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Total stress tensors and heat fluxes of single flow through a porous viscoelastic medium

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Abstract: Using the second law of thermodynamics, we examine the macroscopic equations for mass, momentum, energy and entropy for a biphasic system whose interface has thermodynamic properties. This system is made up of a mesoscopic particle and a fluid, including mass exchange and different phase temperatures. By exploiting the entropy inequality in terms of Coleman and Noll's method we obtain nonequilibrium and equilibrium results. We show how the solid phase stress tensor depends on the solid phase pressure, the Terzaghi stress, the hydration stress and the stress contributed by the interface properties, which is similar to the Terzaghi stress. We determine the heat fluxes. We further linearize the non-equilibrium parts of their constitutive forms in terms of heat conduction, fluid viscosity and viscoelasticity about the equilibrium. Finally we obtain expressions of the total stress and the total heat flux for a particle.
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1 Introduction

The description of physical processes which occur in multi-phase systems has been a topic of practical as well as theoretical interest for many years in subsurface hydrology, waste containment, enhanced recovery of petroleum, aquifer remediation, agriculture and seismic phenomena in geological formation. Porous materials consisting of a swelling solid matrix with fluid-filled pores are ubiquitous. Some examples are food stuffs, drugs, cartilage, plant seeds, carbohydrates, proteins, clay soils and biotissue (see Singh (2002), Singh et al. (2003), (2004) and Weinstein (2006)). Swelling clays, especially Montmorillonites, play a prominent role in several natural and industrial domains, such as soil science, hydrogeology and catalysis, engineering barrier systems for nuclear waste repository and municipal waste disposals sites.

During the past few decades, significant progress has been made in developing general theories describing thermodynamic processes in general multi-phase systems and in porous media (see Bennethum and Cushman (1996b), Gray and Hassanizadeh (1998) and Gray (2002)). Examples of these, are the swelling (see Almeida and Spilker (1998), Bennethum and Cushman (1996a)) and non-swelling systems (see Hassanizadeh and Gray (1980), (1990), Hassanizadeh (1987 a, b)).

The framework which we use is the hybrid mixture theory (HMT). This HMT consists of averaging the microscopic field equations (conservation of mass, conservation of momentum, conservation of energy and balance of entropy) for each phase in order to obtain macroscopic field equation. At this point the medium is viewed as mixture of phases, that is, each phase has defined properties (densities, stress, etc.) at every point in space and time. The HMT approach was pioneered by Hassanizadeh and Gray in a series of papers (1979a, b), (1980), (1990) and (1993). From 1979 to the present, HMT has been successfully used to model swelling and shrinking behaviour of gels, food stuffs, and collodial systems where phase interactions play an important role in the mesoscopic and macroscopic behaviour (see Bennethum and Cushman (1996) and Bennethum (2007)). In Singh (2002), Singh et al. (2003), Singh et al. (2004a, b), Weinstein (2006) and Weinstein and Bennethum (2006) models were developed in which the solid itself was assumed to be viscoelastic but the interface was assumed as not having thermodynamic properties.

The purpose of this research is to develop a constitutive theory, for the total Cauchy stress tensor and the total heat flux in a system under the following assumptions:
  • the system is biphasic, has mass exchange and different temperature.
  • the solid matrix is viscoelastic and the fluid is viscous.
  • the interface has full thermodynamic properties

2 Macroscale equations
Conservation of mass

We consider a viscoelastic solid matrix s, a viscous fluid f, an interface sf which has thermodynamic properties and a system which has mass exchange . The macroscopic balanced equations on which this project is based result from an

averaging process of the mesoscale equations of mass, momentum, energy and entropy, on a representative elementary volume, for each phase and the interface. Details of this averaging process are not included here, but can be obtained from several works of Gray and Hassanizadeh (1989), Hassanizadeh and Gray (1979) and other authors. From Gray and Hassanizadeh (1998), we recall the following macroscale balance equations for both the bulk phases and the interfaces.

The bulk phase equations

$$\frac{D^{\alpha}(\varepsilon_{\alpha}\rho^{\alpha})}{Dt} + \varepsilon_{\alpha}\rho^{\alpha}(\nabla \cdot v^{\alpha}) =$$
$$\hat{e}^{\alpha}_{sf}, \quad \alpha = f, s, \tag{1}$$

where ε_{α} is the volume fraction of the α-phase, ρ^{α} is the intrinsic mass density, v^{α} is the velocity of the α-phase and $\hat{e}^{\alpha}_{sf}$ is the exchange of mass from the only sf-interface to the α-phase. Furthermore, we observe that the two volume fractions satisfy the identity $\varepsilon_{s} + \varepsilon_{f} = 1$.

The interface equation

$$\frac{D^{fs}(\varepsilon_{fs}\rho^{fs})}{Dt} + \varepsilon_{fs}\rho^{fs}(\nabla \cdot v^{fs}) =$$
$$-\hat{e}^{s}_{fs} - \hat{e}^{f}_{fs}, \tag{2}$$

where ε_{sf} is the specific interfacial area of the sf-interface, ρ^{sf} is the mass per unit area of the sf-interface and v^{sf} is the velocity of the sf-interface.

Conservation of linear momentum
The bulk phase equations

$$\varepsilon_{\alpha}\rho^{\alpha}\frac{D^{\alpha}v^{\alpha}}{Dt} - \nabla \cdot (\varepsilon_{\alpha}t^{\alpha}) - \varepsilon_{\alpha}\rho^{\alpha}g^{\alpha} =$$
$$T^{\alpha}_{sf} \quad \alpha = f, s. \tag{3}$$

Here t^{α} is the α-phase Cauchy stress tensor, g^{α} is the α-phase external supply of momentum and T^{α}_{sf} is the exchange of momentum from the interface to the α-phase.

The interface equation

$$\varepsilon_{fs}\rho^{fs}\frac{D^{fs}v^{fs}}{Dt} - \nabla \cdot (\varepsilon_{fs}t^{fs}) - \varepsilon_{fs}\rho^{fs}g^{fs} =$$
$$-\sum_{\alpha=s,f}(T^{\alpha}_{sf} + \hat{e}^{\alpha}_{sf}v^{\alpha,sf}), \tag{4}$$

where t^{sf} is the interface stress tensor, g^{sf} is the interface external supply of momentum, the product $\hat{e}^{\alpha}_{sf}v^{\alpha,sf}$ is the exchange of momentum between the α-phase and the interface due to the exchange of mass and $v^{\alpha,sf} = v^{\alpha} - v^{sf}$ is velocity of the α-phase relative to that of the interface.

Angular Momentum

Due to the nonpolarity assumption which we adopt in this study, we have the following symmetric stress tensors.

For the *bulk phase*, we have
$$t^{\alpha} = (t^{\alpha})^{T} \tag{5}$$

and for the *interface*, we have
$$t^{\alpha\beta} = (t^{\alpha\beta})^{T}. \tag{6}$$

where the superscript T, refers to the transpose.

Conservation of energy
The bulk phase equations

$$\varepsilon_{\alpha}\rho^{\alpha}\frac{D^{\alpha}E^{\alpha}}{Dt} - \varepsilon_{\alpha}t^{\alpha} : \nabla v^{\alpha} - \nabla \cdot (\varepsilon_{\alpha}q^{\alpha})$$
$$-\varepsilon_{\alpha}\rho^{\alpha}h^{\alpha} = \hat{Q}^{\alpha}_{sf}, \tag{7}$$

where E^{α} is the α-phase macroscopic internal energy density function, q^{α} is the α-phase heat flux, h^{α} is the α-phase external supply of energy and $\hat{Q}^{\alpha}_{sf}$ is the exchange of internal energy between the α-phase and the interface due to mechanical interactions.

The interface equation

$$\varepsilon_{fs}\rho^{fs}\frac{D^{fs}E^{fs}}{Dt} - \varepsilon_{fs}t^{fs} : \nabla v^{fs}$$
$$-\nabla \cdot (\varepsilon_{fs}q^{fs}) - \varepsilon_{fs}\rho^{fs}h^{fs}$$
$$= -\sum_{\alpha=s,f}\left[\hat{Q}^{\alpha}_{sf} + \right.$$

$$\left. T^{\alpha}_{sf} \cdot v^{\alpha,sf} + \hat{e}^{\alpha}_{sf}(E^{\alpha,sf} + \frac{1}{2}(v^{\alpha,sf})^{2})\right] \tag{8}$$

where the product $\hat{e}_{sf}^{\alpha}(E^{\alpha,sf} + \frac{1}{2}(v^{\alpha,sf})^2)$ is the exchange of energy between the α-phase and the interface due to exchange of mass, q^{sf} is the interface heat flux and h^{sf} is the interface external supply of energy. Note that $E^{\alpha,sf} = E^{\alpha} - E^{sf}$ is the internal energy of α-phase relative to that of the interface.

Balance of entropy
The bulk phase equations

$$\varepsilon_{\alpha}\rho^{\alpha}\frac{D^{\alpha}\eta^{\alpha}}{Dt} - \nabla\cdot\left(\varepsilon_{\alpha}\frac{q^{\alpha}}{\theta^{\alpha}}\right) - \varepsilon_{\alpha}\rho^{\alpha}\left(\frac{h^{\alpha}}{\theta^{\alpha}}\right)$$
$$= \hat{\Phi}_{sf}^{\alpha} + \Lambda^{\alpha}, \quad \alpha = f,s, \quad (9)$$

where η^{α} is the α-phase internal entropy density function, φ^{α} is the α-phase entropy flux, $\hat{\Phi}_{sf}^{\alpha}$ is the exchange of entropy between the α-phase and the interface due to the mechanical interactions and Λ^{α} is the α-phase net production of entropy.

The interface equation

$$\varepsilon_{fs}\rho^{fs}\frac{D^{fs}\eta^{fs}}{Dt} - \nabla\cdot\left(\varepsilon_{fs}\frac{q^{sf}}{\theta^{sf}}\right)$$
$$-\varepsilon_{fs}\rho^{fs}\left(\frac{h^{sf}}{\theta^{sf}}\right) = -\sum_{\alpha=s,f}(\hat{\Phi}_{fs}^{\alpha} + \hat{e}_{fs}^{\alpha}\eta^{s,sf})$$
$$+ \Lambda^{sf}, \quad (10)$$

where η^{sf} is the interface internal entropy density function, φ^{sf} is the interface entropy flux, the product $\hat{e}_{fs}^{\alpha}\eta^{s,sf}$ is the exchange of entropy between the α-phase and the interface due to exchange of mass, $\eta^{s,sf} = \eta^{s} - \eta^{sf}$ is the entropy of the solid phase relative to that of the interface and Λ^{sf} is the interface net production of entropy.

3 Kinematics and the second law of thermodynamics

Let $X = (X_1, X_2, X_3)$ be the Lagrangian coordinates of a typical particle at time $t = 0$ and let this particle be carried to a point with Eulerian coordinates $x^s = (x_1, x_2, x_3)$ at time t. This motion is defined by the function

$$x_k = F_k^s(X_K, t), \quad k = 1,2,3 \quad and \quad K = 1,2,3.$$

We assume that $x^s = x(X,t)$ possesses continuous partial derivative with respect to their arguments to whatever order needed. Let F^s denote the deformation gradient; i.e

$$F_{kK}^s = \frac{\partial x_k}{\partial X_K} \quad or \quad F^s = GRAD(x^s)$$

where $GRAD$ is the gradient with respect to Lagrangian coordinates. The Jacobian is given by

$$J^s = \det(F^s).$$

Since the motion is invertible, then the Jacobian $J^s \neq 0$. We also have the following expression for the Jacobian, Hassanizadeh and Gray (1980) and Gray (1983)

$$J^s = \frac{(\varepsilon_s\rho^s)_0}{(\varepsilon_s\rho^s)}. \quad (11)$$

The factor $(\varepsilon_s\rho^s)_0$ in equation (11), is independent of time and space. Using this equation and the continuity equation (1) for the solid phase, we obtain (see Gray (1983))

$$\frac{1}{J^s}\frac{D^sJ^s}{Dt} = I:\left[d^s - \frac{\hat{e}_{sf}^s}{3\varepsilon_s\rho^s}I\right], \quad (12)$$

where $d^{\alpha} = \frac{1}{2}(\nabla v^{\alpha} + (\nabla v^{\alpha})^T) \quad \alpha = s,f$

is the α-phase rate of deformation tensor. From Eringen (1980) and Holtzapfel (2000), we have this identity relating the material derivative of the Jacobian and the deformation tensor

$$\frac{\partial J^s}{\partial F^s} = J^s(F^s)^{-1}.$$

By using the chain rule, we have the following material time derivative of the Jacobian

$$\frac{D^sJ^s}{Dt} = \frac{\partial J^s}{\partial F^s}:\frac{D^sF^s}{Dt} = J^s(F^s)^{-1}:\frac{D^sF^s}{Dt}. \quad (13)$$

Substitution of equation (13) into (12), yields

$$\frac{D^sF^s}{Dt} = \frac{F^s}{J^s}\frac{D^sJ^s}{Dt}$$

$$= F^s : \left[d^s - \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I \right] \tag{14}$$

The transpose of (14) is

$$\left(\frac{D^s F^s}{Dt} \right)^T = \left[d^s - \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I \right] \cdot (F^s)^T \tag{15}$$

Since the Lagrangian strain tensor is defined by

$$E^s = \frac{1}{2}[(F^s)^T \cdot F^s - I],$$

then its time derivative is

$$\frac{D^s E^s}{Dt} = \frac{1}{2}\left[\frac{D^s (F^s)^T}{Dt} \cdot F^s + (F^s)^T \cdot \frac{D^s F^s}{Dt} \right]$$

$$= \frac{1}{2}\left[\left(\frac{D^s F^s}{Dt} \right)^T \cdot F^s + (F^s)^T \cdot \frac{D^s F^s}{Dt} \right] . \tag{16}$$

Furthermore, equations (14), (15) and (16) yield this time derivative of the strain tensor

$$\frac{D^s E^s}{Dt} = (F^s)^T \cdot \left(d^s - \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I \right) \cdot F^s$$

or the rate of deformation tensor is (see Weinstein (2006))

$$d^s = (F^s)^{-T} \cdot E^s \cdot (F^s)^{-1} + \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I \tag{17}$$

We define the right Cauchy-Green tensor as

$$C^s = (F^s)^T \cdot F^s$$

and hence the strain tensor is

$$E^s = \frac{1}{2}(C^s - I).$$

Following Holzapfel (2000), we now consider a multiplicative decomposition of the deformation tensor F^s and C^s as follows:

$$F^s = (J^s)^{1/3} \overline{F}^s$$

and

$$C^s = (J^s)^{2/3} \overline{C}^s,$$

where $(J^s)^{1/3} I$ and $(J^s)^{2/3} I$ represent the volumetric deformation, and $\overline{F}^s$ and $\overline{C}^s$ are the modified deformation gradient and the modified right Cauchy-Green tensor respectively. These two modified tensors account for distortional deformation

and are related by

$$\overline{C}^s = (\overline{F}^s)^T \cdot \overline{F}^s.$$

The equation (17) is now expressed in terms of the modified deformation gradient, the modified Cauchy-Green tensor and the Jacobian as follows:

$$d^s = (F^s)^{-T} \cdot E^s \cdot (F^s)^{-1} + \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I$$

$$= \frac{1}{2}(F^s)^{-T} \cdot C^s \cdot (F^s)^{-1} + \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I$$

$$= \frac{1}{3}(J^s)^{-1} \dot{J}^s I + \frac{1}{2}(\overline{F}^s)^{-T} \cdot \overline{C}^s \cdot (\overline{F}^s)^{-1}$$

$$+ \frac{\hat{e}_{sf}^s}{3\varepsilon_s \rho^s} I. \tag{18}$$

The inner product of d^s with I, yields

$$I : d^s = \frac{\dot{J}^s}{J^s} + \frac{1}{2}((\overline{F}^s)^{-1} \cdot (\overline{F}^s)^{-T}) : \overline{C}^s$$

$$+ \frac{\hat{e}_{sf}^s}{\varepsilon_s \rho^s}. \tag{19}$$

Weinstein (2006), has a similar identity without the last term.

Second law of thermodynamics

The conservation laws are supplemented with the second law of thermodynamics which states that, the rate of net production of entropy of a system must be non-negative. Using the macroscopic equations of the phases and the interface, we then develop the entropy inequalities to express this law. We start with the old entropy inequality which is expressed as follows:

$$\Lambda_{old} = -\sum_{\alpha=s,f} \frac{\varepsilon_\alpha \rho^\alpha}{\theta^\alpha} \left(\frac{D^\alpha A^\alpha}{Dt} + \eta^\alpha \frac{D^\alpha \theta^\alpha}{Dt} \right)$$

$$+ \sum_{\alpha=s,f} \frac{\varepsilon_\alpha t^\alpha}{\theta^\alpha} : d^\alpha + \sum_{\alpha=s,f} \frac{\varepsilon_\alpha q^\alpha}{(\theta^\alpha)^2} \cdot \nabla \theta^\alpha$$

$$- \frac{\varepsilon_{sf} \rho^{sf}}{\theta^{sf}} \left(\frac{D^{sf} A^{sf}}{Dt} + \eta^{sf} \frac{D^{sf} \theta^{sf}}{Dt} \right)$$

$$+ \frac{\varepsilon_{sf} t^{sf}}{\theta^{sf}} : d^{sf} + \frac{\varepsilon_{sf} q^{sf}}{(\theta^{sf})^2} \cdot \nabla \theta^{sf}$$

$$- \frac{1}{\theta^{sf}} \sum_{\alpha = s, f} \left\{ \frac{\hat{Q}_{sf}^{\alpha} \theta^{sf, \alpha}}{\theta^{\alpha}} + [T_{sf}^{\alpha} v^{\alpha, sf} \right.$$

$$\left. + \hat{e}_{sf}^{\alpha} \left(A^{\alpha, sf} - \eta^{\alpha} \theta^{sf, \alpha} + \frac{1}{2} (v^{\alpha, sf})^2 \right) \right] \right\}$$

$$\geq 0. \qquad (20)$$

where A^{α} and A^{sf} are the Helmholtz free energies of the α-phase and the sf-interface respectively and are defined as follows:

$$A^{\alpha} = E^{\alpha} - \eta^{\alpha} \theta^{\alpha} \quad \alpha = s, f$$
$$A^{sf} = E^{sf} - \eta^{sf} \theta^{sf}.$$

4 Choice of variables

Since we have more variables than the number of equations and our system has particular assumptions, we need to choose independent and dependent variables. The independent variables will have to capture our assumptions.

Independent variables

We assume the following indenedent variables: ε_f, $\nabla \varepsilon_f$, $\dot{\varepsilon}_f$, $\overset{(m)}{\varepsilon}_f$, $\nabla \overset{(m)}{\varepsilon}_f$, θ^s, θ^f, θ^{sf}, ε_{sf}, ρ^f, ρ^{sf}, d^f, d^{sf}, $v^{f,s}$, $v^{sf,s}$, J^s, $\overline{C}^s$, C^s, $\overset{(n)}{C}^s$, for $m = 1, ..., p$ and $n = 1, ..., q$.

where ε_f is the porosity which accounts for local volume changes; $\nabla \varepsilon_f$, the porosity gradient accounts for buoyancy effects; ε_{sf} is the amount of sf-interface per unit volume; $\overset{(m)}{\varepsilon}_f$ is the m-th order material derivatives of ε_f in the direction of the solid phase velocity. These derivatives from orders 1 to p, i.e. $(m = 1, ..., p)$, capture the viscoelasticity of the solid (see Weinstein (2006)). The higher order gradients of porosity $\nabla \overset{(m)}{\varepsilon}_f$, account for flow due to moisture content. ε_{sf} is the areal density or specific surface of the sf-interface.

The temperature gradients, $\nabla \theta^s$, $\nabla \theta^f$ and $\nabla \theta^{sf}$ account for the conduction of thermal energy at intermediate rates of heat transfer. The inclusion of fluid density gives rise to pressure, p^f; ρ^{sf} is the surface excess mass density of sf-interface. The rate of deformation tensor d^f, incorporates the viscous nature of the fluid. The relative velocities are $v^{f,s}$, the velocity of the fluid phase relative to that of solid phase and $v^{sf,s}$, velocity of the interface relative to that of solid. The Jacobian J^s, captures the volumetric changes of the solid phase. The modified right Cauchy-Green tensor, $\overline{C}^s$, incorporates changes due to shear and the n-th time rates of change of the modified Cauchy-Green tensor $\overset{(n)}{C}^s$, $n = 1, ..., q$ accounts for the viscoelastic nature of the material (2006).

Dependent variables

The following variables A^s, A^f, A^{sf}, t^s, t^f, t^{sf}, q^s, q^f, q^{sf}, η^s, η^f, η^{sf}, $\hat{e}_{sf}^s$, $\hat{e}_{sf}^f$, T_{sf}^s, T_{sf}^f $\hat{Q}_{sf}^s$, $\hat{Q}_{sf}^f$, are not directly measurable but are determined as functions of directly measurable (independent) variables, where A^s, A^f, A^{sf} are the Helmholtz free energies, t^s, t^f, t^{sf} are the Cauchy stress tensors, q^s, q^f, q^{sf} are heat vectors, η^s, η^f, η^{sf} are entropy densities, $\hat{e}_{sf}^s$, $\hat{e}_{sf}^f$ are the mass exchange terms, T_{sf}^s, T_{sf}^f are the momentum exchange terms, $\hat{Q}_{sf}^s$, $\hat{Q}_{sf}^f$ are the internal energy exchange terms.

Postulate

As a departure from the principle of equipresence, we hypothesize that the Helmholtz free energies A^s, A^f and A^{sf} of the solid phase, fluid phase and interface respectively, have the following independent variables (see Weinstein (2006)):

$$A^s = A^s(\varepsilon_f, \overset{(m)}{\varepsilon}_f, \theta^s, J^s, C^s, \overset{(n)}{C}^s) \qquad (21)$$

$$A^f = A^f(\varepsilon_f, \overset{(m)}{\varepsilon}_f, \theta^f, \rho^f, d^f, C^s, \overset{(n)}{C^s}) \quad (22)$$

$$A^{sf} = A^{sf}(\varepsilon_f, \overset{(m)}{\varepsilon}_f, \theta^{sf}, \varepsilon_{sf}, \rho^{sf}, C^s, \overset{(n)}{C^s})$$
$$m = 1, \dots, p, \quad n = 1, \dots, q. \quad (23)$$

Extended entropy inequality

Liu (1972) proposed the extension of the entropy inequality by adding the products of Lagrange multipliers with conservation equations. In the present work we only use the conservation of mass equation as demonstrated in Bennethum and Cushman (1996), Singh (2002), Cushman and Bennethum (2004) and Weinstein (2006),

$$\Lambda_{new} = \Lambda_{old} + \sum_{\alpha=s,f} \lambda_M^\alpha M^\alpha + \lambda_M^{sf} M^{sf}$$
$$\geq 0. \quad (24)$$

where

$$M^\alpha = \frac{1}{\theta^\alpha} \left\{ \frac{D^\alpha(\varepsilon_\alpha \rho^\alpha)}{Dt} + \varepsilon_\alpha \rho^\alpha I : d^\alpha \right.$$
$$\left. - \hat{e}_{sf}^\alpha \right\} = 0,$$

$$M^{sf} = \frac{1}{\theta^{sf}} \left\{ \frac{D^{sf}(\varepsilon_{sf} \rho^{sf})}{Dt} + \varepsilon_{sf} \rho^{sf} I : d^{sf} \right.$$
$$\left. + \hat{e}_{sf}^s + \hat{e}_{sf}^f \right\} = 0.$$

The full expansion of the extended entropy inequality is presented in the appendix. We then use Coleman and Noll (1963) method to exploit this inequality, which leads to non-equilibrium results.

5   Stress tensor and heat flux   results

Non-equilibrium results

Considering the extended entropy inequality from the appendix, the coefficients of the following variables, which are neither independent nor dependent

$$\dot{J}^s, \quad \dot{\rho}^f, \quad \dot{\rho}^{sf}, \quad d^{sf},$$

must be zero. This results in the following non-equilibrium results:

$$\frac{1}{3} tr(t^s) = \rho^s J^s \frac{\partial A^s}{\partial J^s} = -p^s \quad (25)$$

$$\lambda^{sf} = \rho^{sf} \frac{\partial A^{sf}}{\partial \rho^{sf}} = \frac{p^{sf}}{\rho^{sf}} \quad (26)$$

$$t^{sf} = -\rho^{sf} \lambda^{sf} = -p^{sf} I \quad (27)$$

Equation (25) tells us that physical pressure is equal to thermodynamic pressure. Equation (27) tells us that the interface Cauchy stress tensor is given by interfacial surface tension.

Equilibrium results

By letting all the coefficients variables that are neither independent nor dependent be zero, we obtain the dissipative or residual entropy inequality. Results from this dissipative entropy inequality at equilibrium are: the fluid stress tensor is

$$t^f = -(\rho^f)^2 \frac{\partial A^f}{\partial \rho^f} I = -p^f I. \quad (28)$$

the solid stress tensor is

$$t^s = -p^s I + 2\rho^s (F^s) \cdot \frac{\partial A^s}{\partial C^s} \cdot (F^s)^T$$
$$+ 2 \frac{\varepsilon_{sf} \rho^{sf}}{\varepsilon_s} (F^s) \cdot \frac{\partial A^{sf}}{\partial C^s} \cdot (F^s)^T$$

$$+ \frac{2}{3} \rho^s \frac{\partial A^s}{\partial C^s} : C^s + \frac{2}{3} \frac{\varepsilon_f \rho^f}{\varepsilon_s} \frac{\partial A^f}{\partial C^s} : C^s$$
$$+ \frac{2}{3} \frac{\varepsilon_{sf} \rho^{sf}}{\varepsilon_s} \frac{\partial A^{sf}}{\partial C^s} : C^s.$$

or

$$t^s = -p^s I + t^{se} + \frac{\varepsilon_f}{\varepsilon_s} t^{sh} + \frac{\varepsilon_{sf}}{\varepsilon_s} t^{si} \quad (29)$$

where

$$t^{se} = 2\rho^s \left(F^s \cdot \frac{\partial A^s}{\partial C^s} \cdot (F^s)^T - \frac{1}{3} \frac{\partial A^s}{\partial C^s} : C^s \right)$$

$$t^{sh} = 2\rho^f \left(F^s \cdot \frac{\partial A^f}{\partial C^s} \cdot (F^s)^T - \frac{1}{3} \frac{\partial A^f}{\partial C^s} : C^s \right)$$

$$t^{si} = 2\rho^{sf}\left(F^s \cdot \frac{\partial A^{sf}}{\partial C^s} \cdot (F^s)^T \right.$$
$$\left. -\frac{1}{3}\frac{\partial A^{sf}}{\partial C^s} : C^s \right).$$

The term t^{se} is the effective stress and also referred to as Terzhagi's stress in Weinstein (2006). Hydration stress is given by t^{sh}. The last term of equation (29) is new and brought about by the inclusion of the thermodynamic properties of the interface. We notice that t^{si} is directly proportional to the areal density function of the interface and also depends on the change in interface free energy with respect to shear. Furthermore,

$$t^{se} + \frac{\varepsilon_f}{\varepsilon_s} t^{sh} + \frac{\varepsilon_{sf}}{\varepsilon_s} t^{si}$$

forms the deviatoric part of the solid phase stress tensor.

There is no heat flux at equilibrium and thus we have

$$q^\alpha = q^{sf} = 0 \quad \alpha = s, f.$$

Constitutive forms

If at equilibrium, we have a result $A|_e = B$, then away from equilibrium we will have $A = B + C$, where $C|_e = 0$. Note that C will depend on all the chosen independent variables. We will refer to $A = B + C$ as a constitutive form. From equation (28), away from equilibrium the fluid stress tensor becomes

$$t^f = -p^f I + \tau^f, \tag{30}$$

the solid stress tensor becomes

$$t^s = -p^s I + t^{se} + \frac{\varepsilon_f}{\varepsilon_s} t^{sh} + \frac{\varepsilon_{sf}}{\varepsilon_s} t^{si} + \tau^s, \tag{31}$$

the heat fluxes for the phases become

$$q^\alpha = q^\alpha, \quad \alpha = s, f \tag{32}$$

and for the interface, we have

$$q^{sf} = q^{sf}. \tag{33}$$

The additional non-equilibrium terms in the constitutive forms (30) and (31) are highly non-linear.

6   Near equilibrium

We use Taylor's theorem to linearize non-equilibrium terms of constitutive forms about the equilibrium.

The linearization is done with respect to heat conduction, fluid viscosity and viscoelasticity of the solid. For the fluid phase stress tensor the non-equilibrium term becomes

$$\tau^f = H^f \cdot \nabla \theta + D^f : d^f \tag{34}$$

For the solid phase stress tensor the non-equilibrium term becomes

$$\tau^s = H^s \cdot \nabla \theta + \sum_{r=1}^{p} E^{sr} \overset{(r)}{\varepsilon}_f$$
$$+ \sum_{n=1}^{q} F^s K^{sn} : \overset{(n)}{\overline{C}}{}^s (F^s)^{-1} \tag{35}$$

The heat fluxes for the fluid and the solid are given respectively by

$$q^f = -M^f : \nabla \theta + N^f : d^f. \tag{36}$$

$$q^s = -M^s : \nabla \theta + N^s : d^f + \sum_{l=1}^{p} S^{sl} \overset{(l)}{\varepsilon}_f$$
$$+ \sum_{n=1}^{q} F^s \cdot W^{sn} \overset{(n)}{\overline{C}}{}^s \cdot (F^s)^{-1}. \tag{37}$$

We note that the material coefficients in these expressions, viz. S^{sl} is a first order tensor, M^α is a second order tensor, N^α and W^{sn} are third order tensors.

$$q^{sf} = -M^{sf} \nabla \theta + N^{sf} : d^f. \tag{38}$$

In this expression, the material coefficient M^{sf} is a second order tensor and N^{sf} is a third order tensor.

In order to determine the exact nature of all these material coefficients, we need to perform experiments.

Remark: All the heat fluxes generalize Fourier's law of heat conduction.

Constitutive form near equilibrium

The expression of the fluid phase stress tensor near equilibrium is

$$t^f = -pI + H^f \cdot \nabla \theta + D^f : d^f. \tag{39}$$

The expression of the solid phase stress tensor near equilibrium is

$$t^s = -p^s I + t^{se} + \frac{\varepsilon_f}{(1-\varepsilon_f)} t^{sh}$$

$$+ \frac{\varepsilon_{sf}}{(1-\varepsilon_f)} t^{si} + H^s \cdot \nabla\theta + \sum_{r=1}^{p} E^{sr} \overset{(r)}{\varepsilon_f}$$

$$+ \sum_{n=1}^{q} F^s . K^{sn} : \overset{(n)^s}{\overline{C}} .(F^s)^{-1} \tag{40}$$

The expressions of the fluid and solid phase heat fluxes near equilibrium are

$$q^f = -M^f : \nabla\theta + N^f : d^f \tag{41}$$

and

$$q^s = -M^s : \nabla\theta + N^s : d^f + \sum_{l=1}^{p} S^{sl} \overset{(l)}{\varepsilon_f}$$

$$+ \sum_{n=1}^{q} F^s \cdot W^{sn} \overset{(n)}{\overline{C}^s} \cdot (F^s)^{-1}. \tag{42}$$

respectively.

Total stress and heat fluxes
First we have the total pressure given by

$$p = (1-\varepsilon_f) p^s + \varepsilon_f p^f.$$

We then have the total stress tensor as

$$t = (1-\varepsilon_f) t^s + \varepsilon_f t^f$$

or

$$t = -pI + t^{se} + \frac{\varepsilon_f}{(1-\varepsilon_f)} t^{sh}$$

$$+ \frac{\varepsilon_{sf}}{(1-\varepsilon_f)} t^{si} + D^f : d^f$$

$$+ [(1-\varepsilon_f) H^s + \varepsilon_f H^f] \cdot \nabla\theta$$

$$+ \sum_{r=1}^{p} E^{sr} \overset{(r)}{\varepsilon_f} + \sum_{n=1}^{q} F^s \cdot K^{sn} : \overset{(n)^s}{\overline{C}} \cdot (F^s)^{-1}. \tag{43}$$

The total heat flux is

$$q = (1-\varepsilon_f) q^s + \varepsilon_f q^f$$

or

$$q = -[(1-\varepsilon_f) M^s + \varepsilon_f M^f] \cdot \nabla\theta$$

$$+ [(1-\varepsilon_f) N^s + \varepsilon_f N^f] : d^f + \sum_{l=1}^{p} S^{sl} \overset{(l)}{\varepsilon_f}$$

$$+ \sum_{n=1}^{q} F^s \cdot W^{sn} : \overset{(n)^s}{\overline{C}} \cdot (F^s)^{-1}. \tag{44}$$

Conclusion

Using macroscopic balance equation (averaged from mesoscale to macroscale), the hybrid mixture theory method, Coleman and Noll method and Liu's Lagrange multiplier's, we obtained the interfacial tension as the only result which is valid everywhere. All other results were determined near equilibrium by applying linear Taylor expansion about equilibrium. These all have the following dependencies

• From equation (27) the interfacial tension t^{sf}, depends on the interface thermodynamic pressure only.
• From equation (43) the total particle stress tensor t, depends on the porosity, the total thermodynamic pressure, hydration forces, effective stresses due to the solid phase and the interphase, heat conduction, fluid viscosity and the solid matrix viscoelasticity.
• From equation (44) the total particle heat flux q depends on the porosity, fluid viscosity, heat conductio and the solid matrix viscoelasticity.

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Appendix

After appropriate substitutions of the old entropy inequality, the Lagrange multipliers, the conservation of mass equations and simplification, we obtain the following expression of the extended entropy inequality (24):

$$\Lambda_{new} = \Lambda_{old} + \lambda^s \mathsf{M}^s + \lambda^f \mathsf{M}^f + \lambda^{sf} \mathsf{M}^{sf} \geq 0$$

$$= -\left(\frac{\varepsilon_s \rho^s}{\theta^s} \frac{\partial A^s}{\partial \varepsilon_f} + \frac{\varepsilon_f \rho^f}{\theta^f} \frac{\partial A^f}{\partial \varepsilon_f} \right.$$

$$\left. + \frac{\varepsilon_{sf} \rho^{sf}}{\theta^{sf}} \frac{\partial A^{sf}}{\partial \varepsilon_f} - \frac{\rho^f}{\theta^f} \lambda^f \right) \frac{D^s \varepsilon_f}{Dt}$$

$$-\sum_{m=1}^{p-1}\left(\frac{\varepsilon_s\rho^s}{\theta^s}\frac{\partial A^s}{\partial\overset{(m)}{\varepsilon}_f}+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\overset{(m)}{\varepsilon}_f}\right.$$
$$\left.+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\overset{(m)}{\varepsilon}_f}\right)\overset{(m+1)}{\varepsilon}_f$$
$$-\left[\frac{\varepsilon_s\rho^s}{\theta^s}\frac{\partial A^s}{\partial\varepsilon_f^{(p)}}+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\varepsilon_f^{(p)}}\right.$$
$$\left.+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\varepsilon_f^{(p)}}\right]\varepsilon_f^{(p+1)}$$
$$-\left[\frac{\varepsilon_s\rho^s}{\theta^s}\frac{\partial A^s}{\partial J^s}-\frac{1}{3}\frac{\varepsilon_s}{\theta^s J^s}tr(t^s)\right]\frac{D^s J^s}{Dt}$$
$$-\left(\frac{\varepsilon_s\rho^s}{\theta^s}\frac{\partial A^s}{\partial\overline{C}^s}+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\overline{C}^s}+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\overline{C}^s}\right.$$
$$-\frac{1}{2}(F^s)^{-1}\cdot\frac{\varepsilon_s t^s}{\theta^s}\cdot(F^s)^{-T}$$
$$-\frac{1}{2}\frac{\varepsilon_s\rho^s}{\theta^s}\lambda^s\cdot(F^s)^{-1}\cdot(F^s)^{-T}\right):\frac{D^s C^s}{Dt}$$
$$-\left[\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\rho^f}-\frac{\varepsilon_f\lambda^f}{\theta^f}\right]\frac{D^s\rho^f}{Dt}$$
$$-\left[\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\varepsilon_{sf}}-\frac{\rho^{sf}\lambda^{sf}}{\theta^{sf}}\right]\frac{D^s\varepsilon_{sf}}{Dt}$$
$$-\left[\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\rho^{sf}}-\frac{\varepsilon_{sf}\lambda^{sf}}{\theta^{sf}}\right]\frac{D^s\rho^{sf}}{Dt}$$
$$-\sum_{n=1}^{q-1}\left(\frac{\varepsilon_s\rho^s}{\theta^s}\frac{\partial A^s}{\partial\overset{(n)}{C}{}^s}+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\overset{(n)}{C}{}^s}\right.$$
$$\left.+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\overset{(n)}{C}{}^s}\right):\frac{D^s\overset{(n+1)}{C}{}^s}{Dt}$$

$$-\left[\frac{\varepsilon_s\rho^s}{\theta^s}\frac{\partial A^s}{\partial\overset{(q)}{C}{}^s}+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\overset{(q)}{C}{}^s}\right.$$
$$\left.+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\overset{(q)}{C}{}^s}\right):\frac{D^s\overset{(q)}{C}{}^s}{Dt}$$
$$-\left[\frac{\varepsilon_s\rho^s}{\theta^s}\left(\frac{\partial A^s}{\partial\theta^s}+\eta^s\right)\right]\frac{D^s\theta^s}{Dt}$$
$$-\left[\frac{\varepsilon_f\rho^f}{\theta^f}\left(\frac{\partial A^f}{\partial\theta^f}+\eta^f\right)\right]\frac{D^s\theta^f}{Dt}$$
$$-\left[\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\left(\frac{\partial A^{sf}}{\partial\theta^{sf}}+\eta^{sf}\right)\right]\frac{D^s\theta^{sf}}{Dt}$$
$$-\left[\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial d^f}\right]:\frac{D^f d^f}{D^t}$$
$$-\left[\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\varepsilon_f}\nabla\varepsilon_f+\frac{\varepsilon_f\rho^f}{\theta^f}\sum_{m=1}^{p}\frac{\partial A^f}{\partial\overset{(m)}{\varepsilon}_f}\nabla\overset{(m)}{\varepsilon}_f\right.$$
$$+\frac{\varepsilon_f\rho^f}{\theta^f}\left(\frac{\partial A^f}{\partial\theta^f}+\eta^f\right)\nabla\theta^f+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\overline{C}^s}:\nabla\overline{C}^s$$
$$+\frac{\varepsilon_f\rho^f}{\theta^f}\sum_{n=1}^{q}\frac{\partial A^f}{\partial\overset{(n)}{\overline{C}}{}^s}:\nabla\overset{(n)}{\overline{C}}{}^s+\frac{\varepsilon_f\rho^f}{\theta^f}\frac{\partial A^f}{\partial\rho^f}\nabla\rho^f$$
$$\left.-\frac{\varepsilon_f\lambda^f}{\theta^f}\nabla\rho^f-\frac{\rho^f\lambda^f}{\theta^f}\nabla\varepsilon_f+\frac{T_{sf}^f}{\theta^f}\right]v^{f,s}$$
$$-\left(\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\varepsilon_f}\nabla\varepsilon_f+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\sum_{m=1}^{p}\frac{\partial A^{sf}}{\partial\overset{(m)}{\varepsilon}_f}\nabla\overset{(m)}{\varepsilon}_f\right.$$
$$+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\varepsilon_{sf}}\nabla\varepsilon_{sf}-\frac{\rho^{sf}\lambda^{sf}}{\theta^{sf}}\nabla\varepsilon_{sf}$$
$$+\frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial\rho^{sf}}\nabla\rho^{sf}-\frac{\varepsilon_{sf}\lambda^{sf}}{\theta^{sf}}\nabla\rho^{sf}$$

$$+ \frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\left(\frac{\partial A^{sf}}{\partial \theta^{sf}}+\eta^{sf}\right)\nabla\theta^{sf}$$

$$+ \frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\frac{\partial A^{sf}}{\partial C^{s}}:\nabla C^{s}$$

$$+ \frac{\varepsilon_{sf}\rho^{sf}}{\theta^{sf}}\sum_{n=0}^{q}\frac{\partial A^{sf}}{\partial \overset{(n)}{C^{s}}}:\nabla \overset{(n)}{C^{s}}$$

$$- \frac{1}{\theta^{sf}}\left(T_{sf}^{s}+T_{sf}^{f}\right)v^{sf,s}$$

$$+ \frac{1}{(\theta^{s})^{2}}\varepsilon_{s}q^{s}\cdot\nabla\theta^{s}+\left(\frac{\varepsilon_{f}t^{f}}{\theta^{f}}+\frac{\varepsilon_{f}\rho^{f}\lambda^{f}}{\theta^{f}}I\right):d^{f}$$

$$+ \frac{1}{(\theta^{f})^{2}}\varepsilon_{f}q^{f}\cdot\nabla\theta^{f}+\left[\frac{\varepsilon_{sf}t^{sf}}{\theta^{sf}}+\frac{\varepsilon_{sf}\rho^{sf}\lambda^{sf}}{\theta^{sf}}I\right]:d^{sf}$$

$$+ \frac{1}{(\theta^{sf})^{2}}\varepsilon_{sf}q^{sf}\cdot\nabla\theta^{sf}$$

$$- \frac{1}{\theta^{sf}}\sum_{\alpha=s,f}\left(\frac{\hat{Q}_{sf}^{\alpha}}{\theta^{\alpha}}-\hat{e}_{sf}^{\alpha}\eta^{\alpha}\right)\theta^{sf,\alpha}$$

$$- \frac{\hat{e}_{sf}^{s}}{\theta^{sf}}\left(A^{s,sf}-\frac{1}{3}\frac{\theta^{sf}}{\theta^{s}\rho^{s}}tr(t^{s})+\lambda^{sf}+\frac{1}{2}(v^{s,sf})^{2}\right)$$

$$- \frac{\hat{e}_{sf}^{f}}{\theta^{sf}}\left(A^{f,sf}+\frac{\lambda^{f}\theta^{sf}}{\theta^{f}}+\lambda^{sf}+\frac{1}{2}(v^{f,sf})^{2}\right)\geq 0.$$

Nomenclature

A^{α}	Helmholtz free energy function for the α-phase.
A^{sf}	Helmholtz free energy function for the sf-interface.
b^{α}	external supply of entropy to the α-phase.
$b^{\alpha\beta}$	external supply of entropy to the $\alpha\beta$-interface.
C^{s}	Right Cauchy-Green tensor.
C^{s}	Modified right Cauchy-Green tensor.
d^{α}	strain rate tensor for the α-phase.
E^{s}	Lagrangian strain tensor.

E^{α}	internal energy of the α-phase per mass of α phase.
$E^{\alpha\beta}$	internal energy of the $\alpha\beta$-interface per mass of $\alpha\beta$-interface.
$\hat{e}_{\alpha\beta}^{\alpha}$	rate of transfer of mass from $\alpha\beta$-interface to the α phase.
F^{s}	deformation gradient of the solid phase.
F^{s}	modified deformation gradient of the solid phase.
G^{α}	Gibbs free energy function.
g^{α}	external supply of momentum to the α-phase.
$g^{\alpha\beta}$	external supply of momentum to the $\alpha\beta$-interface.
h^{α}	external supply of energy to the α-phase.
$h^{\alpha\beta}$	external supply of energy to the $\alpha\beta$-interface.
J^{s}	Jacobian of the solid phase.
$\hat{Q}_{\alpha\beta}^{\alpha}$	energy transferred to the α-phase from the $\alpha\beta$ interface.
q^{α}	heat conduction vector for the α-phase.
$q^{\alpha\beta}$	heat conduction vector for the $\alpha\beta$-interface.
$\hat{T}_{\alpha\beta}^{\alpha}$	force exerted on the α phase by the $\alpha\beta$-interface.
t^{α}	stress tensor for the α phase.
$t^{\alpha\beta}$	stress tensor for the $\alpha\beta$-interface.
v^{α}	velocity of the α-phase.
$v^{\alpha\beta}$	velocity of the $\alpha\beta$-interface.
$v^{\alpha,\alpha\beta}$	velocity of the α-phase relative to the velocity of the $\alpha\beta$-interface, $v^{\alpha}-v^{\alpha\beta}$.
x	position vector of a solid phase particle in the deformed configuration.
X	position vector of a solid phase particle in the undeformed configuration.
η^{α}	entropy of the α-phase.
$\eta^{\alpha\beta}$	entropy of the $\alpha\beta$ interface.
ε^{α}	volume fraction of the α-phase.
$\varepsilon^{\alpha\beta}$	specific interfacial area of $\alpha\beta$-interface (area per unit of system volume).
ρ^{α}	density of α-phase, mass of α-phase per volume of α-phase.
$\rho^{\alpha\beta}$	density of $\alpha\beta$-interface, mass of $\alpha\beta$-interface per area of $\alpha\beta$

	interface.
φ^{α}	entropy conduction vector of the α-phase.
$\varphi^{\alpha\beta}$	entropy conduction vector of the $\alpha\beta$-interface.
ρ^{α}	volumetric mass density of the α-phase.
ρ^{α}	volumetric mass density of the interface.
Φ_{sf}^{α}	body supply of of entropy to the α-phase from the sf-interface.
Λ^{α}	rate of net production of entropy to the α-phase.
Λ^{sf}	rate of net production of entropy to the interface.
M^{α}	The α-phase continuity equation.
P^{α}	The α-phase momentum equation.
E^{α}	The α-phase energy equation.
M^{sf}	The interface continuity equation.
P^{sf}	The interface momentum equation.
E^{sf}	The interface energy equation.
$\overset{(m)}{\varepsilon_f}$	m^{th} order material derivative of the ε_f with respect to the macroscale

$\overset{(n)}{C^s}$	n^{th} order material derivative of the C^s with respect to the macroscale

Differential operators used

D^{α}/Dt	material derivative following the motion in the α-phase, $\partial/\partial t + v^{\alpha} \cdot \nabla$.
$D^{\alpha\beta}/Dt$	material derivative following the motion in the $\alpha\beta$-interface, $\partial/\partial t + v^{\alpha\beta} \cdot \nabla$.
∇	gradient operator with respect to spatial coordinates.

Superscripts and subscripts

s	solid phase.
f	fluid phase.
sf	solid-fluid interface.
T	transpose of a tensor.

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RFID Antenna Performance Evaluation for Library Inventory Management

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Abstract: Three types of printed radio-frequency-identification (RFID) antennas with the characteristics of high gain, wide beam wave, and omnidirectional beam wave are constructed and evaluated in this study. The objective is to find out their best reading rates for providing effective wireless communications among RFID antenna readers during the library book inventory process. Three kinds of antenna readers have been fabricated on the printed circuit board (PCB) with the operating frequency at 915 MHz, which are tested by using vector network analyses device named Agilent PNA N5230A and simulated by using antenna design kit named ANSOFT HFSS. The fabricated antenna readers are embedded into different locations of bookshelves at the library of Cheng Shiu University in Taiwan. According to the experimental results, the designed prototypes of the antenna readers has the characteristics of the directional radiation pattern, wide beam wave, simple shape, good gain, low cost and easy to be integrated to the bookshelf. They can benefit administrating librarians with the capabilities of decreasing the library inventory processing time and reducing the possibility of the books being misplaced.
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1. Introduction

Traditionally library inventory works not only include books' check-in/out but also include keeping the resources at actual locations [1]. In the past decade, barcode labels and electromagnetic (EM) strips are two common technologies used to support the identification and anti-theft capabilities in the library inventory system. However, the barcode labels could be only stuck on the book with one time, manually scanned, and easily damaged; the EM strips don't support resource identification capability [2]. In recent years, in order to overcome the weaknesses mentioned above, radio frequency identification (RFID) wireless communication technology has replaced the barcode label and magnetic strip with the identification and anti-theft detection capabilities in the library inventory management [3-4]. Such technology utilizes magnetic coupling or electromagnetic field in the electromagnetic radio frequency spectrum. Compared with using barcodes in the library inventory management, a RFID tag could be read more than ten-thousand times, could support high information contents, and would provide more convenient and efficient advantages on check-out and return processes [5].

Generally a typical RFID system consists of antennas, readers, and tags. The reader would send the wireless radio signal which would be then received by the antenna. When the tag senses the radio signal, it returns the electromagnetic wave back to the reader [6].

