of walls thickness**

Walls thickness and the materials used in it were made using materials thermal capacity depending on climate and residents needs to variable cooling and heating. Making two layer roofs whether flat, curve or steep was helped to control the rate of sunheat received through the roof creating a kind of insulation by air trapped between two shells; and choosing the appropriate materials besides their thickness have been a complete insulation against climatic factors.

### **6.10 Climate preparations in coordination with culture, tradition and beliefs**

Each region of Iran has its own regional customs and traditions; and coordination of climate preparations with special culture and traditions of each region besides religious beliefs are very important. For example, the coordination of people culture in desert regions with condensed housing tissue and their introverted architecture compare to people from north territory with their non-dense and open housing tissue for air conditioning and moisture disposal in this region can be noted; and some

examples of architecture in west region cold with limited and small openings can also be mentioned.

### 7. Conclusion

By examining and comparing main components of sustainability with the architecture of traditional houses, it was clarified that the architecture of these houses are in full compliance with the principles of sustainable architecture. Lack of attention to sustainability foundations of traditional Iranian architecture and the factors affecting on it; have shown an unstable condition in existing architectural structure. Forgotten solutions in design of sustainable residential space should be identified and updated regarding to available technology and used in design of buildings. Sustainable strategies which gained from simultaneous intelligent design of climate and architecture are valuable from aspect of sustainability. In fact, the ecology of building emphasizes on its ability to combine with climatic factors and transform it into spatial qualities and comfort form. Using these strategies and solutions in architecture not only is a major step toward sustainable development but also will largely restore and strengthen the lost architectural and urban native structures.

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1/26/2012

## Diagnostic Accuracy of Ultrasonography for Evaluation of Internal Derangement of the Temporomandibular Joint

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**Abstract:** The diagnostic accuracy of ultrasonography for diagnosing internal derangement of temporomandibular joint, and comparing its accuracy with the magnetic resonance imaging gold standard was evaluated in 20 Patients. Patients were divided into two groups: Group I include five patients without any sign or symptoms of temporomandibular joint disorders (control group). Group II included 15 patients suffering from unilateral or bilateral temporomandibular joint disorders such as pain, clicking dislocation, difficulty in opening the mouth. All patients were examined with panoramic radiography, ultrasonography followed by Magnetic resonance imaging. In Group I, ultrasonographic imaging demonstrated a normal disc space ranged between 2.8 and 5 mm in the closed mouth position, and a space ranging between 5 to 7 mm in the opened mouth position. While, magnetic resonance imaging demonstrated normal disc position in relation to the condyle and the glenoid fossa. *In group II:* Ultrasonographic imaging demonstrated a disc space within normal range in four cases; the remaining 11 cases demonstrated increased the disc space which ranged between 7 and 10 mm in the closed mouth position and between 10 and 17 mm in the opened mouth position. While, magnetic resonance imaging demonstrated 12 cases (88%) with anterior disc displacement. The remaining three cases were demonstrated normal disc position. The ultrasonography, as non-invasive and significantly low cost diagnostic technique, can be used for patients clinically suspected to have temporomandibular joint disorders to exclude the negative results before request the more expensive and invasive images.

[Khaled Alashiry, Mahmoud E. Khalifa and Ashraf Abo Khalaf. **Diagnostic Accuracy of Ultrasonography for Evaluation of Internal Derangement of the Temporomandibular Joint.** *Life Sci J* 2012;9(3):2581-2587]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>.374

**Key words:** magnetic resonance imaging, ultrasonography, temporomandibular joint, internal derangement

### 1. Introduction

Internal derangement is one of the most common intra-articular abnormalities of the temporomandibular joint (TMJ) <sup>[1]</sup>, defined as an abnormal positional and functional relationship between the articular disc and the mandibular condyle and the articular surfaces of the temporal bone <sup>[2]</sup>. Different imaging techniques may be used for TMJ evaluation. Conventional radiographic techniques and computed tomography allow accurate evaluation of bony components but are not useful for examining the disc and soft tissues <sup>[3-5]</sup>. Magnetic resonance imaging (MRI) has become the gold standard for evaluating the soft tissue structures of the TMJ, especially disc position <sup>[6]</sup>, and it has the major advantage of not introducing radiation or known biologic hazards to the patient that might produce tissue damage <sup>[7]</sup>. However, MRI unit are quite expensive and not available in a traditional dental setting. The clinician must often rely on the patient's history and clinical examination findings.

Ultrasonography (US) has been introduced recently for the study of the TMJ. This technique allows evaluation of all the components of the TMJ: the condylar head, the glenoid fossa of the temporal bone, the disc, the joint capsule, the articular ligaments and the insertions of tendons. Dynamic US is an inexpensive and non-invasive diagnostic technique <sup>[8-10]</sup>. So this study was aimed to evaluate the diagnostic accuracy of US for diagnosing internal derangement, and comparing its accuracy with the MRI gold standard.

### 2. Patients and Methods

Twenty cases were included in this study, the age ranged between 20 and 55 years

The cases were divided into two groups: Group I (GI) include five cases not complain from any sign or symptoms of TMJ disorders and so used as a control group. Group II (GII) 15 cases were included in this group and they were suffered from unilateral or bilateral TMJ disorders such as pain, clicking

dislocation, difficulty in opening the mouth, deviation of the mandible during movements.

All patients in both groups were examined with panoramic radiography, US followed by MRI.

US, using vertical scans was performed with a linear MHz small-part transducer was connected to a Hitachi EUB-565A, ultrasound scanner. Hitachi medical Corporation- Japan. The transducer was positioned against the patient's face in a vertical direction overlying the zygomatic arch and TMJ to perform a vertical scan. The transducer was gradually shifted posteriorly and in up and down direction to obtain optimal visualization of the lateral pole of the mandibular condyle, which was clearly seen to be nearest to the skin surface while the patient, was in opened or closed mouth position. The distance between the superior surface of the condyle and the inferior surface of the glenoid fossa was measured on the display of the sonographic equipment in both closed and opened mouth position.

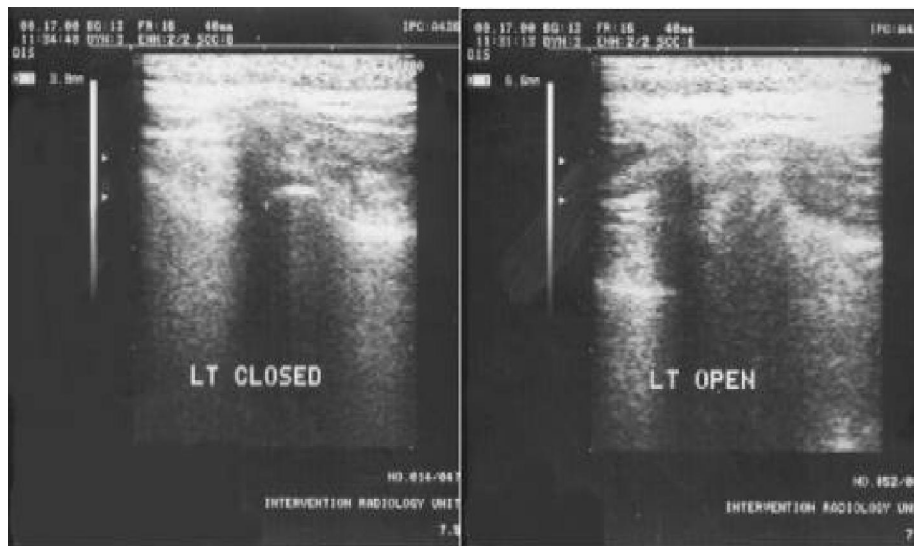
MRI; was performed with a 0.5- tesla superconductive system (GE Sigma contour) using the TMJ surface coil (6.5cm in diameter) placed over the joint as a receiver. The surface coil provides significant improvement in signal to noise ratio and, therefore improves spatial resolution when compared

with images obtained when using the standard head coil as a receiver. T1 weighted fast spin – echo (500/11[TR/TE/excitation]) imaging with a 150- mm field view, 3mm slices thickness and no interslice gap were obtained. Multiple oblique parasagittal slices were obtained perpendicular to the line indicating the long axis of the mandibular condyle on axial slice in both closed and opened mouth positioned. MRI was preformed while the patient was in a supine position. All the selected patients gave their informed consents to participate in this study. The study protocol was reviewed and approved by the central regional ethics committee.

### 3. Results

#### Group 1(G1)

**US results:** Ultrasonographic examination of this group demonstrated that, in the closed mouth position, the distance between the superior surface of the condyle and the inferior surface of the glenoid fossa ranged between 2.8 to 5 mm with a mean of 3.6 mm. In the opened mouth position the distance between the superior surface of the condyle and the inferior surface of the glenoid fossa ranged between 5 to 7 mm with a mean of 5.8 mm (Fig.1).

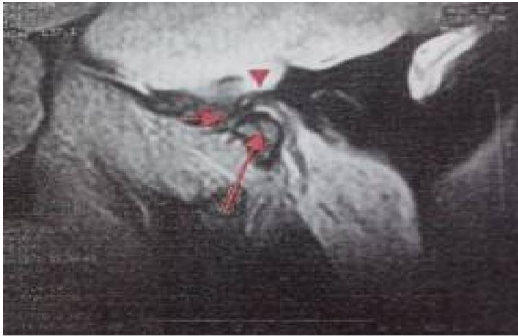


**Figure 1:** Sonographic scanning showing normal distance between the condyle and the glenoid fossa (3.9 mm), *left* closed mouth position, *right* opened mouth position.

#### MRI results:

MRI examination of this group demonstrated normal disc position in both the closed and opened mouth positions. The disc appeared as a low signal intensity structure (black) as a result of its dense fibrous components. The spongiosa of the condyle,

the glenoid fossa and the articular eminence appeared as high signal intensity structures (white) due to the presence of marrow fat. The cortical bone appeared as a low signal intensity structure (black) which interfaces directly with the disc tissue. (Figs. 2&3).



**Figure 2:** Sagittal MR image (control group) demonstrating normal relation between the condyle (log arrow), the disc (short arrow) and the glenoid fossa (arrow head) in the closed position. The condyle is centered below the intermediate zone.



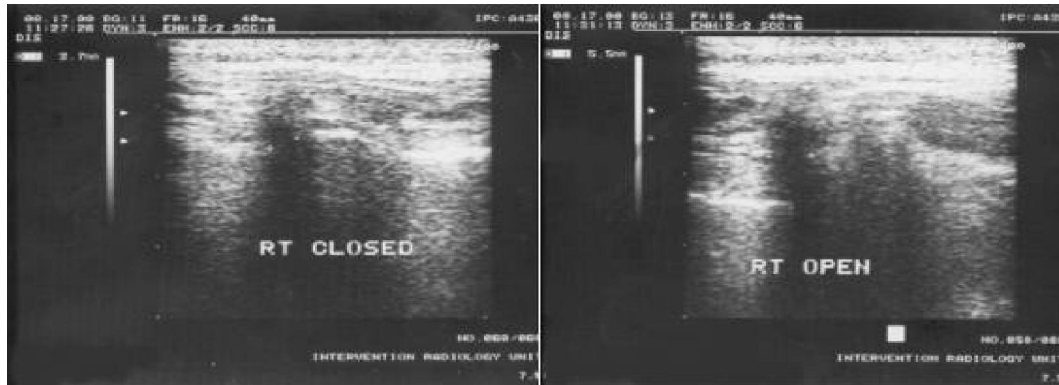
**Figure 3:** Sagittal MR image (control group) demonstrating normal relation between the condyle, the disc and the glenoid fossa (arrow) in the opened mouth position.

**Group II(GII)**

**US results:**

Ultrasonographic examination of this group demonstrated normal range for the distance between the superior surface of the condyle and the inferior surface of the glenoid fossa in 4 cases (27%) (Fig.

4).The remaining 11 cases (73%) demonstrated increased distance between the superior surface of the condyle and the inferior surface of the glenoid fossa. The distance ranged between 7-10 mm in the closed mouth position with a mean of 8 mm and ranged between 10-17 mm in opened mouth position with a mean of 14.5 mm (Fig. 5).



**Figure4:** Sonographic scanning for patient in GII showing normal distance between the condyle and the glenoid fossa (= 3.7mm), *left* closed mouth position, *right* opened mouth position (=5.5)



**Figure 5 :** Sonographic scanning showing abnormal distance between the condyle and the glenoid fossa *left*, mouth position (= 10.2mm), *right*, opened mouth position (= 14.4mm).



**MRI results:**

Three cases (20%) demonstrated normal disc position in relation to the condyle, the glenoid fossa and the articular eminence (Fig. 6). Five cases (33%) demonstrated the disc in normal relation in closed mouth position, and anteriorly displaced in opened mouth position (anterior disc displacement with

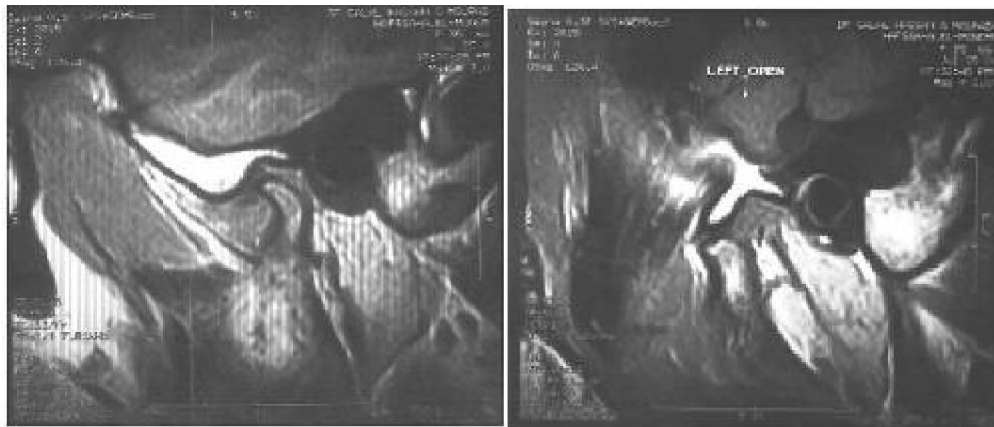
reduction). (Fig.7). In seven cases (47%) the MRI demonstrated anterior disc displacement without reduction. In the closed mouth position the disc appeared anteriorly displaced (Fig. 8), while in the opened mouth position the disc appears grossly displaced below the apex of the eminence.

**Table (1) summarizes of MRI results in GII**

Diagnosis	No. of cases	%
Normal	3	20%
Anterior disc displacement with reduction	5	33%
Anterior disc displacement without reduction	7	47%
Total	15	100%



**Figure 6: Sagittal MR image (TR= 500msec; TE=11msec) of the left TMJ showing normal disc relation (left; closed mouth. Right; opened mouth)**



**Figure 7: Sagittal MR image ( TR= 500msec; TE=11msec) of the left TMJ showing anterior disc displacement with reduction (left; closed mouth. Right; opened mouth)**



**Figure 8: Sagittal MR image (TR= 500msec; TE=11msec) of the left TMJ showing anterior disc displacement without reduction (left; closed mouth. Right; opened mouth**

#### 4. Discussion

Studies regarding the different imaging modalities for the TMJ believe that none of the techniques available today can meet all the requirements for an ideal imaging technique for studying the disc-condyle relationship [11]. The availability of non-expensive, non-invasive, less comprehensive and less complicated radiographic modality that does not cause any complications or reactions is very important in order to make proper diagnosis, management and follow up of the cases [12].

The present study was conducted to identify as well as to compare the accuracy of images obtained by MRI and ultrasonography in the diagnosis of TMJ disorders.

Magnetic resonance imaging is considered overall the best diagnostic modality for the thorough assessment of the internal derangement of the TMJ [13, 14]. Stegenga *et al.* [15] stated that MRI is rapidly becoming the gold standard for evaluating the soft tissue of the TMJ, especially disc position. A high sensitivity (67% -100%) of MRI for diagnosis of the correct disc position and bone changes of the TMJ was confirmed by autopsy studies [16-19]. On the other hand ultrasonography, represents a diagnostic modality that is simple to do, painless non-invasive and does not expose the patient to radiation, in addition, it is inexpensive and easily gains patient's acceptance, offers instantaneous tissue display and it is readily available [12].

MRI results of the 20 cases included in the present study demonstrated normal disc position in relation to the condyle and the glenoid fossa in the 5 asymptomatic volunteers. These findings are very close to those of Kaplan and Helms [1], who found 30 asymptomatic joints investigated by arthrography and 31 asymptomatic joints investigated by MRI respectively to be normal. The specificity of MRI as

calculated from the results of this study was 100 %, a percentage similar to that reported by Smith and Larheim [20].

Twelve cases (88%) in GII demonstrated anterior disc displacement. This finding correlate well with the results reported by Eriksson and Westesson [21]. The remaining three cases were normal in the MRI images; a finding that can be explained by the probability that the symptoms experienced by those patients might not reflected an actual TMJ problem but a problem in other anatomical site with referred pain to the joint area. The sensitivity of the technique was 88%, this correlates well with the results of Schellhas *et al.* [22].

In addition, MRI was accurate in discriminating patients suffering from anterior disc displacement with reduction and those suffering from anterior disc displacement without reduction, a data that might be of great value to surgeons for proper planning of the treatment regimen.

Seven cases (47%) were diagnosed as anterior disc displacement without reduction and five (33 %) cases were diagnosed as anterior disc displacement with reduction a finding similar to that reported by Rausita *et al.* [23].

Since 1992 US has been suggested for the diagnosis of TMJ disorders [24]. US represents a diagnostic modality that is simple to do, painless, non-invasive and does not expose the patient to radiation. It also easily gains patient's acceptance, offers instantaneous tissue display and is readily available [25].

In the present study actual visualization of the articular disc with US was not available, the distance between the highest point of the superior surface of the head of the condyle and the inferior surface of the glenoid fossa was measured. This space represents

the anatomical site in which the disc is located and is referred to as the disc space.

Ultrasonographic imaging of the patients in GI demonstrated a normal disc space ranged between 2.8 and 5 mm in the closed mouth position, and a space ranging between 5 to 7 mm in the opened mouth position. This finding is similar to that stated by Hayashi et al. who examined the accuracy of ultrasonography in 18 patients suffering from TMJ dysfunction, and reported that a distance between the articular capsule and the lateral surface of the mandibular condyle more than 4 mm is diagnosed as dysfunction of the TMJ. The specificity of ultrasonography as calculated from the results of this study was 100%. A percentage similar to that reported by Hayashi et al.<sup>[26]</sup>

On the other hand, Gateno et al.<sup>[12]</sup> stated that the specificity of ultrasonography is 95% for the diagnosis of disc displacement. Ultrasonographic scanning of patients in GII demonstrated a disc space within normal range in four cases. The remaining 11 cases demonstrated an increased distance of disc space. The distance ranged between 7 and 10 mm in the closed mouth position and ranged between 10 and 17 mm in the opened mouth position.

None of the articles available in the literature gave definite ultrasonographic diagnostic criteria for disc displacement. Yet Hayashi et al.<sup>[26]</sup> theorized that a widened distance between the articular capsule and mandibular condyle identified by the use of ultrasonography might mainly result from the interposition of a displaced disc between them. They also stated that a distance between the articular capsule and the lateral surface of the mandibular condyle exceeds 4 mm only if the articular disc is displaced anterolateral. In the study of Hayashi et al.<sup>[26]</sup> they taken two reference points one is hard tissue (lateral surface of the mandibular condyle) and the other is soft tissue (articular capsule). But in this study we have taken 2 hard tissue points (the superior surface of the condyle and the inferior surface of the glenoid fossa) which are considered more accurate to measure the disc space in both closed and opened mouth position.

The 11 cases demonstrating increased disc space in ultrasonography more than that interpreted in the normal control cases might be due to abnormal positioning or deformity of the articular disc. An explanation similar to that presented by Hayashi et al.<sup>[10]</sup>

When comparing the results of ultrasonography and the results of MRI it was evident that all cases that demonstrated an increase in the distance between the superior surface of the condyle and the inferior surface of the glenoid fossa where diagnosed in MRI as anterior disc displacement. While only one case

from the 4 cases that demonstrated normal distance in ultrasonography was diagnosed as anterior disc displacement with reduction in MRI.