Several literatures have been proposed for the smart shelf application in library, including utilizing mobile robot to improve inventory management [7], applying micro-strip lines to enhance energy leaking and improving tag detecting capability [8]. However, these methods are not good for the needs of real time and low cost. As for the use of RFID technology in the bookshelf applications, Kim and Choi [9] proposed a wideband rectangular loop tag antenna for ultra-high frequency radio frequency identification library management systems. The size of the tag antenna is 35 mm × 90 mm, which had a wide impedance bandwidth of 170 MHz less than -10 dB. Lau et al. [10] proposed a small wideband circularly polarized patch antenna printed on the low-cost FR-4 material for radio-frequency-identification smart bookshelves in libraries. The proposed antenna operated at a center frequency of 0.915 GHz and the wave-beam width is 115 °. Qing et al. [11] constructed an antenna prototype, which is printed onto a piece of FR4 substrate, with good impedance matching and uniform magnetic field distribution over the entire UHF RFID band of 840-960 MHz.

In the reviewing some references applying UHF RFID Antenna in the library inventory managements, Kim et al. [12] designed a loop antenna for UHF band RFID tag used for a library

management system. To achieve the wide-band characteristic, both vertical sides of a loop antenna are widened. Lukas et al. [13] and Kaiwen et al. [14] proposed UHF omnidirectional RFID antenna researches to increase the wireless identification and tracking capabilities for the item-level RFID application. Both literatures presented the designs of UHF RFID tag antennas which supported omnidirectional reading pattern and provided great potential for item-level RFID applications in libraries for tracking the books. Pitukwerakul et al. [15] proposed the channel modeling of wooden and metal book shelves for predicting received power and performance system. The channels were measured at frequency of 2.45 GHz. The microstrip antennas were used as both transmitter (Tx) and receiver (Rx) antennas. Vertical-vertical (V-V) and horizontal-horizontal (H-H) polarizations are considered. The results exhibited wooden book shelves of V-V polarization and metal book shelves of H-H polarization are appropriate to use for RFID library management system.

Golding and Tennant [16] investigated the factors that may affect the reading rate of an inventory reader in a library. The investigated factors were read distance, tag location, number of sweeps and sweep direction. Wang [17] studied the RFID-based methodology and approaches that support library services and management, including sensor gate control, circulation, inventory, searches and utilization statistics. The study also discussed barriers, challenges and future work about RFID applications in libraries and concluded that RFID-based technology would improve digital archives and digital humanities in library systems. Zhang and Shi [18] and Bin Abdullah, et al. [19] are two literatures related to self services of library management systems. Zhang and Shi strongly pointed out that the necessity of the new RFID technology of self-service book borrowing and returning system in library, which would replace the barcode technology and accelerate the library's self-service process. Bin Abdullah, et al. developed an integrated the RFID system with graphical user interface (GUI) at the host PC. The study aims to develop an automatic library shelf management system to assist the librarians for more efficient shelf management to find any misplaced books on the library shelf.

In addition, in the reviewing some other RFID related literatures [20-22], two comments were made: (1) such intelligent plan may not meet the library demand because the system have to consider library internal disturbances such as metal, motion communication electric wave, and wireless network electric wave, which could affect the RFID operation; (2) the proposed inventory system have to be convenient to all readers. As mentioned above and driven by the advanced ubiquitous computing technology, in this study, the authors proposes Three types of printed radio-frequency-identification (RFID) antennas with the characteristics of high gain, wide beam wave, and omnidirectional beam wave are constructed and evaluated in this study. The objective is to find out their best reading rates for providing effective wireless communications among RFID antenna readers during the library book inventory process.

In the following, Section 2 describes the proposed optimal library inventory system based on EMID technology. The experimental results are shown in Section 3. Finally, the conclusions and Discussions are summarized in Section 4.

2. RFID Antenna Design

Figure 1 illustrates the structure of the RFID based library inventory system which includes four parts: RFID antennas, bookshelves, readers/writers, and the computer terminal. As illustrated in Figure 1, the library computer terminal through readers/writers obtains RFID antennas' signals of the bookshelf. The database of the computer will then authenticate the location of the book automatically.
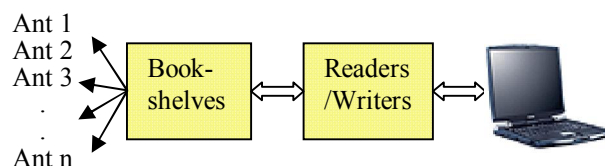
Figure 1. Structure of RFID-based library inventory system.

Figure 2 is the picture of a bookshelf with the width and height of 90 and 19 cm, respectively. Three places, labeled as A, B and C, are tested to find the optimal antenna location in this study. The place A is located on the left hand side of the bookshelf; the place B is located on the middle of the bookshelf; the place C is located either on the 30 cm from the distance of left and right hand sides of the bookshelf. Figure 3 shows the example of antennas' locations in a multi-layer bookshelf. Considering the bookshelf structure, the books are vertically set in the shelf, and the antennas are also set vertically to the shelf and parallel to each other in order to obtain the optimal reading rates of the antenna.

In the following, three types of RFID antennas, including the pictures of geometry planes and prototypes, are introduced.
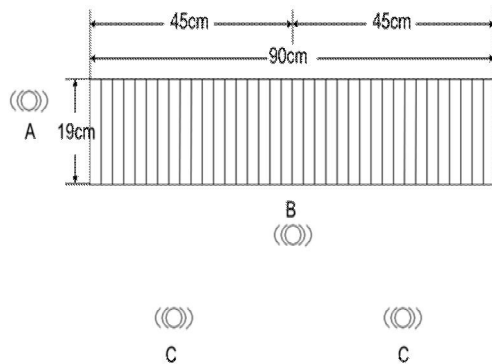
Figure 2. Antenna locations on the one layer bookshelf.

Figure 3. An antenna on location B of a bookshelf.

2.1. Type 1 - High Gain Antenna

The geometry plane and the prototype of the proposed high gain antenna are shown in Figure 4. The antenna consists of a polygon patch and rectangle ground substrates. The antenna is printed on a 150 mm × 300 mm dielectric substrate; the dielectric substrate (FR4) has a thickness of 1.6 mm with the coefficient constant of 4.4. The total high is 18.2 mm with two-layer FR4 board. The lengths of the patch side edge are 95mm, 56mm, and 97 mm, respectively. The ground plane width and length is 150mm and 300 mm. The detecting point is located at the radio frequency (RF) circuitry which is on the reverse side of the printed circuit board (PCB).

(a)   (b)
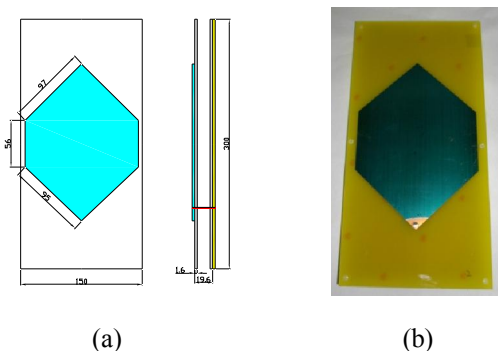
Figure 4. (a) geometry ; (b) prototype of Type 1 antenna (unit: mm).

2.2. Type 2 – Wide Beam Antenna

The geometry plane and the prototype of the proposed the wide-beam antenna are illustrated in Figure 5. The antenna consists of a rectangle patch and ground substrates. The antenna is printed on an 80 mm × 150 mm dielectric substrate; the dielectric substrate (FR4) has a thickness of 1.6 mm a with the coefficient constant of 4.4. The total high is 13.2 mm with two-layer FR4 board. The length and width of the patch substrate are 129mm and 70mm, respectively. The width and length of the ground substrate is 80mm and 150 mm, respectively. The detecting point is located at the radio frequency (RF) circuitry which is on the reverse side of the printed circuit board (PCB).

(a)   (b)
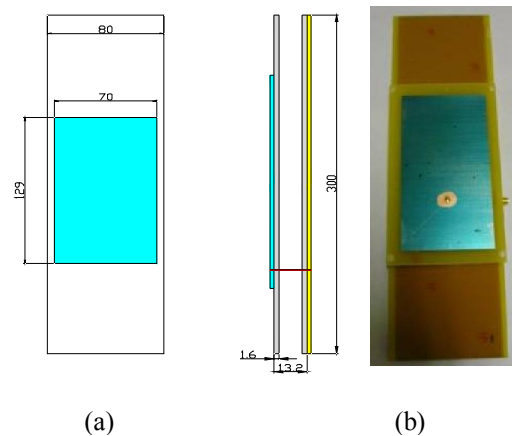
Figure 5. (a) geometry; (b) prototype of Type 2 antenna (unit: mm).

2.3. Type 3 – Omnidirectional Beam Antenna

The geometry plane and the prototype of the proposed omnidirectional beam antenna are shown in Figure 6. The antenna consists of an upside down triangle patch and rectangle ground substrates. The antenna is printed on a 65 mm × 1500 mm dielectric substrate; the dielectric substrate (FR4) has a thickness of 1.6 mm with the coefficient constant of 4.4. By starting from the top view, the lengths of each side of upside down triangle patch are 41 mm, 14mm, 42 mm, 14 mm, and 3 mm, respectively, with two-layer FR4 board. The width and length of the ground substrate board are 65 mm and 150 mm. The detecting point is located at the center area of the upside down triangle printed patch.

15
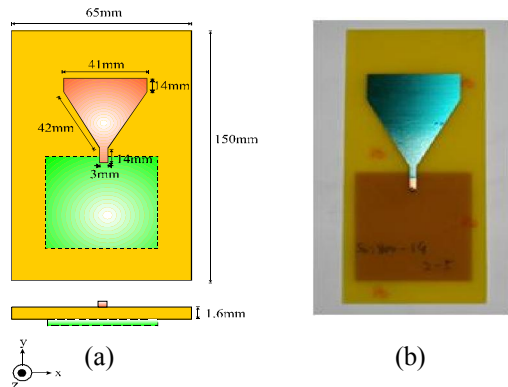
Figure 6. (a) geometry ; (b) prototype of Type 3 antenna (unit: mm).

3. Experimental Results

Three kinds of antenna readers have been fabricated on the printed circuit board (PCB) with the operating frequency at 915 MHz. In this paper, three performances, including the radiation, return losses, and peak gain, are tested by using vector network analyses device named Agilent PNA N5230A and simulated by using antenna design kit named ANSOFT HFSS. Figure 7 shows three types of the proposed antennas' radiation patterns which are in YZ and XZ planes with the operating frequency at 915 MHz. As shown in Figure 7(a), the wave-beam width for the type 1 antenna at the half power is around 100 degree and at the power greater than 0dB is 156 degree; Figure 7(b) shows that the wave-beam width for the type 2 antenna at the half power is around 120 degree and at the power greater than 0dB is 180 degree; as shown in Figure 7(c), the wave-beam width of type 3 antenna is omnidirectional and the wave-beam for the power greater than 0dB is 360 degree. Conclusively, type 3 antenna has the widest wave beam compared with the other two antennas. However, type 1 and type 2 antennas still have enough wide wave-beam performance for the library inventory application.

Figure 8 shows the measured -10 dB return losses of the proposed antennas which are operated at the frequency between 885MHz and 942 MHz for type 1 antenna, between 885MHz and 942 MHz for type 2 antenna and between 795MHz and 1.05 GHz for type 3 antenna respectively. This indicates that three antenna are all suitable for the ultra high frequency (UHF) RFID application. Figure 9 shows the measured peak gain of three types of antennas. As shown in Figure 9(a), the measured gain of the type 1 antenna is between 6.93dB and 7.92dB at the

operating frequency from 885 to 942MHz. Figure 9(b) illustrates the measured gain of the type 2 antenna is between 5.61dB and 5.78dB at the operating frequency from 885 to 945MHz. As for the type 3 antenna, the measured gain is between 2.41dB and 2.52dB at the operating frequency from 885 to 945MHz. According to the experimental results, the peak gain for the proposed antennas is 8.2dB, 6.13dB, and 3.01dB at 920MHz operating frequency, respectively. Conclusively, the type 1 antenna has the highest peak gain whereas type 3 antenna has the lowest peak gain.

(a)

(b)

(c)
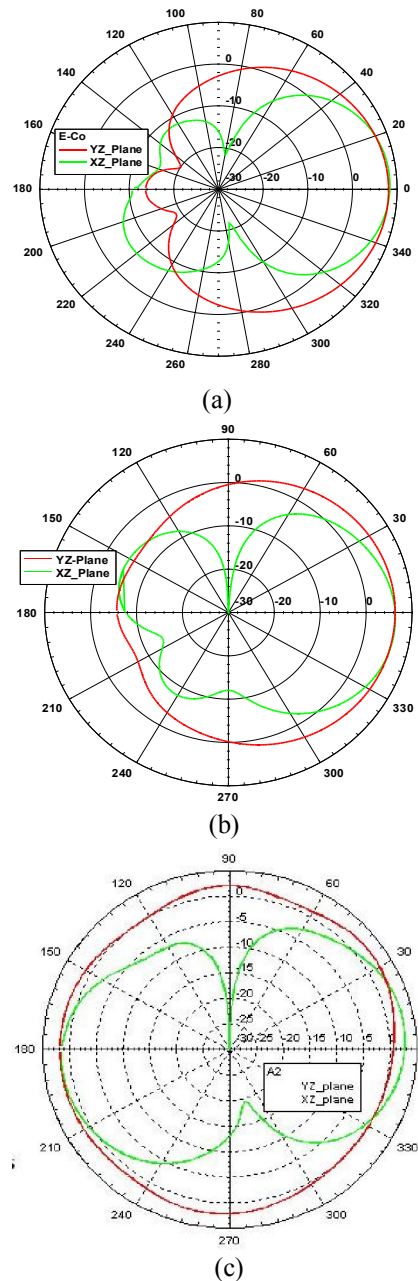
Figure 7. Measured radiation patterns for XZ and YZ plane at 915MHz; (a) type 1 antenna; (b) type 3 antenna; (c) type 3 antenna.

(a)

(b)

(c)

Figure 8. Measured return losses; (a) type 1 antenna; (b) type 2 antenna; (c) type 3 antenna.

(a)

(b)

(c)

Figure 10. Measured total field of maximum gain; (a) type 1 antenna; (a) type 2 antenna; (a) type 3 antenna.

Table 1. Reading rate for different RFID tag locations

Tag Quantity	Location	Reading Time(ms)	Reading Rate (%)
30 (Type 1 Antenna)	A	15	50%
	B	20	66%
	C	30	100%
30 (Type 2 Antenna)	A	20	66%
	B	30	100%
	C	30	100%
30 (Type 3 Antenna)	A	23	77%
	B	30	100%
	C	30	100%

Table 1 shows the reading rates of the proposed antennas located at A, B, and C places as illustrated in Figure 2. From Table 1, the reading rates of 30 type 1 antennas at the location A, B, and C are 50%, 66%, and 100%, respectively. This implies that the location C gets better re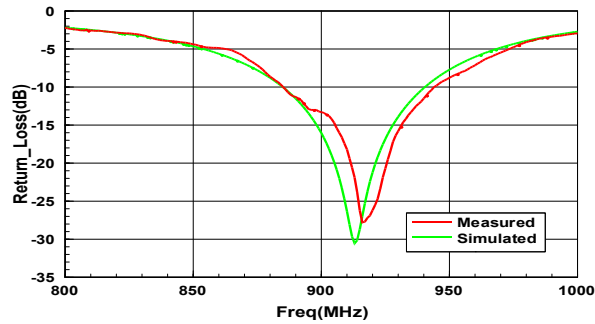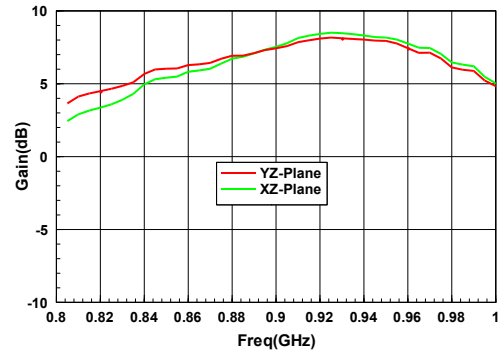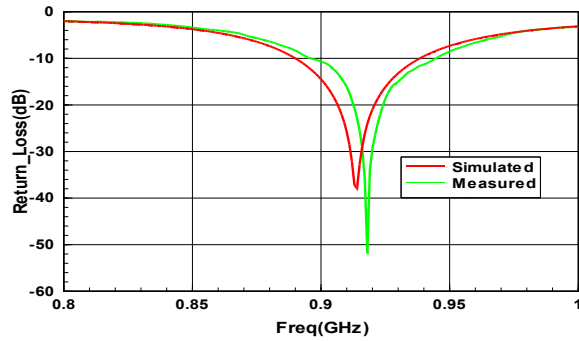ading rate. The reading rates for 30 type 2 antennas at the location A, B, and C are 66%, 100%, and 100%, respectively. This implies that either the location B or C gets better reading rate. As for type 3 antenna, the reading rates are 77%, 100%, and 100%, respectively. This also implies that either the location B or C gets better reading rate. Conclusively, the performance of the antennas at location A tells that the antenna readers are generally hard to identify the responding signals. As for the location B which is in the back of the bookshelf, the wave-beam width of the antenna readers has to have enough good wave-beam width to cover the one layer of the bookshelf. According to the experimental results, the location C gets the best reading rates for the proposed antenna because there are two antennas at left and right side of the bookshelf individually.

4. Conclusions and Discussions

This paper has presented three kinds of UHF antennas specifically for RFID-based book inventory applications. The main contribution of the proposed system is to improve traditional labor-based library inventory methodology for administrating librarians with the capabilities of decreasing the library inventory processing time and reducing the possibility of the books being misplaced. Compared to the exiting methods, the proposed system supports three distinctive advantages: (1) The proposed antennas in the plane form are printed on PCB with the characteristic of easily being integrated into the bookshelf. (2) The prototype antenna has characteristics of the directional radiation pattern; wave-beam width, simple shape, good gain characteristic and low fabricate cost. (3) The performance of the proposed antennas are suitable for RFID based book inventory application.

This work can be practically implemented at the library of Cheng Shiu University in Taiwan for the book inventory management application

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Relationship between Serum Magnesium Levels With Incidence of Cardiac Arrhythmias in Non-diabetic and Type 2 Diabetes Patients Who Underwent Coronary Artery Bypass Graft Surgery (*CABG*)

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Abstract: Introduction: Magnesium (*mg*) depletion plays a key role in the path physiology of diabetes mellitus, cardiovascular disease, arrhythmia and cardiopulmonary bypass. ATRIAL and ventricular arrhythmias are among the most common complications after coronary artery bypass graft (*CABG*) surgery. Our objective was to detect the relationship between the level of magnesium and arrhythmia in non diabetic and diabetic patients who underwent *CABG*. **Methods:** In this descriptive, cross-sectional study, the plasma level of magnesium was measured in 434 diabetic patients who underwent CABG in NAFT Hospital of Ahwaz. Spectrophotometer was used to measure the plasma level of magnesium. Glycosylated of hemoglobin was also measured as a glycemic control index. Data were analyzed using descriptive statistics and t-test. **Results:** The mean concentration of magnesium in type 2 diabetic patients in pre and post CABG was $1.68 \pm .79$ and $1.37 \pm .26$ (p = 000). The mean concentration of magnesium in non diabetic patients in pre and post CABG was 2.53 ± 1.9 and $1.93 \pm .6$ (p = 0.39). There were significant negative correlation (p =0.037) between levels of Mg and arrhythmia, in other hand there was significant positive correlation between levels of Mg and HbA1c (p =. 004). **Conclusion:** According to the results of this and previous studies, we recommend routine serum Mg determination and more attention to hypomagnesaemia patients to prevent further complications.

1. Introduction

Magnesium deficiency is associated with pathogenesis and atherosclerosis progression of coronary artery disease. Relationship between hypomagnesaemia and HDL, LDL, triglycerides have shown that there is increased LDL cholesterol, triglycerides and was decrease HDL cholesterol (13).

In other words, by increasing levels of magnesium, the risk of coronary heart disease in diabetic patients decrease .A prospective studies have shown strong relationship between concentration of magnesium levels and Type II diabetes, so that in these patients diuretic osmotic more happens.

Kao (1999) in a prospective study showed increase levels of magnesium could be act as a preventive measure in atherosclerotic type II diabetic patients (17).

Diabetes is one of the most common pathological situations in which decreased levels of magnesium occur (35).

Several studies reported that in Hypomagnesaemia, instability of ATRIAL and ventricular myocardium increases (11-16).

Despite advances in surgical techniques and preoperative management, still cardiac arrhythmias including ATRIAL fibrillation, ATRIAL and ventricular premature contractions are considered as the most common complications of CABG surgery. These arrhythmias occur 24 and 96 hours after surgery. The peak incidence of these arrhythmias happens in second and third day after the operation (23-28).

Arrhythmias are one of leading cause of state hemodynamic and Thromboembolism that matter their hospitalization duration and distress cardiac surgeons, thus increased cardiac mortality (18-23).

There are several factors effect arrhythmia after surgery which are:
a.*Older age,*
b.*Male gender,*
c.*Cardiac dysfunction,*
d.*Chronic pulmonary disease,*
e.*Chronic renal failure,*

    f. Diabetes, myocardial ischemia,
    g.Electrolyte imbalance,
    h.Metabolic disorders including magnesium deficiency (6, 10).

1.2. Metabolic disorders

Magnesium deficiency is considered as an independent factor after surgery. Serum magnesium in intra operative and following postoperative three days will begin to decline (27).

Approximately 80% of patients who underwent CABG operation   have been experienced low serum levels of total and ionized magnesium after surgery .This reduction depended on many factors including Hem dilution, increase Catecholamine levels and increase urinary excretion (2, 23-30).

The relationship between magnesium deficiency and the incidence of postoperative arrhythmias remains still unclear, however many mechanisms in the fixed relationship between magnesium and the potential of cell membranes.

Magnesium also plays a key role in other cellular functions, including setting enzymes, aerobic energy metabolism and also responsible for exhalation (31-37).

Hypomagnesaemia after *CABG* has harmful effects on cellular processes which are related to actions of magnesium ion that cause instability of cellular activity. According to the above reasons and the lack of the researchers' were motivations of such study in Ahvaz (13).

This study was aimed to investigate the relationship between serum magnesium levels with incidence of cardiac arrhythmias in patients with non-diabetic and Type II diabetes underwent coronary artery bypass graft surgery (*CABG*).

2. Material and Methods

The cross sectional study, 434 patients underwent coronary artery bypass graft surgery *CABG*) (183 patients with type 2 diabetes and 251 non-diabetic patients undergoing open heart surgery) admitted to hospital in Ahvaz Oil Co.

We enrolled in this study patients with age of 88-86 years old. 5cc (ml) fasting blood sampling under sterile condition was obtain from all patients before and after surgery.

After separation of sera, Reagent and sample solutions were prepared to read each single sample by serum magnesium test kit pars Spectra photometric methods which were done under supervision of one person. Normal range of magnesium in the respective kits were as follows: Serum magnesium level of less than 1.5 mg dL consider as Hypomagnesaemia 1.5-2.6 mg dL normal, more than 2.6 mg dL was considered as Hypomagnesaemia. Control of blood glucose levels were evaluated during the past 3 months by Glycosylated hemoglobin measurement. Range of Glycosylated hemoglobin in the colorimeter method was respectively:

Normal range between 4.5-6.9 percent, the limit border line was between 7-9 percent and 9 percent had poor control over blood glucose. (Pars test kit). Both groups of age and gender were matched together.

Incidence of cardiac arrhythmias (heart rhythm disorder in each type) were Monitored during three postoperative days.

The duration of each arrhythmia on the monitor was characterized and reported by the specialist nurse confirmed.   The purpose were of this study, arrhythmias, ATRIAL arrhythmias ventricular (ATRIAL fibrillation and premature ventricular contractions), respectively. Data was analyzed by using descriptive statistics, paired t -independent and the correlation coefficient.

3. Results

The demographic data of patients are in Table 1. Mean serum magnesium in diabetic patients before surgery was 1.68 ± 0.79 and after surgery were 1.37 ± 0.26.

Table 1: Demographic data on study participants (*M: Male, F: Female, Di: diabetic, nDi: Non diabetic, A: Arrhythmia, T: Total, No.: Number*)

G	Vi	No., %	D_i	nD_i	T
-	A ge		57.07 ± 9.06	55.97 ± 10.37	56.26 ± 9.69
S e x	M	No.	144	188	332
		%	79.1	74.9	76.49
	F	No.	39	63	102
		%	20.9	25.1	23.51
A	+	No.	101	107	208
		%	55.2	42.6	47.93
	-	No.	82	144	226
		%	44.8	57.4	52.07

Paired t-test with (p = 000) showed significant differences. Mean magnesium levels in patients with non-diabetic prior to surgery was 2.53 ± 1.9 and after surgery was 1.93 ± 0.6 .Paired t-test with (p =0.39) showed significant difference.

Mean of total serum magnesium of diabetic patients was 1.08 ± 0.6 and in no diabetic patients was 1.37 ± 0.26 and t-test with p = 0.84 showed no significant difference. Average fasting blood glucose level of patients was 130 ± 62.26. Mean Glycosylated hemoglobin in diabetic patients was 7.65 ± 0.8.

Table 2: Mean serum magnesium in diabetic groups and non diabetic
Department of serum magnesium levels before surgery (mg $_b$) and postoperative magnesium (mg $_a$)

Group	Mg $_b$	Mg $_a$	P value Paired t
Diabetic	±0.79 1.68	1.36±1.26	0.000
Non diabetic	± 9.1 2.53	± 6.6 1.93	0.84
P value t	0.78	0.64	

Average blood magnesium showed significant positive correlation with Glycosylated hemoglobin, in other hand, there was significant negative correlation with the incidence of arrhythmias statistically. But there is no significant relationship with gender.

Table 3: Relationship between magnesium levels with some demographic variables Groups
(*HG: Glycosylated hemoglobin*)

G	Di		nDi	
Vi	R^2	P-Value	R^2	P-Value
Age	0.51	0.5	0.013	0.83
sex	-0.003	0.96	0.106	0.096
HG	*0.139	*0.004	-	-
A	**-0.136	**0.037	0.013	0.83

* Positive and significant relationship
** statistically significant negative relationship

4. Discussion

Hypomagnesaemia play key role in the pathogenesis of ischemic heart disease, cardiomyopathy and cardiac arrhythmias after heart surgery. It is Important to know that after cardiac surgery (*CABG*), patients may find hypomagnesaemia even though patients magnesium level preoperatively within the normal range (1, 21).

In addition, Magnesium deficiency has a negative effect on glucose homeostasis and insulin sensitivity in type 2 diabetic patients, therefore, Magnesium deficiency also increase a progression of symptoms such as retinopathy, thrombosis and hypertension (24)
In this study, average magnesium level in both groups of patients before surgery was normal range but after surgery was lower especially in diabetic patients underwent surgery.

In a study that was conducted by Nichols and colleagues in 2002 in London showed that correcting the magnesium level in patients underwent CABG surgery reduces ATRIAL arrhythmia - ventricular arrhythmia (P <0.01) (36).

The average concentrations of magnesium in the Zurich study on diabetic patients were 0.77±0.8 mg dl.

In this study 37.6 percent of diabetic patient's serum magnesium concentrations were lower than normal. While the 10.9 percent of non diabetic was patients had hypomagnesaemia (9).

Hasmn etal (1997) study in Switzerland was seen in diabetic patient's plasma magnesium significantly lower than in no diabetic patients. (0.5 m mol compared 0.53) (19).

In a 1991 study in Denmark found that 30 percent of all diabetics suffer from *hypomagnesaemia* (12).

In India was reported that all patients with diabetes who have normal renal function are suffering *hypomagnesaemia* (33).

Nagasy (1996) in Japan compared serum magnesium level in diabetic patients with non diabetic patients and concluded that diabetic patients significantly serum magnesium levels are lower (26).

Singh etal (1997), in their study concluded that dietary hypomagnesaemia the secondary complications of diabetes (32).

Results obtained in this study were similar to other studies have done in this field. And it seems that a problem of Hypomagnesaemia in patients with normal level should be considered to be more exploring by physicians and researchers.

This study demonstrated that Hypomagnesaemia is associated positively with Glycosylated hemoglobin, it is significant. In a study in Saudi Arabia on 300 patients with Type II diabetes was observed that there is significant relationship between the Glycosylated hemoglobin and hypomagnesaemia (3).

Also, a study in India found that hyperglycemia in diabetic patients inversely associated with Hypomagnesaemia and return this serum magnesium to normal with insulin administration (28).

In a study in Switzerland on 37 diabetic patients a clear positive relationship existed between hypomagnesaemia and glgcosuria (29). But a study in Texas in America between hypomagnesaemia and Glycosylated hemoglobin did not find any significant relationship (6).

Beshart (2006) in the study that conducted on diabetic patients over 90 years old find no significant statistical relationship between Glycosylated hemoglobin and hypomagnesaemia (16).

In all these studies because the relationship between Glycosylated hemoglobin or fasting blood glucose levels with moderate levels of serum magnesium that caused increase urinary excretion of magnesium . This is due to acidosis and osmotic diuresis which should be considered. In this study, gender has no effect on magnesium, but in general the serum magnesium level was higher in male diabetic patients. But in the Beshart study the average serum magnesium in diabetic patient's males was higher than in diabetic patient's females (16).

In other studies, the serum magnesium level of difference between men, women and patients with diabetes type 1 and 2 did not exist (6, 20).

More than 3 decades has marked the serum magnesium levels during cardiac bypass surgery is reduced (14-16).

The study also indicated that postoperative magnesium levels in both groups declined. In addition, incidence of cardiac arrhythmias is associated with hypomagnesaemia following cardiac surgery (*CABG*). Findings of other studies confirm the results of our study (5-8).

A lot justify causes of reducing serum magnesium after CABG surgery are rare, however, they are as following: blood, intracellular magnesium loss during surgery, myocardial hypoxia, binding magnesium ions with heparin and use of blood preservative solution in the absence of allogeneic transfusion (26).

In patients with diabetes increase magnesium deficiency could be noted by renal excretion, reducing consumption or impaired absorption of magnesium (29).

Changes of Magnesium level have significantly impact on the metabolism, cellular structure and processes. The key enzymes of metabolic pathways in mitochondrial ion transport, calcium channel activity in the plasma membrane is adenosine triphosphate, which by changes level of magnesium will be corrected (1).

5. Conclusion

Relationship between serum magnesium levels with incidence of cardiac arrhythmias in non-diabetic and type 2 diabetes underwent coronary artery bypass graft surgery (*CABG*) is very important.

If the lack of attention to these ions, diet and treatment before and after surgery, that will threatens diabetic patients with dangerous arrhythmias and insulin resistance .Therefore, this lack of attention would have serious impact on the outcomes of these patients.

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Effect of Amount & Different Intravenous Tranexamic Acid on Postoperative Bleeding in Patients Undergoing Coronary Artery Bypass Graft (*CABG*)

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Abstract: CABG is one of the most common major surgical procedures. The most important complication is bleeding in CABG under *Cardio pulmonary bypass* (CPB). Tranexamic Acid, an anti-fibrinolytic drug is hydrophilic and a competitive and reversible convert plasminogen to plasmin can be prevented. That can be administered orally or intravenously during certain procedures to reduce bleeding. The most important complication of CABG in patients undergoing Cardio *pulmonary bypass* (CPB) is bleeding, 15 to 20 percent of the consumption of blood products in cardiac surgery patients is about 5% of patients with excessive bleeding due to surgery needs to be re-operation that may increase morbidity and mortality. Various methods to reduce bleeding in CABG surgery around the infusion of blood products and injections of anti-fibrinolytic drugs (Tranexamic acid) are. In this study, treatment with different doses and different methods Tranexamic acid in order to find the minimum effective dose and the injection method in controlling bleeding and reducing the need for transfusion of blood products has been used.

Key words: *Intravenous, Tranexamic Acid, Bleeding, CABG*

1. Introduction

The most important complication of CABG in patients undergoing (CPB: *Cardio pulmonary bypass*) is bleeding, 15 to 20 percent of the consumption of blood products in cardiac surgery patients is about 5% of patients with excessive bleeding due to surgery needs to be re-operation that may increase morbidity and mortality. Various methods to reduce bleeding in CABG surgery around the infusion of blood products and injections of anti-fibrinolytic drugs (Tranexamic acid) are.

In this study, treatment with different doses and different methods Tranexamic acid in order to find the minimum effective dose and the injection method in controlling bleeding and reducing the need for transfusion of blood products has been used.

CABG is one of the most common major surgical procedures (1-2) the most important complication is bleeding CABG under CPB (3). Although blood transfusions and blood products to control bleeding after CABG major bleeding is the control and treatment, 15%-20% of the consumption of blood products associated with cardiac surgery (4-11).

Transfusion of blood products in cardiac surgery increases risk the infection and sepsis (6), lung dysfunction, prolonged mechanical ventilation (13),

hospital mortality (9) short permanent quality of life after surgery (5).

Tranexamic Acid, an anti-fibrinolytic drug Hydrophilic is a competitive and reversible (8) blocks the conversion of plasminogen to plasmin, which can be administered orally or intravenously during certain procedures to reduce bleeding (2).

Tranexamic acid has been reported that anti-inflammatory effects on its chemical form, and therefore its chemical form in parotid surgery, CABG surgery under general use and hemophilia (1).

Tranexamic acid primarily filtered by the glomeruli, and over 95% of the excreted unchanged in urine is (1) Symptoms seen in the drug include the following:

A. *Hypotension in rapid injection. (Faster than 1 CC in minute) intravenously and orally, but not seen.*
B. *Gastrointestinal symptoms include nausea, vomiting, abdominal pain and diarrhea, which decreased the effective dose, is also lower.*
C. *Thrombocytopenia, prolonged bleeding time (10).*
D. *The main risk of Thromboembolism complications of drug inhibition of fibrinolysis, which is a natural defense mechanism against thrombosis formation, is caused (7-12).*

Therefore in this study with different doses and different ways to remedy acid Tranexamic find the minimum effective dose and the injection control

bleeding and reduce the need for transfusion of blood products in CABG surgery has been used.

2. Materials and Methods

This study was a randomized clinical trial in 2011 on 70 patients with ASA Class 2-3 age group 50-70 years and due to arteries disease in coronary heart surgery Ahwaz JundiShapur University of Medical Sciences, Golestan Hospital Affiliated to have been a candidate for elective CABG. Divided into blocks and each block of seven patients randomly treated with a combination of fast or slow infusion technique and dose (10-15 & 20mg/kg) were.

Control group not given drug. The numbers of patients in each 10 were in group therapy.

In all groups studied was a heart surgeon, and hepatic and renal disease in patients with no history of ant platelet and anticoagulant drugs at the time of the cut and coagulation tests were normal before surgery. The night before surgery in all patients after surgery, talk to them and explain the procedures for obtaining informed consent from patients has been.

One hour before surgery as premedication to all patients' 0.1 mg/kg morphine is injected into muscle.

5cc/kg surgical bed volume of normal saline solution as *Compensatory volume expansion* of the volume was injected into the patient, monitoring should include (CV. line-Arterial line-ECG monitoring - Pullsoximetry-) and establish a baseline ABG was sent to patients.

Induction of anesthesia drugs, midazolam, sufentanil, sodium thiopental and atracurium and intubation performed in the same circumstances would do. Patients divided into seven blocks and seven bits in each block, patients randomly treated with a combination of two methods of rapid infusion (over 20 minutes before incision and after Rivers heparin) and slow infusion (over 4 hours during surgery) Tranexamic 10-15-20mg/kg acid with three doses plus 300cc normal saline) were included.

The seven bits of each block as a patient in 300cc normal saline as a placebo was given. Maintenance of anesthesia was in patients with midazolam, atracurium and sufentanil.

Patients transferred to ICU after cardiac surgery, 6-4 hours after surgery, patients were Rivers and X-Tube. All patients with ON PUMP and hypothermia during cardiac surgery were 32 degrees Celsius.

The amount of heparin and protamine sulfate was used based on the same weight. Criteria for measuring the blood volume of postoperative bleeding in patients with chest bottle within 24 hours after the separation time to time is measured and recorded. The amount of blood product transfusions, incidence of side effects, low levels of platelets and coagulation tests within 24 hours after surgery were measured in seven groups,

were recorded and compared. Total operative time and pump time were recorded and were compared.

Statistical Software was performed by data processing for quantitative variables are expressed as mean and standard deviation and maximum and minimum data was used. Qualitative variables were used for the percentage and number of P-Value <0.05 was considered significant.

3. Results

Comparison of the bleeding (6 hours) - (6-12 AM) (12-18PM) (18-24 hours) and total time of 24 hours after surgery showed a significant difference between control group and other groups the (P_V=0.0001).

The second significant difference between bleeding 6 hours (6-12 pm) after the dose groups10-15 & 20mg/kg)) method was performed with a slow infusion of 20 mg kg and the infusion was rapid. Within 24 hours after surgery to control bleeding from other groups has had an average 500cc.

Comparison between the control group received blood products and other studies show a significant difference (P_V=0.26).

Injection between groups with different doses and methods of receiving blood products was not significant difference (P_V=0.1).

Groups were studied in 9 patients experienced adverse events (13.88%) and minimal side effects that are not significant in the group with the slow infusion in groups so that the injection of acid Tranexamic 10-15mg/kg and no slow not shown any symptoms.

Total time of operation and on-pump group showed no significant difference (P_V=0.66).

Injection Tranexamic with periodic acid, 15 mg kg and with a slow infusion method in reducing the incidence of adverse bleeding and Transfusion blood products within 24 hours after CABG surgery has the best performance.

To compare the mean age of patients (seven groups) of ANOVA was used with (P_V=0.819) significant differences between age groups was found.

Patients (58.6%) and males (41.4%) were female. The average age of men (58±9.6) the average age of women (59±7.43) the t-test showed no significant difference in age between the sexes (P_V=0.45).

The mean BMI [2] in different groups (seven groups) of ANOVA were significant differences between groups in BMI was observed P_V = 0.184.

The mean BMI in the total study population (27.48±4.3) and men (26.78±3.9) and women (28.34±4.7) was.

In this study 64 patients (IHD =91.4%) and 41 patients (MI= 58.6%) patients. Of 36 patients (51.4%) Fc = 3 and 34 (48.6%) FC = 2 have. Of 36 patients (51.4%) patients with HTN and 19 (27.1%) with

diabetes and 21 patients (30%), smoking, and 7 patients (10%), use alcohol, and 11 patients (15.7%) Addictions to Drugs have.

ANOVA to compare the amount of bleeding in the seven groups studied during the first 6 hours postoperatively was used (P_V=0.0001) significant difference in bleeding rate of at least two groups was observed (Table 1).

LSD separation test showed that the control group with other groups had significant bleeding (P_V=0.00001).

ANOVA to compare the amount of bleeding in seven cases reviewed in 6 second (now 6-12) was used after the (P_V=0.0001) were significant, LSD tests showed that the control group with other denotative groups had significant bleeding (0.04 ≥ P_V).

The second significant difference between the amount of bleeding at 6 h after the injection Tranexamic acid in doses of 20mg/kg dose 10-15& 20mg/kg and slow infusion and rapid infusion was necessary to mention the amount of bleeding in rapid injection of 20mg/kg and the second at 6 h after injection of the groups has been slow (Table 2).

ANOVA to compare the amount of bleeding in seven cases reviewed in the third after 6 hours (12-18 hours) was used with (P_V=0.17) significant difference was observed in at least two groups.

LSD test for significant differences between control group and other groups indicated the bleeding (P_V=0.05). No difference was observed in other groups.

ANOVA to compare the amount of bleeding in seven quarters examined within 6 hours (18-24 hours) after surgery was used with P = 0.025 least significant difference was observed between the denotative LSD test significant differences between control group and other groups showed (P_V=0.05) together with other groups did not differ significantly.

ANOVA to compare the amount of bleeding in seven groups total about 24 hours after surgery was used with (P=0.0001) the least significant difference was observed between the two groups (Table 3).

Disaggregated LSD test showed significant differences between control group and other groups (p =0. 0001).

It operates 24 hours after the bleeding control of bleeding from other groups is 500cc.

ANOVA to compare the action of platelets in the control group and other groups was not significant difference (p = 0.49).

Pearson correlation coefficient for assessment of the relationship between platelet levels and hemorrhage were studied in patients with (r=-0.11) relationship was not significant (P =0.33).

ANOVA to compare the means of blood products received were used after surgery in patients with

(P=0.026) was a significant difference between the denotative LSD test between the control group and other groups showed significant (P_V=0.03).

Injection between the two groups, significant differences were observed in relation to blood transfusion (P_V <0.1).
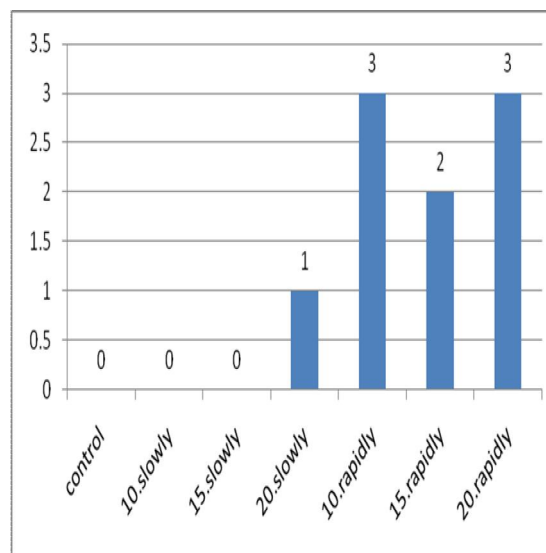
Fig 1. Side effects of slow and fast injection

Side effects

In all patients studied (control group and other groups) 9 people (13.88%) experienced side effects were statistically significant, but the reviews are not in control any side effects not observed in patients in groups of injecting drug Groups with fewer side effects than slow injection was administered as a rapid injection groups 10-15mg/kg and slow infusion methods were not any side effects (Fig 1).

The slow infusion of intravenous injection Tranexamic acid method can be side effects to remove.

The ANOVA comparing the average for the entire time and operate the pump that was used in the study groups (P =0.66) differed significantly between the groups during the entire operation and the pump was not investigated.

Comparison of creatinine and BUN values for repeat test before and after surgery in the groups studied were significant differences between pre and postoperative creatinine and BUN were observed in the groups studied (P =0.001) between the groups but The difference was not significant (P =0. 8).

In our study (paper) no symptoms of Thromboembolism Tranexamic acid injection showed have-not death (mortality) to the time of our follow-up (patients discharged from the hospital) did not happen.

Table 1. ANOVA to compare the amount of bleeding in the seven groups studied during the first 6 hours after surgery

6hrs	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
control	10	395.00	220.668	69.781	237.14	552.86	250	1000
10mg-IV-Slowly	10	146.00	119.648	37.836	60.41	231.59	40	410
15mg-IV-Slowly	10	100.80	59.719	18.885	58.08	143.52	30	230
20mg-IV-Slowly	10	173.00	90.068	28.482	108.57	237.43	0	290
10mg-IV-Rapidly	10	89.50	67.101	21.219	41.50	137.50	0	200
15mg-IV-Rapidly	10	77.00	52.079	16.469	39.74	114.26	0	150
20mg-IV-Rapidly	10	85.00	57.446	18.166	43.91	126.09	0	180
Total	70	152.33	148.836	17.789	116.84	187.82	0	1000

Table 2. ANOVA to compare the amount of bleeding in the seven groups studied during the secondary 6 hours after surgery

6-12hrs	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
control	10	198.50	88.884	28.107	134.92	262.08	80	420
10mg-IV-Slowly	10	57.50	41.982	13.276	27.47	87.53	0	120
15mg-IV-Slowly	10	40.70	31.805	10.058	17.95	63.45	0	100
20mg-IV-Slowly	10	50.00	43.461	13.744	18.91	81.09	0	150
10mg-IV-Rapidly	10	85.00	43.970	13.904	53.55	116.45	0	150
15mg-IV-Rapidly	10	67.50	79.626	25.180	10.54	124.46	0	270
20mg-IV-Rapidly	10	135.50	109.860	34.741	56.91	214.09	10	360
Total	70	90.67	84.333	10.080	70.56	110.78	0	420

Table 3. ANOVA to compare the amount of bleeding in the seven groups studied during the fourth 6 hours after surgery

24hrs	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
control	10	860.00	404.997	128.071	570.28	1149.72	520	1900
10mg-IV-Slowly	10	281.00	141.457	44.733	179.81	382.19	140	600
15mg-IV-Slowly	10	273.80	173.900	54.992	149.40	398.20	85	680
20mg-IV-Slowly	10	332.50	118.539	37.485	247.70	417.30	100	450
10mg-IV-Rapidly	10	293.50	98.094	31.020	223.33	363.67	140	450
15mg-IV-Rapidly	10	304.00	155.863	49.288	192.50	415.50	120	620
20mg-IV-Rapidly	10	315.90	140.283	44.361	215.55	416.25	140	560
Total	70	380.10	275.794	32.964	314.34	445.86	85	1900

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A Comparative Approach to Performance Evaluation of University Professors

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Abstract: The following research investigates a comparative approach to performance appraisal of university professors, professors in compare with educators. In order to go on through this research, we have developed an instrument which is a questionnaire That includes 16 indicators of teaching performance. This questionnaire satisfies a reliability of %70 according to the Cronbach's Alpha. Statistical population chosen for the research is B.S. students of the Shahrood University of Technology. In summary, this research indicated that from the point of view of the students, in 12 indicators, the university professors did make it better in compare with the educators. In 1 indicator, the educators were in higher rank and finally in 3 indicators, no meaningful differences were found.
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Introduction

Planning and performance appraisal in higher education is one of the main functions of university management.

In order to achieve objectives in this system, the performance appraisal must be viewed as superior entity to other university management practices. (Bazargan, 1997). This will cause reaching to suitable expected goals by using resources more effectively. Therefore, the university system should continuously make judgment about suitability of its inputs, process and output. As a result, it should provide some sound bases for decision makers in the field of education, research and specialized services to the society. The remedy for reforming any system without recognition of its inside, outside and changes is not possible. That means a continuous appraisal. Appraisal will only give us optimum result, whenever the appraiser is one of the stake holders in the system. (Bazargan, 2001). In despite of enormous influence of Information Technology and different types of mass media, still using of appraisal system through receiving students opinion remains as a proper method for quality improvement and appraisal of professors within the higher educational systems.

Appraisal of Higher Education

Higher education appraisal is defined as a process of determining, preparing and collecting data and information needed for making judgment about elements of higher educational system in order to make decision for any improvements (Bazargan, 2001). Therefore, higher education appraisal is a tool for achieving objectives in higher education system. In general, expectation from higher education is that it does the five basic functions; teaching, learning, research, search for knowledge and university administration with related services to the society. In order to accomplish such objectives, the higher education management functions should be evaluated. These functions include ; planning and development of higher education, organizing higher education, directing and leading of higher education and appraisal of higher education (Bazargan, 1995). Approaches to the higher education appraisal are;

1.Internal appraisal, 2- External appraisal, 3- Using of performance indicators, 4- Feedback from student and other relevant people, 5- Knowledge and skill test for the educated (Bazargan et al. 2000 quoted from Harman, 1996).

In these approaches, the internal and external appraisals have a theoretical framework in which enable us to make changes within the training groups as well as the higher educational institutions by preparing a suitable conditions for change.

Literature Review

Higher education appraisal in the United States goes back to a century ago. Organized efforts to coordinate quality improvement in higher education in U.S. began from years ending the 19th century and 1st decade of the 20th century. These efforts have been considerably increased in 1950-1960. In the coming decades, the concept of quality and its improvement for goods and services has been center of attention and gradually this concept find its way into higher education as well.

The Total Quality Management (TQM) also has become an important subject in higher education in the United States. (Bazargan, 1999).

In European countries during 1980 - 1990 and in line with creation of European Union, coordinated

efforts took placed in order to prepare proper means for improvement and quality assurance in the higher education. Since 1995, in France, England, Denmark, Finland and Ireland, special institutions were established just for higher education appraisal.

Among Asian countries, South Korean and Indian experiences in appraising higher education were more coherent and stable. Also in Iran, some efforts has been taken for making judgment about quality of higher education system and its continuous improvement through implementing a pre-research proposal in the medical education which started in 1996. Due to its success, the internal appraisal for all the medical groups in more than 30 universities was implemented. In line with implementation of regulation related to the third "5 year development plan" law, the science, research and technology ministry has made efforts to start the internal appraisal since 2001.

Faculty Appraisal (Educators & Professors)

For the first time in the world, the Harvard University students find an opportunity to appraise their professors officially in 1924. In Iran, students from the Hamedan University were the first to appraise officially in 1971. Today, most universities in the world, completing a appraisal form for the professors has become as a university official regulation and has been recognized as one of the higher education laws. (Ahmadi, 2004).

For this purpose, several different methods have been suggested for the professors appraisal. Job interview, test of knowledge, attitude and skill, colleague's opinion, classroom observation, student's feedback about the training process, professor self evaluation and review of any progress regarding professionality and acquired special skill by the faculty member are the most common type of appraisal system used so far (Bazargan, 2001).

Philosophy and the intension for the faculty appraisal can provide us useful indicators for faculty, students and quality of the system evaluation considering if the faculty appraisal will be accomplished on the bases of the value system with the participation of the interested parties. This can create a feeling of satisfaction, support, decrease feeling of hopelessness, personal development and growth, increasing competency, effectiveness, excitement, pleasure, active participation, developing talents and increasing ability for teaching. (Ahmadi, 2004 quoted from Perkins, 2000).

Appraisal By Using Student's Feedback

Student's feedback as a method of appraisal for teaching has been widely used around the world with considerable growth and assumed to be the most commonly method available. For example, regular application of such method is a common practice within the American universities at the end of each term. It is unlikely to find a university that does not use student 's feedback as a means of teaching appraisal. (Nasr Esfahani, 2004 quoted from Centra, 1993).

Appraisal by using student's feedback in Iran also has been taken into considerable attention recently and has been accepted as a basic policy in most universities. For example, planning several training courses, running workshops in this subject and paying attention to the details of scores recorded for the teachers in the teaching appraisal forms show the important of this approach as a indicator for its promotion within the university hierarchy system.

Some of the strong points in getting feedback from the students are as follow: validity of findings, relatively low cost and ease of implementation, using first hand observation from student and accomplishing main objectives of appraisal; namely, teaching improvement, promotion and encouragement of teachers, course selection by the student and related researches. Of course, some criticisms have been made to the student appraisal. These include, lack of agreement on effective teaching criteria, lack of agreement on teaching concepts, student's lack of skill in appraising of some the teaching fields, lack of proper instruments, implementation methods and analysis. (Nasr Esfehani, 2004).

With consideration of strong and weak points in the student's appraisal, It is better to use other techniques along with student's feedback for gaining a clear and complete picture of teaching quality in order to acquire sound bases for making judgment.

Further more, It should be noted that efficiency of this approach depends on a lot of factors including suitability of used instrument and a fair student's report about the teaching (Nasr Esfahani, et al, 2004).

Describing the Problem

Quantitative spread and growth of higher education without any consideration to the quality will create problems such as school leaving,surplus of specialized human resources in some fields and finally loss of human and as well as financial resources (Ghorcheyan, 1994).

Experiences resulted from the evaluations on the national and international levels shows that application of internal quality appraisal system had a considerable effect on the continual improvement in teaching activities, appraisal parameters such as faculty member, students, teaching process and learning. These have had important role in the quality improvement of higher educational system because they caused some task reforms and compensated deficiencies (Bazarghan, 1996).

In this study, the main question is that whether there are any significant differences between the student's views on teaching performance of the educators (Holder of master degree) compare with the associate professors (Holder of Ph.D degree) and higher from factors and indicators such as; proficiency in the theoretical and practical subjects, teaching methods, adequacy and being up to date about teaching resources, creating research motivation in students, accessibility to the teachers and other issues?

Finally, the findings of this research could be used as a bases for the continual quality improvement in the higher educational system and universities in the country.

The scientific evaluation of ministry of science's policy with regard to employment of educators for the universities is also point of attention of this study. The higher education section of the " Third Development Plan " stated that the necessity of reform within faculty member hierarchical system should take placed.Also, with consideration that recruitment of needed employees for most fields in the past years were by the educators, then, it has been decided that;

.1All the universities, higher educational and research institutions related to the ministry of science are not allowed to recruit any faculty member with the educator level.

2.Any changes from the educator level to the faculty level for the employment status of all the university and higher educational and research institution related to this ministry is not allowed. Of course, if necessary situation arrives and when ever the university authorities insist on employing an educator, they have to get permission after sending a report justifying the reasons for recruitment. Although, with an exception, in the field of Islamic theology, the employment prohibition for the educator has been removed.

The main question of this study is that whether or not the effectiveness and performances of educators and assistance professors based on the student 's point of views have any significant differences ?

Research Design

Based on research objective, this is an applied research. The research findings can be used in universities for faculty employment, but from data collecting, this study could be considered as a case – driven descriptive survey.

Statistical Population Sample

The studied statistical population sample includes undergraduate students from the Shahrood University of Technology. Based on the research data, the university educators were 30% of total faculty member. The data collection uses a statistical sample of 400 person from statistical population of nearly 3500 students of different departments were chosen by random and rank sampling method.

Data Collecting and Analysis of Research Data

A questionnaire has been used for collecting required research data. This questionnaire has 16 indicators which was extracted from the different faculty evaluation forms existed in the university supervisory and evaluation office. Validity of the questionnaire was tested by using Cronbach's Alpha method which was estimated to be 70%. This indicates a high validity for a measuring instrument. For analyzing of the research data, the SPSS software and Test of mean comparison method between two statistical population were used. Stages for the statistical hypothesis testing of statistical mean pair includes hypothesis definition of H1 and H0, determining test domain in expected confidence level, calculating test statistic, determining critical value and finally the decision making.

Research Findings

Further, the educators and assistance professors were compared according to the 16 research indicators :

The first indicator; Competency in theoretical subjects

First stage: Defining of hypothesis H 1and H 0

For Indicator of proficiency in theoretical subjects,the mean score for educator and professor are equal.

$$H_o = \mu_1 = \mu_2$$

For indicator of proficiency in theoretical subjects, the mean score of educators and professors are not equal

$$H_1 = \mu_1 \neq \mu_2$$

The second stage; Determining test domain in confidence level of %99.

The third stage; calculating the statistical test

$$t^* = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = 6.405$$

The fourth stage; Decision making (Result). Since the statistical test (t*) in H_1 region is positive with %99 confidence, it can be stated that Hypothesis H0 is rejected. Namely in respect to proficiency in theoretical subjects, the assistance professors are superior to the educators. For other 15 indicators, the above stages have been repeated and the result are shown in following table (Table 1):

Table 1. Comparison table of research indicators between the assistance professors and the educators

Indicators	No Significant Difference	Superiority of Assistance Professors	Superiority of Educators
1-Proficiency in theoretical subjects		1	
2-Power of speech and understandability		2	
3-Teaching methods		3	
4- Teacher accessibility			4
5-Adequacy of teaching resources		5	
6-Being up-to-date in teaching resources		6	
7- Students evaluation		7	
8-Teacher interest in answering student questions		8	
9- Proficiency on scientific and laboratory practices		9	
10-Power of speech and transferring concepts		10	
11-Creating research motivation in students		11	
12-Paying attention to student's views		12	
13-Matching lab subjects with the theoretical subjects		13	
14-Keeping order and discipline in lab administration	14		
15-Active participation of teacher in the lab	15		
16-Optimum use of lab equipments	16		

Results

As the above mentioned table, the analysis of results shows that:

a) From point of view of proficiency in theoretical subjects; the professors are superior to the educators

b) From the view of the power of speech, understandability and transferring concepts; the professors are superior to the educators.

c) From the view of teaching methods; the professors are superior to the educators.

d) From the view of accessibility of teacher; the educators were superior to the professors.

e) From the view of adequacy of teaching resources; the professors were superior to the educators.

f) From view of being up-to-date in teaching resources; the professors were superior to the educators.

g) From view of students evaluation; the professors were superior to the educators.

h) From view of teacher interest in answering student's questions; the professors are superior to the educators.

i) From view of proficiency on scientific and laboratory practices; the professors are superior to the educators.

j) From view of power of speech and transferring concepts to the students in lab; the professors are superior to the educators.

k) From view of creating research motivation in students; the professors were superior to the educators.

l) From view of paying attention to the students's views; the professors were superior to the educators.

m) From view of matching lab subjects with theoretical subjects; the professors were superior to the educators.

n) From view of keeping order and discipline in lab administration; the professors and the educators did not have any superiority to each other.

o) From view of active participation of teacher in the lab; the professors and the educators did not have any superiority to each other.

p) From view of giving the right order and optimum use of laboratory equipments; the professors and the educators did not have any superiority to each other.

Suggestions

i. It is suggested that the university supervisory and evaluation office should declare the average score of each teacher gained for each term. In addition, by determining of the strong and weak points of each one based on the mentioned indicators, continual improvement of weak points and strengthening of the strong points of each teacher can be supervised.

ii. For achieving the higher educational objectives and gaining the satisfaction of its main customers (namely the students), the university should plan and implement continual training courses for upgrading the teaching skills and make the participation of teachers in these courses mandatory along

with providing financial as well as spiritual rewards for them.

iii.   In each educational term or year, the teachers whom have excellent records or good performances should be identified by the accurate evaluation of indicators such as teaching talent, research interest, ethical conducts and so on. In a special gathering of students and teachers, these selected faculty member should be properly recognized and rewarded in order to act as a motivation and encouragement for other teachers to do harder and better work.

iv.   Due to trends in new higher education and necessity of reforms in university faculty hierarchy, a medium term training plan is suggested in order to create opportunity for the educators to continue their education up to the Ph.D level. This will enforce and encourage positive psychological, emotional and scientific feeling in them.

v.   If the situation allows, It is suggested that some of the under graduate or graduate courses which have a mixture of theoretical and practical subjects can be presented jointly by both the professors and the educators.

vi.   It is suggested that within the universities system, the special and challenging issues of new higher education such as university administration and financial independency, changes in university mission, globalization, creation of new knowledge, quality assurance and so on become focus of attention in order to be able to absorb financial support for the related research activities as well.

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Investigate the Prevalence of TB Patients Referred to TB Healthcare Industry

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Abstract: The World Health Organization (WHO) estimates that more than one-third of the World's population is infected with *Mycobacterium tuberculosis*. Even in the developed world, TB rates are stable at best, and actually increasing in many areas. This is due to factors such as immigration, HIV and other immunosuppressive conditions. Tuberculosis is an infectious disease that is transmitted through the air. Patients with pulmonary tuberculosis are infected in this study (39.5%) people are included. This study was performed in since 2001-2006 years in patients referred to TB Ahwaz oil industry. The numbers of Patients were 48 with diagnosed pulmonary tuberculosis and pulmonary that they were treated with drugs. 19 (39.5%) smear-positive pulmonary tuberculosis, 6 cases of scrofula (12.5%), 4 TB neck and axillary lymph nodes (20.8%), 7 cases of renal tuberculosis (14.5%) and 4 cases of TB in smear-negative patients were diagnosed. [**A. sarami. Investigate the Prevalence of TB Patients Referred to TB Healthcare Industry.** Life Science Journal. 2012;9(1):35-38] (ISSN: 1097-8135). http://www.lifesciencesite.com

Key words: Tuberculosis, prevalence

1. Introduction

Tuberculosis is an infectious disease that is transmitted through the air. Patients with pulmonary tuberculosis are infected in this study (39.5%) people are included.

Human tuberculosis (TB) is a highly contagious bacterial infection that is passed from person to person through droplets in the air. It is usually spread by coming in contact with an infected person who is actively coughing or talking. Infection is caused by the bacteria multiplying inside the body, causing tissue and organ damage. Without treatment, half of those with active TB infection will die. Most people know TB as a disease that is in the lungs. However, not all active TB disease is in the lungs. Around 40% of people who have active TB disease have the infection in another part of their body (e.g., lymph glands, brain, spine, kidneys, or other organs). This occurs when the bacteria spread outside of the lungs. In these cases, TB is more difficult to diagnose since the patient does not have the normal signs and symptoms associated with pulmonary TB.

TB bacilli are spread by coughing or sneezing, talking, and therefore these patients should be isolated from the other person if the person with untreated tuberculosis can infect 15-10 people can. In many of these people, the TB bacilli and surrounded by the immune system remain dormant.

With weakened immune systems of these bacilli to a dormant TB bacillus become active and can cause disease. Totally ⅓ World populations are infected with TB bacilli and only 5-10this people, tubercle bacilli in the stage of your life to be suffering from active tuberculosis.

TB was a rare disease in developed countries until 1985, the prevalence of HIV in TB patients in the growing community.

35% of global tuberculosis in sub-Saharan Africa, Southeast Asia has occurred in view of the above amount is estimated to be 350 case in per 100000 and 1.7 million people died from TB in 2009 due to have lost most of the deaths occurred in Africa.

Iran is located in the Eastern Mediterranean Region of WHO, the incidence of multiple divisions in the region of 7.61% and the number per 110 inhabitants is 100000. The prevalence per 180 populations is 100000, which include old tuberculosis in a given time is new mortality rate to 18 per person is 100000.

Although the epidemiology of **tuberculosis,** a disease agent is known and the principles of treatment of about 60 years ago and more than a quarter century as a treatment regimen that used for the short term, but part of the TB patients Yet in many parts of the world including our country undiagnosed and or are not treated properly, and unfortunately we now see that the same shortcomings and the increasing cases of HIV infection, the emergence and spread of multidrug-resistant tuberculosis bacilli (Multi - Drug Resistant TB = MDR-TB) is collected.

Despite being the most common causes of failure in global TB control and lack of government support and shortcomings in the health systems of countries considered, but in many cases, these **doctors** are following such reasons, the delay in diagnosis and mistake patients and hence the formation of the world's failure to play a significant role:

a. *Excessive reliance on the use of radiology in the diagnosis and microscopic examination of sputum,*

b. *prescribe the wrong treatment regimens, and lack of scientific credibility,*

c. *treated with doses of medication errors and / or inadequate treatment,*

d. *Shortcomings in monitoring patients during treatment,*

e. *Follow up and evaluation of the shortcomings identified by people in contact with patients (especially family members of patients with positive pulmonary TB).*

However, these errors result from negligence by anyone and is not something that any government other than wasting assets, issued a cease-morbid diseases and the emergence of multidrug-resistant tuberculosis as fatal (MDR-TB) treatment is impossible if would be difficult and expensive.

Tuberculosis history

3000 years BC

• Tuberculosis of the spine was found in Egyptian mummies.

• Tuberculosis in the law of Manu in India as one of the reasons for the prohibition of marriage with a girl who has had TB disease in their ancestors.

• Cited in ancient Chinese medicine to tuberculosis.

• Referring to the Greek historian Herodotus in Egypt as the center for TB treatment

BC 700 years

• The cult of the prophet Zoroaster in the disposal of sputum transmission

500 years BC

• Fully described and mentioned the great Greek physician Hippocrates health problems and complications of tuberculosis by

300 years BC

• Aristotle refers to tuberculosis

The first century AD

• Galen's experimental medicine and drugs as described in relation to TB treatment is applied. He believed that to prevent the spread of disease, TB patients should be isolated from healthy individuals.

Sixth to eighth century AD

• Abu Bakr Mohammad Zakaria Razi described by tuberculosis in the book Alhavy

He is the first doctor in connection with tuberculosis of bones and organs are discussed.

The tenth century AD

• Provide valuable information in relation to clinical and pathological disease by Sheikh Alryys Avicenna (980-1037 AD) in the book.

Eleventh century

• Interesting presentation about tuberculosis in the book store Kharazm by Sydasmayl Jarjani (1135 AD)

1548

• Founded the science of epidemiology by Frakastrv Italian (1548 AD) and the theory of intervention implemented in a non-factor for the transmission of tuberculosis.

1972

• Pyrazinamide use as a drug of drug-resistant TB, reduce the period to at least 6 months of TB treatment

1982

• TB control until 2000, based on the optimistic theory decreased risk of mortality from tuberculosis in Buenos Aires Complex

1985

• Rising curve of tuberculosis mortality in the world and the first epidemic (World of return) and the second epidemic (associated with HIV infection and tuberculosis) as well as all of the new (Modern Epidemic) has suggested.

1991

• The incidence of the tuberculosis epidemic of the few drugs and TB control targets by the World Health Organization 2000

1993

• Access to 20 million TB patients in the session in Paris and declared tuberculosis a global emergency and failure to acknowledge the World Health Organization program to fight tuberculosis in most developing countries in recent years.

Classification

-Kingdom   Bacteria.
-Phylum   Actinobacteria.
-Order   Actinomycetales.
-Suborder   Corynebacteriaceae.
-Family   Mycobacteriaceae.
-Genus   Mycobacterium.
-Species   M. tuberculosis
approximately (100) species
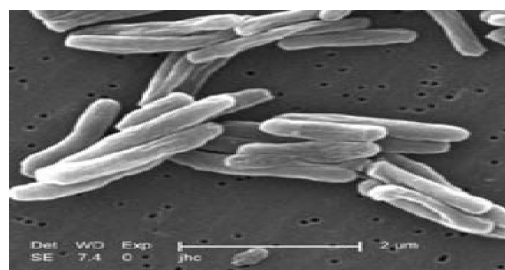
Mycobacteria are Gram-resistant (waxy cell walls), non-motile, pleomorphic rods, related to the Actinomyces. Most Mycobacteria are found in habitats such as water or soil. Tuberculosis, MTB or TB (short for *tubercles* [bacillus](#) *However, a few are intracellular pathogens of animals and humans.* Mycobacterium tuberculosis*, along with* M. *bovis,* M. *africanum, and* M. *microti all cause the disease known as tuberculosis (TB) and are members of the tuberculosis species complex. Each member of the TB complex is pathogenic, but* M. tuberculosis *is pathogenic for humans while* M. bovis *is usually pathogenic for animals.*

Today, tuberculosis and HIV are a deadly two-fold because it helps accelerate the progress of each of these diseases.

AIDS weakens the immune system with a person's risk for fatal form of tuberculosis can be favorable. Tuberculosis is a major cause of death in AIDS patients.

2. Results

The study took the form of pulmonary tuberculosis was often involved in this center (39.5%).

The most common form of pulmonary involvement of axillary lymph node involvement and neck secretary (32.3%) and renal tuberculosis incidence (7.5%) was observed.

Forms of pulmonary tuberculosis from the pericardial TB - Pleural, eye & abdomen - abscess of the chest - and each one case of miliary tuberculosis is reported.

Cell involvement in the family was a member of a people with active pulmonary tuberculosis and pulmonary tuberculosis, pleural involvement of the family after receiving treatment for active pulmonary tuberculosis were the three methods were completely cured Dots.

Total of 19 patients with pulmonary tuberculosis in 11 cases (57.8%) is seen in women and that 29 cases were reported in the lung (68%) were most common in women.

Total (68.5%) patients are women. 73% of TB patients living in areas with low income that is included with TB usually has a hand in the poor areas.

2.1. The prevalence of pulmonary tuberculosis

The highest prevalence was observed in 19 cases of pulmonary tuberculosis at the age of 2-3 to 9 people. In 29 cases had pulmonary tuberculosis meets the highest number in the 4-5 and 5-6 to No. 8 and 7 were.

During treatment of patients with side effects as nausea, regurgitation - severe itching, jaundice,

abdominal pain who do complain of simple arrangements and problems were resolved and treatment was continued. Two-year clinical follow up of all patients are good.

Table1. The prevalence of pulmonary tuberculosis

Total : 29 Patients		Total: 19 Patients	
No.	**×10**	**No.**	**×10**
2	1-2	9	2-3
2	2-3	3	3-4
4	3-4	2	4-5
9	4-5	4	5-6
7	5-6	4	5-6
2	6-7	-	1
3	7-8	-	-
1	8-9	-	-

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Amputation of the Foot in Diabetic Patients

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Abstract: An amputation usually refers to the removal of the whole or part of an arm/hand or a leg/foot. Amputations can occur after an injury (traumatic amputation) or deliberately at surgery. The populations covered by the oil-rich areas (99,062 people) about 5500 diabetic patients were identified. 2 years in 35 cases of amputation due to diabetes was reported that 9 of them did so were excluded. Amputations due to diabetes was 26 of 17 (65%) were related to Ahwaz, and only 12 (70%) of oil have been covered by large hospital diabetes clinic. 6 out of 12 patients (50%) patients had diabetes clinic regularly.

1.Introduction

An amputation usually refers to the removal of the whole or part of an arm/hand or a leg/foot. Amputations can occur after an injury (traumatic amputation) or deliberately at surgery. In vascular surgery amputations are only rarely performed on the arms. Vascular surgeons frequently have to perform amputations of toes or legs. It is one of the oldest surgical procedures with artificial limbs identified from over 2000 years ago.

%10of diabetic patients with diabetic foot ulcers are at a stage of life. With the wounds of the leg nerves (neuropathy) and foot care and is associated with nerve pain. Foot ulcers in diabetes type I and II are reported.

In 2000, according to the World Health Organization, at least 171 million people worldwide suffer from diabetes, or 2.8% of the population. Its incidence is increasing rapidly, and it is estimated that by 2030, this number will almost double. Diabetes mellitus occurs throughout the world, but is more common (especially type 2) in the more developed countries. The greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will probably be found by 2030. The increase in incidence of diabetes in developing countries follows the trend of urbanization and lifestyle changes, perhaps most importantly a "Western-style" diet. This has suggested an environmental (i.e., dietary) effect, but there is little understanding of the mechanism(s) at present, though there is much speculation, some of it most compellingly presented.

Diabetes in the world of a million people a year loses their foot. The appearance of the foot or lower leg ulcers in diabetic patients is usually caused by nerves, skin cannot be restored properly. Or high blood sugar fluctuations, and prevents healing foot ulcers in diabetic patients are.

Thus a small injury can be initiated by a foot ulcer. Controlling blood sugar levels regularly is very effective in healing, so if **Hb A1c** blood sugar control, indicating that in the recent quarter, up from 8, the healing of wounds is a problem.

Related diseases such as foot ulcers, infections and gangrene diabetic patients constitute the main causes.

Lower limb ulcers in patients with social and economic life were that affected their ability to reduce the effects of patient function, reduce the overall drop in income and quality of life for the patient.

Lower limb ulcers in diabetic patients are classified into several categories, including neuropathic ulcers due to impaired sensory and motor nerves in the legs to come, or ischemic ulcers due to peripheral artery narrowing and failure to come up. Infectious ulcers usually cause damage to the skin or nails, and create new microbes that are the focus of infection in the legs.

Infections, bone infections, and in some cases, amputation may be involved. Ischemic ulcers or blisters are caused first and gradually the dead tissue (necrotic area) is evident in the following. Infected wounds may be due to germs entering any holes or dimples in the skin, nails and even the corners are created.

If you examine the feet of diabetic patients with decreased sensation, decreased sweating, muscle analysis, deformed feet and toes, calluses and lack of or weak pulse may be at risk for foot ulcers.

Interestingly the most common type of mechanical stress occurs as a result of walking. Involvement of peripheral nerves of patients who have leg numbness and pain do not realize, with every step they walk leading to the destruction and inflammation. Pressure-sensitive areas are constantly walking the big toe and foot bones.

The prevention of diabetic foot problems, educate the patient. In every business meeting, and we need to educate patients about the importance of accurate and adequate blood sugar control and regular foot care and the harmful effects of smoking on the cardiovascular system and to emphasize the importance of covering for the foot numb.

2. Etiology

Because diabetic neuropathy the nerves of the foot is unable to transmit pain to the brain. Thus, ulcers, blisters and cuts cannot be felt by the people and can lead to diabetic ulcers. Narrowing of the arterial blood flow was reduced and delayed healing of wounds.

Threatening risk of ulcers and amputation in some of the people or the long stretch of healing wounds were. Smoking, Lack of exercise, obesity and high blood cholesterol or high blood pressure were increase the risk of diabetic ulcers.

Old diabetic foot ulcer and complications of diabetic foot ulcers are risk-enhancing factors.

The first signs of loss of sensation in the legs are very important to identify and refer patients immediately.

Purpose:
- A. *Identify the dangerous consequences resulting from lack of proper and timely treatment of diabetic foot ulcers*
- B. *Emphasis on care of the feet (foot care) at least once a year*

3. Results

The study was conducted, we found that (50%) of 12 patients despite regular diabetes clinic, who had suffered amputation. This causes the following results:

1. *Some of these people, despite your insistence upon the use of insulin instead of oral blood glucose lowering accept insulin injections were avoided, the need to increase educational and cultural programs.*
2. *A group of diabetic patients using diet as boring as it did not follow.*

3. *In the group of patients a daily examination of the foot into a small wound, a wound was deep and infectious.*
4. *In cases of severe neuropathy was prevented from feeling the burn and the patient's leg and it was not attached to the heater.*

4. Solutions

I. Need to allocate a foot doctor for a professional examination is a necessity. The lower extremity examination is not the case.

II. %58.3of patients tested in the amputation is above 9 HBAIC and in some cases even above 11, which is indicative of poor control. Why should it be in matters of cultural and educational program search. History of heart problems such as heart surgery, angiography and angioplasty in about 60% of patients are seen.

III. Record of 20-8 was seen in patients with diabetes.

IV. %75of patients with kidney problems that range from dialysis continues to be seen.

V. Approximately 41% of patients with a history of hypertension and 41% and 41% of diabetic foot ulcers and amputation were ocular discomfort.

VI. Obesity was observed in 50% of patients, but the cholesterol was in normal range.

5. Suggestions

i. Educational programs to encourage increased use of insulin and check your feet daily.

ii. Determined by a physician to perform foot examinations

iii. High-risk patients who continued to call on the Diabetes Clinic

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15- Extra link:
http://www.vascular.co.nz/Amputation%20surgery.htm
http://www.nhs.uk/video
http://www.af.org.nz/
http://www.nzalb.govt.nz/
www.limbless-association.org
http://www.nationalamputation.org/
http://www.rcsed.ac.uk/journal/vol46
http://www.amputee-coalition.org/index.html
http://www.amputee.com/table.php
http://en.wikipedia.org/wiki/Amputation
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Peripferal Nerve Regeneration in Response to Synthesized Nanofiber Scaffold Hydrogel

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Abstract: Background: earlier studies have demonstrated that Peptide RADA16-I (AcN-RADARADARADARADA-CONH$_2$) could repair spinal cord injury and optical pathway and restore visual function. The objective of the research is to investigate the role of RADA16-I in the regeneration of peripheral nerve injury in rats. Method: sciatic nerve injury was performed at female Sprague-Dawley rats. Two groups were conducted: crush group and sever group. There were RADA16-I treatment and blank control in each group. Sense Nerve Conduction (SNCV) parameters were EVALUATED on day 30 in the injured sciatic nerve by means of electrophysiological recording. The results indicates that SNCV in test groups shows a faster healing rate than blank control. Conclusion: self-assembling peptide plays a effective role in the regeneration of sciatic nerve in rats.

INTRODUCTION

The synthetic self-assembling peptides (SAP), originally discovered by Zhang et al., can self-assemble into nanofiber *in situ* under physiological conditions, and surprisingly simulate thromboplastin-mediated fibrin blood blot process without any antigenicity 1,2(Zhao and Zhang 2006) (Caplan, Schwartzfarb et al. 2002). For example, RADARADARADARADA (RADA16-I) peptide., consisting of 16 alternating hydrophobic and hydrophilic (also alternating negative and positive charges) amino acids, forms extremely stable β-pleated sheet structure and then self-assembles into nanofibers to produce high-order interwoven nanofiber scaffold hydrogel. It has extremely high water content （＞99.5%(w/v) water) by changing to neutral pH or adding physiological salt solution. This nanofiber scaffold hydrogel was also similar to the extra-cellular matrix 3,4,5,6,7,8(Zhang, Holmes et al. 1995; Zhang and Rich 1997; Altman, Lee et al. 2000; Kisiday, Jin et al. 2002; Hong, Legge et al. 2003; Yokoi, Kinoshita et al. 2005).

This kind of Peptide can establish a nanofiber barrier to achieve complete hemostasis when applied directly to a wound in the site of injury 9,(Ellis-Behnke RG 2006;) and it has been demenstrated that this kind of Peptide could also repair spinal cord injury 10(Guo J 2007) and optical pathway and restore visual function11(Ellis-Behnke RG 2006). In this report, we estimated the healing rate of injured sciatic nerve in SAP treated group using Sense Nerve Conduction Velocity (SNCV) parameters. The purpose is to investagate whether the SAP (RADA16-I) can play a role in the peripheral nerve repair.

MATERIALS AND METHODS
Atomic force microscopy (AFM)

An aliquot of approximately 5 μL of wound dressing solution and different diluted solutions were evenly placed on the surface (10 mm×10 mm or 15 mm) of a freshly cleaved mica sheet. Each sample was left on the mica about 30 sec and then washed with aliquots of 100 μL of Milli-Q water to remove unattached material. The sample on the mica surface was then air-dried for AFM observation.

AFM imaging was performed at room temperature on SPI4000 Probe Station & SPA-400 SPM Unit (Seiko Instruments Inc., Chiba, Japan) using the dynamic force mode. The images utilized a 20 μm Scanner (400) and an Olympus Si-DF20 micro cantilever as well as a Si tip of radius 10 nm, rectangular base 200.00 μm, with tip height of 10.00 μm and spring constant Kz of 12.00 N/m. The main parameters of AFM observation were as follows: Amp. Ref. (Amplitude Reference): -0.15～-0.30, I Gain/ P

Gain (integral gain/proportional gain): 0.10 ～ 0.20/0.05～0.10, Amplitude: ～1V, Scan Speed: 0.5～ 1.5 Hz. Height images were recorded with 512×512 pixels resolution and the brightness of morphology increased as a function of height. All image data sets were subjected to first-order flattening, in order to correct tilt of selected area and cancel any distortion (reversal) of causeless drifting or vibration (creeping) of the scanner. The AFM observation of each sample was repeated at least four times.

To quantitatively analyze the data, a large number of images have been examined in order to find the surface coverage of nanofibers, and further calculate the length of nanofibers. In higher magnification images, the width and height of nanofibers can be determined using SPI3800N-offline image analysis program for win2000 software, also called as "SPIWin".

Animals

50 female Sprague–Dawley (SD) rats, weighing from 250 g to 290 g, from the Center of Laboratory Animals of Clinical Medicine School of Sichuan University were used in this study. The animals were fed a standard diet ad libitum and housed individually at controlled temperature (22-23°C) and lighting (12 hours light and 12 hours darkness).

Experiment Grouping

Fifty rats were divided into five paralleled groups: normal group, crush blank control group, crush test group (SAP treated), suture blank control group and suture test group (SAP treated). 10 rats in each group.

Surgical procedures

All procedures were conducted in accordance with the policy on the Use of Animals in Neuroscience. Adult female Sprague-Dawley ras(180-220g) were deeply anesthetized with sodium pentobarbital(30mg/kg i.p.). After an incision had been in the skin, the sciatic nerve was exposed by making a muscle splitting incision among the muscle tendon of the biceps femoris,semitendinosus and semimembranosus.

In the crush group: The nerve was crushed with a smooth-tipped (2mm) locking suturing needle holder that was clamped on the nerve for 2 minutes. Then 20ul of RADA16-I (1%,w/v)was injected into perineurium of the injured nerve segment using microinjection and in the control group the RADA16-I was replaced by saline.

In the suture groups, the nerve was transected with a microscissors and repaired using 10-0 sutures. RADA16-I was daubed on the two ends (RADA16-I was replaced by saline in blank control).

In the normal group (n=10) the animals were submitted to sham operation. The insicion site was closed by layers and the rats were allowed to recover 12 (RobertoS.Martins 2005).

Electrophysiological recording

One month after surgery, electrophysiological recording was done under anesthesia with sodium pentobarbital(30mg/kg i.p.). After the initial surgical exposure, the animals were submitted to a first electrophysiological evaluation consisting of Sense Nerve Conduction Velocity (SNCV) to measure the degree of regeneration in surgically repaired sciatic nerves in rats: comparison of the size of nerve responses evoked by stimulation distal to the anastomosis. The stimulation electrode was placed on the nerve stem and 2 monopolar straight needle electrodes were installed on the posterior limb at a distance of 3mm from one another the other ground electrode was installed on the tail. Using the exported current flow evoked by electrical stimulator (electromyogram evoked potential machine, Varytech. Co. Ltd. Japan) to stimulate the peripheral nerve of the posterior limb. The recording electrode record the sensory nerves action potential (SANP). The latent time (T) of the SANP was measured using dividers and represented by "S". Sense Nerve Conduction Velocity (SNCV) was expressed as formula: SNCV = S/T. Five different repair procedures were evaluated. 12, (Kazuya Matsumoto 2000; RobertoS. Martins 2005).

Statistical Analysis

All quantitative data were shown as x ± s (Mean ± SD). The mean was analyzed for significance using the two-side t test; the confidence level is 95%. The groups were compared using one factor analysis of variance(ANOVA) followed by Turkey posthoc test for normally distributed data,otherwise by one-way analysis of variance on ranks followed by Dunn's posthoc test.

RESULTS
Electrophysiological recording

Fig. 1 shows the mean values of Sense Nerve Conduction Velocity (SNCV) parameters 30 days after operation. There was statistically difference among the groups for the parameters evaluated. SNCV in test groups shows a faster healing rate than blank control. The four experimental groups all showed significant differences compared with normal group (P = 0.00). In both gourps (crush group and suture group，see figure 2), significant differences between RADA16-I treatment and blank treatment can be observed (P = 0.013, P = 0.036). Figure 3 indicate data of SNCV represented by electrophysiological recording graph.
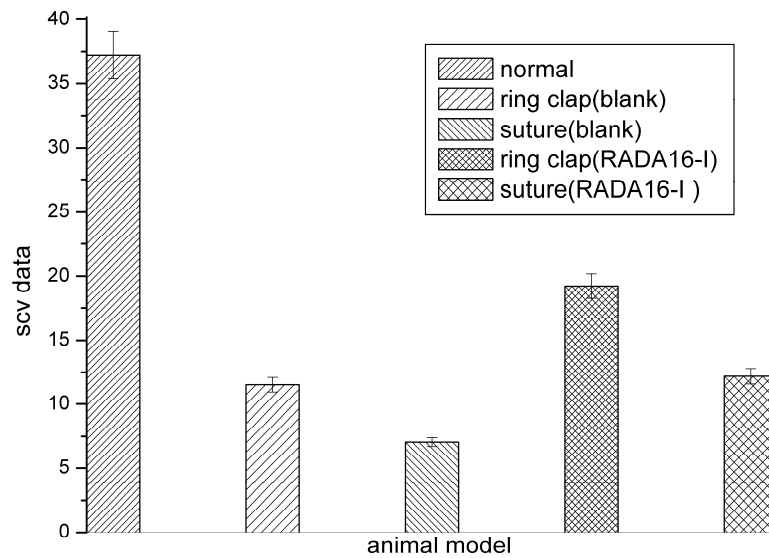
Fig. 1：The data of Sense Nerve Conduction Velocity parameters represented by histogram. The axis X represents animal models in different groups. Sense Nerve Conduction Velocity (SNCV) parameters (average) in different groups listed below: crush group treated with RADA16-I: 19.23 m/s; crush group treated with blank: 12.18 m/s; sever group treated with RADA16-I: 11.51 m/s; sever group treated with blank: 7.05 m/s; normal group: 37.28 m/s.
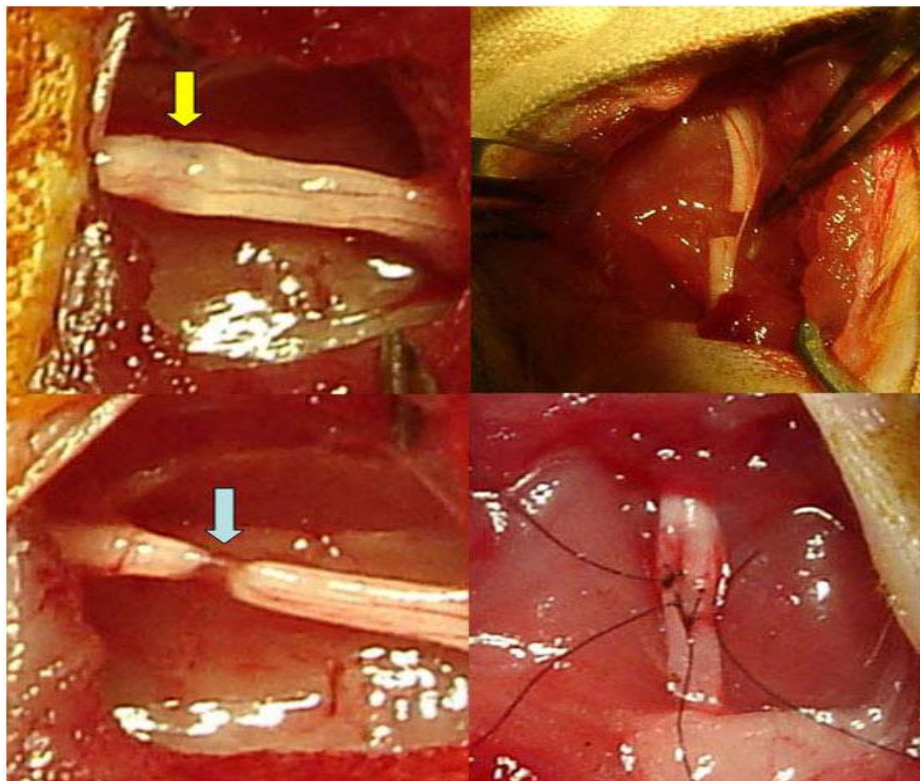
Fig. 2: Sciatic injury model. the wound on the left are crush group and the blue arrow refers to the crushed nerve segment and the upper shows the crushed segment injected with RADA16-Ⅰ(yellow arrow). The right wound shows the shear group and the wound was end to end sutured and the RADA16-Ⅰ was daubed on the broken end.
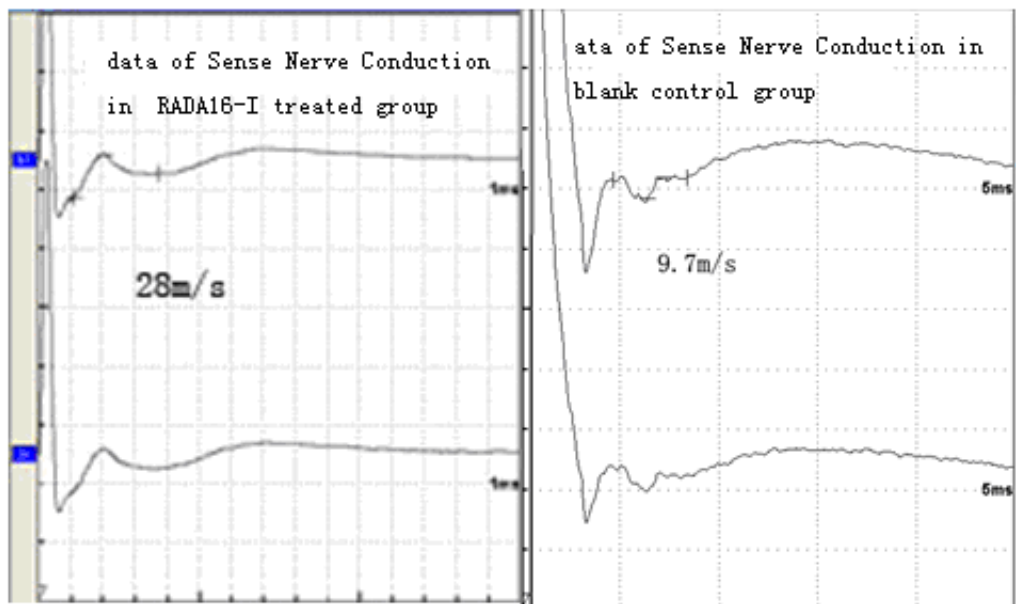
Fig. 3: Graphs of the Sense Nerve Conduction Velocity (SNCV) parameters. graph on the left shows the data of RADA16-Ⅰ treatment and right graph shows the blank treatment.
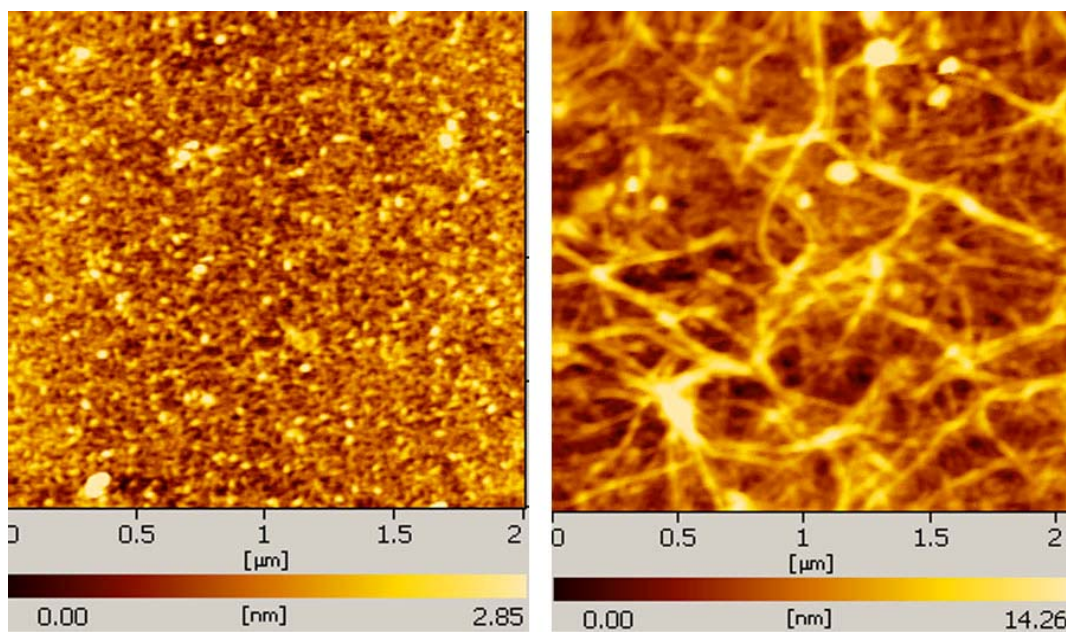
Fig. 4: The typical AFM height images. Right: 10mg/ml RADA16-Ⅰ peptide(1%(w/v) PuraMatrix™ diluting with Milli-Q water), Left: 1%Chitosan acetic acid (1%) solution. Right: The representative morphology is the some globular pieces should be assembled into nanofiber-like aggregation, the height and the weight of the globular pieces are 5.9nm～6.9nm, and 78.9nm～105.9nm, respectively, the diameter data should be corrected; All errors are the 95% confidence level.

Atomic force microscopy (AFM)

Employed with AFM (Figure. 4), researchers investigated the morphological properties of 10mg/ml RADA16- I peptide (right), and a commercially 10mg/ml chitosan fluid dressing (left), shown in Figure. 4, the most difference 10 mg/ml RADA16- I peptide with other topical dressings is its nanofiber 3D scaffold matrix, in which the nanofibers the height and the weight of the globular pieces are 5.9nm～6.9nm, and 78.9nm～105.9nm, moreover, and offered with 17～43% surface porosity(%), which is very benefit for the healing requirements of the injured tissue and cell.

DISCUSSION

The regeneration of nerve is a striking example of plasticity within lorenervous system. Research on regeneration and functional recovery after peripheral nerve injury, both clinical and basic, has come a long way. Research has hitherto focused on the methods of repair and of bridging nerve gap. One of the key questions to be answered is which technique offers the peripheral nerve the best environment to promote regeneration and functional recovery. Biological glues including collagen, Chitosan, poly (DL) lactic acid (PDLA) et al. have been explored for the use of promoting nerve regeneration but their antigenicity more or less limited their use13(Stipcevic T 2006). People are still searching for the new type of proper material.

Concluded from above research, Sense Nerve Conduction Velocity (SNCV) parameter in RADA16- I treated sciatic nerve has been enhanced obviously and thus reflect the healing of the demyelination. The healing mechanism needs further investigation.

CONCLUSION

These experiments demonstrate that self-assembling peptides can create nanofiber microenvironments in the injured sciatic nerve and that these microenvironments promote nerve regeneration. Because these nanofibers may be modified in a variety of ways, this approach may enable injectable tissue regeneration strategies.

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11/29/2011

An Effective and Efficient Class-Course-Faculty Timetabling Assignment for an Educational Institute

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Abstract: This paper proposes a class-course-faculty timetabling assigning model for an educational institute to increase the overall departmental performance, including enhancing teaching quality, making good use of student time, saving college budgets, and sharing departmental resources effectively. To achieve these goals, both faculty and classes are classified into different groups based on teachers' specialties and courses' attributes; the classified data and allocating rules are processed by a heuristic driven process and two fitness functions. The proposed heuristic driven process coupled with two fitness functions is mainly used to satisfy students' needs for taking or retaking certain courses without delaying their graduation where the class sizes are balanced and merged to decrease the number of elective courses opened to the students. Allocating rules applied in the classrooms and laboratories management are based on the attributes of the courses and the availabilities of the resources to ensure that the resources can be shared effectively. The proposed timetabling assigning model has been simulated in C programming codes and MS SQL server is used as backend database. It allows teachers to get on the Website to key in at least 7 different courses of their preferring teaching courses, where the keyed in courses should be either in the same attributes of the specific course group or in the general course group. From the experimental results, there are about 90% of 100 courses assigned to the specific professional teacher. The minimum and maximum average satisfaction for all students' needs is 0.8 and 0.9, respectively, where the lowest index value is 0.7 and the highest index value is 1. These results show that the difference of each student's satisfaction is small; and the teachers' and students' expectations on teaching specific subjects and taking specific courses can be satisfied as nearly as possible.
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Keywords: Class-course-faculty timetabling, heuristic driven and fitness function.

1. Introduction

With the developed e-education technology, many different types of diplomas, certifications, and academic degrees are available from online learning institutions [1]. However, Behzadi and Ghaffari have pointed out that there are four drawbacks existing in e-education. They are (1) lacking face-to-face classroom and office interaction between students and teachers, (2) lacking study materials for traditional institutions with their on-campus libraries, (3) lacking Lab sessions for natural science majors, and (4) difficult self-discipline due to too much freedom for the online education. Therefore, traditional campus-based education cannot be replaced by the online education and it is crucial for an educational institution.

For the traditional campus-based education in an individual department at a university, scheduling class-course-faculty timetables is an routine administrative task because it has to be arranged every semester. This scheduling problem generally allocates all teachers' and students' courses to appropriate timeslots with the limited resources, including facilities, classrooms, and laboratories.

Specifically in Taiwan, this task is complicate and difficult because of multi-educational systems, including four-year undergraduate program, four-year evening class college program, graduate school program, and two-year college program, existing in an academic department. Except that, students' career planning classes are also needed to be scheduled during their university education [2]. In addition, a class-course-faculty assigning problem has to concern about assigning classes to appropriate faculty, proper classrooms, and available timeslots [3]. Commonly, each educational system handles different class-course timetabling task; each professional teacher has different preferences on teaching timeslots; each student has to take (or retake) different courses in a semester for not delaying their graduation; and the board of college directors requires making the best use of the college budget. Therefore, inappropriate class-course-faculty assignment may bring some unwilling consequences, such as decreasing teaching quality, lessening faculties' expectations on preferred teaching courses and teaching timeslots, ineffective sharing departmental resources, increasing college cost by

opening too many same elective courses, and delaying students' graduation.

In this paper, class-course-faculty assigning problem can be functionally viewed as employee scheduling problem which assigns employees to qualified required works where employees are faculty members and qualified required works are specific professional classes [3]. Generally, the employee scheduling problem builds the works and timeslots assignments in one stage. The literatures [4-7] utilize different technology to assign the schedule and place the employees to works simultaneously. Lapierre and Ruiz [4] applied Tabu search meta-heuristic technology on solving hospital supply systems located in Montreal, Canada. The approach mainly emphasizes on making scheduling decisions such as when each employee should work and what task should he do, etc. However, it needs more work on evaluating its performance efficiency by testing its practical value. Alvarez-Valdes et al. [5] proposed a heuristic algorithm to solve the glass factory scheduling problem for incoming customer order. Although this model can provide tight due dates and can perform a complete mid-term plan, it is lack of flexibility on adapting other customer order, such as rescheduling remaining jobs. Sherali et al. [6] and Seckiner [7] are two studies related to balance workload among workers. The study proposed by Sherali, etc. utilizes a quantitative approach to find out the optimal schedule on set-up task assignment for multi-objective program. The study proposed by Seckiner uses a simulated annealing approach to solve job rotation problem.