It was not possible to differentiate by ultrasonographic scanning between anterior disc displacement with reduction and anterior disc displacement without reduction. Ultrasonography was valuable in determining whether the TMJ was normal or not and whether the patient is in need for MRI imaging. Although the sensitivity and the predictive value of negative test for the diagnosis of TMJ disorders were slightly inferior in ultrasonography compared to MRI, yet ultrasonography could be considered a useful and safe imaging method for primary diagnosis of TMJ disorders.

### 5. Conclusion

Ultrasonography was less sensitive or specific than was MR imaging in detecting internal derangement in the TMJ. However, internal derangement of the TMJ should be suspected if a distance between the superior surface of the condyle and the inferior surface of the glenoid fossa (disc space) more than 7 mm in closed mouth position and more than 10 mm in opened mouth position. So the significance of ultrasonography as non-invasive and significantly low cost diagnostic technique can be used for patients clinically suspected to have TMJ disorders to exclude the negative results before request the more expensive and invasive images especially in patients with limitation to be examined by MRI such as patients with artificial metallic devices, vascular clips, base maker or even during pregnancy.

### Acknowledgement:

The authors thank the all medical radiology staff and technicians in Faculty of Medicine Ain Shams University for their scientific and technical support.

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## The Subject and His Desperate Attempts to Regain the Lost Realm of the Real

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**Abstract:** Jacques Lacan, the French psychoanalyst, is renowned for new findings in psychoanalytic approach whose most famous maxim is the triple model of human's entrance into his subject hood. Lacan points out that the first stage for every normal subject is the Real when the subject is fully governed by his needs. At this stage he tries to keep all his needs satisfied. However, the subject cannot make any distinction between himself and the objects which satisfy his needs. In fact, the subject cannot know himself from the objects which he is provided with. Such a sense brings to home for the subject unity, wholeness, and identity. However, this pleasurable state is ephemeral, and the subject loses it. The subject, as long as he lives, will miss and search the Real, the Eden-like state carved on his mind. The second stage is the Mirror or what Lacan interchangeably names the Imaginary where the he acts based on his demands. For the first time he becomes aware of the existence of the other. Subject at this stage doesn't want to approve the reality of the Other. Not completely aware of the changes in the Mirror Stage, the subject considers his mother and all moving bodies as his own reflection. Having passed the Mirror Stage, the subject enters the Symbolic Order which marks the subject's existence in the world of Father, signs, and language. The Symbolic Order, which necessitates learning language, brings castration which leads to subject's separation from his mother. Through language, the subject thinks he can announce his identity and selfhood. Nevertheless, the paternal function and the luring world of language causes the subject get entrapped in another illusion.

[Mehdi Khoshkalam Pour. **The Subject and His Desperate Attempts to Regain the Lost Realm of the Real** . *Life Sci J* 2012;9(3):2588-2592] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 375

**Keywords:** the Real, the Imaginary World, the Mirror Stage, the Symbolic Order, the Other, Paternal Function, Castration.

### Introduction:

Jacques Lacan has used the theories of Freud and many other philosophers to organize his own psychoanalytic system. The crucial influences on Lacan come from Freud and the studies he has had on children. However, Lacan has not contended with Freud's findings, and has exerted his own assumptions in his works. Lacan throughout his works endeavors to bring out the illusions which subject faces in whatever he embarks on. In the Imaginary, the subject has based a false totality for himself upon a relationship with his mother. In the Symbolic, subject is deceived by the world of language where he feels he can declare his independence through words and signs (Fink, 1997, p. 42). Nevertheless, the subject once more comes to the reality that he is entrapped and alienated by the very words he has trusted for expressing himself.

Lacan notifies that for every natural subject, there are three stages. The first stage which occurs during the first months of a subject's life is the Real. In this stage, the subject still a baby, begins its existence as something inseparable from its mother. The baby doesn't know any distinction between self and other, in fact, between itself and its mother. The baby is likened to a kind of blob with no sense of self or individual

identity. It doesn't even feel itself a coherent unified whole. It doesn't know where it starts and where it ends (Lemaire, 1994). This baby-blob is driven by its needs. It needs food, comfort, sense of safety, and changing. These needs can be satisfied by an object. However, the baby is not capable of making any distinction between itself and the objects that supply him with pleasure, and satisfaction. The baby is given a breast when hungry, is hugged when scared, and is shaken to get entertained. Nevertheless, the baby doesn't know what is fulfilling all its needs. Due to the fact that it doesn't have any conception of totality, and wholeness, it doesn't know to whom these satisfying objects belong. No one, and nothing for the baby is recognizable just its needs and the objects which satisfy the needs.

However, the baby can not stay in this stage because by getting older, it has to pass the Real, and enter the Mirror Stage. Indeed, the baby, to enter the civilization, should forget the Real Stage (Fink, 1997, p. 180). To form a separate identity, it must separate itself from the mother. Becoming an individual wholeness eventuates in a sense of loss. The baby can no longer undergo that primal sense of unity which it originally had when unified by the mother. Lacan regards this change as a tragic metamorphosis that the baby has to suffer in order

to be permitted to enter the Mirror Stage. In Lacan's opinion, the Real Stage is like the Eden Garden whose sweet memories never can be forgotten (Barzilai, 1999, p. 104). Once dismissed from the Real, the subject unconsciously and unknowingly seeks it, and tries everything to experience that beautiful and complete sense of wholeness he had there. The Real doesn't include any absence, or loss, or lack. It is all fullness and completeness. There is no need that can't be satisfied. Because there is no absence or loss, there is no language in the Real. Everything is provided instantly. Consequently, the baby doesn't require any sign or communication system to transmit its messages. As a matter of fact, the Real is beyond language; therefore, it is irretrievably lost when the subject enters into language.

The Mirror Stage starts as the baby recognizes distinctions between its body and everything in the world. Now the baby realizes that there are objects and subjects fully independent from its own being. Such a transmission from the legendary state of the Real into the Mirror is accompanied by the sense of loss and anxiety (Brennan, 1993, p. 64). Gradually the needs of the baby will be replaced by demands. Unlike the needs, demands are not satisfied by objects. A demand is always a demand for recognition from another, for love from another. For the first time, the baby becomes familiar with an external, independent being which incarnates itself as the other. The baby notices that its mother is not in fact a part of it. The baby then grows anxiety and fear because it finds itself split and dismantled. Unknowingly it demands reunion, a return to the Real. It demands to be filled in by the other. It wants to regain its unity with the other. Indeed, it demands the other to disappear. The baby, once more, faces a negative answer, as it realizes that erasing the other from the game is impossible. It tries to promote its demands by crying. It doesn't want to approve that mother is different and separated from it, though mother doesn't grasp what her baby means through crying (Blond, 1998, p. 86).

The Mirror by all its profits and disadvantages for the baby might be taken into account as a middle point between the Real and the Symbolic Order. Another phenomenon that Lacan says occurs in the Mirror stage is the misrecognition the baby has of itself. Lacan believes that between 6 and 18 months, the baby hasn't yet mastered its own body, and doesn't have control over its own movements. As remarked, it doesn't have a sense of its body as a whole; it knows itself as a self or body fragmented or in pieces. The baby in the Mirror, unlike the Real has understood that other bodies exist besides itself. But it is difficult for it to know what

belongs to it or others (Mellard, 1992, p. 72). Lacan asserts that in this period the baby considers others as mirrors in which it searches itself. At first, it doesn't want to accept the fact that the images it sees aren't parts of it. Gradually it realizes that these images are actual bodies coming near, and then leaves it. The baby is deceived by these images and mistakenly regards them as parts of it. Lacan names the realm of the Mirror as the stage of Imaginary because the idea of self and independent body is totally based on imaginary identification with the image in the mirror. The Imaginary portrays a more transparent picture of the baby's complexes resulted from its wishes for completeness. In the Imaginary the alienated relation of self to its own image is created and maintained (Rabate, 2001, p. 28). The Imaginary is a stage on which conscious and unconscious pictures are interchangeably replaced. The Imaginary is a pre-linguistic domain where words have not appeared on stage. Visual perceptions are the dominant meaning-makers in it. Illusions and misrecognitions overshadow subject's entire life.

The Real has something in common with the Imaginary in that both are based on a self-indulgent totality. However, both are somehow merged by illusions; the baby innately has the tendency to and enjoyment from being deceived. This phenomenon originates from its desire for wholeness and identity. The mirror-like relationship the baby maintains in its visual communication with other bodies reflects the desire it has for an "ideal ego", a perfect whole self who has no insufficiency. The baby emphatically internalizes this ideal ego to give rise to pleasurable sense of selfhood and totality. The "I" identity the baby considers for it is made by (mis)identifying with this ideal ego. The baby attempts to establish a totality that doesn't include any lack, and no notion of absence or shortcoming might be felt there (Zizek, 1992, p. 69). The baby unconsciously regrets the total unification once it had organized based on the relationship with its mother. Considering other bodies as its own constituents, the baby wants to sympathize with itself for having lost the original oneness with mother's body during the Real. Nevertheless, the baby has to put away its sense of unity with the body of the mother if it wants to enter the culture. We shouldn't, however, regard the baby's persistence on its not having lack and loss.

Having past the Mirror, the baby (now better be named the subject) steps the Symbolic Order. Unlike what Freud says, the Symbolic, and the Imaginary realms frequently overlap, and at times they coexist. A clear-cut division between these two stages seems impossible. In the third stage of the subject's life the

dominance and pressing power of the Symbolic upon the Imaginary is apparent. To become a meaningful and autonomous existence incarnated in "I", the subject has to enter the Symbolic which is structured by language. In the Symbolic, we can designate who we are through being named, and through expressing our ideas. The reason why the Symbolic, and the Imaginary can coexist appertains to the fact that the projection of the self onto an image, or a self-admitted identity expressed in saying "I", is in reality Symbolic features functioning as a facade for the imaginary sense of an independent wholeness, and being an other not relying on someone or something else (Harasym, 1998, p. 41). To put it differently, the Symbolic is a platform on which the subject can represent his internal imaginary identity through words and signs. In the Symbolic, the subject has come clearly to the understanding that the ideas of lack, of loss, and of absence really exist. Unlike the Imaginary, the subject no longer denies or doubts the presence of the other. Now he confirms that he has stepped into the realm of the Other who is the master and predominant figure of the Symbolic Order. The Other is in charge of the Symbolic; he has constructed and defined it through his language, a symbolic and systematized communication structure provided by the Other for enabling the subject to express himself. The subject owes his symbolic existence to the Other and the language system he has put forwards. The subject gradually becomes notified of the fact that the Other is the center and nerve-keeper of the Symbolic. He realizes that the Other has been there before him, and has conquered whatever existing in the Symbolic (Brennan, 1993, p. 92). Indeed, the subject understands that the Symbolic ultimately belongs to the Other who permits the subject to enter his realm.

As mentioned earlier, the subject in the Mirror, for the first time, realizes that there exists an omnipresent body named the other. Then he attempts to regain the ideal perfect state he had in the Real through erasing or ignoring the other. However, in process of time he notices that all his attempts are abortive and fruitless. The subject in the Mirror starts demanding the other to recognize him, to consider him a total self, though still regretting his missed unity with mother (Lemaire, 1994, p. 96). The strategy he chooses in the Mirror is finding him through looking at others. This is done exactly like a child watching itself into the mirror. The subject still feels fragmented and disintegrated so he aims at completing himself through uniting with moving bodies surrounding him. The child demands to be recognized, although the totality he sustains for it is the illusionary melting of the other into it. Despite the false and imaginary completeness the subject contents with, he expects the other to respect his independence as

an integrated whole. That is what the subject wishfully searches and strives to make the other convinced of. In the Symbolic Order, the Other is the king, the center, and the source of everything recognized. The subject now struggles to merge with the Other. He has got exhausted by the alienation and disintegration between the self and the Other since he has left the Real. He aims at surmounting the center, of the system of the Symbolic and/or of language. The subject finally confirms that unification between the self and the Other never happens.

Jacques Lacan remarks stepping into the Symbolic has simultaneous profits and disadvantages for the subject. For the first time, the subject conceives that the pre-designed structure of language magically facilitates his access to completeness and selfhood. Through words, the subject "I" identifies himself as a unique and separate body, what he has longed for since his separation from the Real (Brennan, 1993, p. 118). He expresses his beliefs, joys and grieves. Before this, he had to cry, to suffer, and to gesticulate to express, though hard to understand, himself. Consequently, the subject's access to the social communication codes generates rejoices and pleasure.

However, that is not the whole story. Approaching Symbolic Order can give rise to a series of complexes that, unlike the Mirror, are permanent and lifelong. Suddenly a sense of Lack and despair overshadows the subject and his wishes to dominate the language. Why and how? Lacan comments that the grave and crucial position of the Other, as the founder of the Symbolic, engenders a never-ending lack, a Desire in the subject which is the desire to undermine the Other. The subject appreciates the Other's state, and wishes for his place, the subject entrapped in the binary-oppositions of the Symbolic is not satisfied by his own place, instead, he dreams about taking the center, the core, the omnipresent referent of all concepts, to wit, the Other. In the Symbolic, the subject is governed by his desires the most significant of which is for the central state of the Other. However, this desire can not be fulfilled. It is not a desire for some object (which would be needed) or desire for love or another person's recognition of oneself (which would be demanded), but a desire to be the center of the system, the center of the Symbolic, the center of the language itself.

During the Mirror stage, the most important person to the subject is the mother. The subject, still a child not gaining its proper identity, wants to merge with its mother. Indeed, the child needs to wipe away any obstacle standing between it and the mother. Growing up and entering the Symbolic, it tries regaining its mother in many different ways. In childhood, the

primary caretakers are important to us. We are intensely dependent to them. We make demands on them; they, in turn, demand that we behave in certain ways and meet their expectations (Fink, 1997, p. 82). In the Symbolic, we learn many things from them; to speak their language and to regulate our needs for nourishment, warmth, excretion and, so on in accordance with their schedules. They are our primary source of attention and affection. The better we perform their orders, the more attention they pay to us. The more completely we satisfy their wishes, the more love we are likely to win from them. However, at times we face difficulties in deciphering what they desire. Naturally, we desperately try to know what makes them happier and more satisfied with us.

Lacan asserts that in the Symbolic, the subject understands the importance of the Other; as a result, he attempts to know how he can keep the Other interested in himself. He desires to metamorphose himself into what makes his mOther happy most. He indeed wants to become what the mOther desires, and aims to become the desire of the mOther (which means both the child's desire for the mOther and the mOther's desire) (Silverman, 2000, pp. 59-60). These key concepts from Lacan represent two matters. First, the child still desires his mOther, and wishes to amalgamate with her. He still suffers the nostalgia resulting from the ideal realm of the Real. In this direction, nothing can stop the child. Second, this concept means that the child cajoles his mOther into considering him as what she really needs, what she becomes happy with, and what wipes away all her lacks. Through deciphering what mOther desires, the child, Freud believes, wants to become a "penis", what his mOther lacks and enjoys most (Blond, 1998, p. 76). There emerges an incestuous desire in the child to copulate with his mOther. He aims at perfecting her by filling her up with his penis.

By the way, the child's conspiracy to have sexual intercourse with his mOther is nullified by Father's role in the Symbolic. Father indeed is the structuring principle of the Symbolic order where he is the supreme Other telling the last word (Smith, 1991, p. 65). He guards everything related to the Symbolic, and he is the organizer of the language. The child so soon becomes jeopardized of losing his penis if he used it to seduce his mOther. Father threatens the child to stand as aloof as possible from his mOther. This imposed separation Lacan calls symbolic castration by which the child is kept away from his mOther. But father is not the agent that imposes this relationship between the child and the mOther. Indeed, language is responsible for it, and even father himself becomes a function of the linguistic structure. In other words, the product takes the place of

the producer. Father, rather than being a person, becomes a structuring principle of the Symbolic Order.

The father and the language at times are mentioned interchangeably. Father, Lacan says, appears as the Name-of-the-Father or the Law-of-the-Father the child should be obedient to the father and his laws one of which is rules of language. Wanting to become a speaking subject, you have to be subjected to the language. Lacan results that the rules of language are the rules of the father, and they function as an entry into the Symbolic. Lacan replaces the law of the father by the term Phallus. A phallus is what symbolizes the father: it is the center to which everything in the Symbolic returns. The phallus stabilizes the whole structure. It anchors the chains of signifiers which unconsciously are unfixed and floating, always sliding and shifting. As said, the subject in the Symbolic longs for approaching the centre manifested into the phallus. The subject desires to become the phallus to dictate his dominance on the whole system (Lemaire, 1994, p. 92).

Although the term phallus designates the penis, they are used differently in Lacan's words. In Freud, the subject talks of a real phallus, but Lacan by it means the Paternal Function, the law of the language and the Other. Penises belong to individuals; the phallus belongs to the structure of language itself. Phallus points out the big Other. It governs the whole structure; it is what everyone wants to be. Indeed, no element of the system can approach the center. Lacan says the root for such an attempt is desire, desire for taking the place of the Other. But this desire never gets satisfaction.

The boys often think that they potentially are capable of becoming the phallus, and taking power and standing at the top of the hierarchy of power. They go toward the phallus where there is no lack. Girls for not having penises, reasonably count themselves less fortunate to attain the phallus. That is why girls may in the words of Freud suffer phallus envy (Žižek, 1992, p. 29). However, Lacan says the center or the phallus structurally is unattainable. Girls as well as boys face problem when aiming at the phallus. Why? As said, the phallus is the ideal place in the symbolic circle: it doesn't have any lack and imperfection, and no subject disregarding the matter of gender can approach it. Because of its innate perfection, no language exists in the state of the phallus. It justifies the reason why speaking subject as a lacking element in the symbolic can not get close to the phallus. Though phallus equips the subject with language, he is not still strong enough to get the center.

As seen, Lacan tries to show how difficult is for us to regain the pleasant realm of the Real once we have



dwelled in. throughout our lives we try many things to perfect our imperfections. We refuge many people for providing us what we need, and what we think we can gain total happiness with. Lacan beautifully represents that the world we have stepped in is innately imperfect, and nothing and no one can give us the pleasurable state we had in the Real. The Real becomes an unspoken complex in our unconsciousness. We talk of it unknowingly: we show our desire for it in our behavior. But Lacan concludes that this is where we have come to, a world full of lacks where people wrongfully consider a paradise for finding or all the things they have lost or have been deprived of. Man is a pitiful creature whose tragedy by no means could be written.

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11/13/2012

**Barriers to condom use among Men Living with HIV: A Qualitative study in Iran**Homeira Fallahi <sup>1</sup>, Sedigheh Sadat Tavafian <sup>2</sup>, Farideh Yaghmaie <sup>3</sup>, Ebrahim Hajizadeh<sup>4</sup>, Ali Rastegarpour <sup>1</sup><sup>1</sup> Shahid Behashti University of Medical Sciences, Tehran, Iran<sup>2</sup> Associate Professor, Department of Health Education, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran<sup>3</sup> Associate Professor, Department of Nursing, Shahid Behashti University of Medical science, Faculty of Nursing& Midwifery, Tehran, Iran<sup>4</sup> Associate Professor, Department of Biostatistics, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran[tavafian@modares.ac.ir](mailto:tavafian@modares.ac.ir)

**Abstract:** Unprotected sexual activity is playing an increasingly important role in the currently growing incidence of HIV infection in Iran. Recognizing barriers to safe sexual practice can improve planning for condom promotion, which was the objective of the present study. This qualitative study was performed through three behavioral disease consultation clinics (HIV care clinics) in Tehran, Iran. Participants were selected among HIV-positive men patients initially by convenience sampling and narrowed-down by maximum diversity sampling in order to obtain a sample that would express various viewpoints regarding barriers to condom use. Data were collected using semi-structured individual interviews. All interviews were recorded and codes were extracted after reviewing them several times. In this study 32 participants were interviewed. Barriers to condom use were classified in four sub-themes include: Individual Beliefs (Decreased in sexual satisfaction, No need for condom use in Sero discordant couples, Failure of condom use during sexual contact, Being extra accessories), Access /Availability of Condoms (Shyness of buying condoms, No condom access at the beginning of intercourse, Expensive condoms), Personal (Wish to have children, Laziness and discomfort for condom use) and Condoms (Low quality and no Variety of condoms in Iran). Most of the participants named decreased sexual satisfaction as the most important reason for not using condoms, followed by shyness and diffidence towards buying condoms and limited access to condoms when initiating sexual intercourse. Because of the decreased sexual satisfaction and unpleasantness of condoms, 12.5% of the HIV-positive men had not used condoms on their last sexual intercourse. The most important reason mentioned by the HIV-positive patients, for not using condoms was the decrease in sexual satisfaction. Different strategies have been suggested to overcome this barrier, one of which is the educational-behavioral strategy. Another strategy could be applying a structural strategy in the community.