A number of researches have devoted in solving the class-course-faculty timetabling problem. Burke and Petrovic [8] studied some automated timetabling technologies in which heuristic based evolutionary timetabling algorithm, multi criteria decision method, and case-based reasoning approach are discussed. Burke et al. [9] applied Tabu search to solve permutations of graph-based hyperheuristic for examination and course timetabling problem. Petrovic et al. [10] proposed case-based reasoning methodology to solve metaheuristic examination timetabling problem by selecting the pairing of an appropriate sequential heuristic construction. Smith et al. [11] proposed two alternative formulations, a standard Hopfield-Tank approach and the Hopfield network, for solving school timetabling problem. Ozdemir and Gasimov [12] constructed a multi-objective 0-1 nonlinear model with the consideration of participants' average preferences. Daskalaki et al. [13] used NP-complete concept to solve the organizational associate constraints. Asratian and Werra [14] proposed a theoretical model which corresponds to some situations occurring frequently

in the university's training programs. Three researches [15-17] applied integer programming technology to solve timetabling problem. MirHassani [15] applied 0-1 integer programming approach coupled with a number of operational rules and requirements of Shahrood University, Iran, to enhance the effectiveness of course timetables. Ismayilova et al. [16] proposed a multiobjective 0-1 linear programming model considering both the administration's and instructors' preferences and using weight priority to schedule the class-course timetable. Daskalaki and Birbas [17] developed an integer programming formulation for a university timetabling problem, which adopts universities constrains to ensure consecutiveness of certain courses. The literatures [18-20] built the schedule and place the teachers to classes simultaneously. Hsiung and Chang [18] proposed a genetic based algorithm for solving the course assigning problem with the consideration of faculty preferences, which has the disadvantage of repeating starting searching point for the proposed genetic algorithm. Beligiannis et al. [19] applied the mathematical model to solve course and time-slot assignment without the consideration of teachers' preferences. Head and Shaban [20] formulated a heuristic approach for course-student timetabling, which is the student-oriented scheduling model. The literatures [21-22] solved the class-faculty assignment in two stages, which has the advantage of presenting a complicated model as a more comprehensive model by simplifying one problem into two sub-problems. Badri [21] made class faculty assignments in the first stage and made class faculty time-slot assignments in the second stage, which seeks to maximize faculty course preferences. Alvarez-Valdes et al. [22] developed a set of heuristic algorithms with Tabu search to solve the problem for building the timetable in planning the third year in which the student would choose different professional orientation (Business Management, Financial Management, Accounting, etc.).

As described above, finding an effective and efficient approach for assigning appropriate courses to university faculty and scheduling class-course timetables is an urgent issue that must be solved. The objective of this study aims to solve the academic class-course-faculty timetabling problem existing at Electronic Engineering (EE) department of Kao Yuan University (KYU) based on the considerations of their specific needs and constraints. At EE department of KYU, there are about 25 full-time teachers and 20 classes with totally 100 teaching courses being scheduled every semester. Typically, the number periods per day and days per scheduling week are the same; a weekly timetable is divided into

five days (Monday through Friday); and each day is divided into four and eight time periods for the day and evening classes, respectively. The number period for the day classes begins at 8:15 a.m. as the 1st timeslot, 9:15 a.m. as the 2nd timeslot, and so on; the number period for the night classes begins at 06:45 p.m. as the 1st timeslot, 7:35 p.m. as the 2nd timeslot, and so on. Currently, scheduling these numerous courses to specific time periods is often influenced by four factors, including: (1) the course catalog structure changes with the student demands for certain courses every semester; (2) the limited facilities, laboratories, and classrooms affect the effectiveness of allocating available resources; (3) the consideration of each faculty's preferring teaching timeslots increases the difficulties of the scheduling task; and (4) the organizational policies about requiring the days for each faculty staying at school and requiring the best use of the budgets also increase the difficulties of the scheduling task. Moreover, the class-course timetabling task at EE department traditionally relies on human labors. The generated class-course-faculty timetables have the disadvantages of time consuming, inefficient utilization of facility and human resources, biased class-course assignments, and dissatisfaction among students and teachers. Hence, in order to increase the overall performance of the departmental educational system, this study proposes a two-stage approach for the academic class scheduling and time tabling problem at EE department of KYU. Stage I is concerned with designing a student-oriented class-course timetabling model that has the advantages of making good use of student time, and saving college budgets. Stage II is concerned with assigning faculty members to different classes aiming at increasing teaching quality and sharing departmental resources effectively. The proposed method is based on the considerations of students' needs on retaking different courses for not delaying their graduation, teachers' preferences on specific teaching time periods, course catalog structure, and the organizational constraints and requirements. The proposed model allows teachers to key in their preferences and allows students to get on the Website keying in their needs of taking specific elective courses and retaking certain courses. The developed heuristic driven process coupled with two fitness functions can make good use of student time, cost down the budget by balancing the class sizes, share university teaching resources effectively, and build the optimal schedules for each class as nearly as possible. In the following, Section 2 describes the proposed class-course-faculty timetabling model. The experimental results are shown in Section 3. Finally, the conclusions are summarized in Section 4.

2. Class-Course-Faculty Timetabling Assignment

Figure 1(a) shows the block diagram of the class-course-faculty system, which includes two stages: the class-course scheduling system as shown in Figure 1(b) and the class-faculty assigning system as shown in Figure 1(c). As given in Figure 1(a), the class-course-faculty system consists of inputs, a class-course scheduling process, a class-faculty assigning process, and outputs. The inputs include faculty inventory, faculty/student preferences, course inventory, and resources. The class-course scheduling process and the class-faculty assigning process take the inputs through the heuristic driven process coupled with two fitness functions to generate the expected class/course/faculty assigning outputs. Each part of the system is described in detail as follows.

2.1. Inputs

As shown in Figure 1, the inputs of the class-course-faculty assigning model include faculty inventory, course inventory, resources, and faculty /student preferences on specific teaching subjects and timeslots. The faculty inventory is the list of all full-time teachers in the department; the course inventory is the list of all requirements and elective courses extracted from the class/course catalog; the resources are the departmental available resources including classrooms and laboratories; and the faculty/student preferences are the teachers' preferences of teaching courses/timeslots and students' needs of taking specific elective courses and retaking certain courses for not delaying the graduation. In this study, every faculty has to choose seven different courses and seven half days, at least, via the website. Table 1 shows the data structure of the faculty inventory. As shown in Table 1, the teachers are classified into four groups (including computer engineering, system control, navigation electricity, and semiconductor) and five levels (including instructor, assistant professor, associate professor, full professor, and teacher with administration work) based on their specialties and positions. Table 2 illustrates the data structure of the course inventory. In Table 2, all courses are indexed and classified into five groups (including the fields of navigation electricity, system control, computer engineering, semiconductor, and general courses) based on their attributes. Table 3 lists all departmental available classrooms and laboratories. Currently, there are 10 classrooms and 12 laboratories available at EE department of KYU. Table 4 gives the data structure of the faculty keyed in preferred teaching courses, which lists his/her keyed in classes, the course titles, and teaching hours. And then, Table 5 shows the data structure of the faculty preferring teaching timeslots.
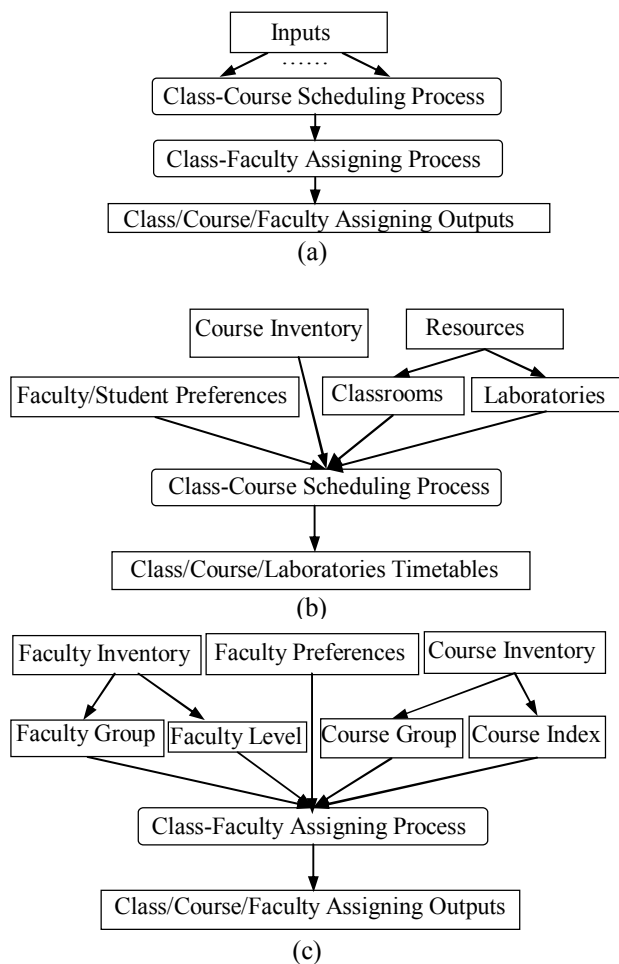
Figure 1. (a) Block diagram of class-course-faculty assigning system; (b) Block diagram of class-course scheduling system (c) Block diagram of class-faculty assigning system.

Table 1. The data structure of the faculty inventory

Teacher Group	Teacher's Name	Position/Priority
Comp. Eng.	David Wang	Prof / 1
Syst. Cont.	Jim Hsu	Asso. Prof / 2
Navi. Ele.	A.O. Brown	Assi. Prof / 3
Semi.	.	.
	.	.

Table 2. The data structure of the course inventory

Course Group	Class/Course Title
Navi. Ele.	4EE21/Electronic Lab.
Syst. Con.	2EE11/Electronic Lab.
Comp. Eng.	5EE11/Fund. Navigation
Semi.	.
Gene. Cour.	.

Table 3. The data structure of the resources

Classrooms	Laboratories
EE101	VLSI
EE102	Network
EE103	Programming--1
.	Programming--2
.	Electronic Lab.--1
.	Electronic Lab.—2
EE201	.
EE202	.
.	.
.	.

Table 4. The data structure of the faculty keyed in preferred teaching courses

Teacher's Name	Class/Course Title/Teaching Hours
David Wang	4EE21/Electronic Lab./3
	2EE11/Electronic Lab./3
Jim Hsu	4EE32/PLD Lab/4
	4EE41/Microcontroller/3
A.O. Brown	.
	.
Joanna Chen	.
	.

Table 5. The data structure of the faculty preferring teaching timeslots

Teacher Grp.	Teacher's Name	Unavailable Time slots		
		M. T. W. H. F.		
Comp.	David Wang			
	Jim Hsu	Morning X X		
Syst.	A.O. Brown			
	.	Afternoon X		
Navi.	.			
Semi.	.			

2.2. Class-Course-Faculty Assigning Process

Both class-course scheduling process and class-faculty assigning process utilize the heuristic method coupled with two fitness functions to optimize the class-course-faculty assignment outputs, which includes three steps: organizing heuristic data, designing fitness functions, and iterative mutation.

Step 1: Organizing heuristic data

Organizing heuristic data means representing all necessary data sets and constraints as useful information in order to find an optimal solution. In this section, all courses, including required and elective courses, are numbered from 1 to n; all students are numbered from 1 to m; and all teachers are numbered from 1 to k where n, m, and k are the maximum index number of courses, students, and teachers, respectively. The definitions of the data

sets and system constraints used throughout in this section are given as follows.

The data sets used in stage I include:

(1) SNum $[i][j]=m$: The student numbered m is assigned to the jth class of the ith year.

(2) CNum$[i][j] =n$: The course numbered n is assigned to the jth class of the ith year.

(3) CAssign$[q][p]=n$: The course numbered n is assigned to the pth timeslot of the qth weekday, where $p=1…40$, the index number of the timeslot for a week; $q =1…5$ (Mon... Fri.).

(4) LAssign$[x][p]=n$: The course numbered n is assigned to the pth timeslot of the xth laboratory.

(5) CRetaken$[m]=n$: The student m has marked the course number n as a retaken course.

(6) Retaken $[n]=1$: The course numbered n is marked as a retaken course.

(7) TPref$[q][r]=k$:The preferred teaching timeslots chosen by the teacher k is on q^{th} weekday; $r =0$ --Morning, $r=1$ – Afternoon..

(8) MutOPT$[i][j]=n$: The course number n is assigned to the jth class of the ith year and labeled as an mutation operator.

The data sets used in stage II include:

(1) TGroup$[i][j]=k$: The teacher numbered k is classified into the index number j of the ith group.

(2) TPosition$[k]=m$: The position of the teacher numbered k is m.

(3) TPref$[k]=n$: The preferred teaching course chosen by the teacher k is the course number n.

(4) TOK$[i][j]=1$: The teacher indexed number j of the ith group has completed the courses assignment.

(5) CGroup $[i][j]=n$: The course numbered n is classified into the index number j of the ith group.

(6) CPref$[i][j]=k$: The course indexed number j of the ith group is chosen by the teacher numbered k.

(7) TAssign$[k][p]=n$: The course numbered n is assigned to the teacher numbered k, where $p=1…5$, the index number of the assigned teaching course.

(8) MutOPC$[k]=n$: The course number n is assigned to the teacher k and labeled as an mutation operator.

The system constraints include:

(1) Before scheduling the general educational courses, scheduling junior-year professional courses' timeslots of four-year college program firstly.

(2) For the first year of four-year college program, evenly scheduling each class's professional courses on weekdays. Currently there are three classes in the bachelor year at EE department of KYU. Generally, only two require and one elective courses need to be scheduled for each class. Therefore, the proposed method would schedule one class's professional courses on Monday and Thursday, the other on Tuesday and Thursday, and another on Wednesday and Friday. This would help senior students to retake the first year's professional courses without conflicts.

(3) For the second year of four-year college program and the first year of two-year college program, scheduling each class's professional courses by considering students' needs on retaking specific courses. In this process, the priority for scheduling consecutive courses such as laboratory courses is higher than that of un-consecutive courses such as theoretical courses; the timeslots for the student needs of retaken courses, including bachelor's general educational courses and professional courses, are unfilled or assigned to the elective courses as nearly as possible.

(4) Scheduling senior courses with the considerations of merging each class's elective courses, balancing the timeslots of elective courses, scheduling requirements without affecting the students' needs of retaking certain courses.

(5) Whenever scheduling a course to a specific time period, checking the faculty's preferences on specific teaching timeslots as given in the Table 1.

(6) After scheduling a course to a specific timeslot, the corresponding classroom or laboratory is also mapped based on the consideration of fully utilizing a classroom's and a laboratory's timeslots

(7) Merging two same classes into one class when the number students are not over 30 students.

(8) Any subject is assigned to the teacher who is the only one choice that subject.

(9) If a subject is chosen by more than two teachers, the first priority of assigning teaching courses is the advisor of the class, the second priority is the teacher with the specific professional of the subject based on the data sets listed in the TGroup and CGroup.

(10) A teacher has to be assigned at least two different subjects except for the teacher also working at administration department; all teachers must have no more than three different subjects.

Step 2: Designing fitness functions

The fitness function is designed by satisfying different specific constraints and meeting the different needs to evaluate the degree of faculty /student satisfaction for their courses/classes assignment. Under the constraints described above, two fitness functions, the satisfaction and the average satisfaction of the faculty and the student, are given as follows.

The satisfaction of the teacher numbered k and the student numbered m are defined as

$$S_k = \frac{TM_k}{p_k} > 0.6$$

$$S_m = \frac{TM_m}{p_m} > 0.7$$

,where TM_k is the total number of the satisfaction matched for the teacher numbered k; TM_m is the total number of the satisfaction matched for the student numbered m; p_k is the total number of the assigned teaching courses to the teacher numbered k; p_m is the total student numbered m keying in their needs. The average all students' satisfaction (AS) and all the faculty (TS) are defined as

$$AS = \frac{\sum_{i=1}^{m} S_i}{m} > 0.8$$

$$TS = \frac{\sum_{i=1}^{k} S_i}{k} > 0.8$$

Step 3: Iterative mutations

An iterative mutation begins at the mutation operator marked in the array of MutOPT and MutOPC. The objective of this process is to increase the algorithm's effectiveness while searching another solution and gain better output optimization for the scheduling and assigning processes. Following shows the procedures of two-stage iterative mutations.

Iterative mutation procedures of Stage I are:
   For each MutOPT do
     For each CAssign do
       Process1. Select another specific timeslots
       Process2. Assign the course to this timeslots, if the selected timeslots is allowed to assign a course, $TM_m = TM_m + 1$, otherwise, go to Process 1.
       Process3. Update new state of CAssign of this course.
     End CAssign
   End MutOPT

Iterative mutation procedures of Stage II are:
   For each MutOPC do
     For each TAssign do
       Process1. Select another specific professional teacher
       Process2. Assign the course to this teacher, if the selected teacher is allowed to assign a course, $TM_k = TM_k + 1$, otherwise, go to Process 1.
       Process3. Update new state of TAssign of this teacher.
     End TAssign
   End MutOPC

2.3. Outputs

The outputs of stage I process include each class's course timetable and laboratory's timetable. Figure 2 gives the 4EE3A class's course timetable where 4 means four-year college program; EE means electronic engineering department; 3 means the 3rd year; and A means class A. Figure 2(a) lists the course timetable of 4EE3A located at classroom EE301; Figure 2(b) lists communication laboratory's timetable.

The outputs of stage II include each faculty's teaching courses, corresponding teaching hours, and their satisfaction matched, as shown in Table 6.

R o o m : E E 3 0 1   C l a s s : 4 E E 3 A

F r	T h	W e	T u	M o		
					0 8 : 1 5 | 0 9 : 0 5	1
		Prog	SigSys.	El Mag.	0 9 : 1 5 | 1 0 : 0 5	2
		Prog	SigSys.	El Mag.	1 0 : 1 5 | 1 1 : 0 5	3
		Prog	SigSys.	El Mag.	1 1 : 1 5 | 1 2 : 0 0	4
	AirMa	Contr	Micrp	Nav Tec	1 3 : 0 0 | 1 3 : 5 0	5
	AirMa	Contr	Micrp	Nav.Tec	1 3 : 5 5 | 1 4 : 4 5	6
	AirMa	Contr	Micrp	Nav.Tec	1 4 : 5 0 | 1 5 : 4 0	7
					1 5 : 5 5 | 1 6 : 4 0	8

(a)

C o m m u n i c a t i o n

F r	T h	We	T u	M o			
					0 8 : 1 5 | 0 9 : 0 5	1	M O R N I N G
	Comm 4EE2B	SigSys 4EE3C.	SigSys 4EE3A.	Comm. 4EE2A	0 9 : 1 5 | 1 0 : 0 5	2	
	Comm 4EE2B	SigSys 4EE3C.	SigSys 4EE3A.	Comm. 4EE2A	1 0 : 1 5 | 1 1 : 0 5	3	
	Comm 4EE2B	SigSys 4EE3C.	SigSys 4EE3A.	Comm. 4EE2A	1 1 : 1 5 | 1 2 : 0 0	4	
		Comm 4EE2C		SigSys 4EE3B.	1 3 : 0 0 | 1 3 : 5 0	5	A F T E R N O O N
		Comm 4EE2C		SigSys 4EE3B.	1 3 : 5 5 | 1 4 : 4 5	6	
		Comm 4EE2C		SigSys 4EE3B.	1 4 : 5 0 | 1 5 : 4 0	7	
					1 5 : 5 5 | 1 6 : 4 0	8	

(b)

Figure 2. The 4EE3A class-course timetable outputs (a) classroom EE301's course timetable (b) communication laboratory's timetable.

Table 6. The outputs of stage II

Teacher Group	Teacher's Name	Cla./Cour. Title	H/Sat
Navi. Ele. Syst. Comp Semi.	David Wang Jim Hsu A.Brown .	4E21/Ele. 2E11/Ele. GE11/Emb	3/ Y 3 /Y. 4/ Y
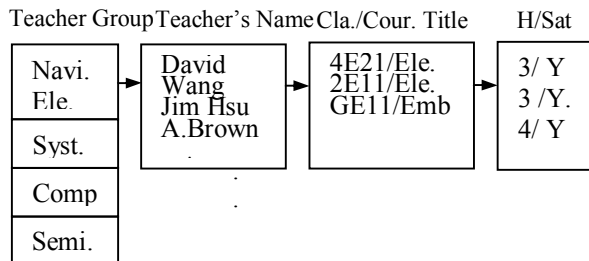
3. Experimental Results

The class-course-faculty assigning system is simulated in C programming codes with using MS SQL server as backend database. The proposed method has been tested at the EE department of KYU, Taiwan. The proposed approach allows teachers to get on the Website to key in at least 7 different courses of their preferring teaching courses, where the keyed in courses should be either in the same attributes of the specific course group or in the general course group. Table 7 lists Prof. Wang's keying in 7 different courses of his preferring teaching courses. From Table 7, because Prof. Wang is classified into the computer group, he can only choose the courses either in the field of computer group or in the general courses' group. Table 7 lists Prof. Wang's assigned courses and whether the assigned courses are matched to his satisfaction. From Table 8, Prof. Wang's assigned courses are all satisfied in his keyed in preferring teaching courses.

In this study, the students' and faculty's satisfaction is modeled as the 0-1 index value. From the experimental results, the difference of each student's and teacher's satisfaction is small, where the lowest index value is 0.7; the highest index value is 1; the minimum and maximum average satisfaction index value for all teachers is 0.9 and 0.95, respectively; the minimum and maximum average satisfaction for all students' needs is 0.8 and 0.9, respectively. Moreover, there are about 90% of 100 courses assigned to the specific professional teacher. Therefore, the proposed approach can support good enough faculty satisfaction and the fairness of the course assignment. Table 9 shows the differences of the number of elective courses and merged elective courses for senior-year classes. From Table 9, the number of merged elective courses takes about 50% off the number of original elective courses. This indicates that the proposed method can cost down the courses' budgets. Table 10 lists the number of laboratories available in the EE department. From Table 10, the laboratory of computer #2 is free for all semester; the unused timeslots for VLSI design laboratory are on Tuesday and Friday morning, etc. Conclusively, the available Labs can be used for certificate training courses, career planning classes, or other expanding courses.

Table 7. Prof. Wang's keying in 7 different courses of his preferring teaching courses

Teacher's Name	Class/Course Title/Teaching Hours
David Wang	4EE21/Electronic Lab./3 2EE11/Electronic Lab./3 4EE31/PLD Lab/4 4EE32/PLD Lab/4 4EE41/Microcontroller/3 4EE42/Microcontroller/3 4EE43/Microcontroller/3
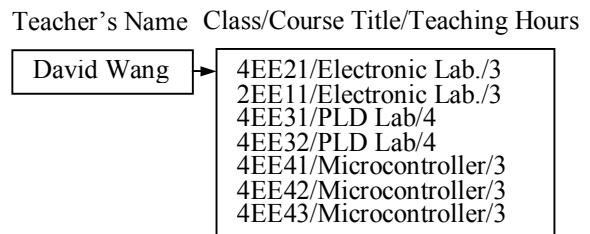
Table 8. Prof. Wang's assigned courses and the satisfaction matched

Name	Class/Course Title/Teaching H.	Satis.
David Wang	4EE31/PLD Lab/4 4EE32/PLD Lab/4 4EE41/Microcontroller/3 4EE42/Microcontroller/3	Y Y Y Y

Table 9. Differences of the number of elective courses and merged elective courses for senior years classes

Prog. #Courses	4-year college		2-year
	3rd yr.	4th yr.	2nd yr.
Normal	12	9	4
Merged	8	6	2
Prog. # Courses	5-year junior college		
	4th yr.	5th yr.	
Normal	6	6	
Merged	6	3	

Table 10. The number of labs available in the department

TimeSlots Labs	M.	T.	W.	H.	F
Microcontr.	MA		A		A
VLSI Design		M			M
Electronic	M		A		
Computer #2	MA	MA	MA	MA	MA

Note. M: Morning A: Afternoon

4. Conclusions

In order to increase the overall department-education performance, this paper proposes a heuristic based class-course-faculty assigning model with the considerations of teachers' specialties and preferences, students' needs of retaking different courses without delaying their graduation, course catalog structure, and all organizational constraints and requirements. The proposed approach provides four advantages: (1) By allowing teachers keying in their preferring teaching courses through the Website, this ensures that the courses can be assigned to a specific professional teacher and teachers' expectations on specific teaching subjects can be satisfied as nearly as possible, therefore teaching quality is guaranteed. (2) By formulating the rules for using the classrooms and laboratories based on the attributes of courses and availabilities of the resources, this makes near-optimal use of department teaching resources. (3) By balancing the class sizes and reducing the number of elective courses opened to students at an individual department, the cost for opening the courses in a semester is decreased. (4) The developed heuristic driven process with iterative mutation applies two fitness functions to achieve teachers' satisfaction, support the fairness of the class-course-faculty assignment, satisfy students' needs, and make good use of the student time. In addition, the proposed method puts the advisor of the class into the first priority of assigning courses. This would increase the teachers' opportunity for involving students' learning.

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A Talent Laboratory Resource Supply Chain Model Based on Fuzzy Analytic Technology

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Abstract: This paper proposes a talent laboratory resource supply chain model for an educational institution to increase the integration, visibility and flexibility of the laboratory resource management. The proposed model utilizes a reasoning engine with fuzzy, parallel fuzzy rules, and de-fuzzy processes to decide the optimal purchase ordering quantity and the best constant stocks in the laboratory resource supply system. The fuzzy process takes the crisp input data through the characteristic function and maps the input data into its corresponding membership degree. The fuzzy rules are processed with different degree of membership and all rules in the system are processed before triggering an action. The de-fuzzy process takes each item's purchase ordering membership through the singleton output function and generates the corresponding crisp data. The proposed model allows users keying in their required experimental materials via the Web Site, uses the database management system to integrate all related information, and applies the fuzzy reasoning engine to generate the final purchase order reports to support the executor making the optimal decisions.

1. Introduction

Nowadays, with the developed e-technology, educational institutions have gradually transferred their paper-based records into the computerized paperless form in order to increase departmental productivity, lower administrative costs, increase the process visibility of an official document, and support information analysis [1]. However, in spite of a great need of e-technology, Beheshtifar and Nekoie-Moghadam [2] stated that effective process on talent management for allocating sufficient resources is also an urgent issue for an institution to improve their overall performance. Besides, Xu, He, and Gen [3] also stated that an integrated management of the supply chain can reduce the propagation of undesirable events through the network and can affect decisively the profitability. Therefore, as driven by educational needs and enabled by information technology, the objective of this study is to propose an intelligent laboratory resource supply chain model to achieve the optimal performance and profit of an educational institution.

Figure 1 shows the paperless process of the laboratory resource supply chain at Electronic Engineering (EE) department of Kao Yuan University (KYU). As given in Figure 1, the departmental administrator (DA) will sends an e-mail in the end of the semester to ask teachers who have Lab. classes such as electronics Lab. and microcontroller Lab. and who manage Lab. facilities

for listing next semester's required experimental resources. The DA then collects all the received lists and checks every resource's specification by human labors. If the received listed item is unclear or lack of the specification, the DA will make a call or send the e-mail to the teacher asking for the correct specifications.
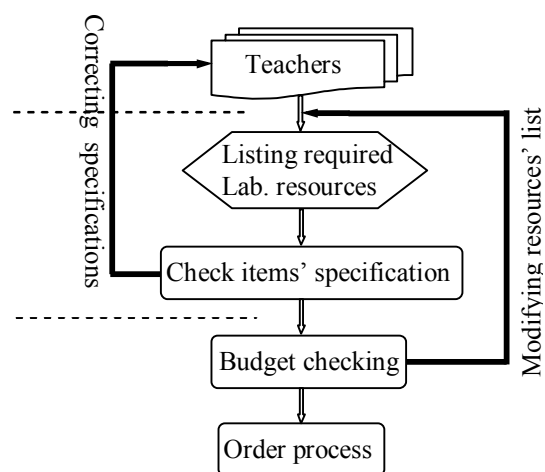

Figure 1. Paperless process of the laboratory resource supply chain

Generally, processing such laboratory resources' supply chain is often influenced by three factors, including: (1) the familiar degree of the administrator and the teacher on materials'

specifications and resources' alternative choices; (2) the limited budget on purchasing the departmental experimental resources for a semester; and (3) the process time of the laboratory resources' supply chain. Therefore, this kind of the laboratory resource supply-chain process has the disadvantages of possibility of ordering wrong experimental resources, delaying the process time, thereby the lack of the experimental resources at the beginning of the semester, decreasing teaching quality, and dissatisfaction among students, teachers, and DA.

Laboratory resource supply chain planning system in an educational institution can be viewed as small/medium sized enterprise (SME) resource supply chain planning system which is an integrated software solution helping organizations to manage their key resources, including money, staff, products, customers and suppliers, more effectively and efficiently [4]. Several literatures [5-10] have applied artificial intelligence technology to improve the effectiveness and efficiency of supply chain management in an institution. Zarandi, Pourakbar, and Turksen [5] proposed a fuzzy agent-based model for reduction of bullwhip effect in supply chain systems. The proposed model can minimize the total cost and can suggest the reasonable ordering policies of a supply chain. Cheung, Cheung, and Kwok [6] presented a knowledge-based customization system with visibility for supply chain integration (KCSSI) which is developed based on the visualization of topologies, network analysis, and knowledge-based system to obtain quantified actionable information and formulating strategies for supply chain configuration leading the long term success.Aburto and Weber [7] proposed a hybrid intelligent system applying neural network concept and autoregressive integrated moving average (ARIMA) technology for demand forecasting. The proposed approach was compared with two different forecasting approaches, named Naïve and MLP models, and was implemented in Economax supermarket supply chain management system in Chilean, Japan. The results showed that the ARIMA model has the advantages of fewer sales failures and lower inventory levels. Symeonidis, etc. [8] incorporated a data mining technique into an organizational selling policy to reduce the company's cost and improve its service. The proposed method, as a recommendation engine, deployed supply chain and customer relationship management techniques to successfully fuse information to customers, suppliers, manufacturers and warehouses. It minimizes system-wide cost and satisfies service level requirements. Canavesio and Martinez [9] proposed a conceptual project-based SME network model using decentralized and autonomous organizational units, named as fractal, to

achieve a high degree of flexibility to environmental changes. The model was implemented by logic programming language Prolog; the simulation results tell emergent behavior and constraints. However, the model like a multi-agent system is lack of the appropriate intelligent technology to integrate all fractal units and evaluate the organizational effectiveness and ultimately performance. To overcome this drawback, Wang, etc. [10] designed a Meta model as the core technology for integrating distributed relational database management systems with the backend of enterprise system developed by the software vendors. The proposed model aims to achieve enterprise resource sharing, shorten purchase time, and lower operation cost, which takes an on-line electronic purchase system as the example to demonstrate its efficiency and effectiveness.

Literatures [11-14] are four studies related to decision support systems. Padillo, etc. [11] developed a strategic decision support system for product allocation and major resources planning. Worley, etc. [12] developed an expert system generator, a neural network simulator, and a case-based reasoning module to provide answers for the users. Due to both supply chain decision support systems only specific to the enterprise's supply chain, they have the disadvantage of inflexibility. To overcome this weakness, Julka, etc. [13] proposed a unified framework which integrates different ERP elements such as the production processes and the associated business data and knowledge to model, monitor, manage, and analyze the business polices. Moreover, in order to rapidly response to a dynamic global market and satisfy frequently changing customer demands, Ni, etc. [14] proposed a configuration-based flexible reporting method to help managers make decisions, perform planning activities and communicate with partners, which allow users to generate reports for different companies by providing different sets of configurations.

References [15-21] evaluated some ERP models and their success and failure factors. Tan, etc. [15] proposed a methodology with activity-based metric measurement models to evaluate the performance of the process flows, including activity, product information, resource, cost, cash, and profit, within manufacturing enterprises. Sarkis and Sundarraj [16] discovered that approximately two-thirds of ERP systems are said to be failure. Evgeniou [17] investigated that organizations are stuck on either suffering from lack of information visibility across enterprise or suffering from information flexibility. The study suggested that an ERP planning system should provide visibility of the ERP system to external constituents via Web linkages, standardization of internal processes, and important

information technology systems to support market needs. Sun, etc. [18] utilized quantitative information to evaluate the cost, planned schedule, and goal achievement, which stated that effective use of enterprise resource planning systems is a critical success factor for many small manufacturing enterprises. Arnold [19] discussed the largely ignored behavioral impacts of enterprise systems' implementation and integration, which revealed that how the benefits will actually materialize from an inter-organizational perspective has received little attention. The study suggested that future research on enterprise systems should include (1) experimentation that focuses primarily on judgment and decision making at the individual level and improvements in organizational performance and (2) triangulation methods that integrate case research, surveys, and cross-sectional field studies. Moreover, Maropoulos, etc. [20] stated that the integration of the supply chain should focus on the early stages of product development where the majority of product lifecycle cost is decided. Sun, etc. [21] also suggested that system, service and information quality are most important successful factors.

In order to improve the drawbacks as described above, the authors propose an intelligent laboratory resource supply chain model to increase the visibility and flexibility of the laboratory resource supply chain process. The proposed model designs a resource database management system and utilizes parallel fuzzy reasoning information technology to achieve the optimal performance and profit. The proposed helps teachers and DA to familiar the resources' specifications and their alternative choices; checks the correctness of departmental received resource list; and provides the best performance of Lab. resource supply chain planning system. If there is something wrong on any step of the process, the system immediately informs the teacher and the DA to make a change or make an alternative choice. The process integration links functions with information, resources, and people, thereby improving internal communication, collaboration, and coordination.

In the following, Section 2 describes the proposed laboratory resource supply-chain model. The experimental results are shown in Section 3. Finally, the conclusions and future works are summarized in Section 4.

2. Laboratory Resource Supply Chain System

Figure 2 illustrates the process integration of the laboratory resource supply chain model, which consists of six steps with five units, including fractal units, web-based supply chain planning system, departmental administrator (DA), general affair, and vendors. The roles of each unit are described

followed by the six steps of the laboratory resource supply chain process.
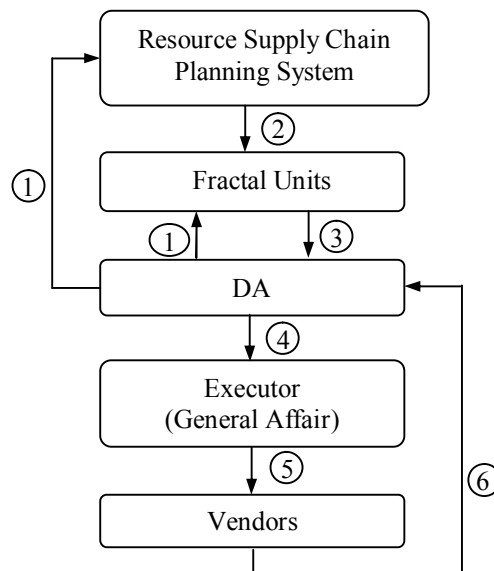
Figure 2. Process integration of the laboratory resource supply chain model.

2.1. Six Steps of the Laboratory Resource Supply Chain Process

Step 1: The DA requests for the tender by sending an e-mail to every fractal unit. Meanwhile, he or she will set the related parameters, including courses' titles, available lab resources, and people with the privilege accessing Lab. resource supply chain planning, and store them as records in the database management system.

Step 2: Every fractal unit submits Lab. resource proposal to the network based resource supply chain planning system via the Web Site.

Step 3: After received Lab. resource proposals from every fractal unit, the network based resource supply chain planning system collects and organizes all the received information; the system then generates final proposal of purchasing order reports for each laboratory and send them to the DA.

Step 4: After received final proposal reports, the DA makes final decisions based on the limited budget and the quantities of available resources; he or she will find three vendors with the best buy qualification in the market and send the decision results to the faculty who is in charge of purchasing Lab. resources in the general affair unit at KYU.

Step 5: The executor of purchasing Lab. resources will collect all the received Lab. resource ordering reports received from each DA at

KYU. If all the ordering reports are correct, he/she chooses one of the best buy qualified vendors and output final purchasing order reports to the chosen vendors.

Step 6: After received the purchasing order reports, the vendors will contact each DA to know the deadline for sending the Lab. resources to the department.

2.2. Roles of Each Unit in the Process Integration

(1)   Fractal units: The teachers who have Lab. classes such as electronics Lab. and microcontroller Lab. and who are in charge of managing laboratory's instruments and facilities.

(2)   Department administrator: The administrator, the faculty in charge of EE departmental laboratory resource supply chain planning system, periodically updates the newest each Lab. Resource status and fractal units stored in the database management system.

(3)   Executor at general affair unit: The administrator, the faculty in charge of university supply chain planning system, collects all the resource ordering reports and outputs final purchase order decision to the specific quantified vendors for each department at university.

(4)   Vendors: The companies provide the best buy of laboratory related instruments, facilities, and experimental materials.

(5)   Network based resource supply chain planning system: The information integration software links functions with information, resources, and people for a departmental laboratory resource supply chain planning system. The aim of the software is to improve internal communication, collaboration, and coordination as well as achieve the best performance and profit. In order to gain the best profit of the system, the proposed system aims to minimize the whole cost of Lab. resource stock. Specifically, the economic ordering quantity should be optimized and the whole semester cost of purchase is defined as:

Whole semester cost of purchase (DCQ)
= Whole semester budget of Lab. resources (NB)
+ Lab. available stock (RS)

where D is the semester demand of certain resources, C is the cost of unit ordering, and Q is the economic ordering quantity. N is the student number at the department and B is the budget for a student; both of them are constant. R is the available resources and S is the quantity of available stock.

The proposed system includes three parts: the database management system, parallel fuzzy reasoning engine, and purchase order reporting system, as described in the following.

2.2.1. Database Management System

Figure 3 illustrates the schema of the entity relational database management system, which includes entities and attributes of entities related information in the database. As shown in Figure 3, the entity set contains entity name, entity identification, office location, entity e-mail, and entity phone number; and it has three attributes, including proposal, key and help. The attributes of the proposal are such as course name, Lab. name, item name, item identification, item specification, etc.; the key attributes store each entity's username and password to ensure teachers accessing the system securely; and the help attributes provide the information, such as item lists, specification lists, examples, etc., to help teachers proposing the required experimental resource.

(a)

(b)
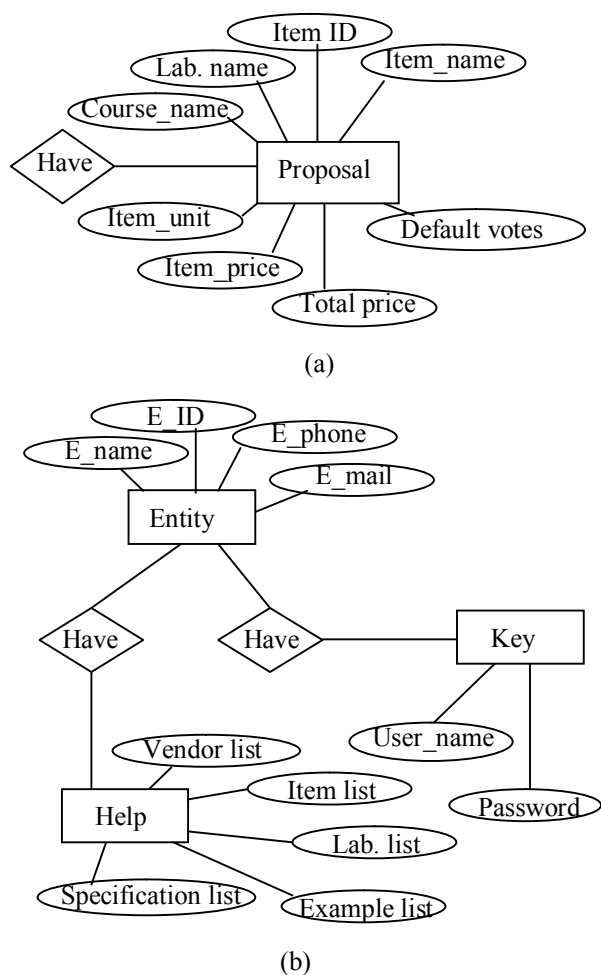
Figure 3. Schema of the entity relational database management system.

2.2.2. Parallel Fuzzy Reasoning Engine

The reasoning engine process consists of three processes, fuzzy, parallel fuzzy rules, and de-fuzzy as described in the following.

(1) Fuzzy: It takes the crisp input through the characteristic function and maps it into the fuzzy data, membership degree of the input data. In this section, the trapezoid membership function is applied to measure the membership degree of the input data as given in the Fig. 4.
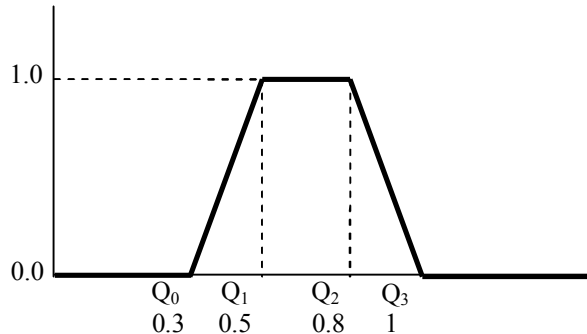
Figure 4. Trapezoid membership function.

,where function $F(Q)$ is defined as

$$f(x) = \begin{cases} 0 & ; Q < Q_0 \\ \dfrac{Q}{Q_1 - Q_0} - \dfrac{Q_0}{Q_1 - Q_0} & ; Q_0 < Q < Q_1 \\ 1 & ; Q_1 < Q < Q_2 \\ \dfrac{-Q}{Q_3 - Q_2} + \dfrac{Q_3}{Q_3 - Q_2} & ; Q_2 < Q < Q_3 \end{cases}$$

As shown in Figure 4, the fuzzification maps crisp input data into four fuzzy sets, Low($Q \le Q_0$), High($Q \ge Q_3$), Medium Low($Q_1 < Q < Q_2$), Medium High($Q_2 < Q < Q_3$).

(2) Parallel fuzzy rules: Parallel fuzzy rules means every rule will be processed with different degree of membership and all rules in the system will be processed. The defined rules can be used for deciding the optimal economic ordering quantity, thereby increase the performance and profit. In addition, all the rules are simply set based on three fuzzy operators: disjunction (FuzzyOR), conjunction (FuzzyAND), and negation (FuzzyNOT), as given in the following.

FuzzyOR = MAX (A, B). For example, High OR Medium High = MAX (1, 0.8) = 1

FuzzyAND = MIN (A, B). For example, High AND Medium High = MIN (1, 0.8)=0.8

FuzzyNOT_A = 1-A. For example, NOT Low = 1-0.3=0.7

Following gives the example of the defined degree of membership fuzzy rule:

EX1: Degree_Purchase_Item
= MIN ((1-degree_Low), degree_High)

The parallel fuzzy rules are

If (budget is high) AND (item is needed) AND (available stock is low) then 100% Purchase,

If (budget is high) AND (item is needed) AND (available stock is medium low) then 80% Purchase,

If (budget is high) AND (item is needed) AND (available stock is medium high) then 50% Purchase,

If (budget is high) AND (item is needed) AND (available stock is high) then 0% Purchase, etc.

Therefore, the final values of process rules can be 100% Purchase=0.5; 80% Purchase =0.6; 50% Purchase=0.3; 0% Purchase=0.2.

(3) De-fuzzy: It takes each Degree_Purchase_Item's degree of membership through the singleton output membership function and maps it into a specific crisp data. The singleton output membership function is defined as

$$output = \frac{\sum_{i=1}^{n} \mu_i x_i}{\sum_{i=1}^{i=n} \mu_i}$$

where u is the degree of membership and x is the final value of processed rules.

2.2.3. Purchase Order Reporting System

Table 1 shows the purchase order format, which includes item number, item name, specification, quantity, unit, price, total price, department, order data and notes. The generated purchase orders can be directly used by the DA to make the final purchase order and initiate a purchase process.

Table 1. Purchase order format.

No	Name	Spec	Qua.	Unit	Price	Total Price	Date
1	Transis	9012	100	pc.	5	500	09/12/1
2	Microc.	8951	100	IC	40	4000	09/12/1
3	Capac.	1u	200	pc.	2	400	09/12/1

3. Experimental Results

Figure 5 illustrates the system structure of the web-based user interface of Lab. resource supply planning system. As shown in Figure 5, a member can send the proposal and an administrator can send the request tender, output the reports, and set the parameters via the web-page. The proposed database management system has been implemented by using the following software and hardware.

(1) Operating system: Microsoft Windows XP Professional
(2) Web Server: Apache Tomcat 5.5.7
(3) Programming Language: Java 2 SDK v.5.0 and JSP
(4) Database management: MySQL 5.0
(5) Homepage: Dreamweaver and Flash

Figure 6 shows the web-based user interface of Lab. Resource database management system built at EE department of KYU. As shown on the bottom of the main homepage in Figure 6(a), there are three clicks, including News, Member login, and Message, used to access the Lab. Resource database management system. If a user wants to know the latest news of the Lab. Resource management, he/she can click "News" icon; or a user wants to leave a message, he/she can click "Message" icon. Figure 6(b) shows the member login homepage which allows user keying their user name and password to access the system to keying their proposals. Table 2 summarizes the definitions and countermeasures of four weaknesses, including invisibility, inflexibility inefficient, and nonprofit, existing in the current Lab. resource supply chain planning system at EE department of KYU.

News   Member   Message
(a)

(b)
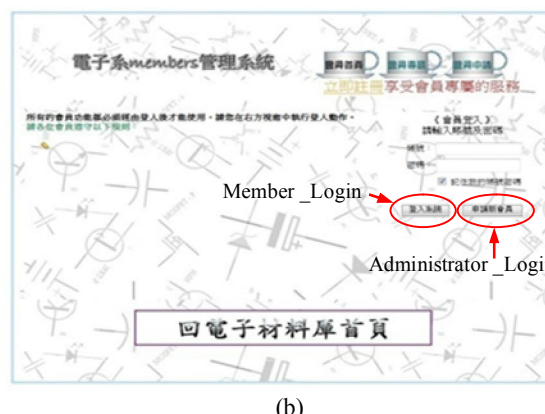
Figure 6. Web-based user interface; (a) Main homepage; (b) Member login user interface.
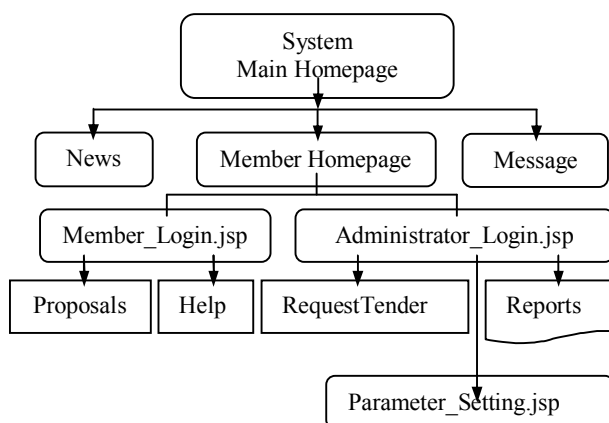
Figure 5. System structure of the Web-based user interface.

Table 2. Countermeasures of four weaknesses existing in the current Lab. resource supply chain planning system

Weaknesses	Improving Principles
Invisibility	Allowing users keying their required Lab. resources via the Web Site
Inflexibility	Constructing a database management system to collect and organize all Lab. resource related information
Inefficient	Decreasing paper and human resources' consumption and allowing information shared among different departments and individuals
Nonprofit	Supporting strategic decision making and information analysis with fuzzy reasoning engine

4. Conclusions

An intelligent laboratory resource supply chain model has been proposed in this study. The main contribution of the proposed model is to establish client-server relationship between supply chain managers and the teachers who either have Lab. courses or are in charge of Lab. resources. Compared to the existing methods, the proposed model supports four distinctive advantages: (1) increasing departmental productivity by allowing information shared among different departments and individuals; (2) supporting strategic decision making and information analysis by using fuzzy reasoning engine; (3) increasing the process and information integration, visibility and flexibility by allowing users keying their required Lab. resources via the Web Site and building a database management system to collect and organize all Lab. resource related information; (4) improving internal communication, collaboration, and coordination by linking functions with information, resources, and people.

This work can be extended to apply radio frequency identification tags [22-23] on each item of laboratory resources for decreasing the processing time and providing more effective and efficient stock management.

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Intracranial Stent Placement for Recanalization of Acute Cerebral Artery Occlusion

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Abstract: To retrospectively evaluate the feasibility, efficacy, and safety of intracranial artery recanalization for acute ischemic stroke (AIS) using a self-expandable stent. All patients treated with an intracranial stent for acute cerebral artery occlusion were included. Treatment comprised intraarterial thrombolysis, balloon angioplasty and stent placement. Recanalization result was assessed by follow-up angiography immediately after stent placement. Complications related to the procedure and outcome at 3 months were assessed. Twelve patients (median NIHSS 14, mean age 63 years) were treated with intracranial stents for AIS. Occlusions were located in the posterior vertebrobasilar circulation (n=6) and in the anterior circulation (n=6). Stent placement was feasible in all procedures and resulted in partial or complete recanalization (TIMI 2/3) in 92%. No vessel perforations, subarachnoid, or symptomatic intracerebral hemorrhages occurred. Three patients (25%) had a good outcome (mRS 0 to 2), 3 (25%) a moderate outcome (mRS 3), and 6 (50%) a poor outcome (mRS 4 to 6). Mortality was 33.3%. Intracranial stent placement for AIS management has an excellent recanalization rate. However, it is associated with high complication risks as our series showed. We believe that the decision to treat acute ischemic stroke with intracranial stent placement should be made after careful consideration of potential benefits and risks

1. Introduction

Various treatment modalities for AIS have gradually evolved during the past decade.[1-2] Among them, stents have been reported as an option for improvement of the recanalization rate and have shown excellent results with an acceptably low complication rate.[3-4] The authors have also used intracranial stents in failed cases of intraarterial thrombolysis (IAT) with pharmacologic and mechanical methods since 2004. We also experienced good results in terms of recanalization. But at the same time, we felt that stent should be selected as an option with care. Its use has often been accompanied by complications that could be directly and indirectly related to the stent. In this article, we summarize the radiologic and clinical outcomes of 12 patients with AIS treated with intracranial stents.

2. Methods

All patients treated at our department with intracranial stent placement for acute cerebral artery occlusion were retrospectively analyzed. Data had been collected prospectively and entered into our stroke database. Inclusion criteria for intracranial stent treatment were confirmed vessel occlusion by digital subtraction angiography (DSA), failed IAT, or contraindication to perform intravenous thrombolysis (IVT) or IAT. Inclusion criteria for IAT were (1) clinical diagnosis of acute stroke established by a stroke neurologist; (2) baseline NIHSS score 4 to 24; (3) exclusion of hemorrhage by cranial Computed Tomography (CT) or Magnetic Resonance Imaging (MRI); (4) vessel occlusion correlating to neurological deficit confirmed by 4-vessel angiography; (5) initiation of treatment within 6 hours of symptom onset for hemispheric stroke and within 24 hours for vertebrobasilar stroke; (6) no clinical or laboratory contraindications for IAT; (7) for patients ＞80 years that their general condition before stroke did not advise against it.

Intracranial Stent Placement Procedures

All procedures were performed with local anesthetics. A standard transfemoral approach was used, and a 6F guide sheath was placed in the lesion side of the common carotid artery and a 6F conventional guide catheter was placed coaxially into the ICA.

Dual oral antiplatelet agents (clopidogrel 300mg and aspirin 300mg) were given orally or through a nasogastric tube after confirming no intracranial hemorrhage on postprocedural brain CT. Clopidogrel (75 mg) and Aspirin (100 mg) were administered daily thereafter. IV heparin was not administered during and

after IAT. However, in case of cardiac embolic occlusion, low molecular heparin was added 24 hours after IAT, which was changed to oral warfarin several days later. Activated clotting time was not checked during IAT. Mechanical IAT was performed with microwires, microcatheters, and balloons (Gateway balloon, Boston Scientific company US). In all patients a self-expandable stent (Wingspan stent system, Boston Scientific) designed for intracranial use was applied. Stents were slightly oversized to allow proper adjustment to the vessel wall (2.5 to 4.5 mm diameter, 15 to 20 mm length). The stent catheter was navigated to the occlusion site using a road map, and the stent was placed during fluoroscopic control. Aspirin (300 mg) was administered intravenously immediately after stent placement. PTA was carried out before or after stent placement at the discretion of the operator. Recanalization result was assessed by DSA immediately after stent placement according to the Thrombolysis in Myocardial Infarction (TIMI) trial criteria: Grade 0, no recanalization; grade 1, minimal recanalization; grade 2, partial recanalization; grade 3, complete recanalization.17 Thrombus formation or residual thrombus inside the stent lumen as well as side wall irregularities corresponding to residual atheroslerotic stenosis or fixated thrombotic material between stent and vessel wall were recorded. Dissection and vessel perforation were assessed. Flow in the lenticulostriate arteries (LA) after stent placement in the middle cerebral artery (MCA) was evaluated and perfusion of major branches (eg, M2 segments, cerebellar arteries, posterior cerebral artery) after recanalization of the main vessel was assessed.

Management of post-procedure and follow-Up

After the intervention patients were transferred to the intensive care unit. Brain CT or MRI was performed in the first 24 hours after intervention as well as in case of neurological deterioration to exclude intracranial hemorrhage and to estimate brain edema. sICH was defined as clinical deterioration (4-point or greater increase in the NIHSS score or a 1-point deterioration in the level of consciousness) combined with space-occupying brain hematoma.15,18 After exclusion of hemorrhage was made, long-term Aspirin (100 mg/d) was given and Clopidogrel (75 mg/d) was added for the next 30 days. Clinical outcome was assessed at 3 months observation according to the modified Rankin scale (mRS).19 Outcome was stratified to "good outcome" (mRS 0 to 2), "moderate outcome" (mRS 3), and "poor outcome" (mRS 4 to 6).

3. Result

From May 2009 until July 2011, 12 patients (7 men and 5 women, mean age 63±13 years) were treated with intracranial stent placement for acute occlusion of cerebral artery in our hospital. Median NIHSS score at admission was 14 (range 5 to 38). In 11 patients 1 stent was placed, and in 1 patient two stents were delivered. Stent placement was feasible in all 13 stent procedures. Occlusion sites are given in the Table. All patients had collateral flow grade 2. We made the decision to place a stent in 4 patients in whom PTA had been unsuccessful. PTA was performed in a further 4 patients before and in 3 patients after stent placement. Partial or complete recanalization (TIMI 2 and 3) was achieved in 11/12 patients (91.6%). Median time from symptom onset to recanalization was 393 minutes (range 20 to 510 minutes.). Preservation of LA was possible in all stent placements in the middle cerebral artery (MCA). Occlusion of a major vessel branch at the site of stent placement persisted in 6 patients. Assessment of the dependent vessel branch territory by follow-up MRI or CT showed infarction in 3 of 6 patients (50%), whereas no infarction of this particular territory was noted in the remaining 3 patients. In 8 patients major branches at the site of the stent showed sufficient perfusion.

At 3 months follow-up 3 patients (25%) had a good outcome (mRS 0 or 1), 3 (25%) had a moderate outcome (mRS 3), and 6 (50%) had a poor outcome (mRS 4 to 6). Mortality was 33.3%.

4. Discussion

A recent meta-analysis of several stroke studies revealed a strong association of recanalization and good outcome after acute ischemic stroke.[1] IVT has been shown to improve patient outcome and is approved by the FDA and EMEA.[5] However, only a minority of patients admitted for acute stroke receive IVT.[6] IAT is also effective for vessel recanalization and is supposed to achieve higher recanalization rates than IVT.[7] On the other hand, application of thrombolytic drugs increases the risk of sICH.[8] These factors as well as failure of thrombolysis to achieve sufficient recanalization in a subgroup of patients led to the introduction of MT. The Merci Retriever System got FDA approaval in 2004. However, recanalization rate remained at 46% to 57% with the Merci retriever and risk of SAH attributable to intracranial vessel perforation has increased.[9] Intracranial stent placement for recanalization of cerebral arteries has been performed in a limited number of acute stroke patients.[10] The present study confirms the high technical success rate using a self-expandable stent system introduced for treatment of atherosclerotic stenosis in the setting of complete acute intracranial vessel occlusion.[11] No technical failure was encountered in our study. The stent catheter was navigated easily up to the intracranial vasculature and placed beyond the occlusion site. High recanalization

rates of 79% to 90% after intracranial stent placement have been reported and are confirmed in the present study (92%).[11] Whereas Levy et al reported results obtained at 4 different clinical centers and used the Neuroform stent in a majority of patients, we report a single center experience with the more recently introduced Wingspan stent system. Compared to the Neuroform stent, the Wingspan stent has an improved delivery system, a higher radial force, and a higher number of struts. The improved delivery system increases stent safety and feasibility. The higher radial force and tighter struts are supposed to compress and fixate the thrombus more reliably.[12]

Mortality (33%) was similar to former studies (32% to in a quarter of the patients.[11] However, stenting was performed as a rescue therapy in patients with major artery occlusions after failure of other techniques. 40%), and a good outcome after 3 months was observed only in a quarter of the patients.

From our point of view important side branches like the LA can be preserved if the thrombus is passed on the ipsilateral side by the microwire and the stent. Stent expansion will fixate the thrombus at the contralateral wall. This technique was successfully performed in all 5 of our patients suffering MCA occlusion and can be translated to the BA and P1 segments with their perforating arteries as well. However, occlusion of major vessel branches (eg, M2 segment, superior cerebellar artery) at the site of stent placement persisted in 6 patients. Remarkably, no infarction occurred in the dependent vessel territory in half of those patients, pointing to a sufficient collateral circulation. In 3 patients follow-up MRI or CT revealed infarcts in the dependent vessel territory. These infarcts were apparent to some extent at MRI before the interventional treatment, and it remains uncertain whether they are related to the primary occlusive disease or to the stent placement.

In our experience care has to be taken if the deployed stent has to be passed repeatedly with other devices. As long as the stent is not covered by neointima, devices might get caught in the stent struts with subsequent complications. Hence stent placement was performed to reestablish sufficient cerebral blood flow with as little mechanical manipulation as possible, additional postdilatation was performed in only 25% of our patients. Before the introduction of stents for the treatment of atherosclerotic stenosis of intracranial vessels, PTA performed alone for acute ischemic stroke yielded some success. However, when treating thrombus rather than atherosclerotic stenosis, reocclusion attributable to thromboaggregation and

thrombus expansion might occur. In our study, all PTAs performed for vessel recanalization failed to establish sufficient flow.

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Investigating the Relationship between Resiliency, Spiritual Intelligence and Mental Health of a group of undergraduate Students

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Abstract: Psychological assessment has tended to focus on the identification of attitudes that contribute to, and are symptomatic of, mental and physical disorders. This focus is most useful when clinicians and researchers seek to identify the degree to which individuals are impaired or at-risk. The purpose of this study is to investigate the relationship between resiliency, spiritual intelligence and mental health among male and female students of Hormozgan University. Statistical sample of the study consists of male and female students of Hormozgan University, among which 100 were selected by random sampling. In this research Resiliency Questionnaire of Connor & Davidson, General Health Questionnaire (GHQ-28) and Spiritual Intelligence Questionnaire of Abdollah-Zadeh were used. The results indicated that there was a positive meaningful relationship ($p<0.01$) between resiliency and mental health, and also between spiritual intelligence and resiliency ($p<0.01$). Based on the results of T-test, there is no meaningful resiliency difference between male and female students. On the other hand, results of multiple regressions analysis indicated that mental health and spiritual intelligence meaningfully explain resiliency. Mental health has more significant role in predicting and explaining resiliency. Mental health and spiritual Intelligence had a significant role in explaining resiliency. Due to the fact that people with higher resiliency represent higher degree of mental health, we can conclude that providing vital factors (religion, spirit) to enhance resiliency can strengthen people in the face of mental stresses, tension and depression.
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Keywords: Resiliency, Spirituality and Mental Health.

1. Introduction

Resiliency is described as individual's response to stressful events of life or continuous confrontation of stress (such as war and sexual abuse) [1]. Resilient people are higher compatible with environmental stressful factors [2,3,4]. Compatibility of people is due to the combination of context/ecological interaction and organic growth [1,5]. However, resiliency is multi-dimensional. A person may be resilient in one aspect, but less resilient in the others. Luther et al. [6] declared that some children showed adequacy in some aspects but have problems in the others. In a study on high-educational resilient students that had experienced misbehavior, Kaufman et al. [7] showed that 21% of them had social resiliency.

Perkins and Jones [1] defined three protective factors for physically and sexually abused, Family processes and beyond family factors. Benzies and Mychasiuk [8], explain family and governmental policy makings for enhancing health and preventing diseases, as two main source of providing protective factors against risky factors. Garmezy and Masten [3] had also explained three effective protective factors in individual resiliency: personal factors, family factors and social factors. In a general review of Masten and Coatsworth [9] for a period of 25 years studies on resiliency, it is recognized that protective factors of resiliency have effects on adolescent's health.

Recent studies show that religious approaches and hope for the future are considered as potential protective factors of resiliency in individuals [10,11]. Various studies show that being religious creates objectivity in adolescents and despite their current problems, some of teenagers use their faith to create hope for improvement of condition in the future [1,12,13]. Family environment can be regarded as a key factor. Family can be effective in individual resiliency by creating protective and harmonious environment. The effect of family processes as a protective factor is emphasized in different studies. Ruther [14], for instance, recognized that having good relationship with at least one of the parents can strengthen adolescent in front of some risky behaviors. Perkins and Jones [1] explained two family factors: family protection, and positive interaction of parents and children.

Beyond family factors, such as positive relationship with people out of family environment

[15], positive atmosphere at school, extracurricular activities, suitable peer pattern [16], and an adult protector of adolescents are also defined as protective factors [17]. Benson [18] had also recognized that having outside-family adult protector for adolescents who had experienced unsuitable conditions inside the family can help to create optimistic feeling in them. Recently, Blum et al. [19] showed that adolescents who had good relationship in school have less abnormal behavior, pregnancy, and mental stress. Positive experience at school is of high importance, especially when the teenager experience problematic experiences at home such as misuse or parental ignorance.

Objectivity and religious approaches are two main protective factors in resiliency [1]. Spirituality is the need for going beyond self in daily life and uniting with others. Aram [20] believes that spiritual intelligence includes meaning, objective and sanctifies in life and optimism toward improvement of life. Those who have higher spiritual intelligent are more flexible, self-conscious, capable of intuition, holistic toward universe, seeks for answer of his basic questions about life and criticizing traditions and cultures. Spiritual intelligence can easily enable people to change and revolve [21].

Spirituality is considered as a basic knowledge that increases environmental adaptability of people, and has at least five efficiency which leads to adaptive behaviors: Capability to sublimate deeds in order to orient with integration of world, experiencing a high level of self-consciousness, investigating and purifying daily experiences about individual and spiritual and religious feeling, using spiritual sources to solve life problems and virtuous deeds such as forgiveness, self-sacrifice, etc. [13]

This research aims to find evidences about relationship between resiliency and mental health and spiritual intelligence among male and female students, what's the effect of these factors in describing resiliency and which one has the most part.

2. Material and Methods

Statistical society of this research constitutes students of Hormozgan University. 100 individuals were selected randomly. Correlation method is used to investigate the relationship between these variables. To measure the resiliency, questionnaire of Connor and Davidson [22] (CD-RISC) was used. The questionnaire includes 25 questions and has five components: competence/self-resistance, trusting the instincts/ tolerating negative emotions, positive acceptance of changes/safe relations, control, and spirituality, and scales from 0 = incorrect, to 5= correct. Stability of the test is proved in internal researches. Mental health test used in this research is General Health Questionnaire GHQ-28 of Goldberg and Hillier [23] that has four scales:

A (physical characteristics): individual's feeling about their own health, tiredness and physical characteristics

B (stressful symptoms): including stress and sleeplessness

C (disorder in social functioning): ability of people in professional desires and daily issues of life, and their feelings about usual situations of life

D (depression): severe depression and tendency to suicide.

The average time specified for this test is 8 minutes. The test investigates positive healthy moods of subject during the last month (one month before test). To score the test, Likert's test scoring method (0-3) was used. In the study of Goldberg and Williams [24], sensitivity of GHQ-28 is 84% and its average trait is 82%. Spiritual intelligent test, first used in Sari University, Iran and was used to test spiritual intelligence in this survey. Cronbach's Alpha is 0.85 that indicates reliability of this test. Scoring is again based on Likert's scoring method.

3. Results

Table 1 represents mean and standard deviation of students in resiliency, spiritual intelligence and mental health. Table 2 represents results of T-test about resiliency, spiritual intelligence and mental health, and its subscales among male and female students

Results showed that there are no meaningful differences among male and female students based on resiliency, spiritual intelligence and mental health, and its subscales.

Table 3 represents correlation matrix of resiliency, spiritual intelligence and mental health variables.

Results of table 3 represent that there is a positive meaningful correlation between resiliency and spiritual intelligence in $p<0.01$. Resiliency and mental health has positive meaningful relation in $p < 0.01$.

Table 1. Mean and standard deviation of students in resiliency, spiritual intelligence and mental health

Variables	Mean			Standard Deviation		
	Female	Male	Total	Female	Male	Total
Resiliency	57.44	58.74	58.09	7.18	7.67	7.42
Spiritual Intelligence	44.16	42.16	43.16	7.32	6.94	7.13
Mental Health	22.45	23.44	22.94	4.13	4.75	4.46

Table 2. Results of T-test about resiliency, spiritual intelligence and mental health, and its subscales among male and female students

Variables	Gender	N	M	Df	T	P
Spiritual Intelligence	Female	50	44.16	98	0.92	0.35
	Male	50	42.16			
Physical Characteristics	Female	50	6.10	98	0.34	0.73
	Male	50	5.84			
Stress	Female	50	6.56	98	0.82	0.41
	Male	50	5.88			
Social Functioning Disorder	Female	50	7.33	98	-0.19	0.84
	Male	50	7.46			
Depression	Female	50	2.95	98	- 1.16	0.24
	Male	50	3.98			
Mental Health	Female	50	22.45	98	- 0.40	0.68
	Male	50	23.44			
Resiliency	Female	50	57.44	98	- 0.39	0.69
	Male	50	58.74			

Table 3. Correlation matrix of resiliency, spiritual intelligence and mental health variables

	Variables	1	2	3	4	5	6	7	8
1	Resiliency	1							
2	Spiritual Intelligence	0.35 **	1						
3	Mental Health	0.47**	- 0.38**	1					
4	Physical Characteristics	- 0.31**	- 0.16**	- 0.79**	1				
5	Stress	- 0.36**	- 0.24*	- 0.83**	0.70**	1			
6	Social Functioning Disorder	- 0.31**	- 0.30**	- 0.67**	0.35**	0.44**	1		
7	Depression	- 0.46**	- 0.46**	- 0.77**	0.50**	0.51**	0.44**	1	
8	Gender	0.04	- 0.09	0.04	- 0.03	- 0.08	0.02	0.11	1

$* p < 0.05, ** p < 0.01$

Table 4. Predicting resiliency based on mental health and spiritual intelligence using Enter method

Variable	Criterion Variable: Resiliency				
Predictor Variables	B	B	R	R^2	Sig
Mental Health	0.46	0.22	0.32	0.27	P < 0.01
Spiritual Intelligence	0.37	0.18	0.13	0.18	P < 0.01

As the results of table 3 indicate, mental health and spiritual intelligence have a positive and meaningful part in describing resiliency (p<0.01), and mental health describes 27% of resiliency variance (R^2= 0.27). In general, mental health is most used in explaining resiliency. 18% of resiliency variance is also explained by spiritual intelligence (R^2= 0.18).

There is also a negative meaningful relation between resiliency and depression, stress, social functioning disorder, and physical characteristics.

In order to predict resiliency based on mental health and spiritual intelligence, multi-variable regression method was use. The results are shown in table 4.

4. Discussion and Conclusion

The results of this study represent that gender is not a determining factor of resiliency, and assumed positive correlation between mental health and resiliency was also proved. The findings are similar to some other studies in this area. Resiliency is a kind of inter-personal source that can adjust stress and disability in crucial situations [12]. Perkins and Jones [1] found that there is a positive meaningful relationship between resiliency and mental health scores and a negative meaningful relationship between resiliency and psychological disability, depression, stress and general health problems. Various levels of resiliency are related to health criteria and psychological vulnerability by affecting self-esteem, competence, and self-strength, tolerating negative feelings, restrain and spirituality [10,11,13].

Garmezy and Masten (1991) also described that mental health has more effect on resiliency than spiritual intelligence. Because high resilient people represent higher levels of mental health, it can be concluded that preparing vital factors to increase resiliency may strengthen people in the face of mental stresses and depression. One of the protective factors is religion, ideology and spiritual intelligence [1]. Due to the lack of rich literature in the effect of spiritual intelligence on mental health and resiliency, there is a need for further researches. Therefore, it's suggested to investigate the effect of spiritual intelligence elements on resiliency in future studies.

The limits of the research include uncontrolled intermediary factors such as economic status, marital status, religious background, child bearing methods of parents, etc. It is suggested to consider these factors in future studies and study resiliency and spiritual intelligence parameters by the use of demographic criteria.

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Metiram-induced histological and histochemical alterations in Liver and kidney of pregnant mice

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Abstract: Metiram is a non-systemically acting fungicide of dithiocarbamate group. It is used on food and ornamental crops to prevent crop damage in the field and to protect harvested crops from deterioration in storage or transport**.** The present work was conducted to evaluate the histological and histochemical effects of miteram in pregnant albino mice. Oral treatment of metiram to pregnant mice from the 2nd day to 19th day of gestation induced many histological and histochemical alterations in the hepatic tissue and kidney cortex. The liver tissue showed congestion of blood vessels, leucocytic infiltrations, cytoplasmic vacuolization of the hepatocytes and fatty degeneration. The kidney cortex showed degeneration of renal tubules, atrophy of glomeruli and intertubular leucocytic infiltrations. Moreover, histochemical observations revealed reduction of total carbohydrates and total proteins in the hepatocytes and renal tubules. It is suggested that the histological and histochemical alterations observed in liver and kidney of pregnant mice by metiram may be mediated by depletion of antioxidants and elevation of lipid peroxidation.
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Key words: Metiram, pregnant mice, Liver- kidney, Histology, Histochemistry.

1. Introduction

Fungicides are extensively used against a wide range of fungal diseases of many field crops fruits and ornamentals On the other hand, some of fungicides showed toxicity to humans, animals, and useful plants, in addition to its persistence (long life) in the environment. Moreover, these chemicals were shown to be present in fruits products prepared for human consumption (Cabras and Angioni 2000). Dasgupta et al. (2011) reported that residues of buprofezin, chlorpyriphos, metalaxyl, and myclobutanil were detected in incurred grape and wine samples. Metiram (polyram) is a non-systemically acting fungicide of dithiocarbamate group. It is used on food and ornamental crops to prevent crop damage in the field and to protect harvested crops from deterioration in storage or transport (Charls et al., 2000). The toxicity of metiram was studied in mammalian animals. Kornuta et al., (1996) reported the genotoxicity of metiram using alkaline unwinding assay DNA. Dermal application of metiram resulted in minimal to moderate exfoliation and ulcerative dermatitis in the skin of rabbits treated at the high-dose level (Ullmann et al., 1987). Sortwell et al., (1977) observed follicular hyperplasia in thyroid of female rhesus monkeys treated with metiram. The effect of the fungicides (maneb, metiram, and ziram) on human natural killer (NK) cells cytotoxic function was studied by Whalen et al., (2003). The results provide evidence of relative toxic potential for these compounds and the immunomodulatory effects on

both T and NK lymphocyte function. Sakr et al., (2009) reported that metiram induced histopathological as well as biochemical alterations in the liver of albino mice. The present study was undertaken to evaluate the histological and histochemical effects of metiram in pregnant albino mice.

2. Materials and Methods
Animals and experimental protocol

Fertile virgin females and fertile males of albino mice weighing 22 ±5 g. were obtained from Hellwan Animal Breeding Farm, Ministry of Health, Cairo, Egypt and used for experimentation. Mice were housed in individual cages and maintained in a room with good ventilation at 23ºC. The housing room was maintained on a 12:12 h light: dark cycle. Standard rodent diet composed of 20% casein, 15% corn oil, 55% corn starch, 5% salt mixture and 5% vitaminzed starch was supplied. Free excess of water was provided *ad-libitum*. All the experiments were done in compliance with the Guide for the Care and Use of Laboratory animals. Females were made pregnant by keeping them at a ratio of 1 male: 3 females with males for 12 hour between 8 P.M till 8 A.M. During the next morning, the prospective pregnant were examined for the presence of vaginal plugs. Vaginal smears were carried out to give a precise determination of the onset of gestation. The pregnant mice were divided into two groups each was composed of 15 individuals as follows:

Group I: Control pregnant mice.

GroupII: These animals were administered orally with $1/10$ LD$_{50}$ (284 mg/kg b.w.) of metiram dissolved in distilled water. It consists of 80% active ingredients [zinc ammoniate ethylene-bis (dithiocarbamate)-poly (ethylenethiuram disulfide) and 20% inert ingredients. Animals given metiram from day 2 to day 19 of gestation.

Histological and histochemical examination

The treated animals and their controls were sacrificed by decapitation on the day 19th of gestation. Their livers and kidneys were removed and fixed in 10% neutral formalin. Fixed materials were embedded in paraffin wax and sections of 5 micrometer thickness were cut. Slides were stained with haematoxylin and eosin for histological examination. For histological examination. For histochemical study specimens were fixed in Carnoy's fluid. Periodic acid Schiff's reaction was used for demonstration of polysaccharides (Kiernan, 1981). Total proteins were detected using the mercury bromophenol blue method (Pearse, 1972).

3. Results
Liver
i. Histological results

Sections of control mice liver revealed that the hepatocytes arranged in strands with one or two spherical nuclei and eosinophilic cytoplasm. The sinusoids are occupied by Kupffer cells (Fig.1a) Examination of liver of metiram-treated mice displayed apparent signs of degenerative changes. The normal structural organization of the hepatic lobules was impaired and the characteristic cord-like arrangement of the normal liver cells was lost. In addition, severe inflammatory leucocytic infiltrations were abundant. Such inflammatory infiltration is spread over several liver areas and around the blood vessels (Fig.1b). Enlargement and congestion of blood vessels, especially veins were observed. The hepatocytes were clearly manifested by marked cytoplasmic vacuolization (Fig, 1c) and most cells showed nuclei with signs of karyolysis and pyknosis. Moreover an obvious fatty degeneration indicated by large number of fatty droplets with different size was observed (Fig. 1d).

ii. Histochemical results

A considerable amount of carbohydrates in the cytoplasm of liver cells of control animals was detected by PAS-technique. These carbohydrates give red or magenta colour with Schiff's reagent and is not uniformly distributed in the cytoplasm of the hepatocytes, but occurred concentrated at one pole of the cells; this is termed glycogen flight (Fig.2a). The nuclei appeared entirely PAS-negative indicating absolute lack of glycogen. Examination of sections obtained from liver of animals treated with metiram exhibited diminution in their carbohydrates content (Fig.2b).

Total proteins contents of the liver cells of control mice are positively reflected by the appearance of blue colour after staining with bromophenol blue. Generally, the cytoplasm of the hepatocytes contains excessive amount of total proteins in the form of fine granules (Fig.2c).In addition, both chromatin bodies and nucleoli exhibiting deep colouration. Kupffer cells, and endothelial lining cells of sinusoids give moderate reactivity with bromophenol blue. Also, the walls of blood vessels exhibited strong stainability. Application of the fungicide induced noticeable reduction in the total protein contents in the liver cells (Fig.2d).

Kidney
i. Histological observations

Figure (3a) showed that kidney cortex consists of renal corpuscles and tubules. Renal corpuscles consist of Bowman'capsule with double membrane with urinary space inbetween. Also, a tuft of glumerular capillaries is enclosed in Bowman's capsule. Renal tubules are of two types, proximal and distal tubules. Proximal tubules lined with low columnar epithelium and have narrow lumen. Distal tubules possess wide lumen and lined by cuboidal epithelial. Animals treated with metiram showed degeneration and deterioration of the cortical constituents. The epithelial linning of the renal tubules appeared with cloudy swelling and vacuolated cytoplasm with pyknotic nuclei. Intertubular leucocytic infiltrations were observed (Fig.3b). A number of glomerular capillaries were suffering from severe signs of glomerular congestion, while others were completely damaged (Fig.3c).

ii. Histochemical observations

In control mice, total carbohydrates exist in brush borders of tubular epithelial cells of these cells and the basement membranes (Fig.4a). Renal tubules as well as glomeruli of animals treated with metiram showed noticeable decrease in PAS positive materials (Fig. 4b).

The protein materials in the cells of renal tubules of control mice were displayed in the cytoplasm in the form of small bluish irregular particles. The nuclear envelope, chromatin materials and nucleoli are positively stained (Fig.4c). Examination of kidney of mice after treatment with metiram showed that most

of the cells lining tubular epithelia appeared degenerated and showed a reduction of their protein content (Fig.4d).The glomeruli appeared with less amount of proteins.
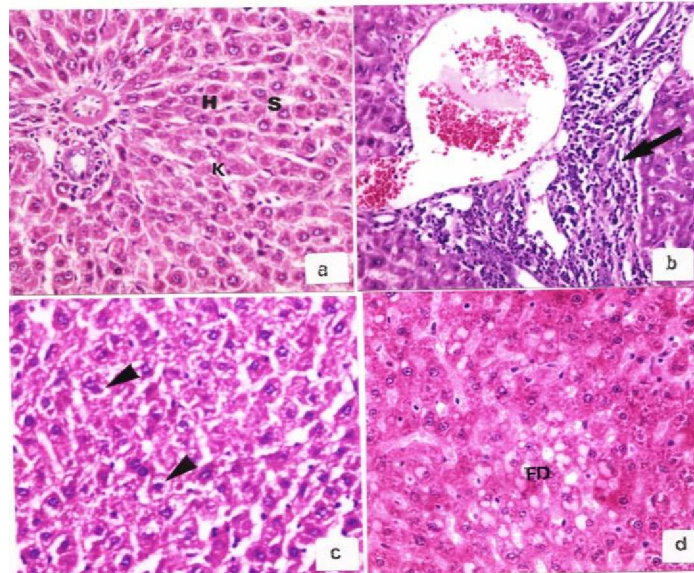
Fig.1. Sections in liver of **(a)**: a control pregnant mouse showing hepatocytes (H), Kupffer cells (K) and Sinusoids (S),X120 **(b)**: a pregnant mouse treated with metiram showing leucocytic infiltrations (arrow),X120 **(c)**: a treated mouse showing cytoplasmic vacuolization of the hepatocytes (arrow heads), X120 **(d):** fatty degeneration (FD), X 120.
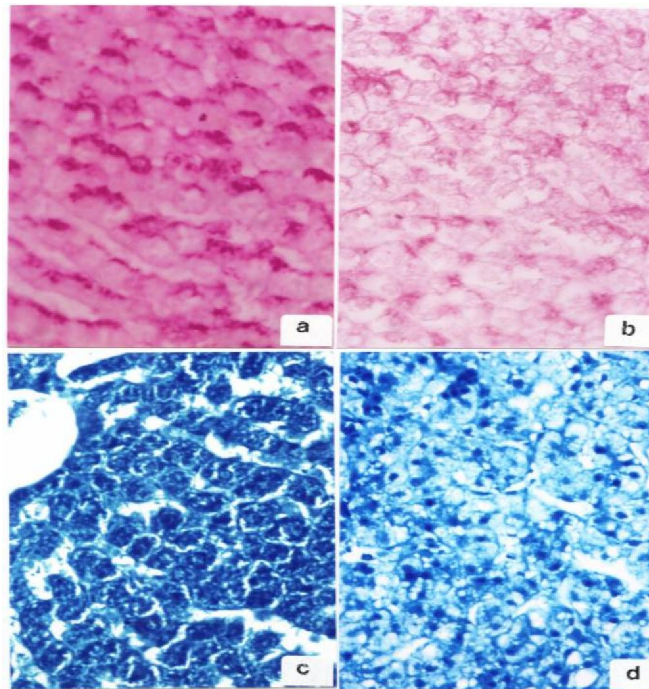
Fig.2. (a): Liver section of a control mouse showing distribution of carbohydrates in the cytoplasm of the hepatocytes,X300. **(b):** Noticeable decrease of carbohydrates in the hepatocytes of a pregnant mouse treated with metiram**.,** X300**(c):** Normal proteinic content in the liver of a control animal,X300 **(d):** Marked reduction of proteins following treatment with metiram, X 300.
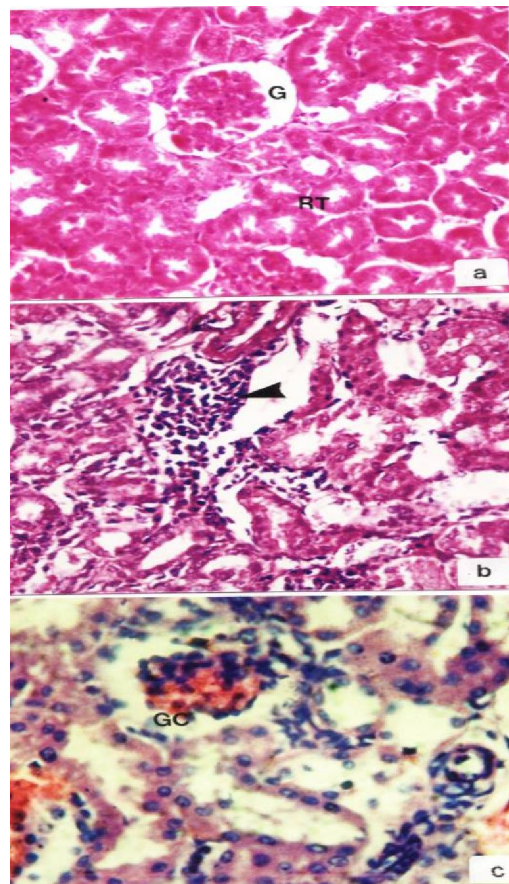
Fig.3.Sections in kidney cortex showing **(a)**: control mouse with normal glomerulus (G) and renal tubules (RT), X 200 **(b):** a pregnant mouse treated with metiram showing leucocytic infiltrations (arrow head) and degenerated renal tubules, X 200 **(c):** congestion of glomerular capillaries (GC), X300.
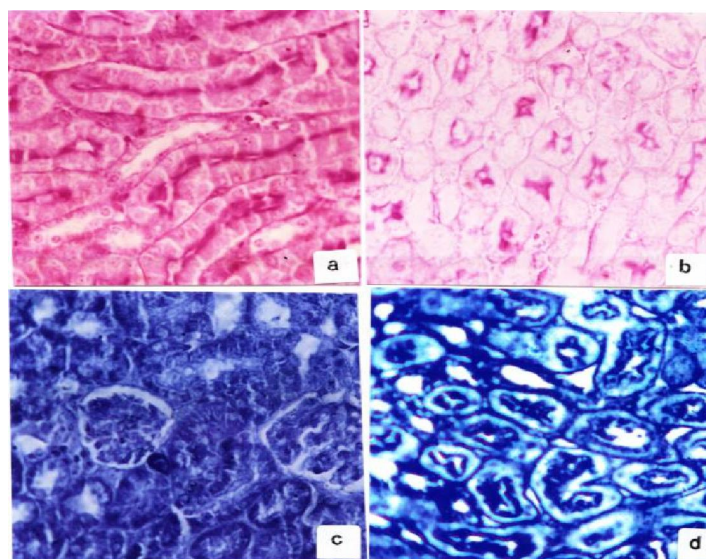
Fig.4. **(a):** T.S. in kidney cortex of a control pregnant mouse showing PAS-positive materials in the brush borders and basement membrane,X300 **(b):** T.S. of kidney cortex of a mouse treated with metiram showing weak PAS reaction, X300 **(c):** Normal protein content in renal tubules and glomeruli of a control mouse, X300(d): Marked reduction of total proteins in a mouse treated with metiram, X 300.

4. Discussion

Results obtained in this work showed that treating pregnant mice with metiram induced many histopathological changes in the liver and kidney cortex. Similarly, Sakr et al. (2009) repoted that metiram caused different histological and biochemical alterations in liver of mice. The effect of fungicides on mammalian tissues was investigated. Lamfon (2011) reported that metalaxyl induced hepatotoxicity in albino rats. Szepvolgyi et al., (1989) reported that when male and female rats were exposed to mancozeb, the liver showed centrilobular necrosis with extramedulary haemopoiesis and the kidney showed tubular dilation, necrosis and congestion of blood vessels. Özbay et al., (1991) reported that exposing mice to the fungicides, maneb and zineb caused blood congestion and mononuclear inflammatory cell infiltrations in the liver and kidney tissues. Ishiyama et al., (1990) found that diethyldithiocarbamate caused liver injury in the form of massive hepatic necrosis in the centrolobular region due to the suppression of the copper superoxide desmotase activity. Intratracheal instillation of diethyldithiocarbamate induced dystrophic changes in the lung and leads to fibrosing alveolitis (Tatrai et al., 1997). Selmanoglu et al. (2001) studied the effect of carbendazim fungicide on kidney of male rats. Their results revealed congestion, mononuclear cell infiltration and tubular degeneration Dithiocarbamates (DTCs) fungicides have toxic effects on liver, kidney, testis and placenta, excessive exposure to the DTCs maneb and zineb caused acute renal failure and nephrotic syndrome in agricultural workers and led to kidney damage and reduced body weights in the offspring of exposed pregnant rat (Odermatt, 2004).

Treating mice with metiram induced reduction of total carbohydrates in hepatic cells and renal tubules. These results are similar to those reported in different organs under the effect of some fungicides. Mahadevaswami et al (2000) reported that mancozeb at a dose level of 600, 700 and 800 mg / kg day induced a significant decrease in the level of glycogen in the liver of albino rats. The decrease of carbohydrates by the metiram seems to be achieved through modifying the activities of the enzymes of glycolytic pathway, TCA cycle, glucogenesis and the oxidative phosphorylation (Shakoori et al. 1988). It was also reported that some pesticides may affect the carbohydrate metabolism through their effects on the endocrine system, especially by modifying the secretion of glucocorticoids and insulin (Pilo and Mehan, 1987). However, one or more of such factors could be considered as the causal agent of carbohydrate reduction observed in treated animals.

Results obtained in this work also revealed that pregnant mice treated with metiram showed a marked decrease in total proteins. Repeated administration of the fungicide, mancozeb induced a reduction in the protein content, in liver and ovary of rats (Baligar and Kaliwal, 2001). Sakr et al.(2004) observed reduction of total proteins in liver of benomyl-treated rats. El-Beih et al., (1991) found that the carbamate insecticide, lannate reduced total proteins in the hepatic cells of guinea pig. Abdeen et al., (1994) indicated that fenvalerate caused a decrease in protein content of mice hepatocytes. They added that protein decreased as a result of vacuolation and degeneration of the cells. The reduction in protein content observed in this work may be attributed partially to the decreased level of hepatic protein synthesis in the cells suffering from pathological changes due to the hyperactivity of hydrolytic enzymes (Sivaprasada *et al.,* 1983).

It is well known that overproduction of reactive oxygen species (ROS) metabolites can initiate lethal chain reactions, which involve oxidation and damage to structures that are crucial for cellular integrity and survival. These free radicals could then cause membrane and macromolecule damage by three basic mechanisms: lipid peroxidation; deoxyribonucleic acid (DNA) fragmentation and protein oxidation (Halliwell and Gutteridge, 1990). Oxidative damage is thought to be one of the main mechanisms involved in nearly all pesticides toxicity. In this concern, Calviello, et al. (2006) reported that fungicides-induced damage is closely associated with increase in lipid peroxidation and the decrease in the antioxidant enzymes. Sakr et al. (2007) found that mancozeb fungicide induced a significant decrease in the serum antioxidant superoxide dismutase and an increase in lipid peroxidation in albino rats. Muthuviveganadavel et al. (2008) reported that carbendazim administration caused significant decrease in lipid peroxidation in liver tissue of male rats. Therefore, it is suggested that the histological and histochemical alterations observed in liver and kidney of pregnant mice by metiram may be mediated by depletion of antioxidants and elevation of lipid peroxidation.

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Effect of nursing intervention on the Quality of life of children undergoing hemodialysis

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Abstract: Renal failure is a major health problem all over the world that significantly lessens Children' s quality of life. Their care is a complex process requires multi disciplinary systems and urgent attention when it is diagnosed. The aim of this study was to assess the effect of nursing intervention on the Quality of life of children undergoing hemodialysis. The study was conducted at pediatrics heamodialysis units of Tanta and Benha University hospitals. A convenient sample of 70 children with chronic renal failure was included in the study (30 of them from Tanta University hospital and 40 from Benha University hospital). Their ages ranged from 8-18 years, with mean age 12.80years±3.43. Interviewing questionnaire sheet and quality of life inventory scales were used to collect the required data. Data were collected in four phases(Initial phase, developmental phase, implementation phase and evaluation phase). The results of the current study revealed that, most of children were males (56%). A significant improvement in psychological domain score was found post intervention, in comparison to that pre intervention with significant decrease in categories of very poor quality of life (P=0.0001), and the percentage increased with the average and high quality of life (P=0.008and 0.061 respectively). There was no significant improvement in physical , social and school attendance domain score of quality of life post intervention in comparison to that pre intervention .with significant improvement only in high quality of life score of physical domain (P=0.002). Regarding to total score of quality of life, significant improvement was found regarding very poor, average and high quality of life post intervention (p=0.0001.0.010 and 0.005) respectively. Conclusion: Nursing intervention had positive effect on all domains of quality of life, specially psychological domain, which showed significant improvement. So it was recommended that, health education sessions should be conducted in heamodialysis units to all nursing staff as care providers, mothers and children to improve the compliance to the prescribed treatment as well as to help them to adapt with their limitation of the disease and its management.
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1. Introduction

Children with chronic renal disease commonly have an incurable condition. They and their families face a lifetime of medical treatment and uncertainty which need renal replacement therapy with dialysis and kidney transplantation. The mortality rate for children with kidney disease remains 30 times higher than for children without kidney disease [1]. Frequent hospitalization, infection, delayed growth and development, short stature, and bone disease are frequent complications.[2,3] Care is complex and multidisciplinary requires multiple medications, invasive procedures, weekly hemodialysis for 4 to 5 hours or continuous peritoneal dialysis, and nutritional supplementation via enteral tubes and pump devices [4,5]. The kidneys play key roles in body function, not only by filtering the blood and getting rid of waste products, but also by balancing levels of electrolytes in the body, controlling blood pressure, and stimulating the production of red blood cells [6] .

The steady increase in the incidence of renal failure in US was 650,000 by year 2010, with accompanying medical care expenditure of 28 billion dollars.6 Kidney disease is the nine leading cause of death in the world (2004). The incidence among pediatric patient on hemodialysis is around 15 million a year[7]. In general population more than 30 people in every 100,000 develop kidney failure each year and the rate increase with age [4-6] .

Renal failure can happen rapidly – over days, weeks or months (acute) or slowly over a period of years. Acute renal failure may occur due to severe infection, sudden blockage to the drainage of urine from the kidney, kidney stone , hemolytic uremic syndrome or nephrotic syndrome .It may occur as side effect of some medications and other rare conditions[7] Acute kidney failure is manifested by ;drop in blood pressure, vomiting, diarrhea, dehydration and anurea.11 Most causes of acute renal failure can be treated and the kidney function will return to normal with time. Replacement of the kidney function by dialysis (artificial kidney) may be necessary until kidney function has returned [8].

Causes of chronic renal failure include: inflammatory conditions affecting the kidney tissue, birth defects, and chronic blockage to the drainage of the kidneys and as a result of certain inherited conditions such as polycystic kidney disease, glomerular diseases, systemic diseases and nephrotic syndrome. The clinical manifestations of such conditions include; tiredness, itching, loss of appetite, nausea, vomiting, breathlessness, edema and weakness [9-10].

Chronic kidney damage is usually not reversible and if extensive, the kidneys may eventually fail completely. Dialysis or kidney transplantation will then become necessary. It is a serious condition which needs urgent attention when it is diagnosed because the kidney damage is usually 'silent' and not noticed at an early stage. Occasionally, it may be possible to identify and treat the cause of the renal failure itself. More commonly, the treatment has to be non-specific. In all cases, careful blood pressure control is extremely important in slowing the progress of kidney failure. One or more medicines to lower blood pressure may be given. Changes in diet may be necessary and include reducing salt intake, avoiding foods containing a lot of potassium and reducing the amount of protein and phosphate in the diet. [10-12]

Hemodialysis is carried out by the person's blood through an 'artificial kidney' machine that cleans the blood and returns it by tubing to a vein. This is done over a few hours, and needs to be repeated on average every couple of days in a specialized dialysis unit attached to a hospital. [13-15]

The prognosis of children with kidney failure and their quality of life depend on the underlying cause and presence or absence of other medical conditions.18 With progression of time, the mortality rate has decreased, due to better understanding of the causes and optimal treatment [16-18].

Quality of life is a state of complete physical, mental and social well-being felt by an individual or a group of people. It refers to patient's ability to enjoy normal life activities. It is also defined as a patient's perception of the impact of disease and treatment functioning in a variety of dimensions It consists of physical, psychological and social aspects. 14 Quality of life is important for children with end stage renal disease; it is an indicator for the child wellbeing and functional statues [19-21].

School attendance and performance also can be affected by heamodalysis sessions which needed to be conducted at least twice or three times per week, which in turn lead to physical exhaustion and lack of their concentration [3].

Hypothesis:

Nursing intervention can improve or affect Childs' knowledge and compliance to treatment which in turn improve their physical and psychological conditions. So this study aimed to assess the effect of nursing intervention on the quality of life of children undergoing hemodialysis.

2. Subject and Methods

Type of the study:
Quazi- experimental design was used in this study.

Setting:

The study was conducted at pediatric hemodialysis units of Tanta and Benha University hospital.

A convenient sample of 70 children with chronic kidney failure was included in the study. Their age ranged from 8 -18 years (30 of them from Tanta University hospital and 40 from Benha University hospital).

Tools

Data were collected by using:
Interviewing questionnaire sheet includes two parts:
- Part one: Biosocial data of children (as age, sex, birth order, educational level).
- Part two: Effect of hemodialysis on physical, social and psychological aspects of the child.

1-   Quality of life Scales:
Health Related Quality Of Life (HRQOL): The pediatric inventory scale of quality of life [22]. Was used to measure children and adolescent quality of life which includes the four domains (physical, emotional, social and school performance), each domain consists of 5 questions. Each question earned score from (0-4) according to their answer as the following:
4 means= never have a problem,
3 means= almost never a problem
2 means= sometimes a problem
1= it is often a problem
0= means almost always a problem
Each domain was scored from 0- 20.   It is considered very poor from 0-<5, Poor from 5-<10, average from 10- < 15 and high if earned 15-20
- The total quality of life score ranged from   0-80 according to the following classifications :
  0-19: very poor quality of life.
  20-39:   poor quality f life.
  40-59: average quality of life.
  60-80 : high quality of life

Methods:

Data were collected in 4 phases:

a) **Initial phase:**

Data were collected from June to Oct. to Feb. 2009-2010 in the previously mentioned setting. Children were met during dialysis in heamodialysis units to fill out the questionnaire. The time for each interview ranged from 35-40 minutes

b) **Developmental phase:**

It includes knowledge about steps and care during dialysis. The intervention also include knowledge about importance of complying with dialysis, diet, follow up and treatment. The practical part of the intervention was lengthy and comprehensive to cover all the items and activities required to maintain compliance with management and proper care.

c) **Implementation phase:**

Children were met individually in the previously mentioned settings;. The nursing intervention was conducted in three sessions; first session for the theoretical part of the intervention, the second and third session for all items of care.

d) **Evaluation phase:**

The effectiveness of intervention was assessed by comparing the results of the pre, and post intervention. Post test was divided into immediate post and three months post intervention .

3. Results:

The biosocial data of children indicated that, male children represented 56% of the studied children .Their age ranged between 12-18 years with mean age 12.80 ±3.43 years .The majority of them (80%) were none educated.

Table (1): presents the general problems of hemodialysis pre, immediately and after three months. It was found that, the highest percentage of children had pallor 99%, followed by insomnia 51% hypotension 49%, nausea and vomiting (25%) with significant improvement post intervention. (P=0. 0008, 0. 0001and 0.019, respectively). During dialysis no significant differences related to their problems were observed .While after dialysis, there was significant improvement regarding their exhaustion (p=0.023).

Table (1): Distribution of the studied children according to problems of haemodialysis.

Problems of haemodialysis	Pre (n=70)		Immediately Post-intervention (n=70)		3months post-intervention (n=70)		X2	P
	n	%	n	%	n	%		
General problems								
Bleeding	12	18	11	16	12	18	0.07	0.966
Shivering	19	28	11	16	14	20	2.82	0.244
Hypotension	34	49	36	51	32	46	21.56	0.0001*
Nausea & vomiting	18	25	6	9	10	14	7.86	0.019*
Allergy	11	16	7	10	4	6	3.67	0.153
Edema	18	25	17	24	16	23	0.16	0.925
Pallor	69	99	69	99	60	86	14.32	0.0008*
insomnia	36	51	5	7	8	11	46.69	0.0001
No problems	23	33	23	33	31	44	4.06	0.131
Problems before dialysis								
Headache	10	14	6	9	3	4	4.28	0.117
Hypotension	3	4	3	4	2	3	0.26	0.878
Exhausted	21	30	15	21	10	14	5.07	0.079
No problems	37	51	40	57	40	57	0.35	0.840
Problems during dialysis								
Headache	17	24	15	21	12	18	1.09	0.579
Hypotension	12	18	10	14	7	10	1.52	0.467
Vomiting	18	26	10	14	8	12	5.63	0.060
No problems	23	33	40	57	40	57	11.01	0.004*
Problems after dialysis								
Tired and exhausted	7	10	7	10	0	0	7.50	0.023*
No problems	52	74	60	86	62	89	5.63	0.060
Problems after 4 hrs from dialysis								
Exhausted	7	10	7	10	7	10	0.00	1.000
No problems	63	90	63	90	63	90		

*Significant (P<0.05).