[Homeira Fallahi, Sedigheh Sadat Tavafian, Farideh Yaghmaie, Ebrahim Hajizadeh, Ali Rastegarpour. **Barriers to condom use among Men Living with HIV: A Qualitative Study in Iran.** *Life Sci J* 2012;9(3):2593-2599] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 376

**Keywords:** HIV/AIDS, Condom, Qualitative research, Iran

**1. Introduction**

Since the beginning of the AIDS epidemic, approximately 60 million people worldwide have been infected with HIV, and 25 million have died of HIV-related causes<sup>1</sup>. Advances in HIV care have resulted in prolonged life expectancy for HIV-positive patients, which can cause increased transmission from infected persons through unsafe sexual practices, if such practices continue and are left unchecked. This provides the dual risk of HIV transmission to non-infected sexual partners, and transmission of other sexually transmitted infections to the infected parties. Therefore, controlling unsafe sexual activities in HIV-positive persons has not only become a necessity, but a main concern in HIV prevention<sup>2-4</sup>.

During the past few years, the prevalence of AIDS in Iran has grown from a low-level status to a

concentrated prevalence. While injecting drug use has been introduced as the primary route of HIV transmission<sup>5</sup>, the lack of information surrounding sexual conduct in Iran has rendered statistics unreliable<sup>6</sup>. In addition, there is much concern that the pattern of HIV transmission in Iran may be changing towards a trend of increasing transmission from sexual intercourse. Some studies have demonstrated low rates of condom use in at-risk populations in Iran. The rate of condom use in injecting drug users has been reported to be around 37%<sup>7</sup>. For female commercial sex workers, this figure was reported as 52% in one study<sup>8</sup>, but only 11% in another<sup>9</sup>. Considering that the rate of condom use is not satisfactory in Iran, identifying the barriers of safe sexual practice in most-at-risk groups may help in planning preventive interventions.

Since it had previously been reported that up to 70% of the HIV cases in Iran were due to transmission from the reuse of syringes for drug injection, the main strategies for disease control in the country targeted injecting drug users. Since transmission through sexual contact was recognized as an increasing mode of transmission, new strategies were enforced, including education at universities, schools, and factories; public educational programs; opening of behavioral disease clinics (clinics that provide services for HIV patients and other patients of diseases with similar transmission routes) throughout the country, with free and confidential voluntary counseling and testing for at-risk populations and free condom distribution; using Drop In Centers (DIC) and out-reach groups to identify and teach at-risk groups and provide them with free condoms and syringes; and the development of consultation centers for at-risk women and providing free service at these centers.

In Iran, no official statistics exist for men who have sex with men, but these persons too can receive free services provided at the abovementioned centers<sup>10-11</sup>. There is an obvious stigmatization and sometimes prejudice towards HIV-positive persons in Iran, as still seen in some countries<sup>12</sup>. In addition, considering that 67% of HIV-positive women in Iran have reportedly been infected through sexual contact<sup>5</sup>, women's education and empowerment regarding negotiation with partners about condom use could be of much importance.

Few studies have examined the attitudes of HIV-positive persons towards condom use in Iran, and since cultural differences play a large role in such perceptions<sup>13</sup>, barriers of condom use may widely differ through various cultures<sup>14</sup>. The Health Belief Model (HBM) is one of the models used to implement interventions for reducing high-risk sexual behaviors<sup>15</sup>.

The present study used a qualitative approach to evaluate the viewpoints of HIV-positive persons regarding condom use, based on HBM. The Health Belief Model consists of perceived susceptibility, perceived severity, perceived benefit, perceived barriers, perceived self-efficacy, and cue to action constructs. This model focuses on the barriers, facilitators, and levels of behavior change and has been utilized in various studies on prevention and behavior change. The HBM constructs have been associated with protective sexual behavior, and have consequently been used to reduce high-risk sexual behavior<sup>16-17</sup>. Since many HIV-positive persons, despite knowledge of their infection, do not use condoms in their sexual contacts, this study was performed as a qualitative study based on the HBM

to evaluate barriers of condom use in HIV-positive persons.

The main reason for interviewing with men living with HIV was assess their viewpoints on HIV-AIDS and condom use in regard to all constructs of the HBM. This study is part of a larger study in which are presented merely barriers of condom use in HIV-positive persons.

## **2. Material and Methods**

### **2.1. Sample**

Qualitative research has many definitions, one of which is that it consists of a scientific approach to evaluate beliefs and identify the causes of behavior in everyday life. The advantage of qualitative research is giving weight to the viewpoints of the participants and maintaining the capacity for explanation, description, and discovery during interviews.

The present study used a qualitative design to evaluate the viewpoints of HIV-positive persons regarding condom use. The study recruited patients referring to three behavioral disease consultation clinics (HIV care clinics) in Tehran during a twelve month period from May 2010 to April 2011. Due to the limited access to HIV-positive patients, a convenience sampling was initially employed. However, the sample was subsequently narrowed-down by maximum diversity sampling to obtain a sample that would express various viewpoints regarding the subject matter of the study and represent various groups in terms of age and education. Interviews were continued until a point of data saturation was accomplished.

In Iran, 91.5% of the known patients are men<sup>5</sup>. In addition, men play a prominent role in decisions for condom use during sexual contact. Therefore, in this study, we mainly focused on men and their viewpoints

Behavioral disease clinics are centers that provide free services to HIV-positive individuals, including diagnosis, consultation, and treatment. Voluntary counseling and testing is also free for most at-risk persons. Three behavioral disease clinics in Tehran were used in this study.

### **2.2. Data Collection**

The interview questions were semi-structured and were asked as open-ended questions to evoke in-depth discussion. After obtaining consent from all participants, the demographic and personal information was recorded on paper. Then, the rest of the interview was recorded with a voice recorder. The interviews were later listened to and transcribed verbatim. At this stage, content analysis was performed manually. The interview texts were reviewed multiple times and after acquaintance with the contents, codes were extracted and categorized, and main themes were identified. As the official and

common language in Iran is Farsi (Persian), all interviews were conducted in Farsi.

Ethical approval was granted by Tehran and Shahid Beheshti Medical Universities. All participants gave oral consent to enter the study and participate in the interviews, only then were the interviews undertaken. Patient confidentiality was observed by omitting demographic data from the transcribed interviews and participants were allowed to discontinue participation at any time.

A total of 32 participants were entered into the study. The time of each interview session was variable and ranged between 41 to 90 minutes. In four cases, the interviews were held in two sessions. Interviews were held in an isolated room where an uninterrupted session could take place without the unnecessary entrance of others.

The findings of this study were supported by adherence to criteria of the following items (evaluating the rigor and trustworthiness of the qualitative data): credibility (gaining participant trust and support, researcher involvement with the data, using peer opinions and allowing for separate coding, investigator triangulation by having more than one person interpret the data, and method triangulation using interviews, observation, and studying the patients' medical records); transferability (by precise describing of the participants, including sampling, time and place of data collection, and maximum diversity sampling); dependability (by using an external check and simultaneous coding by another researcher to find probable discrepancies); and participants, reevaluation of coding, and the analysis of some interviews by other experts).

Data analysis was performed by colleagues who had previously seen adequate courses in qualitative research and data analysis and was based on content analysis.

All interviews were recorded and transcribed, and codes were extracted after reviewing them several times. Then codes were classified and the main themes were identified. Themes were structures of HBM that these structures include; perceived susceptibility, perceived severity, perceived benefit, perceived barriers, perceived self-efficacy and cue to action. This paper is related to the results of perceived barriers.

### 3. Results

#### 3.1. Socio-demographic

Of the 32 HIV-positive male participants, 16 were single, twelve were married, and four were divorced. Their mean age was  $37.5 \pm 6.9$  years, ranging from 27 to 53 years. The mean time from HIV diagnosis was 5 years, ranging from 2 months to 11 years. Eleven were unemployed, 20 were

employed, and one was retired. Five had a university education and three were illiterate, 15 had finished high school and the rest had some amount of school education. Twenty participants had reached the disease stage of AIDS and were under retroviral therapy. The demographic characteristics of patients can be observed in table 1.

**Table 1:** Demographic characteristics of the studied HIV patients

Variable	Men (32 individuals)	Frequency	Percentage
Age	19-29 years	3	9.4
	30-39 years	18	56.2
	40-49 years	8	25
	Above 50	3	9.4
Marital Status	Single	16	50
	Married	12	37.5
	Divorced	4	12.5
Employment	Unemployed	11	34.4
	Employed	20	62.5
	Retired	1	3.1
Education	Uneducated	3	9.4
	Elementary	3	9.4
	Lower secondary	6	18.8
	Upper secondary- diploma	15	46.8
	Higher education	5	15.6

Twenty six (81.2%) had a history of imprisonment and 26 had a history of substance dependence. The main risk activity responsible for infection for 11 of the participants was injecting drug use. Another 15 of the participants had both a history of injecting drug use and unprotected heterosexual activity and six only reported unprotected heterosexual contact. Ten participants reported no sexual contact during the past year. The behavioral characteristics of patients can be observed in table 2.

Among the 22 men who did report sexual activity during the recent year, four (18%) reported unprotected contact on their last sexual intercourse, despite being aware of their infection with HIV. Of these four, two was single and the others had engaged.

#### 3.2. Causes of not complying to condom use

In response to the question, "what are the barriers to condom use to you?" the viewpoints of the participants were investigated. The participants presented a spectrum of factors as barriers to condom use, including: reduced sexual satisfaction, diffidence towards buying condoms, inconvenience of access to condoms when initiating sexual intercourse, wanting to have children, unsatisfactory quality of available condoms, high price of condoms, the possibility for condom failure or tearing during intercourse, inconvenience of condom use, an unpleasant feeling of an extra accessory during sexual intercourse and the lack of necessity for condom use due to already having an HIV-positive partner. The subthemes issued by interviewers are observed in table 3.

**Table 2:** Behavioral characteristics of the studied HIV patients

Variable	Men (32 individuals)	Frequency	Percentage
Imprisonment record	Positive	26	81.2
	Negative	6	18.8
Previous drug addiction	Methanol Maintenance Treatment	12	37.5
	Narcotics Anonymous Recovery	14	43.7
	No addiction record	6	18.8
Previous high risk behavior	Injecting drug use	11	34.4
	Unprotected sexual relationship	6	18.8
	Injecting drug use & unprotected sexual relationship	15	46.8
Sexual contact during the recent year	Had no sexual contact	10	31.3
	Used condom in last sexual contact	17	53.1
	Did not use condom in last sexual contact	5	15.6

**Table 3:** The issued subthemes about barriers of condom

Theme	Subthemes	Codes
Perceived Barriers of Condom Use	Individual Beliefs	1. Decreased in sexual satisfaction. 2. No need for condom use in Sero discordant couples 3. Failure of condom use during sexual contact 4. Being extra accessories
	Access /Availability of Condoms	1. Shyness of buying condoms 2. No condom access at the beginning of intercourse 3. Expensive condoms
	Personal	1. Wish to have children 2. Laziness and discomfort for condom use
	Condoms	1. Low quality and no Variety of condoms in Iran

**Individual Beliefs:**

Most male mentioned reduced sexual satisfaction as the main barrier to condom use. Other barriers were often mentioned as less important. Since most opinions stated were similar in content, only one of the statements is presented here.

The most commonly mentioned barrier to condom use in this study was decreased in sexual satisfaction. A single 37-year-old said:

*"I have been used condoms twice but I didn't feel satisfy so I don't like to use it again."*

Some men believed that there might not be a need to use condoms when their partner was HIV-positive. A 36-year-old single HIV positive man believed that:

*"If the person is positive, I don't know..., I don't think there's a need [to use condoms]."*

Two of the infected men thought condoms where extra accessories. A married 51-year-old man said:

*"[The condom] is something extra. It's both mentally and physically traumatizing for a man."*

Two of the infected men stated the possibility of condom failure as a barrier. A married 44-year-old man believed that:

*"I say what if [the condom] comes off, but we don't notice? When I know that can happen, I try not to use them, I abstain and try to be careful."*

**Access - Availability of Condoms:**

One fourth of the infected men also mentioned diffidence and shyness towards buying condoms as a main barrier. Some thought that if the salesperson at a drugstore were a woman, a situation can occur where coyness may impede purchasing a condom. A single 34-year-old patient reported:

*"If I want to buy [a condom], I go into a drugstore and just wait until the woman goes away and a man comes along so I can buy one. If they make it easier to buy, definitely more people would. I have friends who are older than me and are married; sometimes they ask me if I can buy some for them. They're just too shy to buy 'em themselves."*

One fourth of the infected men the limited access to condoms when needed, due to the distance to the nearest drugstore or the drugstore being closed. A recently 28-year-old married man who had been infected by unprotected sexual activity, said:

*"There aren't enough condoms, or there's no drugstore in the neighborhood, or it just may be noon"*

*and we tell ourselves to just forget it. And on one of these contacts that we say 'just forget it', it happens."*

The cost of condoms was referred to by two of the HIV-positive men. A married 50-year-old man reported:

*"Buying condoms has become a routine cost for me. When I have to buy a box of condoms for 3,500 Tomans (\$3.35 USD) every week, every ten days, I may be able to pay for them now, but it can be a cause [for not using them]. I know people who can't pay 3,500 a week."*

#### **Personal:**

The wish to have children was also mentioned by the infected men who had HIV-negative partners. A 31-year-old, married male indicated:

*"My mother-in-law doesn't know I'm sick. She called my wife the other day and told her she bought stuff for a baby shower. Sometimes she tells her this couple that got married after us already has kids. I want to tell them I have AIDS. That's our problem these days- we want to have kids. My wife wants it, but we're really not in the position to do this."*

One of the HIV-positive men, 47-year-old, divorced named laziness and inconvenience of condom use as a reason:

*"I think I may still be too lazy [to use a condom], I mean, I've changed a lot, but... you know."*

#### **Condoms:**

One of the infected men 36-year-old, single believed that the quality standards of condoms were not adequate in Iran:

*"These condoms they make in Iran, they just change the scent and taste. What good is that? Foreign condoms are something else... We don't have those in Iran. Iranian condoms are no good. They break, they burst and they come off."*

#### **4. Discussion**

Reasons for not complying to condom use included: reduced sexual gratification, diffidence towards buying condoms, inconvenience of access to condoms when initiating sexual intercourse, wanting to have children, unsatisfactory quality of available condoms, high price of condoms, the possibility for condom failure or tearing during intercourse, inconvenience of condom use, an unpleasant feeling of an extra accessory during sexual intercourse and the lack of necessity for condom use due to already having an HIV-positive partner.

In this study, of all HIV-infected men, almost half (46.8%) mentioned a history of injecting drug use along with unprotected sexual activity before infection and six (18.8%) mentioned a history of unprotected sexual contact as the only possible method of transmission. This in itself emphasizes the importance of condom use in high-risk sexual

activities. More than half of the infected subjects were not married, and any unprotected sexual contact would be considered a high-risk contact, which could contribute to the overall spread of HIV in the community. In the Middle East, of all people who recognize the protective effect of condoms against HIV transmission, only a few actually use them and within the group that uses condoms, only a few use them consistently. Even in most-at-risk groups for which condom use is a priority, the rate of condom use is low<sup>18</sup>.

Rahmati Najar Kolaei et al<sup>19</sup> performed a qualitative study on HIV-positive patients in Iran. They too reported a number of HIV-positive persons who were aware of their diagnosis, and yet failed to use protection for sexual contacts. This supported the existence of certain barriers to condom use. Considering that there were no existing studies that evaluated the views of HIV-positive persons towards condom use in Iran, this study was designed to identify these barriers in people who were aware of their diagnosis, and most of which had experienced high-risk behaviors for HIV.

The most commonly mentioned barrier to condom use in this study and the most important for the majority of the participants, was a decreased sexual satisfaction. Our findings are consistent with other studies. In one study on Iranian female sex workers, it was revealed that although many clients did wish to use condoms when engaging in sexual contact with a sex worker, a larger number preferred contact without condoms<sup>20</sup>. The main reasons mentioned in this study for reluctance towards condom use included decreased sexual satisfaction, inconvenience for anal contact, and dislike and fear of condoms. Another study showed that condom use is very low among Tehran injecting drug users despite good access and availability, presumably due to the decrease of sexual sensation<sup>21</sup>. Decrease in sexual satisfaction has also been mentioned as an influential factor in various studies both in Iran<sup>8</sup> and other countries<sup>22-24</sup>. This similarity between findings shows that people strongly believe that condoms reduce sexual satisfaction.

Educational programs and consultation may be able to target this attitude and emphasize the benefits of condom use in return for the drawbacks, especially for most-at-risk groups. By overcoming this barrier, which was constantly mentioned as the most important barrier, condom use can be improved among men. Different strategies have been suggested to overcome this barrier, one of which is the educational-behavioral strategy. In other words, one way to solve the problem is utilizing educational interventions and using specifically-trained counselors in clinics to consult with patients

regarding this barrier in condom use. Part of this intervention should include education towards ways to engage in more pleasurable sexual contact with condoms. Such strategies mainly target the behavior of the patients. Another strategy could be applying a structural strategy in the community. Male condoms that are widely distributed in Iran are latex condoms. Since latex condoms create a more pronounced decrease in sexual sensation, access to polyurethane condoms could be effective for men who avoid condom use for this reason only. In consultation and education sessions, it should be also emphasized that not only can HIV-negative partners become infected in unprotected contacts, but also the HIV-positive party may be predisposed to other strains of HIV and also other sexually transmitted infections.

In the Middle East, drugstores constitute the main source for obtaining condoms<sup>18</sup>. Since in Iran the condoms are frequently located in the cosmetics section rather than the pharmacy, it is not uncommon for the salesperson in this section to be a woman. This could cause the shyness that some mentioned in the current study. Currently, in consultation clinics condoms are distributed for free and to avoid any awkwardness for the patients, sometimes the condoms are offered by the consultants. In Drop In Center (DIC) and at the Positive Club where HIV positive or at-risk populations may refer to, condoms are placed where anyone can take them. Since such centers are only open on work days and in working hours, installing vending machines for condoms in front of drugstores or supplying condoms in department stores and supermarkets could be helpful. The wish to have children was also mentioned as a reason for not using condoms. In some cases, this was the wish of HIV-negative women with infected husbands, despite awareness of the possibility of HIV transmission. This represents the fact that in current Iranian culture, having children is an important issue in family life. Consultation with the couple, and especially the woman, could help them realize the risk of transmission to one another and the child.

In addition, the quality and variety of available condoms in the market should be assessed and if necessary, improved, to ensure that none of the concerns regarding failure, physical side effects, and reduced sexual satisfaction remain valid. Considering that a noteworthy percent (46.5%) of HIV-positive men and women in Iran are in the 25-34 year age group and a considerable number of the infected are single<sup>5</sup>, interventions designed by authorities would undoubtedly need to focus on both sexes, and especially include the young population. Condom negotiation for women is definitely an essential point in HIV prevention.

While it was attempted to overcome limitations of the study where possible, the study still has a number of drawbacks, many of which are limitations of qualitative research in general. One is that the study sample in qualitative research is usually small and cannot be directly generalized to the population. On the other hand, the study subjects are patients referring to a consultation clinic for HIV and cannot represent the entire community of HIV patients and families, since those that do not refer to such clinics may be culturally or socio-economically different populations. Another drawback is that although the necessary measures were taken to gain the participants' trust during interviews, the participants may still have not expressed their uncensored intentions and beliefs, due to the controversial and personal subject of the study.

Even though the Islamic Republic of Iran has been a leading country in HIV prevention and treatment in the Middle East<sup>25</sup>, grounds for not complying with condom use consisted of a variety of reasons. Education and consultation can change many of the negative attitudes towards condom use<sup>26</sup>. One reason condom use is fundamentally and permanently internalized in some HIV-positive men is the realization that they can infect others and the burden of such a possibility on their conscience. Most-at-risk groups should especially be taken into consideration. Most other factors are nothing that cannot be overcome by precise planning and intervention by the policy makers.

#### **Acknowledgements**

The authors of this study would like to acknowledge the participants of this study for their willingness and ingenuousness.

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## Redescription of Three Cichlidogyrids (Monogenea: Ancyrocephalidae) and One Gyrodactylid (Monogenea: Gyrodactylidae) Infecting *Oreochromis niloticus* (Cichlidae) From the River Nile

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**Abstract:** In the present study, the morphology and morphometric characterization of four species of monogenean gill parasites infecting the skin and gills of *Oreochromis niloticus* belonging to family Cichlidae collected from the River Nile at Giza governorates, Egypt were described by means of light microscopy. Thirty six out of 68 specimens of this fish were found to be naturally infected at a rate of 53%. Two Cichlidogyrids (family: Ancyrocephalidae) and one Gyrodactylid (family: Gyrodactylidae) were identified. *Cichlidogyrus tilapiae* Paperna, 1960 was characterized by a copulatory organ found in the midline of the body, with accessory sclerite situated roughly parallel with the copulatory tube and never seen completely isolated from it. In all worms examined, the proximal end of the accessory sclerite was found in contact with the base of the copulatory tube, indicating that there was a connection between the base of the copulatory tube and the proximal part of the accessory sclerite. *Cichlidogyrus longicornis longicornis* which was characterized from all species of this genus by having two long projections of the complex bar and its copulatory organ had a slightly long ejaculatory tube. *Cichlidogyrus tubicerrus magnus* possessed a haptor with two pairs of anchors, its ventral anchor was attached to the V-shaped bar that had a number of tooth – like projections on the inner margin. The dorsal anchor was attached to a complex bar (dorsal bar), which consists of three articulated pieces. The central piece was slightly bent and the other two pieces were attached to the central one in such away that their points of attachments divide the bar in three equal parts. *Gyrodactylus cichlidarum* Paperna, 1968 possessed a haptor resembled a cub holding a variety of hamuli, bars and supportive additional sclerites. The hamuli withdrawn inside a transparent tegumental sheath, the hamulus blade emerged from an opening decorating the distal area of a cone- shaped, transparent, tegumental sheath. *Oreochromis niloticus* fish represents a normal host for all these species except for *Cichlidogyrus tubicerrus magnus* which represented as a new host for this parasite. These species were redescribed by using light micrographs, line drawings and measurements which can be used as a guide material for the identification of these species by following researchers.

[Kareem Morsy; Fathy Abdel-Ghaffar; Abdel-Rahman Bashtar; Mohamed Shazli; Hamed Fayed; Faten Adel. **Redescription of Three Cichlidogyrids (Monogenea: Ancyrocephalidae) and One Gyrodactylid (Monogenea: Gyrodactylidae) Infecting *Oreochromis Niloticus* (Cichlidae) From The River Nile.** *Life Sci J* 2012;9(3):2600-2611] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 377

**Key words:** Monogenea - *Oreochromis niloticus* - *Cichlidogyrus* spp. - *Gyrodactylus* spp.- Light microscopy.

### 1 Introduction

Fish are important members of aquatic ecosystems and an important source of human food. Increased interest in fish culture has also increased awareness of and experience with parasites that affect fish health, growth and survival. The Nile *O. niloticus* is one of the most highly valued main cultured fish in Egypt where the environment mainly the water temperature, is adequate 13–28°C. The disease caused by monogenean parasites produces serious problems in aquaculture (Okamoto, 1963; Ogawa and Inouye, 1997; Yoshinaga *et al.*, 2000, 2001, 2009; Mushiake *et al.*, 2001; Nakayasu *et al.*, 2002) with obvious pathogenicity and its susceptibility to chemicals is low. Immature worms of these parasites attach to the gill filaments of their hosts and migrate to the buccal cavity wall for maturation, as the worms ingest blood from the gills of host fish, heavily infected wild and cultured fish become anaemic (Anshary *et al.*, 2001; Yoshinaga *et al.*, 2009). The public has become increasingly aware in recent years that aquatic ecosystems around the world are deteriorating from

deposition of anthropogenic pollutants. Early warning systems are being developed in response, and fish parasites have been proposed as effective bioindicators of environmental pollution (Lafferty, 1997; Sures, 2004, 2006; Marcogliese, 2005). The logic underlying the use of fish parasites is based on the fact that both parasites and their hosts are exposed and, therefore, may respond to pollution in aquatic environments (Williams and Mackenzie, 2003; Khan and Payne, 2004). Monogenean parasites are recognized as useful bioindicators of environmental quality because of their predictable numerical response to chemical pollution (Khan and Thulin, 1991; MacKenzie, 1999). Monogeneans are the most abundant ectoparasitic flukes of fish; with a great diversity of species, occurring in tropics than in temperate regions of the world (Rohde, 1982). The Monogenea is a class of platyhelminths parasitic mostly on external surfaces and gills of freshwater and marine fish (Morsy, 2012). Few genera of these parasites were recorded to be endoparasites in the

blood stream, urinary system, body cavity and the gut of fish. Generally, monogenean parasites possess a flattened, leaf-like body; they range in length from less than one millimeter to not more than few centimeters. The body has an anterior and a posterior attachment organ, which play a major role during attachment, detachment and relocation on the available microhabitats of the host. To date, more than 4000 monogenean species have been described (Whittington and Cribb, 1998). According to Pariselle & Euzet (1997) Ancyrocephalidae is characterized by the presence of three pairs of cephalic glands, two posterior ocellae with crystalline lenses, two small inconsistent anterior ocellae, intestinal caeca which is unbranched, joined posteriorly, two pairs of anchors, one dorsal and one ventral, two transverse bars, one dorsal with two auricles and a ventral V-shaped one, median posterior testis, vas deferens on right side, not encircling intestinal caecum. Male copulatory complex with penis and accessory piece. Median pre-testicular ovary. Sub-median vaginal dextral opening. Vagina sclerotised or not. Seminal receptacle present. Through the family Ancyrocephalidae, the genus *Cichlidogyrus* Paperna, 1960 (infecting the gills) is host specific to diverse cichlid fish species from Africa (Paperna, 1969). Of the possible parasitic disease-causing organisms, ectoparasitic *Gyrodactylus* Nordmann, 1832 (Monogenea) species are of potential significance to tilapia culture. Clinical outbreaks of gyrodactylosis have been recorded world wide in pond-reared tilapia (Fryer and Iles, 1972; Roberts and Sommerville, 1980) where the species in the latter seven cases were confirmed morphologically by the present authors to be *G. cichlidarum* Paperna, 1968. Monogeneans have been reported to cause severe mortalities in fish hatcheries in Nigeria (Obiakezie and Taeye, 1991) and South Africa in catfish, black bass and freshwater ornamental fish. Overcrowding of fish into culture ponds or tanks together with different environmental and management factors, promote heavy infestation, which can lead to productive losses, tissue damages and in some cases mortality (Hecht & Endemann, 1998). The present investigation aims to study the prevalence of natural infection with monogenetic trematodes in addition to the morphological and morphometric characteristics of the recovered monogenean species by means of light microscopy.

## 2 Material and Methods

Samples of 68 individual *O. niloticus* (F: Cichlidae) collected throughout the whole year of 2011 from different fish farmers at the River Nile in Giza Governorates, Egypt. Fish were immediately transported in water tanks to the Parasitology laboratory at the Zoology Department, Faculty of Science, Cairo University. They are identified and

examined for monogenean parasites infection. Skin surface, fins and gills were examined by naked eyes and with the help of dissecting microscope for any attached parasites, lesions or external changes. After removing opercula and exposing gill arches, each gill was removed carefully from the fish, immersed in normal saline to remove any excess gill mucus. Monogenean parasites were collected with a Pasteur pipette using a dissecting binocular microscope. The monogeneans were fixed in 10% formalin and the worms were washed with distilled water to remove excess fixative. Acetic acid alum carmine was used for staining according to Carleton (1967) for 5-10 minutes for permanent whole mount preparations. Dehydration was maintained by passing in ascending series of ethyl alcohol. Specimens were cleared in clove oil and xylene then mounted in Canada balsam. For each monogenean parasite, the sclerotized parts, namely haptors, copulatory organs, were drawn using Camera Lucida. All measurements, in mm, are given as mean  $\pm$  standard deviation (minimum-maximum), as proposed by Gussev (1962). The sclerotized parts were measured using a measuring ocular micrometer calibrated against a stage micrometer slide according to Gusev, 1955 (in Bychovskaya Pavlovskaya *et al.*, 1964) and the bars according to Douellou (1993). The process of numbering of (marginal hooklets) is adopted according to Euzet & Prost (1981).

## 3 Results

Examination of the collected fish samples indicated that 36 out of 68 fish samples (53% infection rate) were infected with monogenetic trematodes (the intensity of infection was about ten worms per fish in general). Positive correlation was observed between the increase in size and age of the infected fish and parasite abundance. Most of the infected fish had very pale gills and showed symptoms of anaemia. Given measurements of worms were based on the mean of 20 specimens. During this study, three species of monogenean parasites including two Cichlidogyrids and one Gyrodactylid were identified. These are *Cichlidogyrus tilapiae*, *Cichlidogyrus longicornis longicornis*, *C. tubicerrus magnus*, and *Gyrodactylus cichlidarum*.

### *Cichlidogyrus tilapiae*

#### Paperna, 1960 (Figs. 1-6&20A)

**Description:** The body of adult worm was elongated with a total length 0.580 – 0.631 (0.600  $\pm$  0.020) mm, maximum body width was 0.120 – 0.160 (0.140  $\pm$  0.020) mm. The prohaptor possessed three pairs of cephalic glands, two pairs of eyes were present on the dorsal body region anterior to the pharynx. Also, two posterior ocellae with crystalline lenses and two small inconsistent anterior ocellae were present. The muscular pharynx was 0.026 – 0.029 (0.028  $\pm$  0.001) mm in diameter. The subterminal

mouth was found ventrally between the two pairs of eyes, and delayed behind the muscular pharynx. The two simple intestinal branches were united posteriorly near the margin of the opisthaptor. The copulatory organ was found in the midline of the body, posterior to the pharynx. The accessory sclerite situated roughly parallel to the copulatory tube and never seen completely isolated from the copulatory tube. In all worms examined, the proximal end of the accessory sclerite was found in contact with the base of the copulatory tube, indicating that there was a connection between the base of the copulatory tube and the proximal part of the accessory sclerite. The copulatory tube was 0.060 – 0.070 (0.063 ± 0.001) mm, the accessory piece was 0.059 – 0.064 (0.062 ± 0.001) mm in length.

Haptor delicate with two pairs of anchors, strongly developed. The total length of ventral anchor was 0.040- 0.044 (0.041 ± 0.002) mm, its shaft length was 0.034 – 0.039 (0.037 ± 0.002) mm, the point length was 0.011 – 0.015 (0.014 ± 0.002), the inner root was 0.009 – 0.014 (0.010 ± 0.002) mm, and the outer root was 0.004 – 0.007 (0.006 ± 0.001) mm in length. Ventral anchor was attached to V- shaped bar, which has a number of teeth – like projections on the inner margin. The total length of this bar was 0.053- 0.059 (0.058 ± 0.002) mm and 0.008- 0.013 (0.010 ± 0.002) mm in width. The total length of dorsal anchor was 0.039 – 0.043 (0.041 ± 0.002) mm, the shaft length was 0.025 – 0.031 (0.030 ± 0.002) mm, while the point length was 0.009- 0.013 (0.010 ± 0.002) mm. The inner root length was 0.014-0.019 (0.015 ± 0.002) mm, and the outer root length was 0.003 – 0.007 (0.005 ± 0.001) mm. The dorsal anchor was attached to a complex bar (dorsal anchor) which consisted of three articulated pieces, the central piece was slightly bent and measured 0.056 – 0.061 (0.058 ± 0.002) mm in length. The other two pieces were attached to the central piece in such a way that their points of attachment divide the bar into three equal parts, the length of the pieces was 0.013- 0.017 (0.016 ± 0.001) mm and the connection between them was 0.023 – 0.028 (0.025 ± 0.002) mm. The opisthaptor containing marginal hooklets, usually (14). The marginal hooklets of the first pair of anchors measured 0.022 – 0.025 (0.024 ± 0.001) mm, and those of the second pair were 0.010 – 0.016 (0.13 ± 0.002) mm in length.

#### Remarks

*Cichlidogyrus tilapiae* was reported from *O. niloticus*, *S. galilaeus* and *T. simonis* in Israel and Southern Ghana by Paperna, 1960 and 1965. Paperna, 1969 reported this type in *T. mosambica* from Ghana. By comparison of the recorded measurements herein with those recorded by previous studies, we found that

dimensions of sclerites were generally larger in our species.

#### *Cichlidogyrus tubicerrus magnus*

Paperna et Thurston, 1969 (Figs 8-10&20B)

**Description:** The body was elongated with total length of 0.42 – 0.48 (0.43 ± 0.02) mm and the maximum width was 0.12 – 0.17 (0.15 ± 0.02) mm. The length of the muscular pharynx was 0.025- 0.030 (0.026 ± 0.002) mm, and was located in the prohaptor, behind the margins of the posterior pair of eyes. The copulatory organ was 0.081 – 0.085 (0.084 ± 0.001) mm in length and was s-shaped, wide with a constant width and an irregular basal portion variable in shape. The accessory piece measured 0.043- 0.049 (0.047 ± 0.002) mm in length. Haptor with two pairs of anchors strongly developed. The total length of ventral anchor was 0.041 – 0.046 (0.044 ± 0.001) mm, the shaft length was 0.038 – 0.041 (0.04 ± 0.001) mm, the point length was 0.013- 0.018 (0.014 ± 0.002) mm, and the outer root length was 0.006 - 0.009 (0.007 ± 0.001) mm. The ventral anchor was attached to the V-shaped bar that had a number of teeth – like projections on the inner margin. The total length of this bar was 0.043 - 0.050 (0.045 ± 0.002) mm, and its width was 0.005 - 0.008 (0.007 ± 0.001) mm. The total length of dorsal anchor was 0.040 - 0.046 (0.042 ± 0.002) mm. The shaft length was 0.022 - 0.027 (0.025 ± 0.002) mm and the point length was 0.009-0.014 (0.011 ± 0.002) mm. The inner root was 0.017-0.024 (0.020 ± 0.003) mm and the outer one was 0.006-0.009 (0.008 ± 0.001) mm. The dorsal anchor was attached to a complex bar (dorsal bar), which consisted of three articulated pieces, the central piece was slightly bent and measured 0.045 - 0.050 (0.047 ± 0.002) mm in length. The other two pieces were attached to the central one in such a way that their points of attachments divided the bar in three equal parts. The piece length was 0.010 – 0.016 (0.014 ± 0.002) mm and the connection between them was 0.015 – 0.019 (0.017 ± 0.001) mm. The marginal hooklets of the first pair of anchors were 0.014 – 0.019 (0.017 ± 0.002) mm and those of the second pair were 0.021 – 0.025 (0.023 ± 0.001).

#### Remarks

*Cichlidogyrus tubicerrus magnus* was found for the first time on gills of *O. niloticus* in Uganda by Paperna and Thurston (1969) then was reported from *Tilapia zilli* Gervais, 1848 in Egypt by Ergens (1981) as a new host. The examination of the type specimen showed that measurements of the haptor pieces correspond nearly to those of the original description, while those for the ventral anchor length and its shaft, shaft length of dorsal bar, ventral bar length differed in the present description (smaller than original description). This specimen, regarding the drawings and measurements, shows no significant differences with the original study as described by Paperna and

Thurston (1969), the great differences was in the measurements of some haptor sclerites.

***Cichlidogyrus longicornis longicornis***

**Paperna et Thurston, 1969 (Figs. 11-14&20C)**

**Description:** The body of adult worm was medium sized with a total length measured 0.280 – 0.350 (0.320 ± 0.02) mm, and a maximum body width 0.080- 0.140 (0.110 ± 0.02) mm. The prohaptor had three pairs of cephalic glands. Two pairs of eyes were present on the dorsal body region anterior to the pharynx. The length of the muscular pharynx was 0.032-0.036 (0.033 ± 0.001) mm at the widest point. It was located in the prohaptor behind the margins of the posterior pair of eyes. Mouth was subterminal, found ventrally between the two pairs of eyes and delayed behind the muscular pharynx to simple intestinal branches, which united posteriorly near the margin of the opisthohaptor. The copulatory organ was 0.050 - 0.055 (0.052 ± 0.002) mm in total length, consisted of an oval basic portion, a branched supporting portion measured 0.033-0.043 (0.040± 0.002) mm and a fine copulatory tube. Haptor with two pairs of anchors was strongly developed. The total length of the ventral anchor was 0.028-0.036 (0.032± 0.003) mm, its shaft length was 0.023-0.027 (0.024 ± 0.001) mm, the point length was 0.009-0.014 (0.011± 0.002) mm, the inner root length was 0.012-0.017 (0.014 ± 0.002) mm, and the outer root length was 0.007-0.011 (0.009 ± 0.001) mm. The ventral anchor attached to the V- shaped bar, which had a number of tooth-like projections on the inner margin. The total length of this bar was 0.038-0.043 (0.040± 0.002) mm, and its width was 0.004-0.007 (0.005±0.001) mm. The total length of dorsal anchor was 0.030 – 0.036 (0.034 ± 0.002) mm, its shaft length was 0.023- 0.028 (0.026 ± 0.002) mm, and the point length was 0.006-0.010 (0.007 ± 0.001) mm, while its inner root length was 0.009-0.015 (0.012 ± 0.002) mm and its outer one was 0.005 – 0.009 (0.007 ± 0.001) mm. The dorsal anchor was attached to a complex (dorsal) bar with a characteristic shape, its middle portion 0.004 - 0.008 (0.006 ± 0.002) mm, and with markedly widened margins of 0.050-0.054 (0.052 ± 0.002) mm in length. The two pieces attached to the complex bar are long appendages measured 0.033-0.038 (0.035 ± 0.002) mm in length.

**Remarks**

This parasite corresponds to *Cichlidogyrus longicornis longicornis* described also on *O. niloticus* by Paperna and Thurston (1969) and to *C. longicornis* described by Douëllou (1993) on *O. mortimeri*. Also, this parasite was obtained from the gills of *O. niloticus* caught from the River Nile by Ergens, 1981. The same parasite species has been reported only from *O. niloticus* in Uganda by Paperna and Thurston 1969 and from *O. niloticus*, *Sarotherodon galilaeus* and *T.*

*Zilli* in Ghana (Paperna, 1968). This *Cichlidogyrus* sp. is characterized from all species of this genus by having two long projections of the complex bar and its copulatory organ has a slightly long ejaculatory tube and its smaller total length of the ventral bar.