    It was clear from table (2) and fig. (1) that, there was significant improvement in children' knowledge immediately and three months post intervention regarding to different items of renal failure (P=0.0001).
    Table (3) and fig.(2): Presents the total score of psychological domain of quality of life scale among the studied children pre and post nursing intervention. It was observed that, there was significant improvement in psychological domain score post intervention in comparison with pre intervention, with significant decrease of very poor quality of life from 72% pre intervention to 43% immediately post and 36% three months later .Also there was a significant increase of average quality from 9%pre intervention to 20% and 24% immediately and three months post intervention. (P=0.0001and 0.008 respectively) Table (4) and fig.(3): presents the total score of physical domain of quality of life scale among the studied children pre and post nursing intervention. It was noticed that, there was significant improvement with high quality of life score only as the percentage increased from nothing pre intervention to 9% post intervention (P=0.002). Table (5)and fig (4): shows total score of social domain of quality of life scale among the studied children pre and post nursing intervention. It was observed that, there was improvement in social domain post intervention with no significant differences (P=0.095). Table (6) and fig (5): presents the total score of school attendance domain of quality of life scale among the studied children pre and post nursing intervention. It was found that, there was improvement post intervention with no significant differences (P=0.706).Table (7) and fig (6): shows degree of total score of quality of life among the studied children pre and post nursing intervention. It was noticed that, there was significant improvement in total score of quality of life with significant decrease of very poor and significant increase of average and high quality of life. (P=0.0001.0.010and 0.005 respectively).

Table (2): Effect of the nursing intervention on children knowledge regarding renal failure

Correct answers of knowledge	Pre-intervention (n=70)		Immediately Post-intervention (n=70)		3 months post-intervention (n=70)		X2	P
	n	%	n	%	n	%		
• Definition.	11	16	62	88	50	72	83.72	0.0001*
• Causes.	0	0.0	59	84	64	92	149.18	0.0001*
• Clinical picture.	20	28	67	96	70	100	119.07	0.0001*
• Suitable Diet.	14	20	64	92	67	96	118.49	0.0001*
• Complications	0	0.0	64	92	62	88	157.62	0.0001*
• Treatment	3	4	59	84	53	76	109.03	0.0001*
• Management	8	12	62	88	48	68	91.15	0.0001*

*Significant (P<0.05)
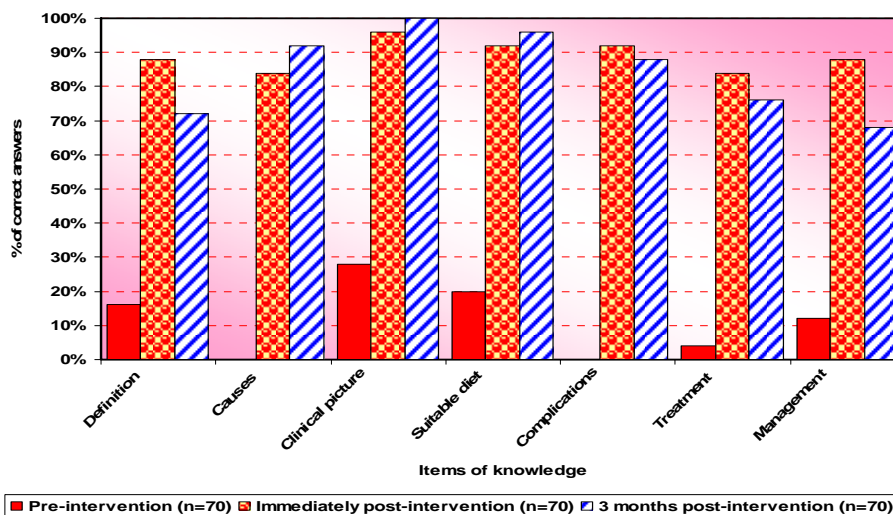
Figure (1): Effect of the nursing intervention on children knowledge regarding renal failure

Table (3): Total score of psychological domain of quality of life scale among the studied children pre and post nursing intervention.

Psychological Domain	Pre-intervention (n=70)		Immediately Post-intervention (n=70)		3 months post-intervention (n=70)		X^2	P
	n	%	n	%	n	%		
Very poor (0-<5)	50	72	30	43	25	36	20.00	0.0001*
Poor (5-<10)	10	14	16	23	12	17	1.80	0.407
Average (10- <15)	4	6	14	20	17	24	9.53	0.008*
High (15-20)	6	9	10	14	16	23	5.60	0.061
X^2 P	17.67 0.0001*							

*Significant (P<0.05)
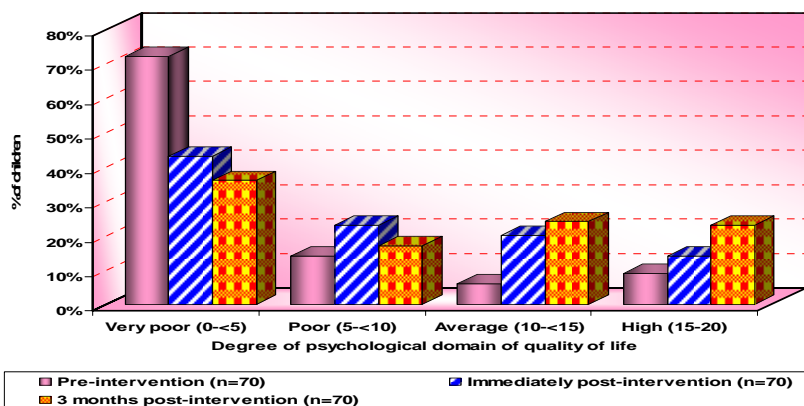
Figure (2): Total score of psychological domain of quality of life scale among the studied children pre and post nursing intervention.

Table (4): Total score of physical domain of quality of life scale among the studied children pre and post nursing intervention.

Physical Domain	Pre-intervention (n=70)		Immediately Post-intervention (n=70)		3months post-intervention (n=70)		X^2	P
	n	%	n	%	n	%		
Very poor (0-<5)	20	28	20	28	20	28	2.64	0.267
Poor (5-<10)	40	57	30	42	30	42	3.82	0.148
Average (10- <15)	10	14	14	20	20	28	4.37	0.112
High (15-20)	0	0	6	9	0	0	12.35	0.002*
X^2 P	5.75 0.072							

*Significant (P<0.05)
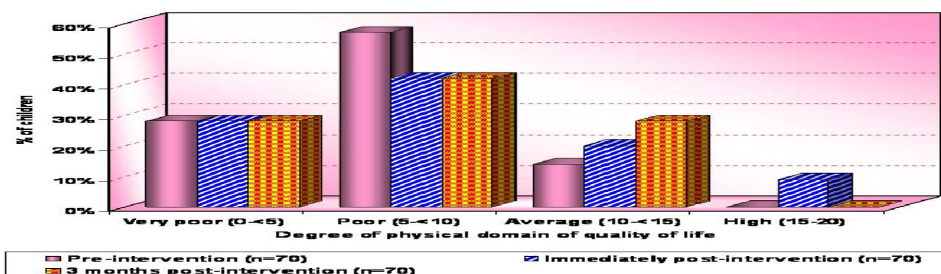
Figure (3): Total score of physical domain of quality of life scale among the studied children pre and post nursing intervention.

Table (5): Total score of social domain of quality of life scale among the studied children pre and post nursing intervention.

social Domain	Pre-intervention (n=70)		Immediately Post-intervention (n=70)		3months post-intervention (n=70)		X^2	P
	n	%	n	%	n	%		
Very poor (0-<5)	44	63	35	50	30	42	5.76	0.053
Poor (5-<10)	12	17	12	17	15	21	0.57	0.753
Average (10- <15)	8	12	13	18	15	21	2.61	0.270
High (15-20)	6	9	10	14	10	14	1.40	0.495
X^2 P	4.71 0.095							
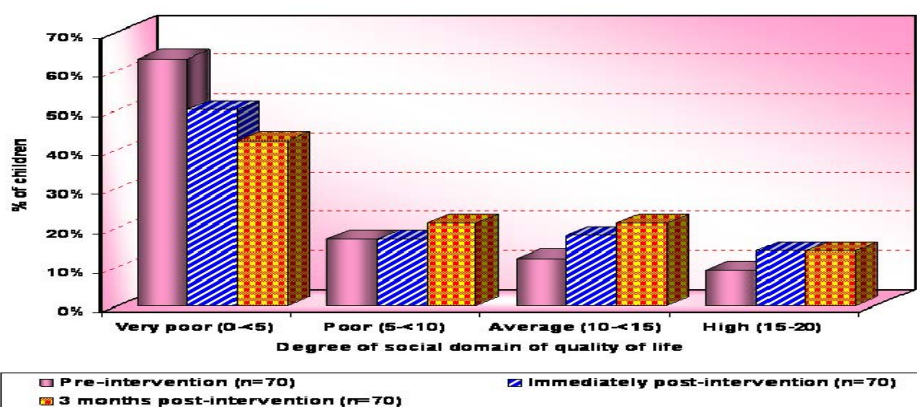
Figure (4): Total score of social domain of quality of life scale among the studied children pre and post nursing intervention.

Table (6): Total score of school attendance domain of quality of life scale among the studied children pre and post nursing intervention.

School attendance Domain	Pre-intervention (n=70)		Immediately Post-intervention (n=70)		3 months post-intervention (n=70)		X^2	P
	n	%	n	%	n	%		
Very poor (0-<5)	40	57	30	42	28	40	4.74	0.093
Poor (5-<10)	10	14	16	23	18	26	2.99	0.224
Average (10- <15)	10	14	10	14	10	14	0.00	1.000
High (15-20)	10	14	14	20	14	20	5.25	0.072
X^2 P	0.70 0.706							
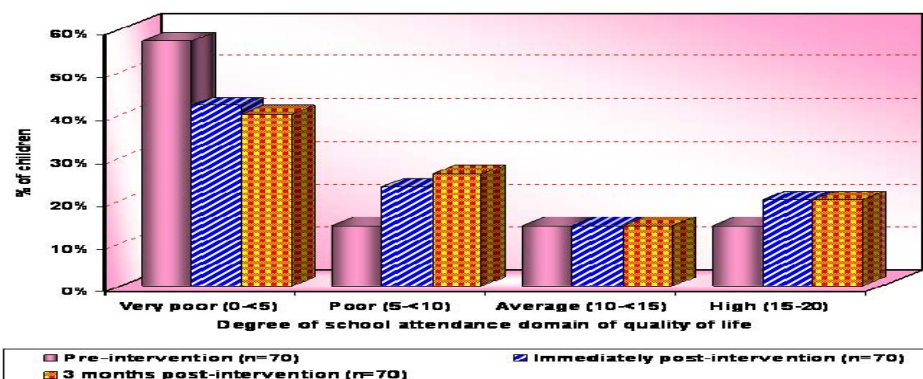
Figure (5): Total score of school attendance domain of quality of life scale among the studied children pre and post nursing intervention.

Table (7): Degree of total quality of life among the studied children pre and post nursing intervention.

Total Quality of life	Pre-intervention (n=70)		Immediately Post-intervention (n=70)		3 months post-intervention (n=70)		X^2	P
	n	%	n	%	n	%		
Very poor (0-19)	42	60	5	7	26	37	58.22	0.0001*
Poor (20-39)	19	27	29	41	19	27	4.38	0.112
Average (40-59)	6	9	20	29	14	20	9.14	0.010*
High (60-80)	3	4	16	23	11	16	10.57	0.005*
	23.70 0.0001*							

*Significant (P<0.05)
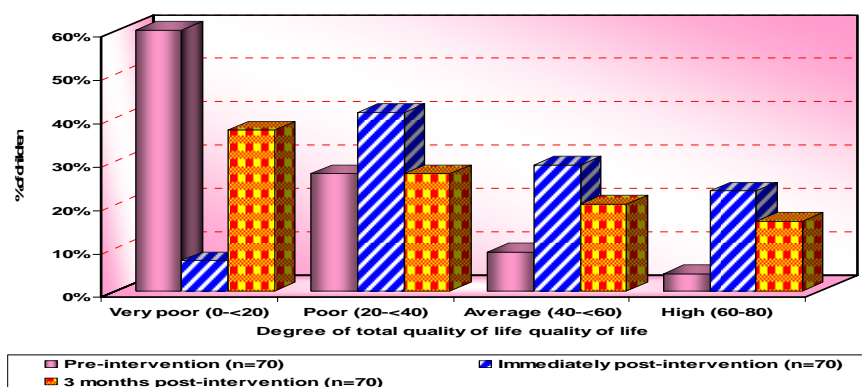
Figure (6): Degree of total quality of life among the studied children pre and post nursing intervention.

4. Discussion:

Kidney disease is considered a major childhood health problem as it causes death all over the world, which requires renal dialysis or kidney transplantation in order to survive(1,2). Kidney failure affects many stages of a child's life and influences their self-image and the relationships with peers and family. it can lead to physical and psychological problems (15-17).

The current study revealed that, males were more affected than females with the main common age 12-18 years. This result was supported by

Conger (23) who found   that ,CRF is much higher among males than females, and disagreed   with others whom found that, more than half of children with hemodialysis were females (24,25).

Regarding to general problems of hemodialysis, it was found that, pre-intervention, the highest percentage of children had pallor (99%), followed by insomnia951%),hypotension (49%), nausea and vomiting (25%). During dialysis, no significant difference was found related to their problems. This is agreed with **Bergstrom** (26) who found the same

finding. While it was contradicted with others who reported that, the most common problems were hypertension, edema, loss of Weight and cardiovascular disease (25, 27).

Significant improvement was noticed regarding to insomnia as it being included in general health problems among children .Its frequency was decreased from 51 % pre intervention to only 7% immediately post intervention and became 11% after three months. This could be attributed to the adequate support and reassurance from the health providers during hemodialysis.

Regarding children's knowledge about renal failure, there was a significant improvement immediately and three months post intervention, comparing to that pre intervention. And this finding was congruent with other study that reported a highly significant difference in knowledge before and after hemodialysis educational program (28) .

From this perspective; more children at this stage need continues education to help them to be aware about their problems. According to cognitive and psychological developmental theories, children during this stage like and interest to be involved in care plan of their treatment and this theory recommended the importance of child's involvement in the plan of their care.

The current study revealed that, the total score of psychological domain of quality of life was significantly improved with the categories of very poor quality of life and the percentage increase with the average quality of life (P=0.0001 and 0.008 respectively) .This could be explained in the context of, the child with chronic illness need long term care and emotional support which help them to survive and to stay healthy. This finding agreed with others who reported that, good communication between ill child and health members are essential (29, 30).

This can be explained by, emotional support and education during hemodialysis may reduce the level of anxiety and stress of children and may also improve their self esteem. The study found a significant improvement in the quality of life of children post the intervention, compared to that pre intervention. Where the percentage was increased from 9% pre intervention to 14% immediately and 23% three months post intervention (P=0.061). This finding agreed with other study who stated that ,"better understanding of the nature of illness and how to manage can improve psychological state and decrease stress which finally improve their quality of life" (9) .

Regarding to physical domain of quality of life scale among the studied children pre and post nursing intervention, in general no significant differences were reported. While there was significant difference only with high quality of life score. (P=0.002). According to **David,** (31) many peoples with chronic kidney disease mentioned that, exercise was the key to help them feel normal again after dialysis. This is may be because exercise can help people with chronic kidney disease feel better physically and control their live emotionally. While others showed that, children of end stage of renal disease were poor in their daily physical living habits (32, 33). This indicates that the children with chronic renal failure are more unable to change their normal life style which in turn leads them to be more dependent on their families. This was supported by **Doulan,** (33)who pointed out that, it affected every aspect of patient life as normal daily activities, work, relationship and self concept. So, it was recommended that, health education is very essential to enhance the children's knowledge and help them to be more independent as much as they can.

Regarding to the total score of social domain of quality of life among the studied children, it was observed that, there was improvement post intervention in the very low quality of live as the percentage was decreased from 63% pre intervention to 50% and 42% immediately and three months after intervention. The percentage of high quality of life was improved from 9% pre intervention to 14% post intervention, with no significant differences. This finding was supported by **Mahmoud** (24) who found that, more than two thirds of the children hadn't problems when dealing with their family members, but disagreed with **Abd El- Tawab,** (25) who reported that, most of children undergoing hemodialysis had poor quality of life regarding to their social domain, where they cannot communicate with others and are socially isolated. This is might be owing to that, children after hemodialysis become very tired and exhausted and tend to be socially isolated. So the nurse can play a key role in supporting those children socially by seeking help from social experts.

As regard the total score of school attendance domain of quality of life scale among the studied children; an improvement was detected in the high quality of life score post intervention (20 %, compared to 10% pre intervention) with no significant differences. This can be explained by the base of recurrent school absence could be related to hemodialysis sessions which needed to be conducted at least twice or three times per week, which in turn lead to physical exhaustion and lack of their concentration. This finding agreed with another study who reported that, the children attend to hemodialysis center miss several hours of school each week and this absences can compound the learning problems that many children with kidney failure face (33).

Finally, it was noticed from the current results that, there was significant improvement in total score of quality of life regarding to very poor, average and high quality of life. (P=0.0001.0.010 and 0.005) respectively. However this finding contradicted with another study which reported that, the total score of quality of life for children undergoing hemodialysis was low and they had poor scores (25).

Conclusion

Nursing intervention had positive effect on the health problems accompanying heamodialysis specially insomnia and other health problems. Also it improved all domains of quality of life, specially psychological domain which showed significant improvement . So the child undergo heamodialysis need continuous education about the nature of the disease to enhance their knowledge that is in turn improve their quality of life. So, it was recommended that, heath education sessions should be conducted in heamodialysis units to all nursing staff as care provider, mothers and children to improve the compliance to the prescribed treatment as well as to help them to adapt with their limitation of the disease and its management.

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Application of PICC Health Education Album to Patients in the Catheterization Period

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【Abstract】 Objective: To popularize the related knowledge of PICC and improve self-care abilities of patients in the catheterization period. Methods: 256 patients received health education by three-day training, questionnaire and follow-up consultation. The patients were randomly divided into the experimental group (n=128) and the control group (n=128). Health education album was used in the experimental group, while common PICC publicity materials were used in the control group. The incidence of PICC complications and indwelling time were analyzed. Results: The complications incidence of the experimental group is 11.72%，which is significantly lower that 24.22% of the control group (*P<0.01*).The average service time of the catheter of the experimental group is longer than that of the control group (*P<0.05*). Conclusions: Application of PICC health education album in patients can reduce the incidence of complications significantly and prolong the indwelling time of the catheter.

【Key words】: Catheterization; Central Venous; Health Education; Complication

Peripherally inserted central catheter (PICC) is a kind of technology to establish an intravenous access by a peripherally inserted central venous catheter [1]. PICC has been widely used in clinical practice with safe, reliable, easy operation, a catheter success rate, etc. Especially those with chronic diseases require long-term treatment of venous access [2]. However, complications, such as mechanical phlebitis, catheter infection, catheter blockage, venous thrombosis, infection, etc., may still occur, affecting the treatment effect [3]. The contents and methods of health education to the patients in the catheterization period can greatly influence the solution to this problem. To popularize the PICC-related knowledge, reduce complications and improve the service time of the catheter, our department reformed and designed PICC health education album, implemented standard health education by the responsible nurses , and have achieved better effects. This study is reported below.

l. Objects and Methods
1.1 Objects
256 hospitalized patients with indwelling PICC catheters were recruited between May, 2005 and March, 2008 for the study. The patients were randomly divided into the experimental group (n=128) and the control group (n=128). The experimental group: 78 males, 50 females, aged l8 to 87, 96 tumor cases, 32 blood diseases cases. The control group: 77 males, 61 females, aged 16 to 85, 90 cancer cases, 38 blood diseases cases. Among the 256 cases, there were 178 basilic vein cases, 59 median cubital vein cases, and 19 ephalic vein cases. There were totally 151 right arm puncture cases and 105 left arm puncture cases. The same type of catheters was used in the two groups and the catheters were all fixed with 3M transparent film. During the catheterization period, all the dressings were changed twice a week. Statistically, there was no significant difference between the two groups in age, gender, illness and intubation positions, etc. (*P> 0.05*).

1.2 Method
Health education album was used in the experimental group, while common PICC publicity materials were used in the control group. Two groups were all educated by 3 days training, questionnaire and follow-up consultation.

1.2.1 Design of PICC Health Education Album
PICC health education album was designed following these four principles below: ① being practical. This is the first principle for the design of the PICC health education album, for the album is the main tool of doing health education to PICC catheter patients. The design should emphasize on being practical, so that patients would like to read it and were able to understand it. And then patients would use the knowledge contained in the album in their daily treatment, care and life. ② being patient/family-oriented. PICC health education album is designed for catheter patients and those who are

interested or have the intention of catheterization. Its purpose is to improve the service time of the catheter and reduce complications. Therefore, the overall style, degree of difficulty and reading volume of the album should be designed according to physical and mental conditions, and the receptive ability of patients in order to facilitate the popularization and promotion of PICC knowledge. ③ being innovative. In addition to conventional textual content, a large number of instance pictures were inserted into the album, which made the album easy to understand and full of the artistic beauty. ④ being educational. At the end of each chapter of the album, exercises, including sentence completion multiple choices, etc., were specially designed to help the reader better grasp the knowledge.

1.2.2 Specifications of PICC Health Education Album

Specifications: l6 mo, 32 pages, 4 chapters including the introduction, puncture, hospital care and home care.

1.2.2.1 Introduction (Chapter 1)

This chapter covered the structure, materials, principles, catherization methods and process, superiority, necessity and possible complications of the PICC catheter, so that patients and their families could have a comprehensive and correct understanding of PICC.

1.2.2.2 Puncture (Chapter 2)

This chapter covered the preparatory work that the doctors, nurses, patients and their families should do before the puncture, such as assessment of the patient's condition, course of treatment, overall body condition and venous conditions, prescription given by the doctor, the informed consent form, selection of appropriate catheters, etc. The puncture process was also covered, including informing the nurse if something uncomfortable happened, no moving of the body at will, no touching of the sterile area and sterile stuff，cooperating with the nurse，etc. These following were also covered: undergoing X-ray after the puncture, doing required exercise, reporting body and puncture side limb conditions objectively and normal ooze blood.

1.2.2.3 Hospital Care (Chapter 3)

This chapter is the core part of the album, introducing the PICC catheter care in the hospital. ① pressure bandage is required within 24h after catheterization to prevent the puncture point from bleeding, during which the nurses must observe the blood circulation of bandaged limbs closely. If the

patient feels the bandage is too loose or too tight, he should promptly inform the nurse to get appropriate treatment. ②Patients should be guided and assisted to do appropriate arm-relieving circular exercise after 24h to increase the catheter compliance, promote blood circulation, and reduce the incidence of thrombosis.③Heavy lifting and strenuous exercise by the punctured arm are not allowed to prevent catheter extrusion and displacement. Stillness is also not promoted. The patient can engage in normal daily work, household chores and physical activity, but swimming, bath, heavy blow to and long-time press on the puncture point should be avoided. Patients can shower with the catheter, but the puncture point should be wrapped in plastic wrap. Patients should get dried timely after the shower and check the wound dressing. If the dressing is wet, curling or loose, it should be replaced timely, for it is necessary to maintain the dressing clean, dry, and secure. Patients should dress or undress gently. When dressing, dress the punctured arm first, and vice versa. ④Patients should also be taught to do self-observation. Local pain, redness, bleeding, back-flow of blood, arm swelling, loose joints, ect. should be reported to nurses promptly.⑤During patients' stay in the hospital, patients and families should be trained to master PICC nursing knowledge and simple operations, such as changing the dressing, washing the catheter, sterilizing the catheter，fixing the catheter, observe the condition of the catheter and the puncture point, etc, to lay a foundation for the PICC home care.

1.2.2.4 Home Care (Chapter 4)

This chapter is an important part of the album, for most cancer patients will go home between chemotherapy sessions and thus the PICC management level of the hospital directly affects the incidence of complications and the service time of the catheter. ① The importance of care outside the hospital should be emphasized to improve the compliance of patients and their families. Patients should be told to have better nutrition, keep a happy and optimistic mood, do appropriate activities and sports, pay attention to personal and family sanitation, and avoid going to crowded public places and various infection factors.②The catheter should be carefully maintained. Patients should live by the standards of the hospital to protect the puncture point and the catheter. Patients and their families should come back to the hospital twice a week to wash the catheter, change the dressing etc. If patients can't return to hospital, the local hospital should be contacted for help. If the back-flow of blood, drainage, joints' falling off are present, patients should contact the medical staff to get professional guidance and help.

1.2.3 Application Methods of PICC Health Education Album

1.2.3.1 Verbal Explanation with the Album before Catheterization

Using PICC health education album，nurses should educate patients and their families that have reading ability. Full-time nurses explain the puncture process to patients. During the explanation, patients' depression period and professional terms should be avoided. Health education should be carried out step by step to let patients develop their understanding in a progressive way. Nurses should answer the questions raised by patients and their families carefully and patiently until they understand and are willing to cooperate.

1.2.3.2 3- day Training Method and Questionnaire Method

A training cycle includes education, correction and guidance, and assessment. On the same day after the catheterization, full-time nurses would explain the hospital care chapter of the health education album with easy language step by step. On the second day, patients and their families would be asked questions to test their mastery of the knowledge and guidance would be provided if necessary. On the third day, a questionnaire based on the exercises at the end of the chapters of the album would be carried out to test their mastery of the knowledge. Before the discharge, a questionnaire would be carried out again after 14-21 day of the catheterization.   It is required that patients' awareness rate of PICC knowledge be more than 80%. Many later opportunities would also be used to organize patients to review the knowledge and learn the fourth chapter of the album.

1.2.3.3 Follow-up counseling and Telephone Interview

When in the hospital, patients can study repeatedly the hospital care and home care chapters in the health education album. Responsible nurses can be counseled during the treatment and care. Before the discharge, nurses should reconfirm the PICC knowledge of patients and their families, and write the important points into the patients' manual for their later use. After the discharge, weekly telephone interview would be carried out by responsible nurses to understand patients' health conditions. Questions raised by patients about PICC catheter maintenance would be answered by nurses during the telephone interview and professional guidance could also be provided.

1.3 Evaluation Methods and Indicators

A patient satisfaction survey was carried out. The questionnaire was designed according to the literature [6] and features of the hospital. A pre-survey was carried out in 10 patients and then the questionnaire was modified for formal use. The survey mainly covered patients' understanding of P1CC, patients' feelings, situations of their catheters, patients' concerns and evaluation of the nurses. The judgment criterion of PICC complications is the occurrence of phlebitis, local infection, catheter blockage, partial thrombosis, and catheter prolapse during and after the catheterization.

1.4 Statistical Analysis

The software SPSS l0.0 and contingency table methods were adopted during the statistical analysis. X^2 test was adopted for the incidence of complications, t test for the indwelling time of the catheter.

2 Results

2.1 PICC Health Education Album Questionnaire

PICC health education album appealed to the majority of patients and their families, because it is innovative, illustrated and easy to understand. The experimental group showed great enthusiasm in the learning process of PICC-related nursing knowledge, their awareness rate in the questionnaire being 80% (102/128).

2.2 The incidence of complications

As is shown in Table 1, statistically, the complication incidence of the experimental group (11.72%) is significantly lower (P=0.009) than that of the control group (24.22%).

Table 1. Comparison of the Incidence of Complications between the Experimental Group and the Control Group [n(%)]

group	n	phlebitis	catheter infection	catheter blockage	partial thrombosis	catheter extrusion	total
Experimental group	128	8（6.25）	3（2.34）	2（1.56）	1（0.78）	1（0.78）	15（11.72）
control group	128	17（13.28）	6（4.69）	3（2.34）	2（1.56）	3（1.56）	31（24.22）
Value of X^2		3.591	1.036	0.024	0.337	1.016	6.784
Value of P		0.058	0.039	0.652	0.561	0.313	0.009

2.3 Indwelling Time of the Catheter

Indwelling time of the catheter of the experimental group was 14-387 d, mean (172.18 ~ 9.29) d; Indwelling time of the catheter of the control group was 15-134 d, mean (103.56 ~ 7.87) d. The difference was statistically significant (P =0.018).

3. Discussions

PICC has been used in the clinical practice for many years, and its technology is becoming more and more mature day by day. Some patients would go home with a catheter between chemotherapy sessions, so the correct care after the catheterization is very important [7]. But complications and accidents always happen after the catheterization, especially in the home care stage, which shortens the service time of the catheter [8]. Health education album which was easy to understand was used to do professional knowledge training in the experimental group. The survey showed that this method greatly improved patients' compliance and satisfaction rate, increased their self-care ability, reduced complications and extended the service time of the catheter. Fan Ruixia and others [9] believe that patients' lack of self-care ability is related to the health education methods in the period of catheterization. The study of An Zhijie[5] showed the application of home care album in the health education of patients with catheter had remarkable achievements. Self-care ability of patients had been greatly improved and the problem ratio decreased significantly. Yap et al [10] reported that certain measures, such as health education, can reduce the incidence of complications.

The PICC health education album we designed was practical, patient/family-oriented, innovative, educational and illustrated. The implementation of systematic and standard health education with album effectively improved patient's compliance and self-care ability, significantly reduced the incidence of complications and extended the service time of the catheter, which showed the superiority and practicality of health education album.

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Effect of *E. coli* 0H157 on Baladi Broiler Chicken and some Biochemical studies

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Abstract: Forty Chicken 4 weeks old and 800 - 1000 g average body weight were used. They kept in a balanced diet to study some performance, and clinicopathological changes under *E.coli* 0157:H7 infection. Ten chickens kept as control and 30 were infected with *E. coli* 015,: H7 by dose 0.05m1 (x 10^7 CFU) inoculated intramuscularly. Body weight were recorded, blood samples were collected at 7, 15, 30 days post infection, serum was separated for determination of AST, ALT, $Total$ protein. Albumin, urea, creatinine, calcium phosphorous, sodium, potassium and cortisol hormone. The biochemical analysis showed increase in AST and ALT and a significant change in protein. Hypoalbuminemia, was observed, increase of serum urea, creatinine, hypocalcaemia, hyperphosphatemia, and decrease in level of potassium, sodium and cortisol hormone in areas. Blood examination revealed pancytopenia. This indicates that *E. coli* 0157: H7 causes deleterious effect on the Hematopoietic system.
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Key words: *E. coli;* Baladi Broiler Chicken; AST, ALT; Biochemical analysis.

Introduction

Infection with *E. coli* 0157:H7 presents with a wide spectrum of clinical manifestations, including severe abdominal cramps with little or *no* fever and watery diarrhea that often progresses to grossly bloody diarrhea **(Levin, 1997).** Infection can be asymptomatic or can present with only nonbloody diarrhea **(Belongia** *et al.,* **1990).** Extraintestinal involvement, including cardiac and neurologic manifestations, has been reported, and infection can be associated with the hemolytic-uremic syndrom and thrombotic thrombocy-topenic purpura. The disease can be fatal (Karmali *et al., 1985).*

Esherichia coli comprises a group of bacteria found in the intestines of humans, animals and birds, E. coli 0157:H7 strain produces potent toxins and can cause food born pisones to person transmitted disease after ingestion of very low numbers of microorganism E. coli 0157:H7 was first identified as a human pathogen in 1982 (Riley et al., 1983).

Griffin and Tauxe, (1992), a recorded reported that strain of E. coli infection is more often reported in the young, illness signs are bloody diarhreae, severe abdominal pain, low grade of fever and vomiting. The major source of food born E. coli 0157:H7 ciated disease is undercooked grand beef. Roast beef, roast chicken, raw milk and water an out break of the disease in persons who had eaten fast food in these restaurant chain. Marks and Robert, (1993), reported that the cytotoxins of E. coli 0157:H7 production seems to be important

factors in the pathogenesis of disease. These cytotoxins are among the most potent bacterial toxins. These toxins in active host cell ribosomes disrupting protein synthesis and causing cell death Obrien et al. (1992).

Prevention of illness is especially critical in addition to strategies designed to prevent food born illness. Controlled production of live animal, meat processing relatively little information is available on clinicopathological changes in experimental animals with this disease. The present work designed to study some serum biochemical changes after experimental infections of chicken with E. coli 0157:H7.

2. Material and Methods
E. coli strain:

E. coli 0157: H7 strain was used for the experimental infection for 40 chicken 4 weeks old as well as 800-1050 gm average body weight. Bird proved to be free from pathogenic bacteria and parasitic infection. I/M with 0.05 * 107cfu colony forming unit ml of viable organisms of E. coli 0157:H7.

Blood samples:

Two blood samples were collected from wing vein the first blood sample was collected into dry clean tube containing dipotassium. Ethylene diamine tetracetate (EDTA) as anticoagulant to covering out the hematological studies including red blood cells counts (RBCs) hemoglobin, (H) packed cell volume .(PCV), mean corpuscular. Hemoglobin

(MCH) and mean corpuscular hemoglobin concentration (MCIIC) were calculated from these hematological parameters according to Jain, (1986).

Second blood samples were collected from wing vein and serum was separated and used for the determination the activity of asparatate aminotransferase. (AST) and alamine aminotransferase (ALT) according to Reitman and Frankel, (1957). Total protein and albumin according to Doumas and Biggs, (1972). Urea according to Sanders, (1980) creatinine was estimated according to Bartels, (1971), calcium was determined according to Sarkar and Chankan, (1967), phosphorous was measured according to Goodwin, (1970), Na, K were determined by atomic absorption. Serum cortisol was analyzed by means of a gammacoat 125 I cortisal radioimunassay kit according to the method described by Campbell and Coles, (1986). Also at the time of scarification feaces from these birds are cultivated on sorbitol MaConkey agar medium for bacteriological examination according to Ratnam and March, (1986).

Statistical analysis according to Snedecor and Cochran, (1967).

3. Results

Bacteriological results recorded fail to ferment sorbitol can be recognized as colorless colonies. Further confirmation we made by agglutination test with anti-serum against the flagella antigen H7 it give positive results.

In Table (1) there is a significant decrease on body weight at 7, 15, 30 days and mortality rate is increase in the 1" week after infection, signs of infection appears in the form of depression, loss of body weight, bloody diarrhea and ascites.

Table (3) revealed a significant decrease in RBcs count Hb concentrations PCV, MCV, MCH, McHc also TLC such decrease was very highly significant on days 30 of infection ($P < 0.01$).

In Table (4) there is a significant increase in ALT and AST if compared with control group $P < 0.05$. Total protein and Albumin showed highly significant decrease if compared with control group. Concerning cortisol the result showed highly significant increase if compared with control group.

Table (5) revealed a significant increases in serum urea and creatinine and Hyperphosphatemia in d15 and d30 .p<0.01.also there is a significant decrease in serum level sodium,potassium and Hypocalcemia in d15 and d30 p<0.01.

Table 1: Changes in body weight in infected baladi chicken with E coli

	7 days	15 days	30 days
Control	860 ±0.72	880 ± 0.13	1000 ± 0.40
Infected	800 ± 0.70	700 ± 0.75*	708 ± 0.56**

*P<0.05 **P<0.01

Table 2: Composition of the basal diets (according to National Research Council)

Ingredients (%)	Started diet	Grower-Finisher diet
Yellow corn ground	67.40	72.90
Soyabean meal (44 %)	21.30	18.30
Fish meal (72 %)	4.00	3.00
Meat meal (60 %)	5.84	4.30
Bone meal	0.08	0.10
Dicalcium phosphate	0.15	0.10
Limestone ground	0.79	0.94
Salt	0.71	0.17
Methionine	0.12	0.04
Premix *	0.15	0.15
Calculated analysis		
Crude protein (%)	2150	19
ME (Kcal/kg)	2989	3040
C/P ratio	139.02	160

Broiler premix furnishing the following ingredients per kg of feed vit. A 12000 IU, vit D_3 2000 IU, Vit E 10 mg, folic acid I mg vit Niacin 20 mg, pantothenic acid 10 mg, vit K 2 mg, vit B_1 1mg, vit B2 4 mg, vit B6 1.5 mg vit B12 10 µg, iron 30 mg, copper 10 mg, Zinc 55 mg, Mn 55 mg, Iodine 1 mg, Se 0.1 mg, choline chloride 500 mg.

Table 3: Hematological values (mean Values ± S.E of normal and affected Baladi Chicken by E. coli

Groups	R.B.C.S 106 µL	HB gm/dl	P.cv %	M.cv	MCH pg	M.CH.C% * 103 µl	TL. C
Control	2.2 ± 0.23	8.4 ± 0.16	28.9 ±0.43	117.5 ± 11.8	40.1 ± 1.72	37.3 ±	31.2 ± 0.21
7 days	2.6* ± 0.20	8.7 ± 0.32	25.9 ±0.73	114 ± 6.2	35.4 ± 0.23	34.1 ± 0.16	24.2 ± 0.70
15 days	2.1 ± 0.84	7.60 ± 0.57*	21.8±0.11*	105.5 ± 4.13*	33.6 ± 0.25*	22.4 ± 0.26*	22.2 ± 0.23*
30 days	1.74 ± 0.62*	6.80 ± 0.70*	21.0±0.70*	100.0 ± 2.20*	21 ± 0.64*	20.4 ± 0.13**	20.2 ± 0.13**

Table 4: Changes Of Liver function test and cortisol hormone in baladi chicken infested with E coli 0157:H_7

Pavameter	A S T µ/d	A L T µ/d	Total protein gm/dl	Albumin gm/dl	Cortisol µg/dl
Control	26.0 ± 0.12	15 ± 0.24	5.0 ± 0.12	2.50 ± 0.04	0.08 ± 0.11
Infected 7 days	27 ± 0.12	17 ± 0.17	4.8 ± 0.80	2.56 ± 0.19	0.11 ± 0.64
Infected 15 days	37 ± 0.12	20 ± 0.20	3.8 ± 0.56*	1.93 ± 0.13*	0.10 ± 0.65*
Infected 30 days	46 ± 0.27*	28.8 ± 0.66**	3.6 ± 0.70	1.00 ± 0.70	0.17 ± 0.90**

* $P<0.05$ ** $p<0.01$

Table 5: Renal Function in chicken infested with E coli 0157:H_7

Parameter	Urea mg/dl	Creatinine mg/dl	Calcium mg/dl	Phosphorous mg/dl	Sadium Meg/l	Potassium Meg/l
Control	3.17 ± 0.72	1.45 ± 0.76	9.00 ± 0.12	6.19 ± 0.23	155 ± 0.62	8.0 ± 0.13*
Infected 7 days	4.00 ± 0.12*	2.1 ± 0.10*	7.70 ± 1.00*	6.12 ± 0.248*	140 ± 0.7*	7.0 ± 0.2*
Infected 15 dys	4.82 ± 0.21*	2.8 ± 0.30	7.14 ± 0.21*	7.00 ± 0.11	130 ± 0.20*	5.8 ± 0.9*
Infected 30 days	5.60 ± 0.72**	2.98 ± 0.90*	6.1 ± 0.12*	8.1 ± 0.80	122 ± 010*	5.00 ±

** $P\ 0.01$ * $P< 0.05$

4. Discussion

Hemorrhagic colitis caused by E. coli 0157:-H7 is a clinical syndrome that consists of abdominal cramps; diarrhea that progresses to become bloody; radiologic or endoscopic evidence of clonic mucosal edema, erosion, or hemorrhage; and the absence of conventional enteric organisms in the stool.

The present study shows a significant decrease in RBcs count, Hb concentration and PCV in the affected birds indicate anemia of microcytic hypochromic as showed by the erythrocytic indices that were proportionally correlated with the severity of infection of *E. coli.* This result is in accordance with **Jain, (1986).**

The increase in serum AST levels in this work could be due to liver damage produces by the infected bacteria. **Campell and Coles, (1986)**; mentioned that the increased of the activity of.AST has been associated with hepatocellular damage in birds.

Concerning ALT in chicken some studies reported elevation of ALT *it* birds infected with bacteria. **(Bokori and karasi, 1969).** Our result agrees with **Omaima (1987),** who observed a significant increase in (AST & ALT; in chicken infected with *E. coli.* The significant change in total protein anc albumin in the present work could be due to liver and kidney damage whicl could be associated with bacterial infection.

Similar findings were previously mentioned by **Riley et al., (1983) Pai, (1984); Campbell and Coles, (1986) and Ostroff et al., (1989).**

The increase in Urea and creatinine could be due to the effect of th+ micro-organisms and its Toxin on the kidneys. Our results is completely agree with **Pai et al., (1986); Tzipori et al., (1987) and Obrig et al., (1987) who** reported increased creatinine, urea level in case of renal disease.

Hypocalcaemia, and. Hyperphosphatemia could be due to decreas calcium resorption by damaged renal tubules and associated wit: Hypoalbuminemia as reported by **Campell and Coles, (1986); Beer et al . (1985) and Marks and Robert, (1993).**

The decrease of potassium and sodium level in serum could be due t renal disease as reported by **Campbell and Coles, (1986).** Also th metabolism of Calcium and Phosphorus is closely linked in the body an hypocalcaemia always accompanied with hyperphosphatemia concernin serum cortisol level, the significant increase of serum cortisol level may t attributed to the activation of Hypothalamus piutitary axis due to stress. Oi result agree with **Ghanem, (1986) and Campbell and Coles, (1986).**

In conclusion infection of chicken with *E. coli* 0157: H7 injured live, and Kidneys. The change in liver and kidney function were more severe in days of infection.

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Impact of Flood Disaster on the Mental Health of Residents in the Eastern Region of Jeddah Governorate, 2010: A Study in Medical geography

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Abstract: The impact of natural disasters over the last decade has resulted in many lives lost and livelihoods destroyed. Recent disasters, such as the earthquakes, the drought in the Horn of Africa, and landslides in Yemen have tested the capacities of Member States as well as national and international humanitarian agencies to provide quick and effective assistance. Flood disaster constitutes the most costly natural as well as technology-induced disaster, in terms of both human suffering and financial loss. Natural disaster risk assessment is a complex task, involving a wide variety of processes which require large amounts of spatial and temporal thematic data and information coming from disparate sources. In conjunction with the natural disaster risk assessment, medical geography aims at explaining the distribution of health status and disease. It identifies efficient ways to intervene and distribute trained personal and technology and has a crucial role in assessing and managing the consequences of disasters.Aim of the study: Exploring the impact of the floods on the mental health of the residents in the Eastern region of Jeddah Governorate, Locate neighbourhoods affected by the flood disaster in the city of Jeddah; Identify the natural factors causing the disaster; Human impact and negative role in the disaster; Measuring the psychological impact on the population in the affected place; Estimate the prevalence of PTSD among residents in the eastern region of Jeddah, as well as the residents who were shifted to the lodging houses; Describe the potential and exacerbating factors associated with occurrence of PTSD among residents exposed to the flood disaster and finally develop plans and recommendations that would reduce the recurrence of the disaster in the future. Methods and subjects: The study depends on the objective approach ,using many methods in analyzing the information such as the descriptive, analytical and interpretative in addition to field studies. Through a cross sectional community based on a design sample of 450 individuals, who were selected randomly from an estimated 336000 residents who were living along the stream courses of the flood. Cluster sampling using ArcGis 9.1 was made to assign 40 random clusters distributed proportionally according to the expected severity of exposure and from each cluster 10 households were selected by systematic random sampling plus 50 individuals who were selected randomly from those who were evacuated to lodging houses. PTSS-10 questionnaire was used to discover PTSD among people exposed to disasters. The results obtained from this study are explained and illustrated in tables and figures, in addition the study covering the following topics:Re-experiencing symptoms(Flashbacks— reliving the trauma over and over, including physical symptoms like a racing heart or sweating, bad dreams and frightening thoughts); Avoidance symptoms(e.g. Staying away from places, events, or objects that remind of the experience, feeling emotionally numb, feeling strong guilt, depression, worry, losing interest in activities that were enjoyable in the past and having trouble remembering the dangerous event) and Hyper-arousal symptoms (Being easily startled, feeling tense or "on edge", having difficulty sleeping, and/or having angry outbursts). Conclusion and Recommendations: While it is extremely difficult, if not impossible, to predict the occurrence of most natural hazards; it is possible to take action before emergency events happen to plan for their occurrence when possible and to mitigate their potential effects putting into consideration the expected scenario of the event. Our study revealed two important issues that would help in the preparedness plan for flood disaster in Jeddah Governorate, first, the anatomy of the expected flood that could be modified through establishment of properly designed underground drainage tunnels leading to the red sea on the western border of the city. Secondly, in addition to the direct effect of the disaster represented by loss of properties and morbidities that could be ameliorated by compensations and concurrent health services, an overlooked post disaster impact shown as Post Traumatic Stress Disorders should be put in consideration in planning for the comprehensive health services provided to the victims of the flood. Thirdly, the authorities must prevent the establishment of any buildings, roads or infra-structure along the courses of dry valleys.
[Katibah Maghrabi **Impact of Flood Disaster on the Mental Health of Residents in the Eastern Region of Jeddah Governorate, 2010: A Study in Medical geography**. Life Science Journal 2012; 9(1):95-110] (ISSN: 1097-8135). http://www.lifesciencesite.com

Keywoed: Flood Disaster, Mental Health ,Jeddah, Governorate, geography.

1. Introduction

The impact of natural disasters over the last decade has resulted in many lives lost and livelihoods destroyed. Recent disasters occurred in

the East Mediterranean Region such as the earthquakes in Pakistan (2005) and Islamic Republic of Iran (2003), the drought in the Horn of Africa (2006), and landslides in Yemen (2005), have tested the capacities of Member States as well as national and international humanitarian agencies to provide quick and effective assistance[1]. Subsequently, many of the affected countries and communities in the Eastern Mediterranean Region are now calling for better disaster preparedness and mitigation programs to avert the adverse effects of major disasters.[2] The ability to determine disaster risk for a region and its resident populations could strengthen its disaster management capacity by providing the information necessary to decision makers to advocate for resources to improve emergency preparedness and mitigation; supporting emergency response; help to identify, plan and prioritize areas for mitigation activities to minimize the effects of natural hazards[3]. Natural disaster risk assessment is a complex task, involving a wide variety of processes which require large amounts of spatial and temporal thematic data and information coming from disparate sources. In this context, geography and Geographic Information Systems (GIS) can provide an ideal platform for the integration of the different data, their analysis and, ultimately, the development of disaster risk models for a region and its resident populations[4-6]. One potential application of the hazard distribution maps is the calculation of the population exposed to each of the hazard specific level of intensity. This can be achieved through the combination of the hazard distribution layers with a population distribution grid covering the area of interest[7;8].

In conjunction with the natural disaster risk assessment, medical geography aims at explaining the distribution of health status and disease. It identifies efficient ways to intervene and distribute trained personal and technology[9]. It has a crucial role in assessing and managing the consequences of disasters.

Flood disaster constitutes the most costly natural as well as technology-induced disaster, in terms of both human suffering and financial loss. More important, it continues to profoundly impact the livelihood and the mental and physical health of those who experienced evacuation[10].

Hunter, noted in a comparative overview of global natural disasters that migration decisions related to disaster vary by hazard type, settings, household characteristics, and perception of risk, and that this variance is particularly visible among vulnerable populations[11]. The place identity is concerned with the sense of self based on the places in which one passes one's life." After a major life interruption event, such processes are "threatened by

displacement, and the problems of nostalgia, disorientation, and alienation may ensue." This is especially true following environmental disasters[12].

The consequences of disasters on public health are often thought of in terms of mortalities, physical injury, and epidemics. However, according to the comprehensive view of health adopted by the World Health Organization **(WHO)**- "a complete state of physical and mental well-being"—suggests that mental health requires post disaster attention throughout the "disaster community"[13]. The Recent reports suggest that after natural disasters mental health problems and mental health needs pose a resource problem for primary care providers, as it is expected that about 4–5 percent of the survivors of a large-scale natural disaster can develop Posttraumatic Stress Disorder (PTSD)[14].

Disasters have many consequences on public health, in terms of mortalities, physical injury, and epidemics. However, according to the comprehensive view of health adopted by the World Health Organization **(WHO)**- "a complete state of physical and mental well-being"—suggests that mental health requires post disaster attention throughout the "disaster community",[15].

The Recent reports suggest that after natural disasters mental health problems and mental health need pose a resource problem for primary care providers, as it is expected that about 4–5 percent of the survivors of a large-scale natural disaster can develop Posttraumatic Stress Disorder (**PTSD**),[16].

Post-Traumatic Stress Disorder, PTSD, is an anxiety disorder that can develop after exposure to a terrifying event or ordeal in which grave physical harm occurred or was threatened. Traumatic events that may trigger PTSD include violent personal assaults, natural or human-caused disasters, accidents, or military combat[17].

There are various types and causes of disasters; natural and human. The natural disasters come on top of the most devastating ones. Literally, natural disasters occur when extreme and magnitude of stochastic natural processes cause severe damage to society. Some natural disasters could be predicted before its propagation e.g. volcanoes and tornadoes, while others are still unpredictable through our available technologies e.g. earthquakes. On the other hand, floods are coming in between,[18].

Flooding is caused by prolonged and intensive rainfall, which inundates the surrounding area. Flash floods occur within six hours of a rain event, or after a dam or levee failure. It can catch people unprepared, without warning[19].[4]

Several factors contribute to flooding; two key elements are rainfall intensity and duration. Intensity is the rate of rainfall, and duration is how long the

rain lasts. Topography, soil conditions, and ground cover also play important roles. Most flash floods are caused by slow-moving thunderstorms or heavy rains from hurricanes and tropical storms. Floods, on the other hand, can be slow- or fast-rising, but generally develop over a period of hours or days, [20]. [3]

As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb water. Urbanization increases runoff two to six times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers, while basements and viaducts can become death traps as they fill with water [21]. [3]

Apart from the physical harms occurring during the flood, psychological disorders are expected to increase after its vanishing. The commonest is the Post-Traumatic Stress Disorder (PTSD), [22]. [3]People with PTSD have persistent frightening thoughts and memories of their ordeal and feel emotionally numb, especially with people they were once close to. They may experience sleep problems, feel detached or numb, or be easily startled.

Background:

By the end of 2009, Jeddah which is considered as the main sea port for the Kingdom of Saudi Arabia on the Red Sea coast was afflicted by heavy rains that lasted few hours and caused massive floods, which left behind several casualties in addition to massive destruction in buildings, main highways and private properties in the eastern part of Jeddah governorate. Although the physical casualties were circumscribed accurately to put forwards adequate compensations for the residents in the affected area, however, the impact of the disaster on the mental and psychological conditions has not been elaborated.

The city of Jeddah on Wednesday, the 8th of Dhu al-Hijjah 1430, was exposed to a wave of heavy rains, which caused the creation of torrents, leading to the collapse of houses and cutting off the main roads, the destruction of a large number of cars and the loss of many of victims. Furthermore, the emergence of many diseases such as dengue fever, cholera, malaria, respiratory problems and skin diseases was another serious problem. The number of damaged property was 11,799 in addition to 10,913 vehicles, (Civil Defence), in the Eastern and South-eastern districts of Jeddah, including the neighbourhoods (Al-Shorouk, Al-Mareekh, Al-Waha, Al-Nakheel, Raghma, Hadaek Al-Salam, Al-Rabbwa, Kilo 14, Al-Amir Fawaz, Al-Jamiaa, Sulaymaniyah, Harazat, Al-Suwaydaa, Qoizp) figure (1). This is due to the following:

- Location in the arid region, which is characterized by sudden and variable rainfall.
- Presence of a large number of dry valleys, which restrict the speed of run-off such as

(Wadi Al-Mareekh, Breiman, Bani Malik, Qoizp, Galil, Wadi Fatima) figure (2).

- Delay in carrying out the establishment of projects to avoid water flooding.

The study is a selected topic to ameliorate the impact of the disaster on those who lost their homes. The Kingdom's authorities shouldered the responsibility of providing instantaneous housings for those who lost theirs. To solve this problem, the affected people were moved to lodging houses, which are widely spread in Jeddah Governorate, and the costs were covered by the government.

Although the physical casualties were circumscribed accurately to put forwards adequate compensations for the residents in the affected area, however, the impact of the disaster on the mental and psychological conditions of the people who experienced the disaster has not been elaborated.

Aim of the study:

1. Exploring the impact of the floods on the mental health of the residents in the Eastern region of Jeddah Governorate.
2. Locate neighbourhoods affected by the flood disaster in the city of Jeddah.
3. Identify the natural factors causing the disaster.
4. Human impact and negative role in the disaster.
5. Measuring the psychological impact on the population in the affected place. 6. Estimate the prevalence of PTSD among residents in the eastern region of Jeddah Governorate, as well as the residents who were shifted to the lodging houses.
7. Describe the potential and exacerbating factors associated with occurrence of PTSD among residents exposed to the flood disaster.
8. Develop plans and recommendations that would reduce the recurrence of the disaster in the future.

Questions of the study:

1 - What are the neighbourhoods affected by the flood disaster in the city of Jeddah?
2 - What are the factors causing the natural disaster?
3 - What is the role of human factors in the disaster?
4 –Does measuring the psychological effects on the population in the affected area agree with the applicable measure of psychological effects of non-affected population?

Methodology:

The study depends on the objective approach in dealing with disaster. It uses many methods in analyzing the information such as the descriptive, analytical and interpretative in addition to field studies.
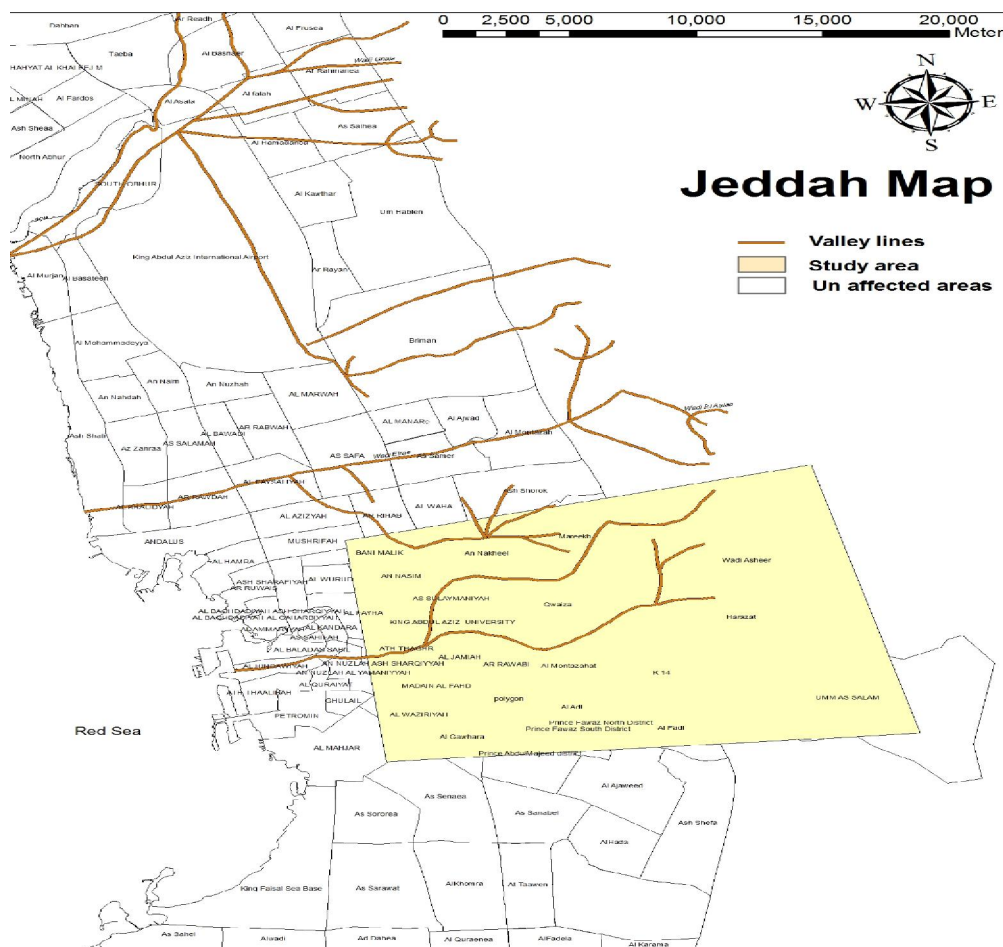
Figure 1: The neighborhoods affected by flood disaster and showing the tracks of the valleys in the affected neighborhoods and non-affected
Source: The work of the researcher depending on the secretariat of the Jeddah 1425

Methods and subjects:

Through a cross sectional community based on a design sample of 450 individuals, who were selected randomly from an estimated 336000 residents who were living along the stream courses of the flood. Cluster sampling using ArcGis 9.1 was made to assign 40 random clusters distributed proportionally according to the expected severity of exposure and from each cluster 10 households were selected by systematic random sampling plus 50 individuals who were selected randomly from those who were evacuated to lodging houses. PTSS-10 questionnaire was used to discover PTSD among people exposed to disasters. Other demographic characteristics were taken into consideration such as age and gender, in order to explore exacerbating factors associated with the stress.

The sample was distributed among districts as follow:
-    150 in Harazat
-    250 in Qoisah
-    100 from lodging apartments

Terms of the study:
1. Disaster:

Unexpected incidents caused by the forces of nature, or because of human action, followed by consequent loss of lives and destruction of property. It has severe impact on national economy and social life.

2. Natural hazards:

Are harmful events that occur in the environment due to natural factors, which results the loss of lives and resources . They are divided into high-risk, medium and weak ones [23].

3.Torrents:

Natural disaster that occurs as a result of heavy and intensive precipitation in sudden and large amounts for a short period of time, as tropical cyclones, which are loaded with heavy rain. They cause the rising of river water, which flood buildings, roads and agricultural fields [24].

4. Posttraumatic stress disorder (PTSD):

It is a severe anxiety disorder that can develop after exposure to any event that results in psychological trauma.[1][2][3] This event may involve the threat of death to oneself or to someone else, or to one's own or someone else's physical, sexual, or psychological integrity,[1] overwhelming the individual's ability to cope. As an effect of psychological trauma, PTSD is less frequent and more enduring than the more commonly seen acute stress disorder.

Population of study:

The whole population living in the south eastern region of Jeddah Governorate in the area covered by the following coordinates.

39°24'53.707"E   21°32'44.928"N
39°25'25.452"E   21°25'32.385"N
39°13'14.81"E   21°24'46.8"N
39°12'43.566"E   21°31'55.58"N

This area consists of five districts either totally or partially. The total population living in this area is estimated to be about 336000, distributed as following: Quiza (42000), Montazahat (58000), Harazat (26000), Kilo 14 (60000) and Jamea (150000).

Sampling:
Sample size:

The sample size was calculated using EPI program ver. 6.04 based on the following assumptions:

- The expected frequency of the (PTSD) is 5% (0.05);
- The worst acceptable frequency is $\pm 2\%$ (0.02);
- The confidence level is set at 95%.
- The power is set at 80%.

The total sample accounted for 457, which was rounded to 500.

Selection of the sample:

The main sample was taken from Harazat, Quiza and the adjacent three districts. These areas were extremely affected by the floods.

The majority of those who were shifted to the lodging houses are driven from these two districts, accordingly, the sample of the study will be withdrawn from the residents of Quiza and Harazat in addition to those in the lodging houses it is as

follow:
- 250 from Quiza
- 150 from Harazat
- 100 from the lodging houses.

Sampling technique:
Two techniques will be adopted to allocate the participants of the study:

- *Cluster sampling*: will be used to select individuals from the studied area, twenty clusters will be selected from Quiza and 10 clusters from Harazat. From each cluster, ten adults are equally divided between males and females, who will be selected randomly and interviewed.
- *Systematic random sample:* will be used to select individuals from families shifted to the lodging houses after the flood.

Inclusion criteria:

- Adults (18+ years) who were living in Quiza and Harazat and were present at home at the time of the flood.

Exclusion criteria:

- Young individuals.
- Adult individuals who are proven to have previous mental disorders or have been under treatments, which affect the mental ability of the patients.

Tools of the study:

The reviewed literature revealed that the PTSS-10 had been used for discovering (PTSD) among people exposed to disasters. The PTSS-10 (Appendix) was originally developed by the Division of Disaster Psychiatry, University of Oslo and the Norwegian Armed Forces Joint Medical Service in Oslo as a clinical screening instrument to identify persons at risk of developing post-traumatic stress reactions, (25).

The questionnaire was translated into Arabic language and back translated to ensure its lexical equivalence. The final Arabic version was reviewed by psychologist to ascertain its face content validity in the Saudi community.

Data collection:

Data will be collected from the participants through trained interviewers from 4th year students in the Faculty of Arts, King Abdul Aziz University.
The researcher will train the students on the skills of interviewing and the completion of the questionnaire.

Ethical consideration:

Informed consents from potential participants are considered as a prerequisite for inclusion in the study after informing them of the study's aim and procedures. They will be informed about their rights

to refuse participation or withdraw at any time of the study without giving reasons and with no further consequences. They will be also reassured that all the information collected will be used only for the purpose of this research and would not be used for any other purpose without notifying them. Lastly, ensuring personal confidentiality the questionnaires will be left anonymous, and only code numbers will be used to track each individual participant.

Statistical analysis:

Data entry and statistical analysis will be done using SPSS 14.0 statistical software package. Quality control will be done at the stages of coding and data entry. Data will be presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Statistical significance will be considered at p-value <0.05.

Information Sources:
Previous studies:
There are many studies, which deal with similar subjects:

- **Bussman** study (1989) on the psychological stress during the Red River flood. The study clarified the benefit of predictability in the occurrence of natural disaster in order to save resources by using models.
- **Hobfoll study (1989)** about natural disaster as imminent phenomena, which lead to the loss of resources. The study concentrated on the negative mood and the psychological symptoms affecting the population.
- **Al-Nabulsi study (1991)** on the psychological trauma of war and disaster. The study points out that wars affect several aspects of live, physical, psychological, social.
- **David et al.,** study **(1992)** on the psychological effects among the victims of the shelter after Hurricane Andrew, which struck South Florida. The victims suffered from psychological symptoms as they lost their homes and were living in shelters for four and a half weeks.
- **Al-Saud study (2004)** on the environmental problems in the city of Jeddah confirms that Jeddah is located in the natural basin on the east at the mouths of series of valleys that descend from mountains towards into the sea. Poor sanitation also contributes to the spread of flood water in the streets.
- **Robertson** and others study (2005) on the impact of Hurricane Katrina on the mental health of adolescent offenders. The researchers explained that exposure to multiple traumas are common

among juvenile delinquents. Where used in the study of stress theory to study the effect of shocks. The Hurricane Katrina had negative effects on mental health for adolescent offenders in the state of Mississippi.

- **Al-Zahrani study (1428 / 2006)** in which the risks of floods in Mina have been presented. He suggested many protection ways for pilgrims. Also the natural pathways of water flood were pointed out.
- **Moamen and Solomon study (2007)** aimed to describe the psychological effects of disasters in a sample of victims of the vessel (Al-Salam 98).
- **Moamen and Hashad (2008)** studied the psychological effects of Dahab bombings (2006) in Egypt.

It is clear from the previous review that the previous studies on the impact of disasters are in several countries. However, to the knowledge of the researcher there is no study on the impact of spatial and psychological effects combined in the city of Jeddah.

2. Documentary sources:

They contain the scientific material that have been published about the region from documentary sources such as governmental publications and statistics.

3. Maps and satellite images:

They are an important source of information and have been used largely in this study.

4. Field study:

It is the main source of many data which the study relied upon such as:
- Identifying the exact area of study by using GPS
- Applying the questionnaire for the population affected and non-affected by the disaster.

Geographic study of the disaster area:

The city of Jeddah located on the eastern coastal plain of the Red Sea, which represents a natural extension of the coastal plain known as Tahama between latitudes 21° 25, 21° 45 N, and longitudes 39° 5, 39° 20 E. It is bounded by a set the hills from the east, followed by high mountains which are apart from Hijaz mountain range [25].

Relief:

Towns and villages are always located near valleys where fresh water and fertile soil are available. In the case of dry valleys in deserts the conditions are changeable as sudden and intensive rainfall collects in their courses and flowingly damage everything.
There are hundreds of dry valleys, which descend

from the western highlands of Hijaz into the Red Sea. For example: Wadi Obhour and Wadi Fatima in the area of Jeddah. Water does not run in the courses of these valleys except after heavy rain, so they remain dry for many years. That is why many inexperienced citizens and planners forget the nature of these valleys and its exposure to torrents, so they construct

buildings and roads in them. When torrents occur they destroy and sweep off all these constructions, in addition to the lives of many humans[26].

The main dry valleys (Wadis) which cross the city of Jeddah are from north to south: Obhour, Dgash, Bani Malik, Asher, Goz, Golal and Fatima [27].

Figure (2): Map of the Kingdom of Saudi Arabia showing the location of the studied area. Source: prepared by the researcher

Valley Paths:

There are three courses of dry valleys which cross the urban area of the city of Jeddah. All of them descend from the eastern mountains of Jeddah and terminate in the Red Sea.

The first track:

It extends next to Qweza, east of the highway, which borders the west side of King Abdul-Aziz University and Al-Sulaymaniyah bridge. It passes through the residential area of Qweza crossing under the highway.

The flooding of 2009 destroyed this residential area and the whole district. The flood water continued damaging the walls of King Abdul-Aziz University and also the Sulaymaniyah bridge. The torrent stopped at the Mekka road through the old stadium of Prince Abdallah Feisal.

The second Track:

It came from the south through Waziriya district. That is where the disaster has begun. The torrent passed through residential neighborhoods. In this district two tracks of torrents converged causing more damage. The rate of water absorption was not enough

compared to the high water level.

The Third and Fourth Track:

They began east of the highway in the middle of Jeddah. The third track starts in a residential area and the water of the torrent arrived at the dam level there, which turned the surface there into a muddy area. The third track runs towards north-west through Rehab district. There it converged with the forth track and they continue their courses towards the west along the Prince Mohammed bin Abdul-Aziz Street (previously called Tahlia). In this location the water stopped, after damaging the residential area, before reaching the sea. The collecting water formed swamps, which attract mosquitoes, flies, and support the emergence of germs and bacteria, which pollute the environment. (Saudi Society for the Environment)

Climate:

Jeddah is located within the tropical arid region, where temperature is high throughout the whole year. This region is characterized by scarcity of rainfall and extreme disparity in the amount and timing of rainfall, which concentrates only in one or few hours [28].
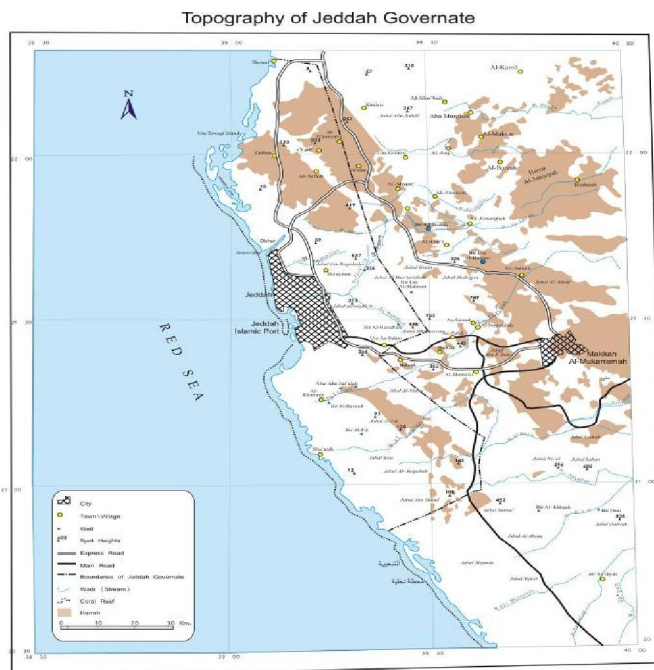
Source: Centre for Information Technology in Jeddah Municipality

The climate of Jeddah is influenced by geographical location and high humidity during summer. Temperature reaches more the 40 Celsius in the summer. Rain is rare and scarce.

Lower temperatures in Jeddah are reported in December and January (11.4 Celsius), highest temperatures are reported in June and July (39 Celsius) as in the following table:

Table (1) Mean monthly temperature maximum and minimum (C°) in Jeddah (1985-2008)

Month	Maximum temperature C°	Minimum temperature C°	Range
January	28.8	18.2	10.6
February	29.4	17.9	11.5
March	31.7	19.3	12.4
April	34.8	22	12.8
May	37.3	24	13.3
June	38	24.7	13.3
July	39.4	26.4	13
August	38.7	27.4	11.3
September	37.7	26.4	11.3
October	24	36.6	12.6
November	33.4	22.3	11.1
December	30.6	19.9	10.7

Source: Student work based on data from the Ministry of Defence and Aviation, the General Presidency of Meteorology and Environment Protection.
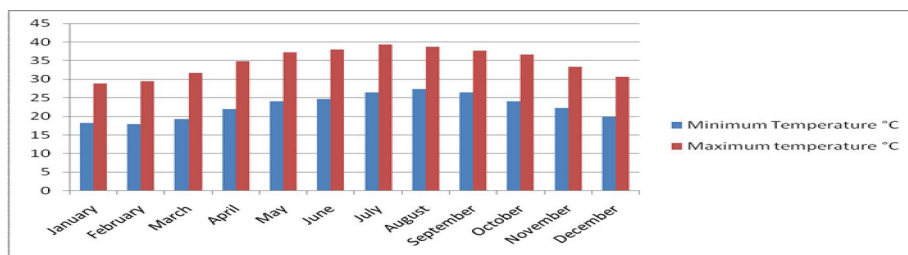
Figure (4): Mean monthly temperature maximum and minimum (C°) in Jeddah (1985-2008)
Source: Student work based on table (1) data

Table (2): rainfall in Jeddah (mm) average of the period 1985-2008

Month	Average rainfall
January	10.746
February	2.804
March	3.117
April	3.021
May	0.183
June	0.0
July	0.0
August	0.542
September	0.012
October	1.213
November	24.921
December	10.562

Source: Student work based on data from the Ministry of Defence and Aviation, the General Presidency of Meteorology and Environment Protection.
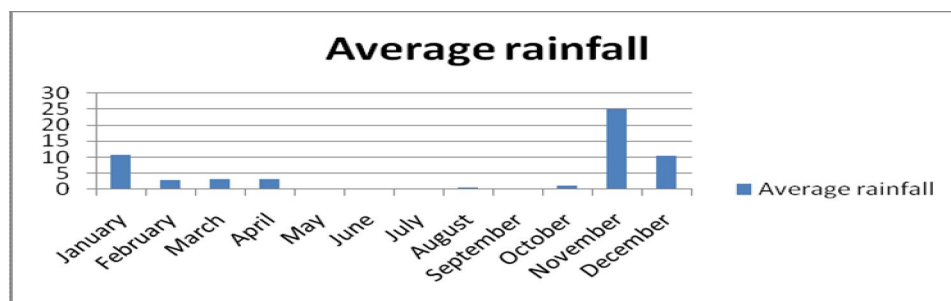
Figure (5) rainfall in Jeddah (mm) average of the period 1985-2008
Source: Student work based on data table 2

Wind:

The prevailing wind in the city of Jeddah is north-westerly, its speed is usually light to moderate most days of the year. Sometimes as southerly wind blow through spring and fall, temperature rises. The high speed of this wind causes dust storms accompanied by thunderstorms and heavy rain, which result torrents.

The history of floods in the City of Jeddah:

Jeddah is always exposed to violent torrents because of its location in the arid region and at the foot-slops of Hijaz Mountains. The main floods, which happened in Jeddah, are:

- The floods of 1968, which came from the valleys east of Jeddah and destroyed many constructions as well as the walls of the old airport. However, the built-up area was not as big as the current one.
- The flood of November 1972: the quantity of rain reached 83 mm fell in a short period of time and left its destructive action on the streets of the old districts and formed swamps, which pollute the environment [29].
- Floods of 1979, which were resulted by continuous rain. The water rose in the streets above 1 meter, life ceased for three days.

- Floods of November 1985, which happened after heavy rain over Jeddah and the surrounding area.

Analysis of the climatic situation in Jeddah 25/11/2009:

Jeddah was exposed to a depression from south-east Jordan that pushed a cold front, causing heavy rain on Wednesday morning. The rain concentrated for a very short period of time (only several hours). The quantity of rain reached about 90 mm in some areas, which formed the dangerous flood.
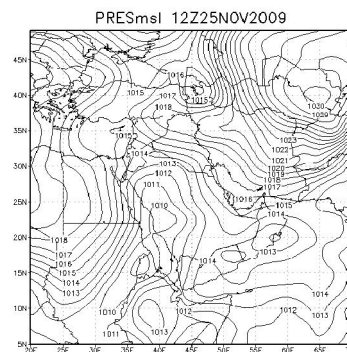
Figure (6): shows the weather forecast for the city of Jeddah on 25/11/2009
Source: http://forum.arab mms.com/t200265.html.
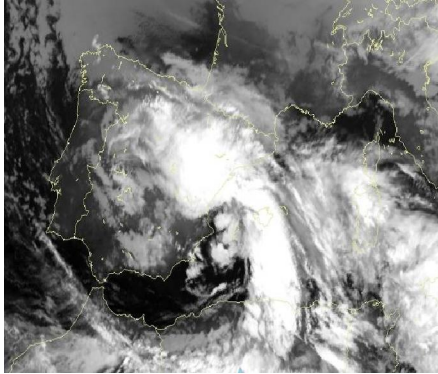
Pressure on the Red Sea was very low and it is an extension of a low pressure found on the Caspian Sea. The value of the low pressure was 1010 ms bar, this shows the great depth of the low pressure. (1 bar = 1000 ms bar)
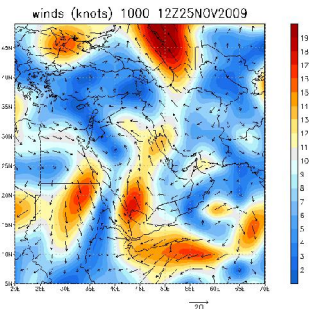
Figure (7): shows the surface winds coming from the east of Jordan.

http://forum.arab-mms.com/t200265.html

Referring to the maps, which show the surface wind circulation, their was a cold air mass on south-east Jordan, which came from the west and the north-west. This mass met with a warm humid one, which came from the south-west. These two masses collided near Jeddah and the south-western part of the Arabian Peninsula.
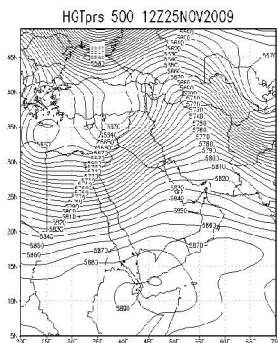
Figure (8): shows the low air coming from the east of Jordan

http://forum.arab-mms.com/t200265.html

The collisions of the different masses composed a cold front over south-east Jordan and withdraw clouds and rains from the south. Maturity stages have been observed over Jordan on Tuesday 24.11.2009.
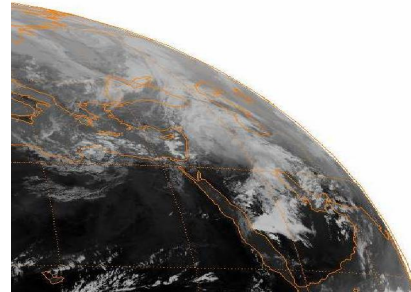
Figure (9): shows the maturity of the low air over Jordan and Syria.

http://forum.arab-mms.com/t200265.html
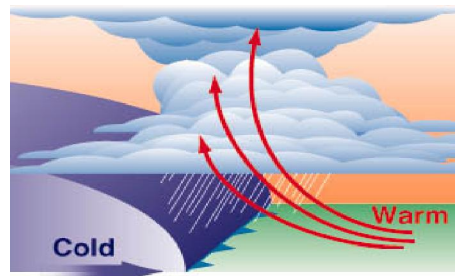
Figure (10): shows the maturity of the low air over Jordan and Syria.

http://forum.arab-mms.com/t200265.html
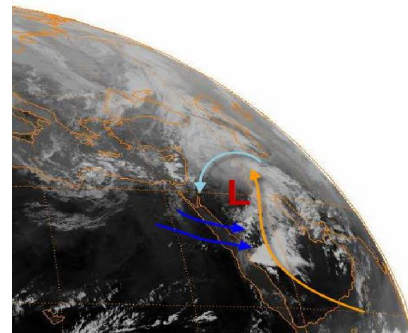
Figure (11): shows the low air and a cold front and warm on the region.

http://forum.arab-mms.com/t200265.html
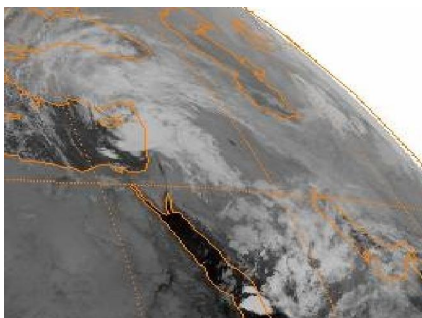
Figure (12): three-dimensional image shows what happened in Jeddah:
Source: http://forum.arab-mms.com/t200265.htm

Figure (13): A comparison of maturation of depression on the western Mediterranean and Jordan. Source: http://forum.arab-mms.com/t200265.html
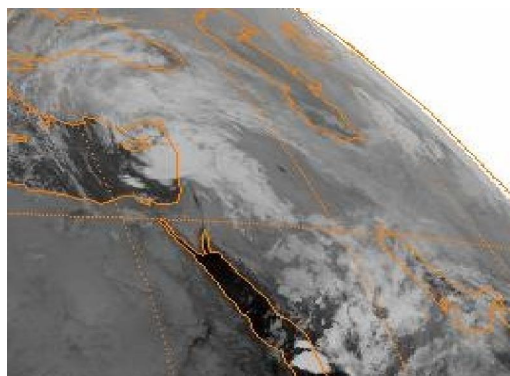
Figure (14): shows the status similar to mature over the Jordan.
  http://forum.arab-mms.com/t200265.html

2. Material and subjects:

The previously mentioned rainfalls are the main cause of the destructive flood in the eastern part of Jeddah. As a natural geographic disaster it has an impact on health and, therefore, can be considered as an example under the field of medical geography. The methods used in the current study will be described in this view.

All population living the south eastern region of Jeddah Governorate in the area covered by the following coordinates who were potentially exposed to the flood disaster were considered as the population of study from which a sample was withdrawn.
39°24'53.707"E   21°32'44.928"N
39°25'25.452"E   21°25'32.385"N
39°13'14.81"E   21°24'46.8"N
39°12'43.566"E   21°31'55.58"N

The inclusion criteria specified adult individuals (18+ years) who were living in Quiza and Harazat

and were present at home at the time of the flood, and we excluded young individuals, and adult individuals who were proven to have previous mental disorders or they were under treatment which are known to affect the mental conditions of the patients.

The sample size was calculated using EPI program version 6.04 based on the following assumptions: the expected frequency of PTSD is 5% (0.05); the worst acceptable frequency is +2% (0.02); the confidence level is set at 95%, and the power is set at 80%. Accordingly, the calculated sample size accounted for 457.

The reviewed literature revealed that the PTSS-10 had been used for discovering Post-Traumatic Stress Disorder (PTSD) among people exposed to disasters. The PTSS-10 (Appendix) was originally developed by the Division of Disaster Psychiatry, University of Oslo and the Norwegian Armed Forces Joint Medical Service in Oslo] as a clinical screening instrument to identify persons at risk of developing post-traumatic stress reactions[15] . The people who are exposed to such disasters suffer from many psychological symptoms. These symptoms can be grouped into three categories [29]. [5]

1. Re-experiencing symptoms:

Flashbacks— reliving the trauma over and over, including physical symptoms like a racing heart or sweating, bad dreams and frightening thoughts.
Re-experiencing symptoms may cause problems in a person's everyday routine. They can start from the person's own thoughts and feelings. Words, objects, or situations that are reminders of the event can also trigger re-experiencing.

2. Avoidance symptoms:-

These are for example: Staying away from places, events, or objects that remind of the experience, feeling emotionally numb, feeling strong guilt, depression, worry, losing interest in activities that were enjoyable in the past and having trouble remembering the dangerous event.

Things that remind a person of the traumatic event can trigger avoidance symptoms. These symptoms may cause a person to change his or her personal routine. For example, after a bad car accident, a person who usually drives may avoid driving or riding in a car.

3. Hyper-arousal symptoms:-

Being easily startled, feeling tense or "on edge", having difficulty sleeping, and/or having angry outbursts.
Hyper-arousal symptoms are usually constant, instead of being triggered by things that remind one

of the traumatic event. They can make the person feel stressed and angry. These symptoms may make it hard to do daily tasks, such as sleeping, eating, or concentrating.

It's natural to have some of these symptoms after a dangerous event. Sometimes people have very serious symptoms that go away after a few weeks. This is called acute stress disorder, or ASD. When the symptoms last more than few weeks and become an ongoing problem, they might be PTSD. Some people with PTSD don't show any symptoms for weeks or months.

3. Results:

Out of all interviewed individuals (n=450), males constituted slightly more than one half of them 258(57.3%) and the majority were Saudis 367(81.6%). The mean age accounted for 31.8±12.8 years (ranged between 15-85 years), and the married were 248(55.1%). Only 24.9% have university qualifications and 54.4% have jobs. According to the study design, the great majority of the respondents were basically living in houses present along the main stream of the flood, mainly in Qweza 250(55.6%) and Harazat 171(38.%) and only 29(6.4%) were living relatively away from the main stream. The mean number of persons who were present in a house during the flood accounted for 6 individuals (ranged between 1-21 individuals).

More than one third of the interviewees 162(36%) indicated that they shifted from their homes either to lodging apartments 87(19.3%) or rented new houses away from the disaster scene.

Regarding incidents encountered during the flood, the great majority of the interviewees 416(92.4%) were sight witnesses for the disaster scene, and almost equal percentage 407(90.4%) denoted that they lost some or all of their properties during the flood. One third 146(32.4%) indicated that they had been injured, and 71(28.4%) expressed that one or more members of their families had been injured or being admitted to hospitals, in addition to 194(43.1%) who indicated that one or more of their companions had been injured. Moreover, 71(15.8%) addressed that they lost one or more of their family members, and 191(42.4%) said that they lost one or more of their companions and friends.

The aftermath assessed by the PTSS-10 questionnaire revealed the overall stress disorder mean score among the interviewees accounted for 3.50±1.39 out of 7. The following table describes the mean score for each item included in the questionnaire.

Table (3): Mean scores for items reflecting Post Traumatic Stress Syndrome.

Items	Mean score	SD
Sleep problems	3.80	1.99
Nightmares	3.36	1.93
Depression, feeling dejected/downtrodden	3.59	1.92
Jumpiness, easily frightened by sudden sounds or sudden movements	4.34	1.96
The need to withdraw from others	2.90	1.84
Irritability, easily agitated/annoyed and angry	3.34	1.89
frequent mood swings	3.39	1.90
Bad conscience, blaming self, have guilt feelings	3.13	2.03
fear of places and situations, which remind the disaster scene	4.43	1.93
Muscular tension	2.76	1.83

The table shows that the highest stress score was recorded for the feeling of fear of places and situations which remind the interviewees with the disaster scene (4.43±1.93) followed by feeling jumpiness, easily frightened by sudden sounds or movements (4.34±1.96), and the least score was realized for the muscular tension (2.79±1.83) followed by the perceived need to withdraw from others (2.90±1.84).

Geographically, as displayed in the map illustrated in Figure 1, the mean stress score was found to be significantly higher among those who indicated that they were residents of Queza (3.84±1.36) followed by Harazat (3.44±1.01) which are present along the geographical stream of the flood, if compared to districts adjacent to the stream namely Kilo 14 (3.03±1.36) $p<0.05$.

Table (4): Mean stress scores among interviewees according to their demographic characteristics.

Demographic characteristics	Post Disaster Stress score		P value
	Mean	SD	
Gender			
Males	3.62	1.40	0.045
Females	3.35	1.38	
Nationality			
Saudi	3.46	1.42	0.186
Non Saudi	3.69	1.27	
Marital status			
Married	3.49	1.43	0.811
Unmarried	3.52	1.35	
Occupational status			
Has a job	3.67	1.35	0.007
Jobless	3.31	1.42	

The table demonstrates that the mean stress score was significantly higher among males (3.62±1.40) than females (3.35±1.38), and was significantly higher among those who have jobs (3.67±1.35) if compared to the jobless interviewees (3.31±1.42) $p<0.05$. On the other hand, it was found that neither nationality nor marital status has significant impact on occurrence of post disaster stress.

Table (5): Mean stress scores among interviewees according to direct exposure and encountering different forms of casualties.

Exposure and casualties	Post Disaster Stress score		P value
	Mean	SD	
Sight witness			
Yes	3.55	1.41	0.001
No	2.93	0.95	
Had been injured			
Yes	3.95	1.34	<0.001
No	3.29	1.37	
Lost family member			
Yes	4.41	1.31	<0.001
No	3.34	1.34	
Injury of family member			
Yes	4.17	1.17	<0.001
No	3.24	1.39	
lost friend or companion			
Yes	3.97	1.16	<0.001
No	3.16	1.45	
Injury of friend or companion			
Yes	3.86	1.17	<0.001
No	3.24	1.49	
Lost properties			
Yes	3.53	1.39	0.213
No	3.25	1.37	

As expected, the table illustrates that the mean stress score was found to be significantly higher among those who were sight witnesses to the disaster scene, those experienced physical injury, loss or injury of one or more of family members, loss or injury of one or more of the friends or companions $p<0.05$. On the other hand, it was noticed that the score of stress was higher among those who lost their properties than those who didn't, however this difference is in not statistically significant.

Conclusion and Recommendations:
While it is extremely difficult, if not impossible,

to predict the occurrence of most natural hazards; it is possible to take action before emergency events happen to plan for their occurrence when possible and to mitigate their potential effects putting into consideration the expected scenario of the event. Our study revealed two important issues that would help in the preparedness plan for flood disaster in Jeddah Governorate, first, the anatomy of the expected flood that could be modified through establishment of properly designed underground drainage tunnels leading to the red sea on the western border of the city. Secondly, in addition to the direct effect of the disaster represented by loss of properties and

morbidities that could be ameliorated by compensations and concurrent health services, an overlooked post disaster impact shown as Post Traumatic Stress Disorders should be put in consideration in planning for the comprehensive health services provided to the victims of the flood.

Thirdly, the authorities must prevent the establishment of any buildings, roads or infra-structure along the courses of dry valleys in order to avoid these
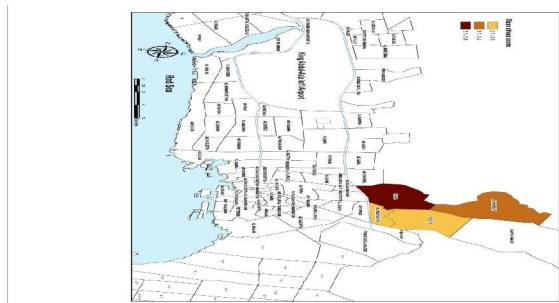
Figure (15): The mean stress score in the affecte d areas
Source: Prepared by the researcher

4. Discussion:

Disasters can strike uncontrollably whenever or wherever, leaving horrendous marks of physical and psychological damage on people upon their passing[32]. Jeddah 2009 flood started by heavy rains accumulated on the high mountainous area, present along the eastern border of the Governorate, and it ran along narrow valleys crossing towards the western area. Along its streams it caused remarkable destruction in buildings, infrastructures, properties of individuals in addition to direct morbidities and mortalities. Loss of a dear is considered as one of the triggering situations for depressive disorders [33], this notion support our findings which showed that PTSD was significantly more frequent among those who lost one of their relatives and/or those who lost one of their friend than those who didn't. Moreover, physical injury had been documented to be associated with constellation of symptoms including pain, post traumatic stress disorder (PTSD), and depression[34-36], which explain our findings where it was realized that those who were injured were significantly more likely to acquire PTDS. Fair compensation for the lost assets of victims would make them able to re-establish themselves productively; that would diminish the likelihood for occurrence of massive psychiatric disorders [37]. This claim explain our findings where it was found that

there was no significant difference in the occurrence of PTSD between those who lost and those who didn't lose their properties. In general and as expected, the nearer to stream of the flood the more exposure to its destructive effect, therefore, it was remarked that the frequency of PTSD was significantly higher among those who indicated that they were living very near to the flood stream and those who were sight witnesses for the scene and those who were shifted to lodging houses if compared to those who were relatively away from the flood stream.

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Molecular studies on some barley genotypes in relation to salt stress tolerance

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Abstract: Environmental stress, especially saline soils and saline water, are one of the most important limiting factors for agricultural crops in particular all around the world. Thus, yield enhancement in agricultural crops such as barley under saline conditions is a major goal of plant breeding. Leaf Sample from five barley genotypes and their F_1 offspring were collected at 30 days old seedlings growth under three treatments (control, 7000 and 14000 ppm) of NaCl to develop initial material for salinity tolerance breeding program using biochemical and molecular tools. These genotypes differ genetically in their salt tolerance potentiality and classified to salinity stress tolerant (Arar, Giza 123 and Giza 124), moderate (Mari) and susceptible (Beecher). Based on SDS-PAGE of water soluble protein for all genotypes under study , newly synthesized protein bands of salt treated parents observed at molecular weight (102, 96, 67 and 23) KDa and (28 and 87 KDa) for treated parents and hybrids, respectively . Also Native PAGE was carried out in this experiment to study six isozymes (EST, SKD, FDH, GDH. MDH and PER) patterns. In general theses isozymes patterns were reliable system for discriminating between tolerant and sensitive salinity genotypes under salt stress. Using RAPD-PCR with 5 primer arbitrary oligonucleotide (P18, P86, P24, P92 and P93), the results showed that all barley genotypes are not always identical in their DNA ability to be amplified and the total of amplified bands is 352 PCR bands. On the contrary, primers P18, P86 and P24 were able to generate positive marker, P92 was able to generate negative marker and 93 was able to generate positive and negative marker for salt tolerance. The phylogentic tree succeeded in clustering together the three tolerant parents and moderate parent while sensitive parents in another cluster.   These results indicated that protein, isozyme and RAPD analysis are useful molecular tools to indicate genetic polymorphism between the barley genotypes under salt stress.
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Abbreviation: NaCl-sodium chloride; RAPD- random amplified polymorphism DNA; PCR- polymerase chain reaction; EST-esterase; PER-peroxidase; MDH-malate dehydrogenase; GDH-glutamate dehydrogenase; FDH-formate dehydrogenase; SKD- shikimate dehydrogenase.

1. Introduction:

Barely , *Hordeum vulgare L.*, is recognized as one of the most economic and important cereals in the world. By area and production barley is the fourth most important cultivated crop, following, wheat, rice and maize. It can be grown in a wide range of environmental conditions and give satisfactory yields in areas that are not suitable for growing most of the others cereals crops due to problems of abiotic and biotic stress [1-2].

Abiotic stress in fact is the principal cause failure worldwide, dipping average yield for most major crops by more than 50% [3]. Abiotic stress causes losses worth hundreds of million dollars each year due to reduction in crop productivity and crop failure [4]. Among Abiotic stresses, salinity in soil and in irrigation water is very harmful and adversely affects plant growth, development and restrict yield on 40 million hectare of irrigated land in the world [5-6]. Increased Stalinization of arable is expected to have devastating global effects resulting in 30% land loss within next 25 years and up to 50% by the middle of 21st century [7].

When salinity exceeds to optimum tolerance of a plant, the result is stress to the plant, which in turn influences its developmental, structural, physiological and biochemical processes [8], also can cause damages to sensitive plant Species by altering patterns of gene expression including change in cellular structures and impairing membrane function [3-9].

For many years breeding for salt tolerance has been an important task to increase crop productivity under salt stress and choice of parents for crossing is considered an important step in any plant breeding program aimed to an increase in the salinity tolerance of barley which could improve the profitability of some of the more than one billion salt affected hectares present in the world [10]. Using non-conventional approaches such as molecular marker as a strategy to obtain plants with higher performance under salt stress conditions by identify the genes and banding patterns that take place when the plant become growing under salt stress may further accelerate the progress of such breeding programs [11]. Molecular markers developed by

analysis of proteins, isozymes and randomly amplified polymorphism DNA (RAPD) has shown excellent potential to assist selection of quantitative traits [12].

Sodium dodecyl sulphate polyacrylamid gel electrophoresis (SDS-PAGE) is most economical simple and extensively used biochemical technique for analysis of genetic structure of germplasm. Gel electrophoresis can directly equate variation in protein banding patterns to gene coding various proteins and proved to be useful in revealing polymorphic loci that encode isozyme or proteins [13]. The important of protein profiling has long been acknowledged in plant abiotic stress studies and previous study have provided useful information on individual enzyme or transporters, measuring their stress-dependent change in quantity, activity, as well as modifications of structure protein, protein interaction , stress dependent protein movement [14]. Salinity has been reported to cause either decrease or increased in the level of soluble proteins, a complete loss of present protein and the synthesis of new protein in barely [15]. **Karimazadeh *et al.*,** [16] observed changes in the electrophoresis pattern of water-soluble proteins from barley cultivars and pointed out accumulation of stress proteins in leaves on exposure to salinity. **Ali *et al.*,** [17] showed 12 polymorphic bands with different expression in the six barley genotypes. Salt tolerance genotypes under salt treatment were characterized by specific band no. 10 with approximate molecular weight of 17.54 KDa, this specific bands of water soluble protein profiles may used as marker for identification of genotypes under salt stress.

Isozymes have proven to reliable genetic markers in breeding and genetic studies on plant species [18-19]. **Wier** [20] indicated that the ability to observe allelic variation and designated allozyme polymorphism at isozyme loci is useful tools to examine genetic processes for different genotypes under stress conditions. In order to take advantage of isozyme markers potential for genetic studies and plant breeding programmes, the knowledge of their inheritance is a prerequisite. Once the genetic control of enzyme systems is known, allozyme or isozymes can be designated more accurately. Within the genus Hordeum, isozymes have been used to study genetic variation under abiotic stress. Salinity like other abiotic stresses alters general metabolic processes and enzymatic activities, causing increased production of reactive oxygen species (ROS) and lead to oxidative [21]. ROS-mediated membrane damage has been demonstrated to be a major cause of cellular toxicity by salinity in crops [22]. To minimize the effect of oxidative, plant cell have evolved a complex antioxidant system, which is composed of low molecular mass antioxidants (Glutathione and Malate) as well as ROS scavenging enzymes, such as Superoxide dismutase (SOD), Esterase (EST), Malate dehydrogenase (MDH) and Glutamate dehydrogenase (GDH) [23].

Crop plants depend on the broad genetic base of variation for resilience and adaptability for ever changing environments and pathogens. In recent years, attention has increasingly focused on the DNA molecule as a source informative polymorphisms, because each individual's DNA sequence is unique. DNA polymorphisms as DNA fingerprinting is becoming the technique of choice for laboratory assessment of cultivar identify. Characterization of genotypes using DNA fingerprinting techniques provides quantitative estimates of genetic structure and the information required for a rational utilization of germplasm in breeding programme [24]. The random amplified polymorphic DNA (RAPD) assay, which detects nucleotide sequence polymorphism by means of the polymerase chain reaction (PCR) and a single primer of arbitrary nucleotide sequence, have been developed and used in genetic and breeding studies in barley [24-25]. It is useful method for provides virtually unlimited number of markers to compare individual genotypes under normal and stress conditions , considering easy handling, cheaper cost assay and it is possible to carry out large scale screening of breeding populations and genetic resources [26-27-28]. Also, **Albayrak and Gözük** [29] indicated that, RAPD-PCR can be used as a tool in the selection of commercially important traits such as resistance against diseases, drought and salinity present in wild barley lines.

Therefore in this view, using five barley genotypes and their F_1 offspring, the objective of present study was to attempts biochemical (protein and isozyme) and molecular (RAPD-PCR) markers associated with salt tolerance in barley genotypes and to assess the level of genetic diversity relationship among them using RAPD molecular marker procedure. This relationship could be used by breeder in establishing strategies for selecting early generation materials in variety developmental programs.

2. Material and Methods:

The present study was carried out during period 2007/2008 and 2008/2009 barley growing seasons, at the experimental farm of the Faculty of Agriculture, El-Jabal El-Gharbei-Zaweia University, El-Zaweia, Libya. Five barley (*Hordeum vulgare* L.) genotypes differing in tolerance to salinity were obtained from Barley Department, Agriculture Research Center, Giza, Egypt, to including in this study. The origin and pedigree of these genotypes are presented in Table 1.

Using diallel mating system, in 2007-2008 season the five parents were crossed in all possible combination to obtain a total of 10 F_1 hybrids.

Table 1.   The entry name, pedigree and degree of salt tolerance of the studies barley genotypes.

Genotypes	Pedigree	Origin	Degree Of Salt Tolerance
Giza 123	Giza 117/FAO 86 (Giza 117 = Baladi 16/Palestine 10)	Egypt	High Tolerant
Giza 124	Giza 117/Bahteem 52// Giza 118/FAO 86	Egypt	Tolerant
Beecher	Atlas/Vaughn	Syria	Sensitive
Arar	Perga/Sekitorisai	Syria	Tolerant
Mari	Bouns X Ray-mutant	Syria	Moderate

In 2008/2009 seeds of the five parents with their ten hybrids (15 entries) were sown, in plastic pots (300 mm) filled with 2 Kg of soil mixture containing clay soil, sand and petmous at 1:1:1 ratio, in the green house. 10 seeds of each of the 15 entries were sown in each pot per entry with three replications and all pots were watered with tap water (300 ppm salt) up to 14 days after sowing. On day 15 salt treatments of 7000 ppm, 14000 ppm NaCl with unsalted treatments as control were applied. All treatments were designed in split-plots design with three replicates, where the three salinity treatments arranged randomized within the main plots.