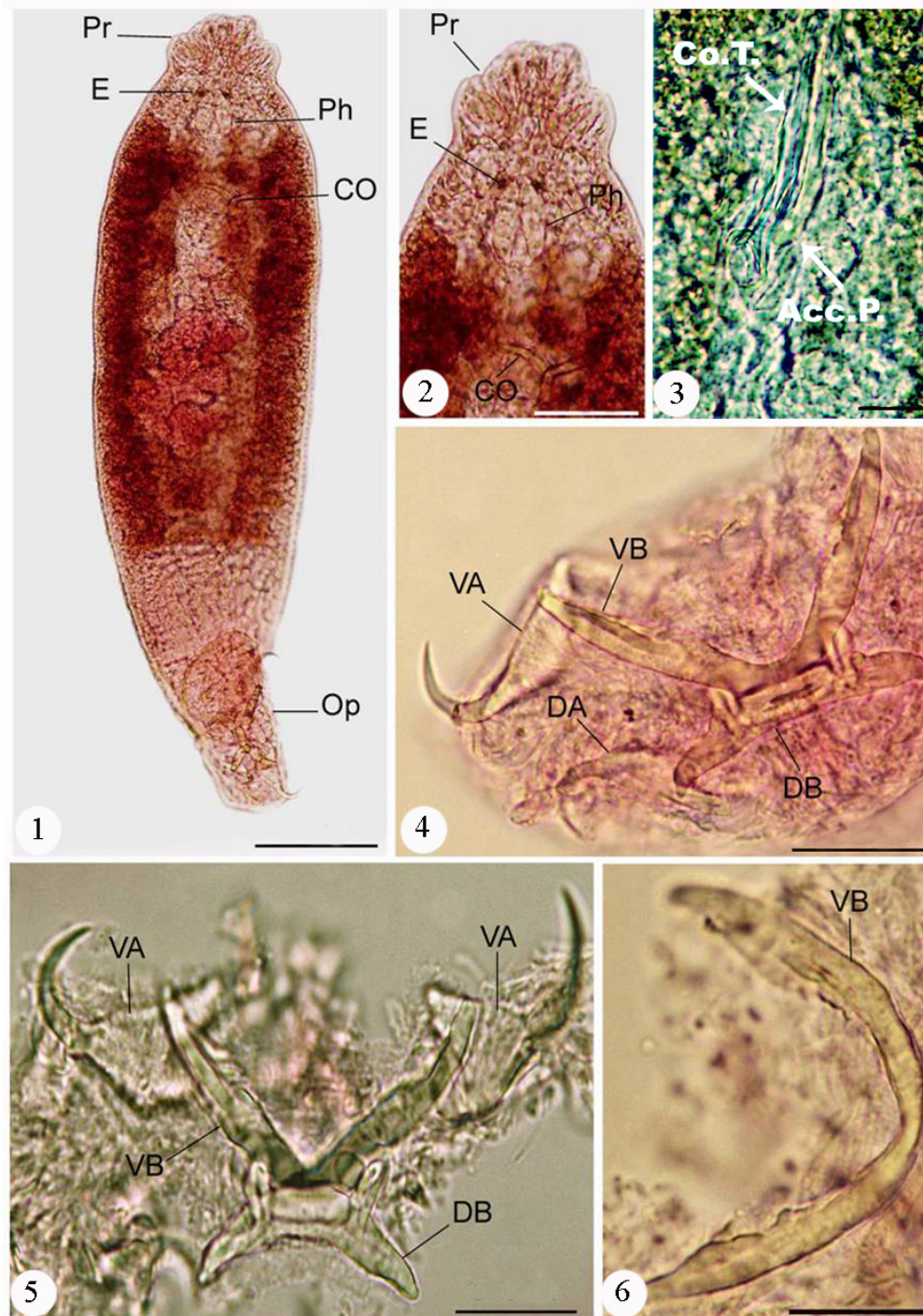
***Gyrodactylus cichlidarum***

**Paperna, 1968 (Figs. 15-19& 20)**

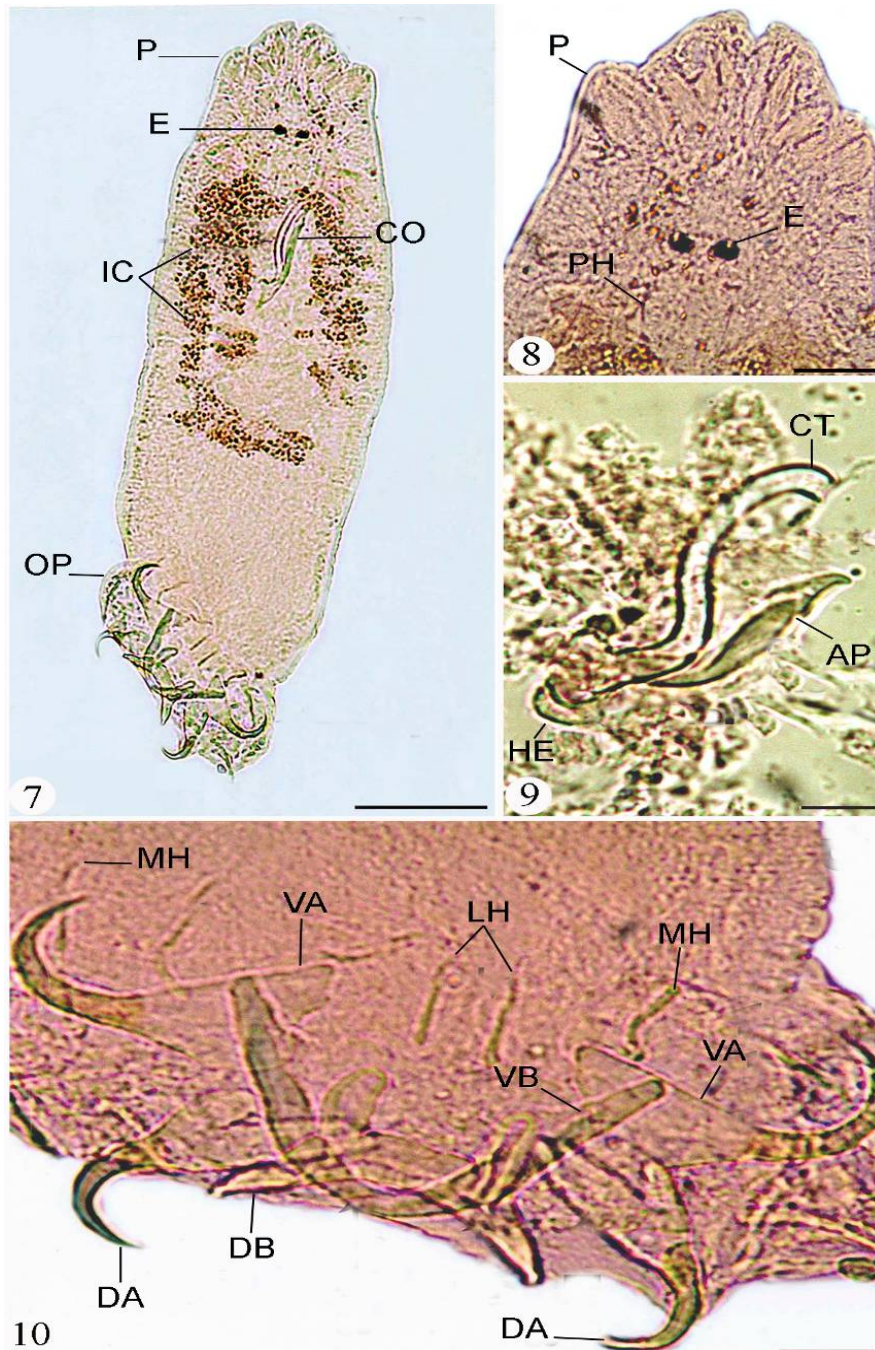
The total body length was 0.33 – 0.38 (0.35 ± 0.02) mm and the maximum body width measured 0.050 – 0.090 (0.070 ± 0.02) mm. The diameter of opisthohaptor was 0.090 – 0.130 (0.110 ± 0.01) mm. In the prohaptor, the glands located anterior to the pharynx, were more developed than those located lateroposteriorly. The pharynx consisted of 8-10 basal large cells and a layer of smaller elongated apical cells inserted in the membranous wall of the buccal cavity. Cirrus pouch possessed five spines arranged in one circle, and a large apical hook with a short spike and a wide base. The haptor resembled a cub holding a variety of hamuli, bars and supportive additional sclerites. The hamuli withdrawn inside a transparent tegumental sheath, the hamulus blade emerges from an opening decorating the distal area of a cone-shaped, transparent, tegumental sheath. The hamulus length was 0.095 – 0.115 (0.108 ± 0.05) mm, the shaft length was 0.060 – 0.090 (0.08 ± 0.005) mm. The hamulus roots length was 0.03 – 0.05 (0.04 ± 0.008) mm, the point length of the ventral bar was 0.020 – 0.025 (0.022 ± 0.002) mm. The dorsal bar length was 0.024 000– 0.028 (0.026 ± 0.002) mm, and 0.003 – 0.006 (0.004 ± 0.001) mm in width. The length of marginal hooklets was 0.026 – 0.030 (0.028± 0.002) mm.

**Remarks**

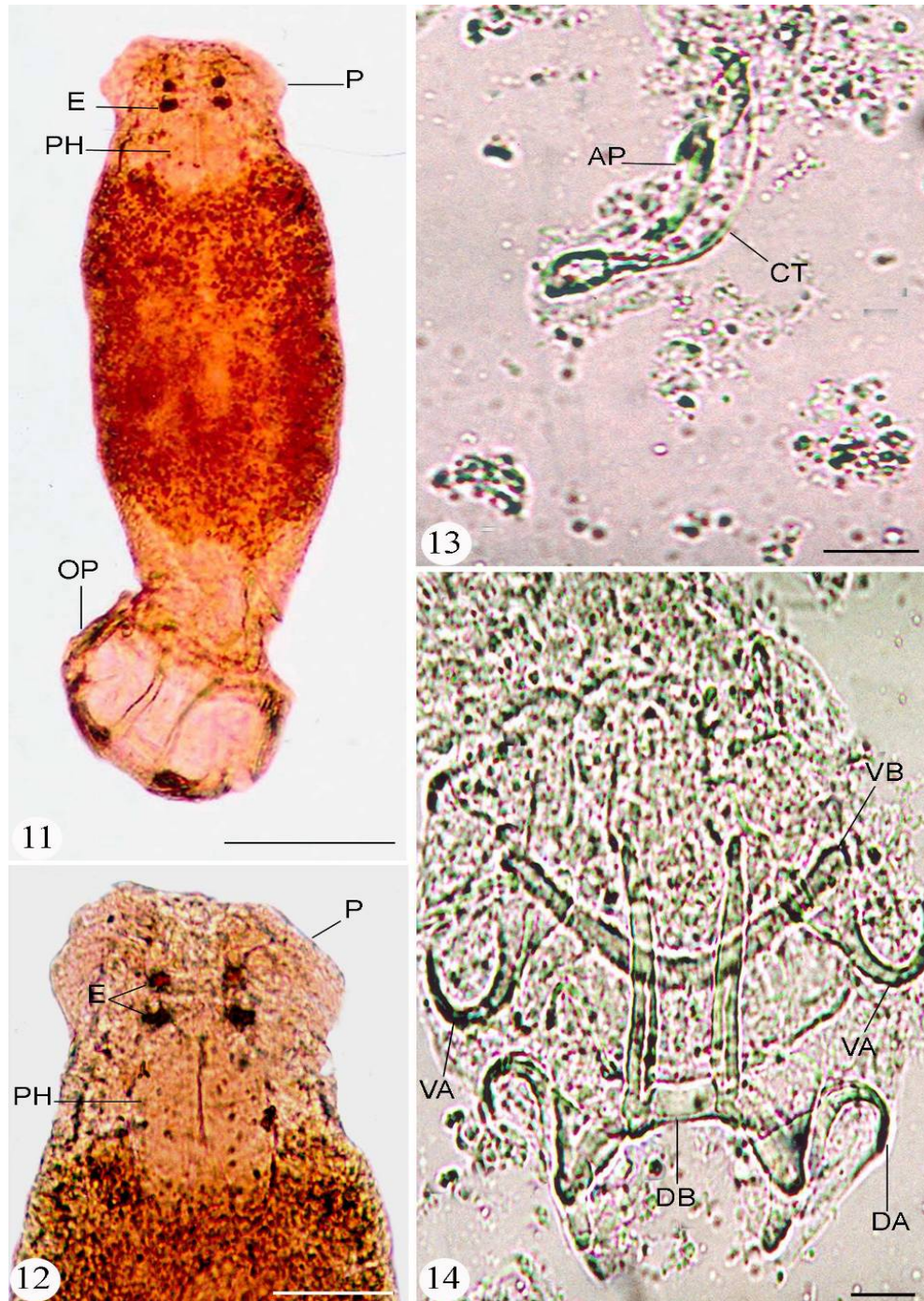
*Gyrodactylus cichlidarum* was originally described from *Sarotherodon galilaeus galilaeus* (L.) (syn. *Tilapia galilaea*) from the Accra plains and Akuse lagoon, Lower Volta, Ghana, but has also been recorded from *Tilapia zillii* (Gervais) (syn. *Chromis zillii*), *Hemichromis fasciatus* Peters and *H. bimaculatus* Gill from various locations around the Volta Lake (Paperna, 1968). Paperna (1979) cited additional hosts and locations for *G. cichlidarum* namely *Sarotherodon melanotheron heudelotii* (Duméril) and *Tilapia guineensis* (Günther) from coastal saline lagoons in Ghana; *T. zillii*, *S. galilaeus galilaeus* and *Oreochromis aureus* (Steindachner) from coastal Israel and Jordan systems; and *Haplochromis flavijosephi*. The examination of the type specimen showed that measurements of the haptor pieces correspond nearly to those of the original description by Paperna, 1969, while those for the copulatory organ were more or less different.



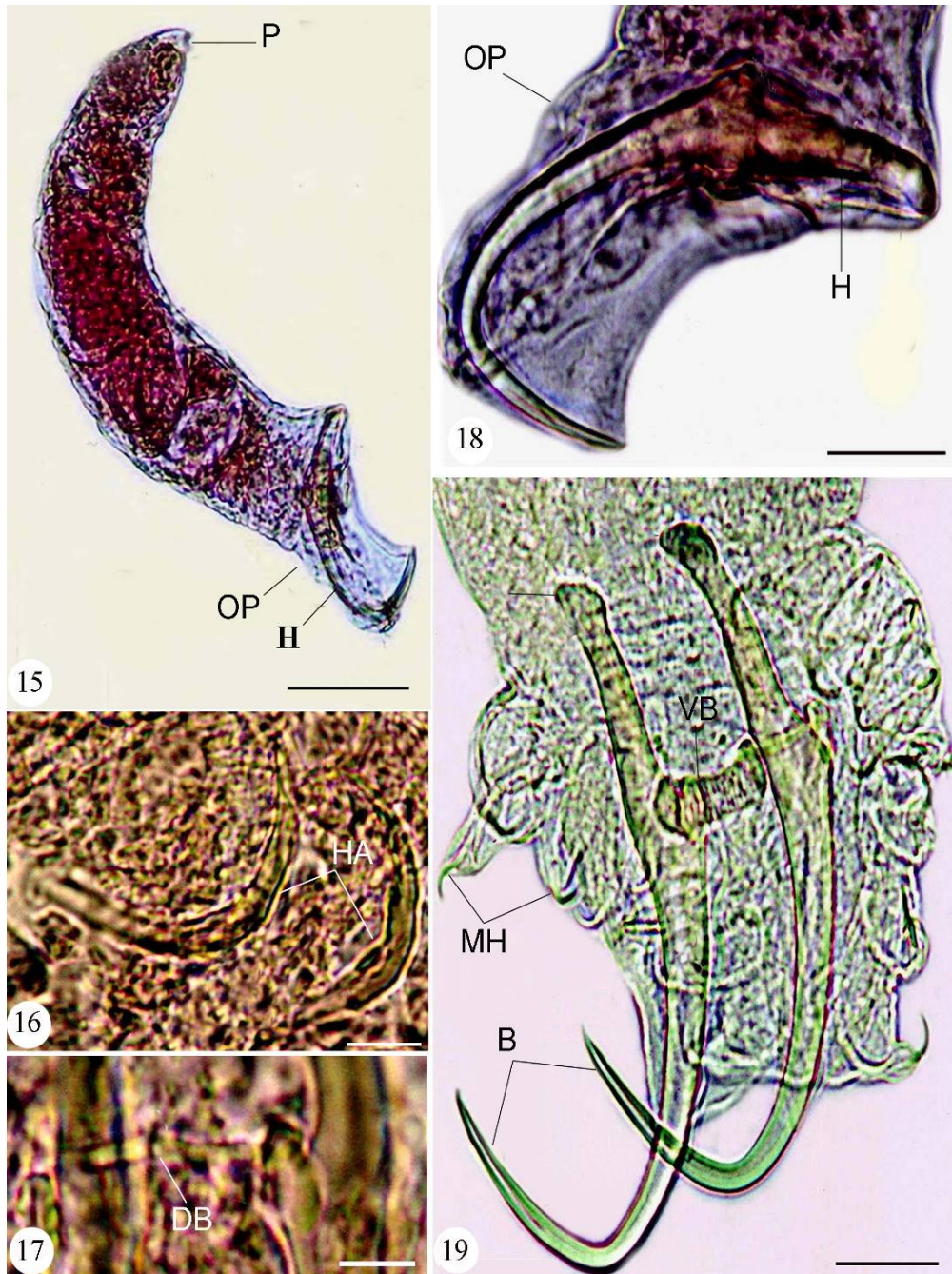
**Figs. 1-6: Photomicrographs of *Cichlidogyrus tilapiae*.** 1 Whole mount preparation of the adult worm with its anterior attachment organ or prohaptor (P), two pairs of eyes (E), pharynx (PH). The worm terminates at a posterior attachment organ or opisthohaptor (OP). (Scale bar 0.1 mm) 2 High magnification of the anterior attachment organ or prohaptor (P) surrounding two pairs of eyes (E), pharynx (PH) and the copulatory organ of the worm (CO). (Scale bar 0.04 mm) 3 High magnification of the copulatory organ (CO), it is composed of a coulatory tube (CT) and an accessory sclerite (AP). (Scale bar 0.02 mm) 4,5 High magnification of the posterior attachment organ or opisthohaptor (OP) showing its haptoral sclerites, a ventral bar (VB), V shaped and one pair of ventral anchors (VA) a dorsal bar (DB), with two short appendages and one pair of dorsal anchors (DA) (Scale bar 0.03 mm) 6 High magnification of the a ventral bar (VB). (Scale bar 0.02 mm).



**Figs. 7-10: Photomicrographs of *Cichlidogyrus tubicerrus magnus*.** 7 Whole mount preparation of the adult worm with its anterior attachment organ or prohaptor (P), eyes (E), pharynx (PH) and clearly visible copulatory organ (CO). The worm terminates at a posterior attachment organ or opisthohaptor (OP). (Scale bar 0.1 mm) 8 High magnification of the anterior attachment organ or prohaptor (P) surrounding eyes (E), pharynx (PH). (Scale bar 0.02 mm) 9 High magnification of the copulatory organ (CO), it is composed of a couulatory tube (CT), terminates at the heel (HE) and an accessory piece (AP). (Scale bar 0.02 mm) 10 High magnification of the posterior attachment organ or opisthohaptor showing its haptoral sclerites, a ventral bar (VB), V shaped and one pair of ventral anchors (VA) a dorsal bar (DB), with two short appendages and one pair of dorsal anchors (DA),6 High magnification of the a ventral bar (VB), there are two types of hooklets, one pair of larval hooklets (LH) and marginal hooklets (MH). (Scale bar 0.02 mm)

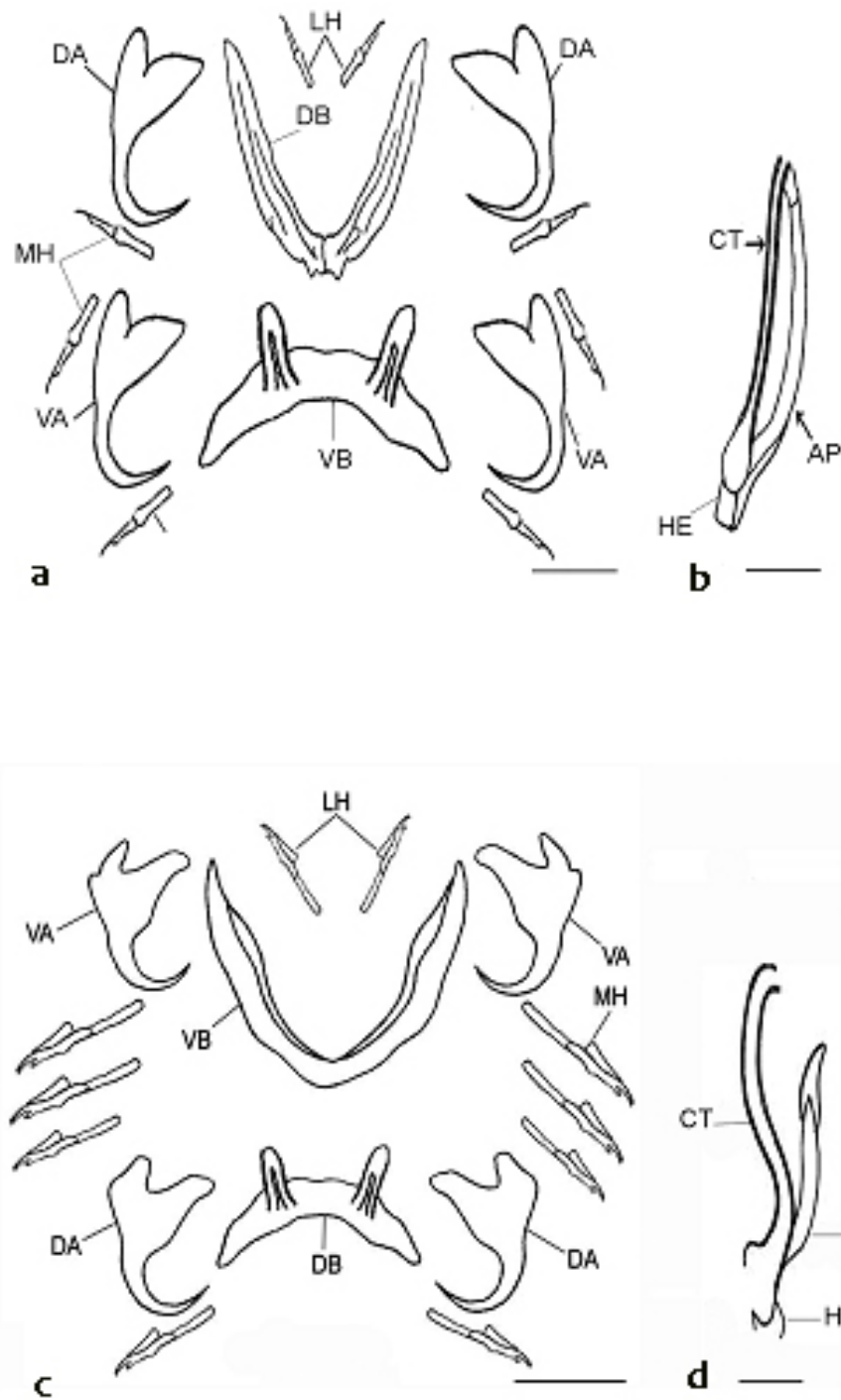


**Figs. 11-14: Photomicrographs of *Cichlidogyrus longicornis longicornis*.** 11 Whole mount preparation of the adult worm showing its anterior attachment organ or prohaptor (P), two pairs of eyes (E), pharynx (PH). The worm terminates at a posterior attachment organ or opisthaptor (OP). (Scale bar 0.1 mm) 12 High magnification of the anterior worm body showing its prohaptor region (P) surrounding eyes (E), pharynx (PH). (Scale bar 0.02 mm) 13 High magnification of the copulatory organ (CO) of a adult worm, it is composed of a couulatory tube (CT), terminates at a heel piece (HE) and an accessory piece (AP). (Scale bar 0.02 mm) 14 High magnification of the posterior attachment organ or opisthaptor showing its haptor sclerites, a ventral bar (VB) is a V-shaped and one pair of ventral anchors (VA) a dorsal bar (DB), fan shaped with two long appendages and one pair of dorsal anchors (DA). (Scale bar 0.02 mm)

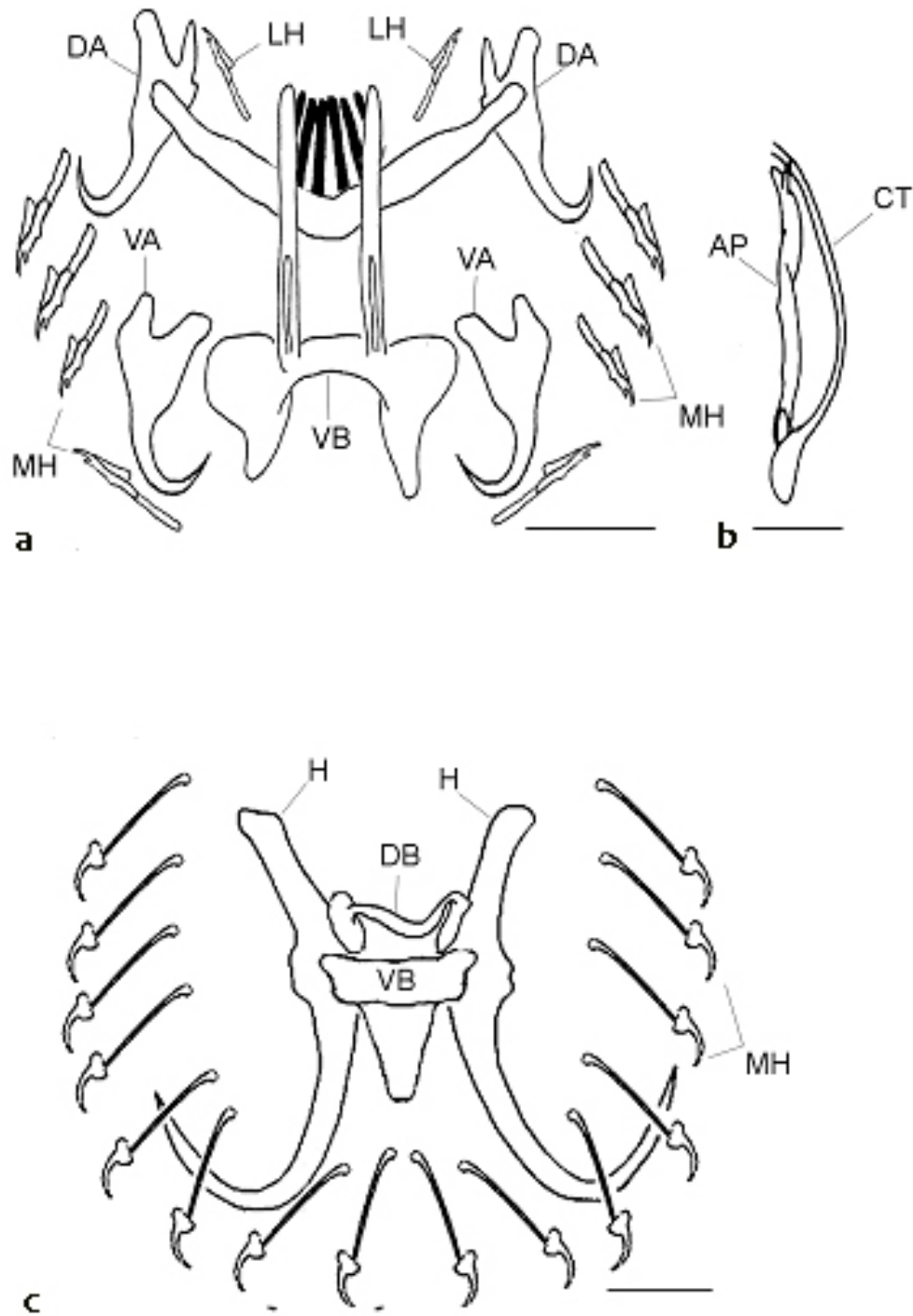


**Figs. 15-19: Photomicrographs of *Gyrodactylus cichlidarum*.** 15 Whole mount preparation of the adult worm with its anterior attachment organ or prohaptor (P), the posterior attachment organ or opisthaptor (OP) is composed of two long hamuli (H). (Scale bar 0.1 mm) 16- 19 High magnifications of 16 haptors of embryo (HA) (Scale bar 0.02 mm) 17 Dorsal bar (DB) (Scale bar 0.02 mm) 18 Opisthaptor showing hamuli (H) (Scale bar 0.01 mm) 19 Opisthaptor (OP) showing its two hamuli (H), blades (B), Ventral bar (VB) and marginal hooklets (MH) (Scale bar 0.01 mm)





**Figs. 20:** Semi schematic drawing showing the structures of both haptors (a,c) and copulatory organs (b,d) of *Cichlidogyrus tilapiae* (a,b) and *Cichlidogyrus tubicerrus magnus*. (Scale bars a 0.03; b, c, d 0.02 mm)



**Figs 21:** Semi schematic drawing showing the structures of both haptors (a,c) and copulatory organs (b,d) of *Cichlidogyrus longicornis longicornis* (a,b) and *Gyrodactylus cichlidarum*. (Scale bars a-d 0.02 mm)

#### 4. Discussion

Two hypotheses may be speculated to explain the morphological differences between these described species above: these different morphologies have been patterned by the adaptation to specific microhabitats on the gills (i.e. adaptation resulting from interspecific competition), or patterned only by the ontogeny (i.e. limited by the energy available to build the hard parts of the haptor). No answer could actually be given, but microhabitat segregation between monogenean species on the gills is well documented (Lambert and Millard, 1974, Wooten, 1974, Cloutman, 1975, Fernando and Hanek, 1976, Hanek and Fernando, 1978, Sanfilippo, 1978, Silan, 1984, Ramasamy *et al.*, 1985, Koskivaara *et al.*, 1992). Further studies have to be done to confirm this segregation in the present tilapiine monogeneans model (see Bilong Bilong *et al.*, 1999) to highlight the link between the morphology of haptor sclerites and specific microhabitat, and finally to conclude about the determining factor in monogenean site selection (Pariselle and Euzet, 2003).

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## General Overview of Effective Posters in Islamic Revolution of Iran and their Symbolic Connotations

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**Abstract:** Art is one of the highly effective means of promulgation and demonstration of culture. Among the different kinds of art graphic designing is considered as one of the most important means for its suggestiveness and visual effect. Islamic Revolution in Iran formed a new historical and cultural identity for Iranians, so that great change in every class of society happened. And both intellectuals and common people joined the stream to advance the objectives of the Revolution. Artists and among them graphic designers were among the heralds who played an important role in this way. They made great movement in the Revolution. By creating beautiful and effective works of art without mentioning their names in their works, artists start a new stage in the life of people and themselves. They also changed the way this art had been evaluated by people, and also they could save the art from absurdity and nothingness, and made it purposeful and used it in accordance with the human values, dignity and heavenly values.

[Hamid Alami. **General Overview of Effective Posters in Islamic Revolution of Iran and their Symbolic Connotations.** *Life Sci J* 2012;9(3):2612-2614] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 378

**Keywords:** posters, Islamic Revolution, symbol, martyrdom

### Introduction

A poster, a picture, a sketch or a poem could have an effective role in revival of beliefs. Revolutionary artists tried to create their works of art under the influence of Imam Hossein cause and based on martyrdom, ethics in Alavi school of thought. They used this thought in order to join people, to support the Revolution and also demonstrated the objectives of the Revolution in their works of art.

Graphic designers in continuity of their activity in the first and second decade of Islamic Revolution tried to demonstrate the humanistic and spiritual values in their works, and transmit those important and unrepeatable incidents to the new generation. They used the language of art to show if there were not ideologies like sacrifice, and martyrdom in Islam how could empty-handed people defeat such a powerful regime. They tried to teach and warn the new generation not to go astray from the main issues and not to be trapped in the quagmire of the enemy. The language of art is the most effective, valuable and elaborated language. "Poems of a poet can be a cop data in the calm country of words." (Razi, 1985) Drawings of a graphic designer, poster, and words of a preacher can make big changes in the society. Iranians thinkers and poets talked about the impressive language of art a lot. Molavi, a great Iranian poet, says "a simple word can destroy the world, and it can create a lion out of the corps of a fox." (Molavi, 1991)

Because of the effectiveness and impressiveness of the works of art, artists are expected to create special and beautiful works of art in order to make essential changes in society in crucial times. Because "creation of beauty is one of the definitions

of art," (Moin, 1992) beauty can make great change in society.

The posters which were created during the Revolution considering the current condition of the society, and lack of suitable facilities and opportunity, were designed beautifully and simply to have the highest effect on common people. In this regard this article tries to answer the following questions: what was the role of Islamic Revolution on the change in the outlook of art? What were the especial symbols of Revolution? What were the common symbols used in revolution? What was the idea of the artists about art before and after the Revolution?

In addition to the physical and materialistic needs of human beings have some other needs such as truth-seeking, worshiping God, sympathy, kindness and tendency to art and beauty. Human beings' tendency toward art and beauty is rooted from his aesthetic beauty-seeking. Art invites human to look for the source of beauty and calm his restless soul. It should be mentioned here that art and religion are very close to each other; both of them are bestowed to human being by God Almighty and the creator of beauty in order to help him know God better. Thus if human being come to this knowledge that whatever he has is from God, he tries not to step in astray and worship false gods, and establish his life in Godly manners. For sure artists understand it better that they should not use their pens and brushes in wrong ways, and use their art to bring human soul, which is Godly, close to God. This way they could at first make the art a cosmic substance and in the next step they made it heavenly. The artists tried to consider this role of art in posters of Islamic Revolution. Inspired by this

notion artists transformed the words of Imam Khomeini which were influenced by Ashoora into works of arts. Graphic designers like other people in society tried hard and put themselves and their lives into trouble in order to gain victory. Most of the posters were spiritual rather than materialistic since they demonstrate the heartbreaking event of Ashoora and Imam Hossein, this idea made Islamic Revolution of Iran different from other revolutions.

#### **Political posters and their symbols**

In addition to their artistic values the posters which were created during Islamic Revolution had social and political messages. There were many symbols that were common in political posters pigeon, rainbow, broken chains, closed fist, blood drop, barbed wire, the crowd, bayonet, flower, gun, cloud, and eagle. Sometimes traditional and Islamic motifs were added to the posters in order to explore the national, cultural and religious identity of people. These motifs were applied either masterfully or amateur. The symbols that were mentioned above were quite familiar and could be found in other nations. In other words, they were not belonged to any especial group or party, on the other hand, there were some symbols which were foreign to Iranian. The reason behind the use of these symbols was rooted from political view of those groups or parties. Star, hand in hand, and V are a few examples of these symbols. The other symbols which were used and mocked in political posters during the Revolution were the flags of some superpowers and symbols of some parties and groups which plotted against Iranian Islamic Revolution. Half-burned flag of the United States, an eagle with an arrow in its hand, sickle and hammer of Soviets Union, six-angled star or Zionist regime of Israel, Kremlin Palace, bear as the symbol of Soviets Union, fox and multi-headed dragon as the symbol of interference of superpowers in Iran.

One of the especial symbols which were used in the posters of artists was tulip which is the symbol of martyrdom and this symbol was not used in other nations. The root of this symbol can be traced in literature, namely poetry of Iran. There is a famous line in poetry saying "the tulips are grown from the blood of martyrs". The reddish sky that can be found in some posters is the symbol of sadness and mourning of the sky for the martyrs. The gray and cloudy sky shows the tyranny of the rulers and the stormy condition of the society. In one of the posters a martyr is pictured with open eyes which show the awareness and insight of the way of the martyrs. Cedar which is an ever green tree and the symbol of life, height and beauty was used as symbol of martyr. Bent tree in some posters is the symbol of curtsy and also the tree's sadness for the loss of martyr.

#### **Classification of political posters of Islamic Revolution based on their subject matter**

Posters during the Islamic Revolution can be classified as follows: Ashoora, Moharram, Mahdaviyat, Islamic Revolution, Imam Khomeini, martyrs, women in Islamic Revolution, holy defense, soldiers, chemical bombing, human rights, crimes of the enemy, Qods, murdering in Hajj, unity. (Gholizadeh, 2001)

#### **Techniques and size of posters of Islamic Revolution**

The most common size for posters in Iran was 50/70 cm and they were created by techniques like photography, collage, using paintings for animation, airbrush, color pencil, and hand machine developing of posters, one of the characteristics of political poster of Islamic Revolution unemphasized role of written text in posters. By looking at posters WWII and other revolutions the major role of written text in posters is quite obvious. Moreover, some of these posters were designed by written materials. On the other hand, in the works of Iranian designers the symbolic use of written text and painting and calligraphy tracts are noticeable. (Gholizadeh, 2001)

There were many professional and amateur designers during the Revolution; the most famous of them were Ahmad Aghagholizadeh, Mohammad Zarabi, Hosseir Khosrojerdy, Seyed Hamid Sharifi Ale Hashem, Habibollah Sadeghi, Abolfazl Aali, Majid Ghaderi, Ali Vazirian Kashi, Korosh, Behzad and Esmail Shishegaran. (Habibolahi)

#### **The role of Islamic Revolution in changing the artistic view**

Regarding the role of Islamic Revolution in changing the artistic view it can be said that before Islamic Revolution, generally speaking, the art was in the hand and service of well-to-do and wealthy class of society, art had been used materialistically and had been used for non-religious purposes and sometimes against it. In short it can be said that art was in the service of sexual and sensual and materialistic pleasure, but Islamic Revolution made a great change in art. Islamic Revolution directed art toward spiritual and high values, Islamic Revolution not only influences the form, but also the content of art works. Because of the political condition before Islamic Revolution, artists were not free to express their ideas. But after Islamic Revolution the suffocating condition collapsed and young artists get the chance to express their feeling and artistic talent without fear, create unique works of art and started a new stage for graphic in Iran. (Godarzi, 2011) Young artists who were among the main stream of Islamic Revolution based on their instinctive motivation wanted to express what they got as truth about Islamic Revolution in their works. They created valuable

works of art truthfully and enthusiastically. (Godarzi, 2011) When the art of Islamic Revolution created from the initiation to the representation honestly, it was highly valuable and could present the meaning of humanity and Islamic Revolution literally. For this reason, in the works of Islamic Revolution they were not just heroes and dignified people that determine the horizons of humanity in essence and existence, but they were individuals and common people that retell the how of their presence to world. It should be mentioned that artists usually think of their creativity as something purposeful, and they are free in their creation of artistic works, but they are not aware of what influence their purposeful creativity or they do not pay attention to it. Although William Butler Yeats considers artists as lonely and dissociable people, he believes that creation of work of art is the result of social interaction of artist. (Haves, 2007) Islamic Revolution of Iran as a great social change made a great change in art, and artists could change the dull and useless art to an active and hot art under the influence of social changes.

It can be said that since most of the artists of this era were young. They were in rush to picture and demonstrate their works to common people and they did not pay attention to the beauty and techniques. This is not just applicable to the Islamic Revolution of Iran, similar facts are found in other revolutions in the world. For example, in analysis of artistic works of French Revolution Prodon said "revolution does not have enough time to introduce itself to artists and painters by aesthetic or induction of thought and idea. The revolution presented itself by the best possible way and used any available tools such as Greek, Latin, classics, and even the Holy Scripture, but since borrowing from languages was based on style, methods and forms sometimes the works of art turned to be rough, cheap and wrong. (Prodon, 1992)

Because the Islamic Revolution of Iran was influenced by religion, honesty and piety, the graphic designers of Islamic Revolution, too, were far from selfishness and proud, they designed their works by honesty, simplicity and what they had in their mind without being involved in artistic details, and this spiritual simplicity created the ultimate beauty which had the highest effect on common people. As what a poet says, what comes truly from the heart penetrates to other hearts.

### Conclusion

Finally it can be concluded that there are good works and plain truth in these posters and they can convince the thoughts, and this is the value of art that could transmit the messages and objectives of this

posters to the thoughts and soul of the audience. All these posters contain religious and spiritual messages and though there might be more beautiful posters but without religious or spiritual messages. Generally Islamic Revolution in any field has its root in heavenly Nabavi thought and instructions. Since religion has the least attention to the worldly prosperity and materials, so most artistic works put the emphasis on afterlife, in Islamic art, art is not just using the color, design, and symbols, but art is rooted from Islamic and religious thought. It should be mentioned that in Islamic art using color, design and symbols have the secondary importance and the main concern is devoted to the content and meaning. In most of the posters Islamic, there are messages of martyrdom, holy Jihad, Imam Hossein's cause, because these posters can be spiritual, religious and political posters, rooted from Islamic thought and beliefs in a Islamic country for Islamic Revolution. It is a fact that the art of a country is rooted from the belief of its nation. In Islamic culture martyrdom is the ultimate beauty, Imam Hossein says "martyrdom is like a beautiful necklace around the neck of a woman. (Godarzi, 2005) The relationship between martyrdom and honor can be grasped from this valuable saying. Islamic artists tried to put this message in their works in order to influence people.

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## Origin and domestication of the goat and history of the Angora goat and the mohair industry

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**Abstract:** Goats are thought to have been among the first species of farm or ranch livestock to have been domesticated. Insofar as can be determined, only the dog predates the goat as an animal to have been tamed and brought into a symbiotic relationship with man. There appears little doubt that Angora goats, as a breed, developed in the region known as Asia Minor. This area lies between the Black Sea and the Mediterranean within which Turkey is located. Specifics of where they originally developed are largely speculation, but it is fairly certain that fiber producing goats have occupied the area of Asia Minor for at least 2,000 years. The first importation of Angoras to South Africa reportedly occurred in 1838. Most countries which have a significant mohair industry have one or more organizations supporting their industry. These may be concerned with maintaining pedigrees or herdbooks or supporting marketing or promotional efforts for both breeding animals and for mohair. For reasons of time and space, this discussion will relate primarily to those organizations which directly impact the Angora goat and mohair industry in the United States.

[Tofiq Froghi, Azad Hosaini. **Origin and domestication of the goat and history of the Angora goat and the mohair industry.** *Life Sci J* 2012;9(3):2615-2618] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 380

**Keywords:** History of Angora; Mohair industry; Goat

### 1. Introduction

Goats are thought to have been among the first species of farm or ranch livestock to have been domesticated. Insofar as can be determined, only the dog predates the goat as an animal to have been tamed and brought into a symbiotic relationship with man. It is unlikely that domestication can be regarded as a single or specific event or that the total population of this or any species traces to a single instance of domestication. Thus, it is probably not logical to insist that domestication of any species totally predates that of another. It is generally conceded that the species; sheep, goats and dogs were among the first to be domesticated. It has been suggested that animals which have some type of social relationship with one another, such as the formation of flocks or herds, are more likely or are more easily domesticated and adapt to a long-term association with man. The terms "taming" and "domestication" are used here somewhat interchangeably, but, in fact, they have quite different meanings according to Squires (1975). Taming would be generally defined as "the elimination of the tendency to flee from man," whereas, domestication often involves morphological, physiological and behavioral changes in the animal as the result of man's control of breeding, feeding and activity patterns. According to this definition, an individual wild animal might be tamed and made into a pet, but domestication would involve a large number of animals over many generations. Thus, it is impossible or inappropriate to be very specific as to the date, but domestication of the goat is thought to have occurred

"at least by the eighth millennium B.C.," or, at least 10,000 years ago perhaps at more than one site in Asia or Africa. The reader should also be reminded of the close chronological relationship of domestication of the three species mentioned earlier to the transition of man from a nomadic hunter to one who actively managed the resources around him. Clearly, the domestication of the sheep and goat played an important role in placing man on the long road to civilization. Over the years, and even to this date, many people have been almost self-sufficient on the products obtained from sheep and goats. Both species produce, or have the capability to produce meat, milk, fiber and skins. At times, they are also kept for other purposes such as sport, beasts of burden or for their manure. Goats belong to the order Artiodaggle, the family Bovidae, and subfamily Caprinae. Other animals comprising this subfamily are the antelope, sheep, chamois, Rocky Mountain goat (not a true goat), musk ox and aoudad. Within the genus *Capra*, to which the goat belongs, there are a number of related wild types. These include the Bezoars or Pesangs (*Capra hircus*), Markhor (*Capra falconer*), Turs (*Capra caucasica*) and Ibex (*Capra pyrenaica*). These are not always easily distinguished from related genera such as *Ovis* (sheep), *Hemitragus* (tahr), *Ammotragus* (Barbary or aoudad) or *Pseudosis*(Bhara1). Within the wild types of *Capra*, the Ibex is most widespread, with a number of subtypes such as the Spanish Ibex, Alpine Ibex, Caucasian Ibex, Siberian Ibex, Nubian Ibex and Abyssinian Ibex. It is not known precisely which wild type contributed to the domestic goat, but the



Bezoars (*Capra aegagrus*) are thought to have been the most important. The domestic goat (*Capra hircus*), especially the Angora, is sometimes referred as *Capra hircus aegagrus*. However, any type could have contributed, as they are all interfertile. True wild types such as the Ibex are most often found at higher elevations and in rough terrain. As a result, most are sure-footed and produce well-developed undercoats, thus contributing to their early exploitation as fiber producers. Most wild types are larger than domestic goats. So-called "wild goats" are found at many places in the world in relatively large numbers, but in general, these are more properly called "feral goats" or domestic goats which have reverted to the wild state. The *Capra* genera apparently did not cross the Bering Strait in prehistoric times, as did wild sheep. As a result, there were no true indigenous wild goats in the Americas. The so-called Rocky Mountain goat is not a goat, but is more closely related to the antelope. Several species of Ibex have been introduced to the U.S. in more recent times and have been intentionally crossed with domestic goats. In general, this crossing has been for reasons of science or novelty or to develop populations of wild types for hunting. Up to the present time, they have apparently not been seriously introduced into commercial types. Most types of Ibex are larger than domestic goats, but they are more difficult to control, late to mature sexually, and are very seasonal in breeding. This would suggest caution in crossing these into domestic goat populations. Since time immemorial, man has attempted to separate the sheep from the goats. This is made more difficult, even for the scientist, when it is realized that there are many species, or subspecies, of each group and that various degrees of hybridization between some of these may occur. Closely related to the efforts to separate the sheep from the goats are the attempts to mix them up again by crossing the two species. In general, these efforts have not been successful, but this statement requires some qualification. Matings between the two species occasionally occur under field conditions, and many specific cross-matings have been made by man. This may be done naturally, by selecting individual males which will mate with a female of the opposite species, or by artificial insemination. When a male goat is mated to a female sheep, conception does not, in general, occur. The apparent explanation is a failure of sperm transport due to immunological antagonism. If a male sheep is mated to a female goat, conception will occur in a large number of cases, but the conception rate of 30-50% is below that of intra-species mating. The normal result of mating a male sheep to a female goat is a hybrid embryo which dies in the 40-50 day range, with some

surviving for a more extended time. Over the long period of history, many alleged viable hybrids have been reported, and in recent years, some have been verified as such by chromosome studies. The inability to successfully cross the two species was initially-attributed to the differences in chromosome number. However, this was not easily reconciled with the early growth of the embryo, followed later by death. As of this writing, an alternative theory is that of an allergic reaction in which the hybrid embryo is rejected by the maternal organism. Unconfirmed reports have suggested that hybrids have been carried to term when they are carried "in utero" with a nonhybrid of the same species as the dam. The above discussion will appear to most as being of academic interest only. However, it is not without at least a minimal practical interest. For instance, if mating between the species did occur under field conditions, normal reproduction could be interfered with. This would more likely be the case where male sheep mate with female goats, where the resulting conception could at least delay normal within-species reproduction possible for a breeding season. The writer is aware of instances in which crossspecies matings have been observed to occur under field conditions. However, the long history and widespread practice of running the two species together would indicate that this is not normally a problem. It is more likely to be a problem where high-libido types of young male sheep are run with young replacement female goats.

## 2. Origin and history of the angora

There appears little doubt that Angora goats, as a breed, developed in the region known as Asia Minor. This area lies between the Black Sea and the Mediterranean within which Turkey is located. Specifics of where they originally developed are largely speculation, but it is fairly certain that fiber producing goats have occupied the area of Asia Minor for at least 2,000 years. In the Bible, it is recorded that Moses directed that articles of goat's hair be brought to the tabernacle. Four separate references are made to articles of goat's hair in these passages. Although fiber-producing goats were originally found over a much wider area, it is accepted that the white fleeced animal we now recognize as the Angora evolved on the Anatolian Plains of Turkey near the city we now know as Ankara and from which the name "Angora" derives. The term "mohair" apparently derives from arabic (*mukhayyar*). In Turkey, it is known as "tiftik," but this term refers specifically to white goat hair, as other colors have different names. The first recorded information about Angoras as a breed, in any detail, became available during the second half of the

nineteenth century. Early books written by Hayes and Schreiner contain details gathered from reports and correspondence obtained from early importers of Angoras. The Angora, in its native or homeland, was a small goat with long ringlets, very white in color and containing little oil in its fleece. These goats were found in the valleys and elevated plateaus around Angora (Ankara). The region is described as extending 80 miles east; 80 miles west, 100 miles south and 150 miles north of Ankara. The earliest Angoras were described as a small, refined, delicate animal of great beauty, clipping from 2 to 4 pounds (according to sex and age; kids considerably less). The fleece consisted of dazzling white, fine, soft, silky, very lustrous mohair, curling in ringlets from 8 to 10 inches long, based on a single annual shearing. The doe was smaller and finer than the male and had only one kid at a birth. Its delicacy was thought to be due mainly to inbreeding. It should be pointed out that the Angora was not the only goat found in this region of Turkey and, no doubt, some mixing occurred from time to time. This point has significance to early attempts to establish a mohair industry in other parts of the world. This may also be a factor in the quality of mohair from Turkey at the present time. Beginning as early as the sixteenth century, Angoras were taken from Turkey to a number of countries, mostly in Europe; attempting to establish a mohair industry in these areas. For a variety of reasons, these attempts were largely failures; leading to the belief that Angoras could not be produced outside the dry and cool plateaus of Turkey. Based on more recent experience, we now know that this is not true as Angora goats are being successfully reared in many European countries, although large-scale industries have not as yet developed in these areas. In general, it should probably be recognized that as the Angora is taken into higher-rainfall and colder areas a higher level of management (particularly in respect to disease and parasite control and shelter or protection) is required. The technology or resources to provide these inputs may have been largely unavailable in the earlier period. Although it was inferred above that the Angora can be produced almost anywhere, major industries became established (outside of Turkey) only in South Africa and the U.S. (largely in areas on or adjacent to the Edwards Plateau of Texas). The uniqueness of these areas and their similarity to the Plains of Turkey warrants further attention.

### 3. Importations to South Africa

The first importation of Angoras to South Africa reportedly occurred in 1838. The one surviving fertile male from this shipment was bred to Boer goats, thus initiating the industry, at least

partially, on a crossbred foundation. However, in the period from 1856 to 1896 it is reported that over 3,000 head were shipped from Turkey to South Africa including shipments as large as 500 and 700 head. Some of these animals made their way to Basutoland (currently known as Lesotho), thus establishing the breed in this area, where it persists to date in numbers approximating one million head. In this century, several exchanges of breeding stock occurred between the U.S. and South Africa. Two shipments, totaling 40 head, went from the U.S. to South Africa in 1961 and 1965.

### 4. Organizations supporting the Angora goat and mohair industry

Most countries which have a significant mohair industry have one or more organizations supporting their industry. These may be concerned with maintaining pedigrees or herdbooks or supporting marketing or promotional efforts for both breeding animals and for mohair. For reasons of time and space, this discussion will relate primarily to those organizations which directly impact the Angora goat and mohair industry in the United States.

#### Acknowledgements:

Authors are grateful to the Islamic Azad University, Maku Branch, Maku, Iran for financial support to carry out this work.

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9/6/2012

## Some nutritional strategies to reduce subacute ruminal acidosis in dairy cattle

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**Abstract:** Acute acidosis is defined as a condition in which the ruminal pH is less than approximately 5 to 5.2, while subacute ruminal acidosis (SARA) is defined as a ruminal pH of approximately 5.2 to 5.6. Lameness and SARA both appear to be very prevalent throughout the world dairy industry. Reduced ruminal efficiency, liver and lung abscesses, and laminitis are all thought to be related to SARA. Both the nutritionist and dairy managers are responsible for the delivery and consumption of a ration that is likely to produce a ruminally healthy pH. Nutritionists should consider the expected amount of physically effective neutral detergent fiber provided by ration ingredients, along with their expected ruminal fermentabilities and resultant microbial acid production. Environmental conditions, such as heat stress, overcrowding, and uncomfortable stalls, which may alter feed intake patterns and animal behavior, should also be considered in ration formulation. Additional amounts of physically effective neutral detergent fiber, and/or a reduction in ruminal nonstructural carbohydrate availability, may be warranted during times of increased animal stress. Higher levels of intake may also predispose the rumen to SARA, since salivary buffer secretion may not adequately compensate for additional acid production. Forage dry matter should be determined twice weekly or more frequently if results vary by more than 5 percent of the dry matter value. [Tofiq Froghi, Azad Hosaini. **Some nutritional strategies to reduce subacute ruminal acidosis in dairy cattle**. *Life Sci J* 2012;9(3):2619-2624] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 380

**Key words:** Ruminal fermentation, Subacute rumen acidosis, Laminitis, Physically effective fiber.

### 1. Introduction

Lameness, the very prevalent disease throughout the dairy industry has been associated with nutrition, specifically with acute and subacute ruminal acidosis (SARA) (Nocek, 1997; Vermunt, 2000). Clarkson et al. (1996) assessed the incidence and prevalence of lameness in 37 dairy herds in the United Kingdom. The mean annual incidence of lameness was 54.6%, while the prevalence was 20.6%. Prevalence rates were higher in the winter (25%) than in the summer (18.6%). Lameness prevalence averaged 15.2% in 17 Minnesota and Wisconsin dairy herds, 2.5 times higher than the rate estimated by herd managers (Wells et al., 1993). Warnick et al. (2001) found the incidence of lameness in 2 New York herds to be 52 and 40% over a one and a half year period. Cook (2002) reported that lameness prevalence averaged 24.8% during the winter and 21.8% during the summer in 30 Wisconsin dairy herds.

Laminitis-related hoof problems (sole ulcer, white line abscess, and solar hemorrhage) are typically one of the leading causes of lameness (Clarkson et al., 1996; Smilie et al., 1996; Warnick et al., 2001). For example, in a study involving 13 Ohio dairy herds, all of the herds and at least 62% of the evaluated cattle had hoof lesions associated with laminitis (Smilie et al., 1996).

Although the exact relationship between SARA and laminitis is not known, one of the theories relates SARA-induced damage to the ruminal epithelium,

allowing for the absorption of histamine and endotoxins. These and possibly other compounds disrupt normal circulation and cause inflammation within the hoof, leading to the condition commonly referred to as laminitis (Vermunt, 1992). Because published data pertaining to the prevalence of SARA, lameness in general, and specific causes of lameness, along with losses caused by each of these disorders, are scant, it is difficult to estimate the cost of these disorders to the dairy industry.

The importance of reducing SARA was demonstrated in a 500-cow dairy diagnosed with SARA by Stone (1999), who replaced high-moisture corn with corn meal. In an apparent response to increased ruminal pH, milk production increased by 2.7 kg/d, and milk fat and protein increased by 0.3 and 0.1 percentage points, respectively. The production and component increases resulted in an increased monthly income of \$20,000 for the dairy, presumably in large part from a reduction in the prevalence of SARA and an increase in rumen microbial growth. The objective of this paper is to discuss the primary nutritional factors that should be considered to minimize the occurrence of SARA and laminitis.

### 2. Acute acidosis vs. SARA

Acute acidosis is defined as a condition in which the ruminal pH is less than approximately 5 to 5.2, while SARA is defined as a ruminal pH of approximately 5.2 to 5.6 (Owens et al., 1996, 1998).

Acute acidosis classically occurs when an animal consumes a large excess of grain. Rumen pH plummets to 5.2 or less as *Streptococcus bovis*, and then the lactic acid-producing bacteria produce large quantities of lactic acid (Nocek, 1997; Owens et al., 1998). Lactate levels have been low in studies involving dairy cattle with SARA (Oetzel et al., 1999; Oba and Allen, 2000a). It appears that ruminal pH in dairy cattle with SARA is usually closer to a pH range of 5.5 to 5.6 than 5.2 (Oetzel et al., 1999; Keunen et al., 2002). *Streptococcus bovis* is generally regarded as the primary lactate producer when ruminal pH is above 5.0. The fermentation products of *Streptococcus bovis* depend on both pH and growth rate. Acetate and ethanol are produced above a pH of 5.7, while lactate levels do not increase markedly until the pH drops below 5.2 (Russell and Allen, 1984). Subacute ruminal acidosis appears to be caused more by an elevation in total VFA as compared with lactate (Britton and Stock, 1989; Oetzel et al., 1999). Lactate accumulation may occur in animals post freshening if the shift in fermentable carbohydrates between the pre and post freshening diets is too dramatic, as has been observed in beef steers abruptly switched from a diet containing 100% hay to one containing 65% hay and 35% concentrate (Fulton et al., 1979).

### 3. Occurrence of SARA

There are probably 4 types of cattle at high risk of developing SARA: transition animals, high DMI animals, and those subject to either a high degree of variability in their ration and meal patterns, or to poorly formulated diets. Transition animals have been considered to be more prone to developing SARA if their rumen bacterial populations and papillae have not been gradually acclimated to a higher starch ration prior to freshening. Rumen papillae significantly increased in size and ability to absorb VFA when animals were switched from a diet mainly of hay and straw (70% NDF, converted from crude fiber according to Mertens, 1992) to a higher energy diet containing a mixture of grass hay and grain 2 wk prior to freshening (Dirksen et al., 1985; Dirksen, 1989). Starch was gradually increased and fiber reduced during the postcalving period. Rumen papillae appeared to reach their maximum length 4 to 5 wk postcalving. In vivo VFA absorption rates performed 14 wk postcalving were substantially greater at this time compared with when cows were fed the hay-straw diet. Andersen et al. (1999) changed the diet fed to dry cows from a grass-silage based diet (approximately 64% NDF, converted from crude fiber according to Mertens, 1992) to one supplemented with a small (ration approximating 55% NDF, 11% nonstructural carbohydrates; NSC)

or large (ration approximating 38% NDF, 38% NSC) amount of barley grain and concentrate at 4 wk precalving. Allowable intakes were relatively low, ranging from 6.5 to 9.4 kg DM during this period. Postcalving, cows in both treatments were offered grass silage ad libitum and 8.8 kg of grain. In contrast to the results seen by Dirksen (1989), increased carbohydrate levels did not result in any macroscopic or histologic differences in rumen papillae between treatments. Eight days postcalving, cows fed the additional grain during the prefresh period had lower DMI and a more rapid decline in ruminal pH following the morning feeding than control cows. The authors concluded that the lack of rumen papillae response may have been because grain levels were not increased enough during the prefreshening period. Another possibility is that the grass silage was more digestible than the hay and straw mixture fed in the Dirksen studies (1985 and 1989), resulting in a more functional ruminal papillae in both treatments. Additionally, the low intakes in the prefresh period (9.4 and 8.2 kg maximum in the control and treatment groups, respectively), coupled with a substantial amount of concentrate (8.8 kg) offered on d 1 postfreshening, may have resulted in rumen acidosis, which could have negatively affected papillae development.

Stone et al. (2003) evaluated papillae size and their ability to absorb valerate in 4 Holstein heifers during the prefresh period and for the first 5 wk of lactation. Substantial variability occurred in papillae size and in ruminal absorption of valerate within individual heifers between consecutive weeks during the first 5 wk postcalving. Much of this variation appeared to be related to postfreshening health disorders. A common recommendation based largely on the papillae results from the Dirksen studies (1985, 1989) is to gradually increase NSC levels over a 5-wk period during the pre- and postcalving time periods. However, cows started these studies with poorly developed papillae, having been fed a 70% NDF diet composed of grass hay and straw. Less time is probably needed to develop papillae when animals are fed rations that contain higher levels of rumen-fermentable carbohydrates during the early part of the dry period. At freshening, slightly more (1 to 3 percentage units) forage NDF and physically effective NDF (**peNDF**) (1 percentage unit) than what is contained in the lactating cow TMR is commonly fed to fresh cows in an attempt to minimize ruminal health disorders (SARA and displaced abomasum). More research is needed to better define the relationships between DMI, carbohydrate amount and ruminal fermentability, ruminal mat formation, and rumen papillae development in transition cows. Fresh animals are

also at an increased risk of developing SARA if component-fed compared with being fed a TMR. Due to the increased rate of consumption, less saliva is produced per unit of feed consumed when grain is fed separately from forages. Additionally, animals fed ingredients separately may consume all of the allotted grain and leave some of the forage (Maekawa et al., 2002). The net result is the consumption of a diet containing less forage than intended, increasing the risk of SARA. Cows rarely ruminate for more than 9 h, with 10 h proposed as the physiologic limit (Welch, 1982). Salivary flow rates are highest during rumination (1.8 times resting rate), followed by eating (0.18 to 0.22 L/min; Cassida and Stokes, 1986; Maekawa et al., 2002), and then resting (0.10 to 0.15 L/min; Cassida and Stokes, 1986; Maekawa et al., 2002). Although the total flow of salivary buffers reaches an apparent maximum, the intake of rumen fermentable carbohydrates, and hence ruminal acid production, increases with increasing DMI (Beauchemin, 1991; Allen, 1997; Oetzel, 2000). Firkins (2002) used regression equations evaluating relationships between DMI, carbohydrate digestibility, and chewing time (Firkins et al., 2001) to predict that an increase in DMI would still result in an increase in ruminal degradable starch, despite a reduction in the percentage of ruminally degraded starch caused by the increase in passage rate. Thus, high-producing cows may be at an increased risk of SARA due simply to higher DMI.

#### 4. The rumen balancing act

The design of a ration, and the manner in which it performs in the rumen, is a balance between physically effective fiber (pef) and its associated salivary flow, and rumen fermentable carbohydrates and the resultant microbial VFA (Allen, 1997). As expected, rumination and total chewing times were greater in the diets containing long haylage (Krause et al., 2002b), while effective ruminal digestibility of diet DM tended to be higher ( $P = 0.08$ ) in the diets containing high-moisture corn (Krause et al., 2002a). Diets containing finer haylage particles and high-moisture corn reduced mean ruminal pH, the minimum daily pH, and both the time and area (time\*amount) below pH 5.8 compared with diets containing coarser haylage and dry ground corn (Krause et al., 2002b). The results from this study indicate that ruminal pH is influenced both by dietary components affecting chewing and salivary buffer secretion, and by those affecting ruminal carbohydrate fermentation, as emphasized by Allen (1997). Environmental conditions, such as overcrowding, stall comfort, heat stress, and feed availability can alter cow behavior, resulting in a shift in this balance and a decrease in rumen pH.

Ruminal pH separates ration components that are more likely to increase ruminal pH (structural carbohydrates) from those that are more likely to decrease pH (NSC). The 2001 Dairy NRC provides ration guidelines for forage NDF, dietary NDF and nonfiber carbohydrates (NFC), and contains an excellent discussion pertaining to formulating healthy rations while using minimal levels of forage. The objective of the following discussion is to expand on these guidelines and to provide a frame work that can be used to formulate diets that minimize the risk of SARA.

#### 5. Structural Carbohydrates

Fiber of adequate particle size promotes chewing and rumination (Welch, 1982); each of these behaviors can act to elevate rumen pH. Dietary NDF level is an important component of ration formulation, both because it is generally associated with forages, and the positive effects they tend to have on rumen pH, and because its level is inversely related to the more fermentable NFC component of the diet. Dietary NDF alone, however, did not have a significant relationship with ruminal pH (Allen, 1997), probably due to variability in ruminal fermentability and particle size across forages and fibrous by-product feeds. The 2001 NRC committee chose to adjust NDF recommendations based on the dietary forage NDF percentage. The committee recommended a minimum of 19% forage NDF, but cautioned that these guidelines were developed primarily from alfalfa-based rations of adequate particle size, fed as a TMR, with dry ground corn as the main energy source. A variety of systems have been proposed to estimate the minimum amount of fiber necessary in rations for lactating dairy cattle. These systems have generally attempted to guide ration formulation by predicting the amount of chewing that various feedstuffs would generate, or their relative effectiveness at maintaining milk fat percentage (Mertens, 2002). A new system, peNDF, attempts to relate the ability of a feedstuff to promote chewing relative to a hypothetical long grass hay containing 100% NDF (Mertens, 1997). The peNDF system is of particular interest in this discussion since it more closely relates to ruminal pH than other proposed fiber systems. Indeed, the peNDF approach explained 71% of the variation in ruminal pH in published trials used to evaluate the system (Mertens, 1997). The peNDF of a feed is the product of its pef and NDF concentration. It was proposed (Mertens, 1997) that the pef of a given feedstuff could be either estimated from tabular values or determined by measuring the proportion of dried sample retained on vertically oscillating screens >1.18 mm. Ideally, the NDF concentration of this retained proportion would

also be determined. The peNDF of a feed would then be determined by either multiplying its tabular pef by the measured NDF level, or by multiplying the percent retained on screens greater than 1.18 mm by the NDF concentration of the sample or of this retained portion. Although peNDF was not correlated with mean ruminal pH, it was negatively correlated with the area (time\*amount) below pH 5.8, implying that there was an increase in ruminal pH and a decrease in ruminal pH fluctuations in the higher peNDF diets. The amount of peNDF was positively correlated with rumination time. The authors concluded that the diet should contain about 22% peNDF to maintain an average ruminal pH of 6.0 when using the wet sieving technique to determine pef values (Beauchemin et al., 2003). Ruminal pH was not accurately predicted by peNDF when pef values were determined on alfalfa haylage-based TMR with the modified PSPS (Kononoff and Heinrichs, 2003). When using the PSPS in a research setting, particular attention should be paid to sample volume (1.5 L), shaking speed (66 cycles/min), and stroke length (17 cm) (Kononoff et al., 2003a). The rate and extent of forage NDF digestibility may influence ration formulation. Oba and Allen (2000a, 2003b) fed lactating cows diets based on corn silage that contained either a brown midrib hybrid or an isogenic control at 2 NDF levels (29 and 38%). The 30 h in vitro NDF digestibility of the brown midrib variety was greater (55.9 vs. 46.5%) than the isogenic control. Despite this, there were no differences in rumination or total chewing time, either per day or per unit of NDF, between the 2 types of corn silage. The authors concluded that enhanced degradability of the corn silage NDF did not reduce its physical effectiveness in promoting chewing. However, the BMR corn silage resulted in a significant increase in the time that ruminal pH was <5.5, although the area below 5.5 did not differ between the 2 types of corn silage ( $P = 0.10$ ) (Oba and Allen, 2000a). Rations should be adjusted to increase peNDF and/or reduce rumen fermentable carbohydrate when feeding forage of increased NDF digestibility to decrease the risk of SARA.

### 6. Nonstructural Carbohydrates

Nonfiber carbohydrate levels are calculated by difference [ $100 - (\%NDF + \%CP + \%fat + \%ash)$ ], while NSC levels are determined enzymatically. The NFC component of a feed contains the starch and sugar of NSC, along with primarily VFA, pectin, and galactans. Nonstructural carbohydrates are usually more digestible than forages. Increasing the NSC proportion of the ration results in higher yields of VFA and microbial protein, and increased milk yields, until decreasing rumen pH

offsets these gains due to reduced ruminal microbial efficiency. Allen (1997) and Kolver and de Veth (2002) demonstrated significant relationships between ruminal VFA concentrations and ruminal pH, emphasizing the effect that the more fermentable NSC component can have on ruminal pH. These studies further indicate that the amount of buffer required in the rumen is not a constant, but instead is related to the amount of acid being produced, along with its absorption and passage rates (Allen, 1997). Ranges for appropriate NFC and NSC levels are quite large (Figure 1), reflecting variability in both the composition and ruminal fermentability of each fraction. Wheat, barley, and oats all ferment more quickly than corn, which is quicker than sorghum (Herrera-Saldana et al., 1990). Reducing grain particle size generally increases ruminal fermentability (Galyean et al., 1981), although passage rate can also increase (Ewing et al., 1986), offsetting some or all of this gain. Ensiling of grain (Nocek, 1987) and steam flaking (Galyean et al., 1976) act to disrupt the crystalline structure of starch and increase its ruminal digestibility. Diets should be balanced toward the higher end of the NFC/NSC range when ruminal starch digestibility is expected to be lower (e.g., coarsely ground corn or sorghum), and toward the lower end when it is expected to be higher [e.g., wet (>30% moisture), fine high-moisture shelled corn, finely ground barley or oats]. By-product feeds such as soyhulls and beet pulp are high in digestible fiber and low in starch and provide an additional option in diluting the level of feeding of high-starch grains.

### Acknowledgements:

Authors are grateful to the Islamic Azad University, Maku Branch, Maku, Iran for financial support to carry out this work.

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9/6/2012

## Effect of dietary protein levels on carcass traits and fleece characteristics of Markhoz goats

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**Abstract:** The effect of dietary varying levels of crude protein on carcass traits and fleece characteristic of Markhoz (Iranian Angora) kid goats was studied. Fifty four male kids were used in a completely randomized design with 3×3 factorial experiment and given different diets for 98 d. The results showed that, the effects of dietary different levels of CP were statistically significant ( $P < 0.05$ ). The higher supply of dietary protein resulted in heavier ( $P < 0.05$ ) slaughter BW, empty BW, hot carcass weight and higher ( $P < 0.03$ ) dressing percentage than lower dietary nutrient concentrations. Increasing dietary protein increased ( $P < 0.05$ ) fiber length and fiber diameter but had little effect on greasy fiber weight, fiber strength and fiber efficiency. In conclusion, it could be said that dietary nutrients concentration has a main role in increasing mohair fiber and particularly meat production by Markhoz kid goats. [Farzad Abdollahzadeh, Rahim Abdulkarimi. **Effect of dietary protein levels on carcass traits and fleece characteristics of Markhoz goats.** *Life Sci J* 2012;9(3):2625-2628] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 381

**Key words:** Mohair fiber, Carcass traits, fleece characteristic.

### 1. Introduction

Markhoz goat (Iranian Angora) is the only single coat goat producing shiny fine fibers in Iran. Markhoz goat population in Iran is estimated at 25000 heads in 1996 (Bahmani et al., 2011). The fleece taken from Markhoz goat is called mohair. Mohair production by Angora goats is an important livestock enterprise in some parts of the world (Luo et al, 2004). The nutritional management of the animal can interfere on the mohair production and a poor quality diet will curtail mohair development. Mohair fiber is pure protein thus, Angora goats has a high protein requirement due to their rapid hair growth compared to other ruminant species. It has been shown that fiber production (wool or mohair) can be increased by as much as 20% through the use of rumen by-pass proteins. The kind or quality of protein consumed by ruminants, including the Angora goat, is not considered to be particularly important. Production efficiency would potentially be improved if a significant proportion of these feed proteins could get through the rumen without being degraded. This would be especially true with respect to mohair production if the protein feeds used were made up of high quality protein, rich in limiting amino acids such as methionine. Some protein concentrates (fishmeal, blood meal, meat meal or feather meal) are poorly or slowly digestible and thus have some rumen escape properties. Fishmeal not only has escape value, but is also high in the sulfur containing amino acids and has been shown to be useful to increase fiber production. Because nutritional variation and especially quality of dietary protein is the most important

environmental factor influencing mohair growth and carcass components of Angora goat (Galbraith, 2000) this experiment have been undertaken to assess the effects feeding different levels of By-pass protein (Fishmeal) on fleece characteristics and diet digestibility of Angora male kid goats.

### 2. Material and Methods

#### 2.1. Animals and management

The current experiment was carried out at the Saqqez Animal Breeding Research Institute, during 2008 to 2009. twenty four male Markhoz goat kids aged 4 months, and weighing  $19.10 \pm 3$ kg BW were selected for the feeding trial during 98 days (adaptation: 14 d and experimental period: 84 d). The animals were then allotted randomly to four treatments. At the beginning of the experiment, all goats were treated with an effective anathematic and vaccinated against enterotoxaemia. The kids were housed in individual metal-mesh cages (1.5m×1.0 m) and given ad libitum access to standard completely mixed diets (Table 1) throughout the study. The animals also, had free access to drinking water, limestone and salt at all times. Animal pens were cleaned weekly and the kids weighed monthly on two consecutive days (before morning feeding) for monitoring body weight gain. All animals taken into this study received equal management and the kids maintained good health throughout the study.

#### 2.2. Feeds and experimental diets

Four diets contained different levels of CP (8, 10 and 12 percent) were fed to experimental animals for 12 weeks. The diets were prepared according to the NRC, (1981) guidelines and offered

as total mixed rations twice daily, at 7:00 and 16:00 h, to ensure 10% refusal each day (as-fed basis). Ingredients and chemical compositions of the diets are presented in Table 1. Cottonseed meal and barley grain were used in diet as protein and energy supplements respectively.

**Table 1.** Experimental diets differing in CP ratio fed in male goat kids

item	Feeding treatments (diets)			
	1 control	2 10% cp	3 12% cp	4 14% cp
Alfalfa hay	40	36	34	26.5
Wheat straw	20	30.5	21	35
Barley grain	27.5	26	34	23
Cottonseed meal	11.2	6	9.5	14
Limestone	0.8	1	1	1
Salt	0.5	0.5	0.5	0.5
<b>Chemical compositions:</b>				
CP (%DM)	15	10	12	14
NDF(%DM)	52.6	53.3	43.8	45.5
ADF(%DM)	26	24.6	22	20.4
Ash (%DM)	8.1	9.4	9.2	8.7

\* CP, crude protein; NDF, neutral detergent fiber; ADF, acid detergent fiber.

### 2.3. Data collection and laboratory analyses

Daily feed intake was monitored on individual goats and any refusals were taken into account, weighed and sub sampled for later analysis. The diet and refusal sub samples were ground through a 1.0 mm screen then analyzed for DM (using oven drying at 100 °C), CP ( $N \times 6.251$ ), and ash (combustion at 550°C for 6 h) according to standard procedures (AOAC, 1990). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) was determined as described by Van Soest et al., (1991). At the end of the experimental period goats were shorn and greasy fleece weight was determined just after shearing. A fleece sample (10-cm × 10-cm areas) from the mid side was meticulously sheared and bagged separately in moisture proof- plastic bags and taken to the Wool Laboratory for length (Hauteur and Barbe length items) and diameter analysis. The sub samples were prepared for measurement with the projection microscope technique in accordance with ASTM, (1988) short – section procedure to determine fiber diameter, as well as paralleled in fibro liner component of Almeter 100 (Peyer Texlab FDA 200 Siegfried Peyer Ltd. Ch- 8832 Wollerau – Switzerland), to determine the Simi rigid Hauteur and Barbe length. The staple strength of sub sampled fleece was determined using an Agritest Staple Breaker System (Agritest Pty,

Sydney, Australia) as the maximum load (Newtons) needed to break a staple.

### 2.4. Carcass characteristics

At the end of the feeding trial (14d adaptation and 84d experimental period), half of the animals (3 kids/each treatment) were withheld for water and feed after an overnight period and slaughtered (according to Farid, 1989 procedure) the next morning after weighing. The abdominal fat was removed and measured then warm carcass weighed immediately after dressing and removal of the offal parts. Over and above, subcutaneous fat thickness was measured by caliper. The carcasses were split sagittally, weighed and taken for cooling in a cold storage chamber (from 2 to 4°C) for 24 hours. The left sides were quartered between the 12th and 13th ribs. At first subcutaneous fat and bone were physically separated from each quarter and the residual (e.g. lean and intramuscular fat) analyzed for moisture, crude protein, ether extract and ash according to AOAC, (1990) method.

### 2.5. Experimental design and statistical analysis

54 male kids (aged 4 months,  $18.19 \pm 3$  kg BW) in completely randomized design with a  $3 \times 3$  factorial arrangement were used to evaluate the effects of feeding diets containing different levels of CP and ME. The kids were assigned randomly to each of the nine treatments ( $n= 6$  kids per each treatment) and fed with experimental diets for 98 d. The collected data were subjected to statistical analysis using the PROC GLM procedure of SAS, (2001) (SAS Inst. Inc., Cary, NC). Level of significance was  $\alpha=0.05$ , and the Duncan test was used to compare differences between treatments. The model used for this analysis was:

$$\hat{Y}_{ijk} = \mu + E_i + P_j + E_j \times P_k + \sum e_{ijk}$$

Where Y is the dependent variable;  $\mu$  is the overall mean; E is the effect of energy level ( $i= 2.1, 2.3$  and  $2.5$  Mcal ME /kg DM); P is the effect of protein level ( $j= 8, 10$  and  $12$  percent of CP);  $E_j \times P_k$  is the interaction effect of energy and protein and  $\sum$  is the random residual error term.

## 3. Results and Discussion

### 3.1. Fleece characteristics

Influence of diets differing in ratio of CP on mohair fiber characteristics are shown in Table 2. As a result, fiber diameter and fiber length (Hauteur and Barbe length) was affected significantly ( $P<0.05$ ) by dietary nutrient concentration but, differences between treatments for greasy fleece weight, strength fiber and fiber efficiency (e.i. kg fiber/kg live body weight) was not significant. In the mohair

production industry, mean fiber diameter is one of the main criteria used in determining the price of mohair (Taddeo et al., 1998). Table 2 showed that, fiber diameter in diets contained highest and lowest level of CP varied as 26 versus 24 respectively and diet 1

(control) had lower fiber diameter than other treatments. In general, present results are in agreement with those observed in similar experiments.

**Table 2.** Effects of diets differing in CP ratio on fleece characteristics in male goat kids

items	Feeding treatments (diets)				SEM	P value
	1 control	2 10% cp	3 12% cp	4 14% cp		
Greasy fleece(g)	453	493	450	469	0.30	0.64
Fiber diameter ( $\mu\text{m}$ )	24 <sup>b</sup>	24.2 <sup>ab</sup>	25 <sup>ab</sup>	26 <sup>a</sup>	0.16	0.02
H length (mm)	31.5 <sup>b</sup>	29.5 <sup>a</sup>	34 <sup>a</sup>	29	0.46	0.01
B length (mm)	46.5 <sup>a</sup>	49.7 <sup>a</sup>	55 <sup>a</sup>	48.1	0.13	0.02
Fiber strength	8.1	8.0	8.	7.16	0.44	0.28
Fiber efficiency	28.4	27.8	25.5	28	0.38	0.08

SEM, Standard error of the mean.

Means in a row with a different letters (a, b, c) differ ( $P < 0.05$ ).

Both the rate of fiber growth and fiber diameter were increased when the dietary energy (Huston, 1980; Calhoun et al., 1988) or protein (Stewart et al., 1971; Deaville and Galbraith, 1992; Shahjalal et al., 1992; Hart et al., 1993; Sahlu et al., 1993) Angora goats was increased.

### 3.2. Carcass traits

Effects of dietary treatments on some carcass traits are listed in Table 3. Analysis of these data showed significant differences for empty (digesta-free) BW, hot carcass, dressing percentage and carcass length among treatments. Table 3 also showed the mean values for some chemical

compositions (dry matter and crude protein) of animal carcasses which was affected significantly ( $p < 0.05$ ) by feeding treatments. The higher supply of dietary protein resulted in heavier slaughter BW ( $P < 0.02$ ), empty BW ( $P < 0.04$ ), hot carcass weight ( $P < 0.03$ ) and higher dressing percentage ( $P < 0.03$ ) than lower dietary nutrients concentration. In addition, the animals fed diets containing highest protein level presented greater carcass chemical components compared to lowest level. These data confirm earlier report (e.g. Shahjalal et al., 1992) which suggested that some carcass characteristics improved by dietary protein supplementation.

**Table 3.** Carcass characteristics and carcass compositions of Angora male kids given diets differing in ratio CP

items	Feeding treatments (diets)				SEM	P value
	1 control	2 10% cp	3 12% cp	4 14% cp		
Slaughter weight, (kg)	22.4 <sup>c</sup>	26.2 <sup>ab</sup>	25.9 <sup>ab</sup>	27.4 <sup>a</sup>	0.42	0.02
Empty BW, (kg)	18.3 <sup>b</sup>	20.9 <sup>ab</sup>	22.8 <sup>ab</sup>	24.6 <sup>a</sup>	0.66	0.04
Hot carcass, (kg)	8.5 <sup>b</sup>	10.1 <sup>ab</sup>	10.8 <sup>ab</sup>	11.4 <sup>a</sup>	0.52	0.03
Dressing percentage	39.1 <sup>b</sup>	41.7 <sup>ab</sup>	42.8 <sup>ab</sup>	44.2 <sup>a</sup>	0.34	0.03
Carcass length, cm	49.3 <sup>b</sup>	47.8 <sup>ab</sup>	51.3 <sup>ab</sup>	52.2 <sup>a</sup>	0.38	0.01
<b>Chemical compositions of carcass components:</b>						
Dry matter %	47.2 <sup>a</sup>	42.6 <sup>b</sup>	43.6 <sup>b</sup>	46.2 <sup>ab</sup>	0.45	<0.01
Crude protein, %DM	32.7 <sup>b</sup>	33.7 <sup>b</sup>	36.8 <sup>ab</sup>	38.7 <sup>a</sup>	0.39	<0.01
Fat, %DM	31.8	31.6	30.3	36.9	0.35	<0.06
Ash, %DM	8.4	8.6	9.2	9.4	0.65	<0.07

SEM, Standard error of the mean.

Means in a row with a different letters (a, b, c) differ ( $P < 0.05$ ).

**Acknowledgements:**

Authors are grateful to the Islamic Azad University, Maku Branch, Maku, Iran for financial support to carry out this work.

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Volume 9, Number 3, (Cumulative No.30) Part 17 September 25, 2012 ISSN:1097-8135

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