Biochemical and molecular genetic analysis:

Leaf samples from each entry were collected at 30 days old seedlings grown under control and saline conditions and placed directly in deep freezer at -80C° until they were used for biochemical and molecular analysis.

1- Soluble protein analysis using SDS-PAGE:

SDS-PAGE was used to compare among the 15 entries under different salt treatments by their protein finger prints such as water soluble protein as follow:

Sample extraction: 0.5 g of each leaf sample was manually ground in cold pestle mortar to a fine powder under liquid nitrogen and mixed with 2 ml water-soluble extraction buffer containing 1M Tris HCl, pH 8.8, 0.25 M EDTA. Samples were transferred to eppendorf tubes and left in refrigerator overnight, then vortexed for 15 seconds and centrifuged at 12000 rpm at 4C° for 20 minutes. The supernatants were collected and considered as the soluble leaf protein extract. Protein concentration was estimated using Bradford's method – **Bradford** [30] - by measuring absorbance at 595 nm using spectrophotometer and expressed as µg/g fresh weight. A standard curve was prepared with bovine serum albumin.

Application of samples:

A volume of 50µl of protein fraction was added to the same volume of LAN's buffer (10 % SDS, Glycerol, 1 M Tris HCL, pH 8.8, 0.25 M EDTA) in eppendorf tube, and 10 µl 2-Mercaptoethanol was added to the each tube and boiled in water bath for 10 min, then 10 µl Bromophenol blue was added to each tube before sample loading. A volume of 15-20 µl, depends on the concentration of protein in the sample were applied to each well by micropipette and control wells were loaded with protein standards. SDS-PAGE was performed by the methods described previously by **Laemmili** [31]. Gels were stained using silver staining   as described by **Blum et al.,** [32] and after bands becomes clear the gels were photographed and electrophoregrams for each entry under different treatments were scored depends on the presence (1) and absence (0) of bands.

2- Isozyme analysis using Native PAGE:
Enzyme Extraction

0.5 gm from young leaves of each homogenised in 2 ml of cold extraction buffer containing 0.1 M Tris-HCl, 1, pH 8. 1 mM EDTA, o.5 PVP-10, 2mMDTT, 10 mM Mercaptoethanol and 2% PVP were added. Each sample was vortexes for 14 second by electric vortex and centrifuged at 20000rpm for 15 min at 4C°. The amount of total protein in the supernatant was assayed as described previously in protein analysis, about 15µg of the total   protein   was   applied   to   native polyacrylamide gel according to Apavatjrut et al., [33].

Enzyme staining

Six enzymatic systems were examined in this study.   The   gel   was   stained   after electrophoresis according to its protocol and incubated at 37C° in the dark for complete staining adding the appropriate substrate and staining solution. The staining protocol for Esterase's (EST),Glutamate dehydrogenase (GDH), Formate dehydrogenase (FDH) and Shikimate dehydrogenase (SKD) was used according to Jonathan and Wendel [34], While Malate dehydrogenase (MDH) from Falk et al., [35] and peroxidase (PER) by Guikema and Sherman [36].

Gel Fixation

After the appearance of the isozyme bands, the reaction was stopped by washing the gel two or three times with tap water, this was followed by adding the

fixing solution (10 % glacial acetic acid, 20% ethanol and 70% distilled water) Falk et al., [37]. The gel was kept in the fixing solution for 24 hours and rinsed with tap water two times then was photographed and analyzed electrophortically as in Stegemen et al.,[38-39] and developed as reported by Scadalios [40].

3- PCR-RAPD analysis:

DNA isolation: DNA was extracted from leaf tissue from each using a hexadecyltrimethylsmmonium bromide (CTAB) method according to **Maniatis et al.,** [41]. 2 grams of frozen barley leaves from each entry were ground in cold pestle mortar with 10 ml buffer (100 mM Tris-HCl pH 8.0, 20mM EDTA, 1.4 M NaCl, 0.2% PVP40 (w/v), 0.2% (v/v) 2-mercaptoethanol) , mixed ,transferred to 50 ml eppendorf tube and incubate at 65 ℃ for one hours. After incubation the mixture was centrifuge for 20 minutes with 4000 rpm at room temperature degree. Supernatant was taken and RNAse 1:1000 dilution of RNAse (100 mg/ml) was added and keep it at 37 ℃ at 30 minute, then mixed with the same volume of chlorophorm-isomylalcohol (24:1) and centrifuged at 4000 rpm for 30 minutes . DNA was precipitated by the addition of 2/3 volume of cold isopropanol for overnight in 4℃. the supernatant was removed from the tube and the pellet was washed with wash buffer (70 % ethanol), centrifuged again for 10 minutes with 1000 rpm at 20℃ and the pellet was dried under vacuum. The DNA pellet was resuspended in 100 μl of deionized H_2O and incubated at 50℃ for 15 min, centrifuged for 5 min with 1000 rpm at 20℃ then the solution was transferred to a new microfuge tube.

Polymerase Chain Reaction (PCR): After checking the concentration of genomic DNA by agarose gel electrophoresis for all 15 entries which will used to detect a marker related to salt tolerance, PCR reaction was conducted using arbitrary 10-mer primers (Sigma Company) as shown in table 2.

Table 2. List of five arbitrary primers and their nucleotide sequences used to generate RAPD markers in barley

Primer code	Sequence
P18	5'-GGGCCCTTTA-3'
P24	5'-ACAGGGGTGA-3'
P86	5'-GAGCTCGCGA-3'
P92	5'-CCTGGGCTTT-3'
P93	5'-GGGGGGAAAG-3'

Each PCR mixture was 25 μl containing 12.5 μl of master mix (Fermentas), 0.1 μl of each primer, 0.1 μl of plant genomic DNA and the volume was completed by deionized autoclaved water. The reaction were performed in a thermal cycle (Perkin Elmer) with the following temperature conditions: 94 ℃ for 4 min, followed by 45 cycles of 94 ℃ for 30 sec, 36 ℃ for 30 sec, 72 ℃ for 2 min and ending with 72 ℃ for 8 min.

PCR products were analyzed using 1.4% agarose gel electrophoresis and visualized with ethidium bromide staining. The size of the fragments were estimated using Qx174RFDNA / HaeIII fragments as a standard DNA,   which consisted of 5 double stranded DNA fragments with size of (1353, 1078, 872, 603, 310 and 271 bp). RAPD data were scored for presence (1), absence (0).

Hierchical cluster procedure:

An assessment of genetic divergence and cluster analysis between barley genotypes was analyzed through clustering analysis based on data from RAPD-PCR analysis with 5 primers on the basis of genetic distances according to **Johnson and Wichern** [42], the multivariate analysis was done by SPSS program.

3. Results and Discussion:

Electrophoresis technique for protein and isozyme polymorphism have been used as identification and quantitation methods, which provide association between the altered expression of specific genes and changes in the environmental stress. These changes in expression of genes would be involved in adaptation and could be used as molecular markers for salt stress [17].

3.1 Soluble protein analysis

Electrophoresis analysis was carried out on water-soluble SDS-protein fraction for 5 parental barely genotypes and their hybrids under control and two salt treatment. Densitometer analysis of W.S.P S.D.S-PAGE representing Protein bands with different molecular weight ranged from 18 KDa. to 130 KDa (data not show). All the bands did not exhibit a specific trend to salt tolerance. Total number of bands ranged from 24 to 33 under control, 25 to 34 under 7000 ppm and 28 to 35 under 14000 ppm as shown in Figure 1. More bands (33, 31, 33) under 14000 ppm were exhibited in the tolerant parents (Arar, G.123 and G.124), respectively followed by Mari as moderate genotypes (30 bands), while the sensitive ones (Beecher) showed relative low number of bands (28), this results agree with **Rashed et al.,** [43]. Various investigator suggested that the decrease number of bands in sensitive genotype compared with tolerance genotypes is associated with denaturing of the enzymes involved in amino acids and protein synthesis under abiotic stress [44]. **Katja et al.,** [2] concluded that more protein are affected by stress-specific regulation in

the less tolerant barley genotype.

Based on SDS-PAGE of water soluble protein for all genotypes under study, there are nine bands finding in all genotypes (Fig. 1). The newly synthesized protein bands of salt treated parents observed at molecular weight (102, 96, 67 and 23 KDa.). The tolerant genotypes G123, G124 and Arar exhibited also higher intensity in the appearance of bands under salt stress than the sensitive and moderate genotypes Beecher and Mari, respectively.

The band number 11 at molecular weight (96 KDa) which presents in G123 under 7000 and 14000 ppm, all the treatments in G124, and also the band number 16 at molecular weight (67 KDa) which presents in Arar and G124 under 14000 ppm, G123 under 7000 and 14000 ppm might be used as a molecular marker for salt tolerance in barley, as they present in tolerant parent under treatment only while the sensitive parents did not exhibit these bands (Figs. 1 a & b). The newly synthesized protein band in treated hybrids is observed at 87 and 28 KDa. in most of the hybrids (Figs.1 b, c, d & e). These expression of this polypeptide might have been due to the plant adaption to NaCl via expression of a stress resistance gene. This results supports the previous results of **Ali et al.,** [17] and **Vahid et al.,** [45], since they indicated that the 17.54 KDa and 50 KDa protein was salt enhanced in salt barley and sorghum genotypes, respectively. On the other hand, no negative molecular marker associated with salt tolerance in barley genotypes was detected in this experiment. Other results indicate that the 32 KD protein was salt enhanced in sensitive barley genotypes (**Bendary**) [46].

There are quantitative (band intensity) differences for water soluble proteins under salinity stress compare to control. All Genotypes exhibited higher intensity in the appearance of bands under salt stress whereas were faint in control treatment. These fluctuated effects of the salt stress on the number and intensity of protein bands were detected in previous study by **Hurkman and Tanka** [47-48], and **Diana et al.,** [49], who considering that the band intensity is directly related to protein concentration. Higher plants exposed to abiotic stress such as drought condition exhibit a characteristic set of cellular and metabolic response, including a decrease or increase in the synthesis of protein , **Bayoumi et al.,** [50].

3.2. Isozymes analysis

Barley, *Hordeum vulgare L.*, was among the first plants studies with isozyme technique, in the current study six isozyme patterns were studies as follow.

(Fig.1a)   (Fig. 1b)   (Fig. 1c)

(Fig. 1d)   (Fig. 1e)
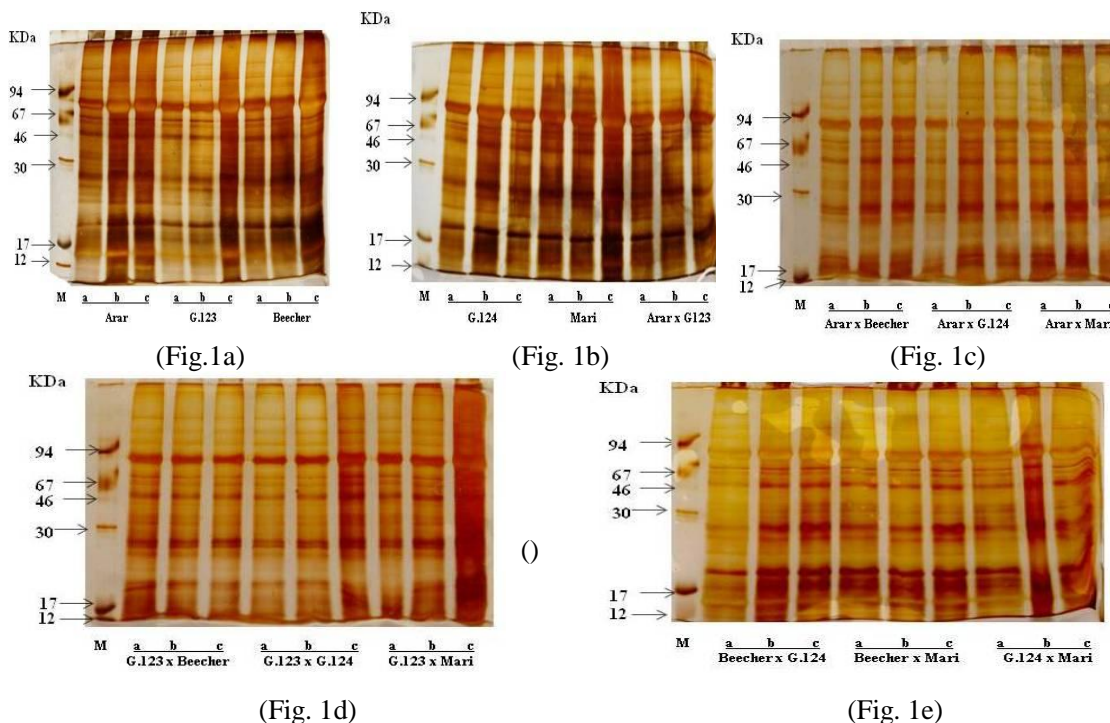
Figure 1 a, b, c, d & e. Protein profile on SDS-PAGE of 15 barley Genotypes under salt stress. Lane M) Protein Marker; lane a) Control; Lane b) 7000 ppm and Lane c) 14000 ppm.

3.2.1. Esterase polymorphism

Esterase isozyme showed high level of variation (81%) with nine polymorphic enzymatic bands out of total eleven enzymatic bands, these bands showed clear different between sensitive and tolerant parental genotypes (Table 3). Bands number six appeared in tolerant parents (Arar and G.123) under 7000 and 14000 ppm and also G.124 and Mari under 7000 ppm. While it is disappeared in sensitive parent (Beecher), this band might be induced as results of response to salt stress. on the other hands, bands number eight showed constitutive occurrence in the sensitive parents under salt treatment while it was absence in both control and salt stress in other genotypes, also band number two was appeared in all genotypes under control while it was appeared in sensitive and moderate genotypes under control and 7000 ppm, these bands could be used as a negative marker for salt stress in barley. These results indicated that esterase isozyme gave reliable to obtain molecular markers linked with salt tolerance in barley.

3.2.2. Shikimate dehydrogenase polymorphism

Shikimate dehydrogenase isozyme showed high level of variation (100 %) with six polymorphic enzymatic bands which were not necessarily present in all genotypes. Electrophoresis patterns of SKD are presented in ideogram (Table 4). All parental genotypes and G.124 x Mari shared bund number one under control and 7000 ppm while it was appeared in all hybrids under control, also band number three were appeared in all genotypes under control. This was interpreted as due to the effect of salt stress which may cause some shift in gene expression and stop gene expression. General variation between control and salt treatments represented in two bands number two which were presented only under salt treatment while absence under control in all genotypes and band number four which was appeared only under 7000 ppm in Arar, G.123 and Mari and all salt treatment in G.124. The hybrids showed also one adaptive band, number four, for salt treatment which appeared under 7000 and 14000 ppm in some hybrids. These result clearly suggested the presence of an association between salt tolerance and the presence of this band. The SKD isozyme system was reliable system for discriminating parents and their hybrids under saline condition.

3.2.3. Formate dehydrogenase polymorphism

Data of FDH isozyme for barely parental genotypes and their hybrids are shown as ideogram (Table 5). Concerning the presence of a given band, it can be concluded that only two bands were polymorphic for all genotypes in the present study. The band number one appeared in the tolerant parents, moderate and all hybrids except Arar x G.124, G.123 x Beecher, G.124 x

Beecher, Beecher x Mari and G.124 x Mari under 7000 and 14000 ppm and in sensitive parent and previous hybrids under 14000 ppm only, this band considered as adaptive band for salt stress. In the mean time, all parental genotypes and hybrids except Beecher, Arar x G.124, G.123 x Beecher, G.124 x Beecher, Beecher x Mari and G.124 x Mari exhibited the occurrence of band number two with high intensity under control while this band was uniquely and constitutively exhibited in the other genotypes under 7000 ppm, this may due to the different in gene expression under stress. This band might be considered as a marker negatively associated with salt stress.

3.2.4. Malate dehydrogenase polymorphism

The Malate dehydrogenase isozyme extracted from leaves of salt sensitive and tolerant barley parents and their hybrids exhibited a total of five bands as shown in Table 6. One band number two was exhibited among the profiles of all genotypes which considered as common band. The tolerant parent Arar and hybrids G.123 x Beecher, G.123 x G.124, Beecher x G.124, Beecher x Mari and G.124 x Mari exhibited the same MDH pattern in both control and salt treated plants. In addition to the tolerant parent G.124 and Moderate parent Mari exhibited also the same MDH pattern in control and salt treatment except that control plant showed absence band number one under control. The sensitive parent Beecher manifested only four band (no. 1, 2, 3 and 5) and three band (no 1, 2 and 5) under 7000 and 14000 ppm, respectively. While the control plants revealed three band number 2, 3 and 5. Only band number four was uniquely and constitutively exhibited in the tolerant and moderate parents with complete absence in sensitive parents and also band number three which appeared in all parental genotypes except Beecher under 14000 ppm. In their hybrids there not clearly different between hybrids under control and salt stress.

3.2.5. Glutamate dehydrogenase polymorphism

Electrophoresis patterns of GDH are presented in Table 7. The five parents and their hybrids exhibited one band number three in both control and salt treatment except Arar, G.123 under 14000 ppm. The parents genotypes under control showed presence of band number two while this band was absence under salt stress, also this band was appeared under control in Arar x G.123, Arar x Beecher, Arar x Mari, G.13 x G.124. G.123 x Mari and Beecher x G.124 while in the rest of hybrids it was appeared only under control and 7000 ppm. This interpreted due to the effect of salt stress which might cause some shift in gene expression in genotypes. In the mean time, new band number one present to appear in the hybrids Arar x G.123 , Arar x Beecher, Arar x Mari, G.13 x G.124 and G.124 x

Beecher under 7000 and 14000 ppm, while appeared in another hybrids under 14000 ppm only. This result clearly suggests that the band number one in the hybrids genotypes could be considered as salt shock protein bands which appeared after saline treatments.

3.2.6. Peroxidase polymorphism

As in ideogram (Table 8), a total of three bands number two, three and four were characterized in the parental genotypes and their hybrids which were present in some genotypes and absent in the others except band number one which was present in all genotypes, this band could be considered as a common band for all the study genotypes.

The tolerant parental genotypes, Arar x G.124 and G.124 x Mari revealed the band number two under control and salt treatment while this band was absence in Beecher, Arar x Beecher, Arar x Mari and G.124 x Mari under 7000 and 14000 ppm, which may be due to the different in gene expression under salt stress. In general the electrophoresis banding pattern of peroxidase isozyme revealed that the variation between the sensitive and tolerant genotypes under salt stress, represented in one band number two which was appeared under salt treatment in all tolerant parental genotypes and disappeared in sensitive parent. This result clearly suggested the presence of an association between salt tolerant and the presence of this band.

Sang *et al.,* [51] reported that increases in the expression of activities and isoform of some antioxidant enzymes such as Ascorbate peroxidise were associated with decrease in hydrogen peroxidise in the salt-stressed barley and the quantitative and qualitative aspect of changes are often related to the level of resistance to salinity. Metwali *et al.,* [52] revealed that plant grown under salinity showed induction or suppression in the synthesis of few polypeptides. Isozymes of EST, MDH and GDH showed differences under salt stress, these differences might reflect the gene activation for the adaptation of plants to salt conditions and provide good marker for discrimination among salt-tolerant and salt-sensitive accessions.

3.3. Molecular genetic marker

Genomic DNA of the barley genotypes were extracted and were used in performing Randomly Amplified polymorphic DNA (RAPD). 5 arbitrary oligonucleotide primers, base sequence and number of fragment amplified using these different primers showed that: the number of amplified fragments different from one genotype to another indicating that all barley genotypes are not always identical in their DNA ability to be amplified and these primers have amplified 352 PCR bands (Table 9). A maximum of 102 fragments were amplified with primer P93 and minimum of 45 fragments were amplified with primer P86. These results agree with Adrian *et al.,* [53], Baum *et al.,* [54] and Noli *et al.,* [55]. The five primers produced multiple band profiles with a number of amplified DNA fragment ranging from Zero to eleven. Three primers P18, P29 and P39 were reacted and generated PCR product with all genotypes, whereas primer P24 and P86 reacted only with twelve and fourteen genotypes, respectively.

All five used RAPD primers generated polymorphic bands, The P93 primer recorded the highest percentage polymorphism (76%) as it revealed 10 polymorphic bands in 13 amplified fragments, while the P92 primer recorded the least percentage (30%) by revealing 7 polymorphic bands in 13 amplified fragments (Table 10).

Table 3. Ideogram of esterase (EST) isozyme of five parental genotypes and their hybrids under control and salt treatments

bands	A.			G.123			B.			G.124			M.			A. x G.123			A. x B.			A. x G.124			A. x M.			G.123 x B.			G.123 x G.124			G.123 x M.			B. x G.124			B. x M.			G.124 x M.		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	-	+	+	+	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+
2	+	-	-	+	-	-	+	+	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	-	+	+	+	+	-	-	+	-	-	+	-	+	+	+	+	+	+	+	+	+	-
3	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	+	-	-	+	-	-	+	+	+	+	+	+	+	-	-	+	+	+
4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	-	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8	-	-	-	+	-	-	+	+	+	+	+	+	-	+	+	-	-	-	-	+	+	-	-	-	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
11	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Table 4. Ideogram of Shikimate dehydrogenase (SKD) isozyme of five parental genotypes and their hybrids under control and salt treatments

bands	A.			G.123			B.			G.124			M.			A. x G.123			A. x B.			A. x G.124			A. x M.			G.123 x B.			G.123 x G.124			G.123 x M.			B. x G.124			B. x M.			G.124 x M.		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
2	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	-	+	-	-	+	+	-	+	+	+	+	+	-	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Table 5.   Ideogram of formate dehydrogenase (FDH) isozyme of five parental genotypes and their hybrids under control   and salt treatments

bands	A.			G.123			B.			G.124			M.			A. x G.123			A. x B.			A. x G.124			A. x M.			G.123 x B.			G.123 x G.124			G.123 x M.			B. x G.124			B. x M.			G.124 x M.		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	-	+	+	-	+	+	-	-	+	+	-	+	+	-	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	-	+	-	+	+	-	+	+	-	-	+	-	+	+	-	-
2	+	-	-	+	+	-	-	+	+	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-	+	+	-

Table 6.   Ideogram of Malate dehydrogenase (MDH) isozyme of five parental genotypes and their hybrids under control and salt treatments

bands	A.			G.123			B.			G.124			M.			A. x G.123			A. x B.			A. x G.124			A. x M.			G.123 x B.			G.123 x G.124			G.123 x M.			B. x G.124			B. x M.			G.124 x M.		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+	-	+	+	+	+	+	-	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	-	-	-	-	+	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+

Table 7.   Ideogram of glutamate dehydrogenase (GDH) isozyme of five parental genotypes and their hybrids under control and salt treatments

bands	A.			G.123			B.			G.124			M.			A. x G.123			A. x B.			A. x G.124			A. x M.			G.123 x B.			G.123 x G.124			G.123 x M.			B. x G.124			B. x M.			G.124 x M.		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	-	-	+	-	+	+	-	-	+	-	-	+	-	+	+	-	-	+	-	+	+	-	+	+	-	-	+
2	+	-	+	-	+	+	-	+	+	-	+	+	+	-	+	-	+	+	-	-	+	+	-	+	-	+	+	-	+	+	-	-	+	-	+	+	-	-	+	-	+	+	-	+	+
3	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Table 8.   Ideogram of peroxidase (PER) isozyme of five parental genotypes and their hybrids under control and salt treatments

bands	A.			G.123			B.			G.124			M.			A. x G.123			A. x B.			A. x G.124			A. x M.			G.123 x B.			G.123 x G.124			G.123 x M.			B. x G.124			B. x M.			G.124 x M.		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
1	+	+	+	+	+	+	-	+	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	-	+	-	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

A.= Arar,   G.123=Giza 123,   B.=Beecher ,   G.124=Giza 124 ,   M.=Marei.

- = absent   + = present

A= control,   b= 7000 ppm,   c= 14000 ppm

Table 9.   List of primer, their nucleotide sequences and amplification results with 15 barely genotypes.

Primer code	Sequence 5` to 3´	Number of amplified fragment in each genotypes															Total
		Arar	Giza 123	Giza 124	Marei	Beecher	A. x G.123	A. x G.124	A. x B.	A. x M.	G.123 x G.124	G.123 x M.	G.123 x B.	G.124 x M.	G.124 x B.	M. x B.	
P18	GGGCCCTTTA	5	5	5	3	2	5	5	2	4	5	5	3	5	2	3	59
P24	ACAGGGGTGA	6	0	5	3	0	5	5	4	6	4	0	3	5	5	5	56
P92	CCTGGGCTTT	6	4	8	8	8	5	5	4	9	4	5	7	7	5	5	90
P93	GGGGGGAAAG	4	5	9	7	8	7	7	4	8	8	11	5	6	7	6	102
P86	GAGCTCGCCA	3	4	3	4	1	5	5	2	4	4	4	3	3	3	0	45
Total		24	18	30	25	18	27	27	16	31	25	25	21	26	22	19	352

A. = Arar   M. = Mari   B. = Beecher   G.123= Giza123   G.124=Giza124

Table 10: Polymorphism rate for the 15 barley genotypes using P18, P24, P92, P93 and P86 primers.

Primer code	Total amplified band	Polymorphic band	Polymorphism (%)
P18	10	3	30
P24	11	8	72
P92	13	7	53
P93	13	10	76
P86	9	6	66
Total	55	33	

The size of amplified fragment ranged from 310 bp to 1853 bp approximately (Figure 2). When the oligonucleotide P18 was used it produced amplified DNA segments of 945 and 772 bp in three salt tolerant genotypes only (Fig. 2a). This primer also produced an amplified segment 1148 bp in salt tolerant parents and moderate parent as shown in

Figure 8. Also these bands present in the hybrids for these genotypes. These fragment which appeared in the tolerant genotypes but not in sensitive genotypes referred to be positive markers for salt tolerance.

The results of RAPD analysis using Primer P24 are illustrated in Figure 2b. The primer produced zero bands in G.123, Beecher and G.123 x Mari to six bands in Arar and Arar x Beecher .The primer produced three common bands in all genotypes of molecular weight 872, 603 and 310 bp. The other bands were polymorphic as they present in some genotypes and absent in others. The oligonucleotide of P24 produced one amplified DNA segment of 1335 bp in two salt tolerant parents Arar and G.124,

this one positive marker can be used to distinguish the salt tolerant genotypes.

Figure 2c represented the amplified fragment patterns of primer 86. The molecular weights of PCR products generated by this primer ranged from 450 to 1110 bp. Moreover no reaction were detected with hybrid Mari x Beecher, which means that this primer had no complementary sequence with this genotypes. From the RAPD profiles generated by this primer, one common band was produced in all genotypes with molecular weight of 520 bp. Bands with molecular weight 1110 and 450 bp were absent in sensitive genotypes and presence in all genotypes. This fragments which appeared in all genotypes except Beecher referred to be positive marker for salt tolerance.

The results of RAPD analysis using primer 92 are illustrated in Figure 2d. It is interesting to note that the parental genotypes Beecher and Mari as a sensitive and moderate genotype have one bands of Molecular weight 872 bp which are present in these genotypes only and absent in salt tolerant genotypes.

Also Beecher has one band of MW 1150 bp which also present only in sensitive parent and absent in other parents, these bands could be used to distinguish these parental genotypes from other and also these two negative DNA markers can then be used to distinguish the salt tolerant genotypes, represented by Arar, G.123 and G.124 from the salt sensitive and moderate ones, represented by Beecher and Mari.

Figure 2e represented the amplified fragment pattern of primer 93. There are two DNA negative marker at 872 and 1450 bp. First negative marker was observed only in salt sensitive genotypes Beecher while second negative marker was observed only in Beecher and Mari, this fragments is referred to negative salt tolerance marker. Also this primer produced an amplified DNA segments of 1353 bp in three most tolerant parental genotypes Arar, G.123 and G.124 which was not observed in salt sensitive parent Beecher and also moderate parent Mari, so this segment might be used as a dependable marker linked to salt tolerance.

Fig.2 a)   RAPD –PCR with primer   (P18)

Fig.2   b) RAPD –PCR with primer (P24)

Fig.2 c) RAPD –PCR with primer (P86)

Fig.2 d) RAPD –PCR with primer (P92)

Fig.2 e) RAPD –PCR with primer (P93)
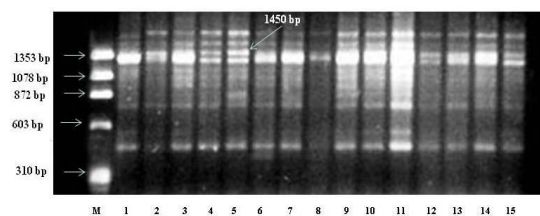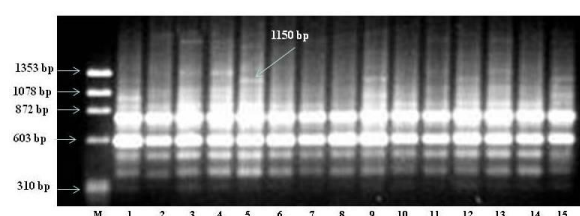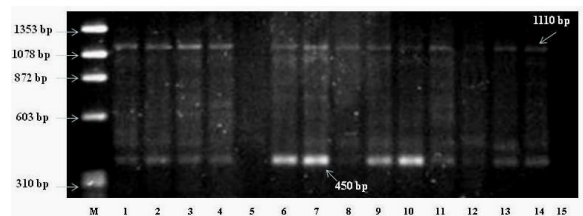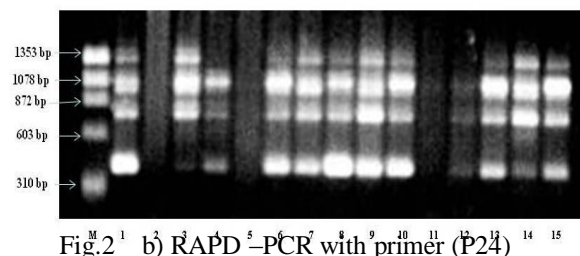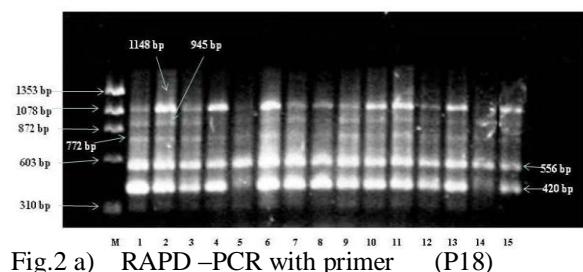
Figure 2 a, b, c, d & e. DNA banding pattern generated by RAPD-PCR with different primers P18, P24,P86, P92 and P93 in 15 barley genotypes. Lane M: DNA marker, lane 1-15:Barley genotypes as follow; (1) Arar, (2) G.123, (3) G.124, (4) Mari, (5) Beecher, (6) Arar x G.123, (7) Arar x G.124, (8) Arar x Mari, (9) Arar x Beecher, (10) G.123 x G.124, (11) G.123 x Mari, (12) G.123 x Beecher, (13) G.1224 x Mari, (14) G.1224 x Beecher and (15) Mari x Beecher.

Table 11. Squared Euclidean distance between barley genotypes on the basis of combined RAPD-PCR products from five primers

	A.	G.123	G.124	M.	B.	A. x G.123	A. x G.124	A. x M.	A. x B.	G.123 x G.124	G.123 x M.	G.123 x B.	G.124 x M	G.124 x B.
G.123	10													
G.124	13	9												
M.	15	14	11											
B.	21	14	19	10										
A. x G.123	11	12	11	10	18									
A. x G.124	8	13	10	11	19	3								
A. x M.	13	12	17	16	16	12	15							
A. x B.	10	15	12	11	17	9	8	17						
G.123 x G.124	10	9	10	11	15	3	6	11	10					
G.123 x M.	16	9	12	13	15	9	10	19	14	8				
G.123 x B.	12	9	16	7	9	13	14	13	12	12	14			
G.124 x M.	10	11	10	7	15	7	10	13	10	6	14	8		
G.124 x B.	10	11	12	9	13	7	10	7	12	6	14	8	6	
M. x B.	14	15	16	11	11	11	14	11	14	10	18	8	8	6

A. =Arar, G.123 = Giza 123, G.124 = Giza 124, M. = Mari & B. = Beecher
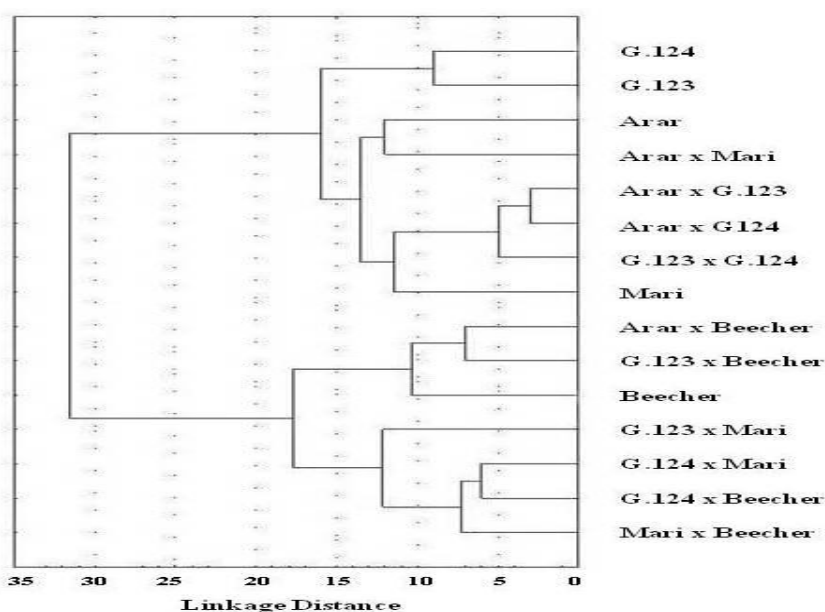
Figure 3. Linkage dendrogram for barley genotypes on the basis of combined RAPD-PCR products from all primer

On the contrary, we concluded that Primers number 18, 86 and 24 were able to generate positive marker for salt tolerance while primer number 92 was able to generate negative marker for salt tolerance and primer number 93 was able to generate positive and negative marker for salt tolerance. **Lucia *et al.,*** [56] used long primer PCR markers specifically targeted to sequence involved in the response to abiotic stress to analyse genetic marker within and among wild barley populations, the results demonstrate the effectiveness of PCR-based molecular markers targeted to environmental regulated genes in detecting useful variation and thus in monitoring the impact exerted by adaptation to environmental on genetic differentiation. Our results are also in parallel with those of **Ali *et al.,*** [17] who identified amplified band with molecular size 2000

and 500 bp in tolerant parents and was not detected in sensitive parents in barley by using primer D20 and Z7, respectively

Interestingly, many bands were shown to appear in tolerant parents but absent in their hybrids. There is no way that we can make linkage between these RAPD marker and salt tolerant gene. In other word, they can be successfully used as RAPD marker for salt tolerant parent but not for salt tolerance gene (s). The result of F_1 against different primers indicated that RAPD marker are dominant, where they were present at F_1 generation. However no explanation can be given to interpret absence of this marker at F_1 generation. As a conclusion the RAPD analysis seems to be one of the powerful tools for detecting polymorphism and could be discriminate between all the five parental genotypes. The results are also

agreement with the finding of **Geiese *et al.,*** [57], and **Adnan and Katsuhiko** [58].

Cluster analysis

The barley genotypes were subjected to hierarchical Euclidean cluster analysis to determine the genetic divergence between parents and their corresponding F1 hybrids. The actual values of genetic distance which based on RAPD using different five oligonucleotide primer are give in table 11. The genetic distance obtained between these 15 genotypes were ranged from 6 to 21. The magnitude of genetic distance measured the extent of genetic diversity between the genotypes. Considering the genetic divergence between parental genotypes, the minimum distance (9) was recorded between Arar and G.123 (tolerant parents), while the maximum genetic distance of (21) was between Arar (Tolerant) and Beecher (sensitive). The distance observed among hybrids were found to be lower in both magnitude and range than those observed between the parental genotypes, indicating that the parental genotypes were widely dispersed from their F_1 hybrids and these 10 F1 hybrids had intermediate genetic background between their corresponding parents, where the least genetic distance (3) was observed between Arar x G.123 and Arar X G.124, Arar x G.123 and G.123 x G.124. The genetic divergence among fifteen genotypes is shown diagrammatically by linkage dendrogram (Figure 3), which resulting from combined data of RAPD-PCR analysis using different five primers (Fig. 2). The fifteen genotypes were grouped into two clusters. Cut off point at 20 dissimilarity point (genetic distance) was fixed as minimum dissimilarity. **Email *et al.,*** [59] indicate that determining true genetic dissimilarity between individuals is an important and decisive point for clustering and analyzing diversity within and among populations.

The barley parental and their hybrids genotypes were distributed in two clusters. Cluster 1 consist only salt and moderate tolerance parental genotypes and most of their hybrids, while cluster number 2 consisted sensitive parent with their hybrids. These data indicated that considerable variation was created by hybridization in some hybrids but not all. It is interesting to note that the two parental genotypes Giza 123 and Giza 124 were grouped in a single sub-cluster, which may due to similarity in their genetic structure and common selection history. **Pahang *et al.,*** [60] found DP555BR and Dp449BR shared cv.DP5690 in their pedigree but they were grouped separately and they concluded that pedigree information or geographic origins of cultivars may not accurately reflect genetic relatedness among genotypes, whereas DNA markers could better reveal the genotypic relationships when there are sufficient markers and they are distributed across all chromosomes.

4. Conclusion:

The protein of 102, 96, 67, 23 KDa mw that are synthesized either specifically or at a higher rate under salt stress play an adaptive role in plant during osmotic adjustment, protecting the key cytoplasmic enzymes and protein synthesizing apparatus against adverse effect of high salt concentrations. Using isozymes such as EST, PER, SKD, GDH, FDH and MDH as genetic marker for genotype identification in barley under salt stress would be useful for displaying the effect of salt stress among the barley genotypes under salt stress. It is evident from this study that the RAPD assay is important since it is relatively easy to obtain valuable data and it can be useful in barley breeding programmes, where breeders can select related or unrelated parental germplasm to maximize variability in barley breeding programme under abiotic stress. During inter-mating accessions with grater genetic distance may provide unique genetic combination and useful variation for breeding. Construction of genetic relatedness tree can done using RAPD molecular marker, the RAPD dendrogram revealed that the closer the geographical locations and salinity tolerance the closer the genetic relationships. The use of molecular markers will be good alternative to the agronomic selection, where it allow a quick selection and provides the breeder with the genetic marker for salt stress.

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Statistical Modeling of Extreme Values with Applications to Air Pollution

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Abstract: In this paper the Block Maxima and the Peak Over Threshold methods are used to model the air pollution in two cities in Egypt. A simulation technique is suggested to choose a suitable threshold value. The validity of full bootstrapping technique for improving the estimation parameters in extreme value models has been checked by Kolmogorov-Smirnov test. A new efficiency approach for modeling extreme values is suggested. This approach can convert any ordered data to enlarged block data by using sup-sample bootstrap. Although, this study is applied on three pollutants in two cities in Egypt, but the suggested approaches may be applied on other pollutants in other regions in any country.
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1. Introduction

The traditional method of analyzing extreme values is based on the extreme value limiting distributions, which were derived by Gnedenko (1943) and Reiss and Thomas, (2003). These limits are known as Extreme Value Distributions (EVD) and they arise as limiting for distribution of maximum sample of independent and identically distributed (iid) random variables (rv's). EVD are often used to model natural phenomena such as sea levels, river heights, rainfall and air pollution. Two main methods for modeling, the Block Maxima (BM) method and the Peak Over Thresholds (POT) method, have been developed (Coles 2001).

In the BM method it is supposed to have observed maxima values of some quantities over a number of blocks. A typical example is a block is year or day and the observed quantities may be some environmental quantity such as the wind speed or air pollutant at a specific location. In this method, the block maxima is modeled by EVD. The choice of EVD is motivated by the facts: (i) The EVD are the only ones which can appear as the limit of linearly normalized maxima. (ii) They are the only ones which are max-stable, i.e., such that a change of block size only leads to a change of location and scale parameters in the distribution.

In the POT method it is supposed to have all observed values, which are larger than some suitable threshold. These values are then assumed to follow the Generalized Pareto Family of Distributions (GPD). The choice of GPD is motivated by two characterizations: (i) The distribution of scale normalized exceedance over threshold

asymptotically converges to a limit belonging to GPD if and only if the distribution of BM converges (as the block length tend to infinity) to one of EVD. (ii) The distributions belonging to the GPD are the only stable ones, i.e., the only ones for which, the conditional distribution of an exceedance is scale transformation of the original distribution.

A number of studies have shown a positive association between air pollution and human health effects (Goldberg et al., 2001 and Kim et al., 2004). We choose in this study three pollutants: Sulphur Dioxide SO_3, Ozone O_3 and Particulate Matter $PM10$ in 10th of Ramadan and Zagazig cities. The study of the Ozone pollutant was restricted on 10th of Ramadan city. The first city is one of the largest industrial cites in Egypt and the second is one of the most populous. Devices have been installed to monitor these pollutants in different places in these two cities. The places of these devices have been selected by experts in environmental measurements. The measurement units of the pollutants is $\mu gm/m^3$. The data for these pollutants were recorded every hour on the twenty-four hours through year 2008 for the two cities, except Ozone was recorded every half hours. The detail description of these pollutants and the collected data can be founded in (Barakat et al., 2011). This study considered the BM and POT methods, which are used to evaluate the measurement O_3, SO_2 and $PM10$ in two cities in Egypt. Bootstrapping technique for improving the estimation parameters in extreme value model is used and its validity is checked by the

Kolmogorov－Smirnov test. A simulated technique is suggested to choose a suitable value of threshold in the POT method. Moreover, a new efficiency method for modeling extreme values is suggested. This method, based on the work of Athreya and Fukuchi (1997), can convert any ordered data to enlarged block data by using sup-sample bootstraps. This method enables the engineers to analys the rare events to construct dam for rivers, breakwater for sea defence, and to design nuclear power plant against earthquakes, where the number of available maxima about the relevant phenomena of these activities are often limited.

2. Mathematical Models

Let $X_1, X_2, \cdots, X_n$ be iid rv's with common df $F(x) = P(X \le x)$. Suppose that $M_n = \max\{X_1, X_2, \ldots, X_n\}$. The cornerstone of extreme value theory is the Extremal Type Theorem (ETT) (see, Reiss and Thomas, 2003), which states that: If there exist sequences of constants $a_n > 0$ and b_n, such that

$$P(\frac{M_n - b_n}{a_n} \le x) = F^n(a_n x + b_n) \qquad \text{weakly}$$

converges to a nondegenerate df $G(x)$, then G should be of the same type of the Generalized Extreme Value Distribution (GEVD)

$$G_\gamma(x; \mu, \sigma) = \exp[-[1 + \gamma(\frac{x - \mu}{\sigma})]^{-\frac{1}{\gamma}}], \quad 2.1$$

which is a unified model for the EVD. Apart from a change of origin (the location parameter μ) and a change in the unit on the $x-$axis (the scale parameter $\sigma > 0$) the GEVD yields the three EVD, according as $\gamma > 0$, $\gamma < 0$ and $\gamma = 0 \, (\gamma \to 0)$, which are known as Frechet, Weibull and Gumbel families of df's, respectively. In this case, any suitable standard statistical methodology from parametric estimation theory can be utilized in order to derive estimate of the parameters μ, σ and γ. In this paper, we used the maximum likelihood method (ML) and improved the obtained estimates by the bootstrap technique. The bootstrap is a data-driven method that has a very wide range of applications in statistics. This technique is initiated by Efron (1979). The classic bootstrap approach uses Monte Carlo simulation to generate an empirical estimate for the sampling distribution of the statistic by randomly drawing a large number of samples of the same size n from the data, where n is the size of the sample under

consideration. Therefore, the bootstrap is a way of finding the sampling distribution, at least approximately, from just one sample. Here is the procedure:

Step 1: Re-sampling.

A sampling distribution is based on many random samples from the population. In place of many samples from the population, create many re-samples by repeated sampling with replacement from this one random sample. Each re-sample is of the same size as the original random sample.

Step 2: Bootstrap distribution.

The sampling distribution of a statistic collects the values of the statistics from many samples. The bootstrap distribution of a statistic collects its values from re-samples.

The BM approach is adopted whenever the data set consists of maxima of independent samples. In practice, some blocks may contain several among the largest observations, while other blocks may contain none. Therefore, the important information may be lost. Moreover, in the case that we have a few number of data, block maxima can not be actually implemented. For all these reasons, the BM method may be seen restrictive and not very realistic. In our study, we used this method to get the preliminary result, to help simulate data with the same nature as the real data.

An alternative approach, POT method, to determine the type of asymptotic distribution for extremes is based on the concept of GPD. This approach, which was initiated by Pickands (1975), is used to model data arising as independent threshold exceedances. Actually, the POT method is based on the fact that the conditional df $F^{[u]}(x + u) = P(X < x + u \mid x > u)$ may be approximated for large u (i.e., the threshold u is close to the right endpoint $w(F) = \sup\{x : F(x) < 1\}$)

by the family $W_\gamma(x; \overline{\sigma}) = 1 - (1 + \gamma \frac{x}{\overline{\sigma}})^{-\frac{1}{\gamma}}$,

provided that the df of BM weakly converges to the limit G_γ, which is defined by (2.1). In this case we have $\overline{\sigma} = \sigma - \gamma\mu$ (Reiss and Thomas, 2003). This family is connected by the GEVD by the simple relationship

$W_\gamma(x; \sigma) = 1 + \log G_\gamma(x; 0, \sigma), \log G_\gamma(x; 0, \sigma) > -1.$

It is worth to mention that the left truncated GPD yields again a GPD, namely:

$W_\gamma^{[c]}(x; \sigma^*) = W_\gamma(x; \overline{\sigma}), \text{where } \sigma^* = \overline{\sigma} + \gamma c. \quad 2.2$

Notice that the GPD nests the Pareto,

uniform and exponential distributions. Evidently, in the statistical modeling of threshold exceedance data, the whole data are used, in opposite of the case of the BM method. Possibly, the most important issue in statistical modeling of threshold exceedances data is the choice of threshold u. Did we choose a high enough threshold? the threshold should be hight enough to justify the assumptions of the model but low enough to a capture a reasonable number of observations. A threshold choice based on the observed sample is required to balance these two opposing demands. In this paper we used a simulation technique to choose a suitable threshold value. Namely, we first note that the GPD are the only continuous df's W such that for a certain choice of constants b_u and a_u,

$$W^{[u]}(b_u + a_u x) = W(x)$$

is again the exceedance df at u (Reiss and Thomas, 2003). This property is the (POT)-stability of GPD. Now, let γ_0, σ_0 and μ_0 be the preliminary estimates of the parameters γ, σ and μ, respectively (which is obtained by the BM method). Then, simulate data with the same size n as the real collected data from the GPD

$$W_{\gamma_0}^{[c]}(x; \sigma_0^*), \quad \text{with} \quad c = \min\{x_1, x_2, ..., x_n\},$$

where $x_1, x_2, ..., x_n$ is are the real data (this choice of c grantees that the simulated and realistic data have nearly the same range) and $\sigma_0^* = \sigma_0 + \gamma_0(c - \mu_0)$ (in view of (2.2)). In view of the POT stability property of GPD, the simulated data will have the same nature as the real collected data. Moreover, any POT u from the simulated data follows the GPD with the same shape parameter. Therefore, we choose the value of u which makes the estimate of the known shape parameter as best as we can. Finally, we take this value of u as a suitable threshold for our real data.

All the described models so far can be fitted by the method of ML, Cox and Hinkley (1974). Actually, the log likelihood function of the GEVD is given by

$$l(x; \mu, \sigma, \gamma) = -n\log\sigma + \sum_{i=1}^{n}(-[1 + \gamma(\frac{x_i - \mu}{\sigma})]^{-\frac{1}{\gamma}} - (1 + \frac{1}{\gamma})\log[1 + \gamma(\frac{x_i - \mu}{\sigma})]) \quad 2.3$$

provided $1 + \gamma(x_i - \mu)/\sigma > 0$, for each i, otherwise (2.3) is undefined. For the maximization of $l(x; \mu, \sigma, \gamma)$ for a general model indexed by parameters μ, σ, γ, this may be performed using a packaged nonlinear optimization subroutine, of which several excellent versions are available. Also

the log likelihood function for GPD is given by

$$l^*(x; \bar{\sigma}, \gamma) = -n\log\bar{\sigma} - (1 + \frac{1}{\gamma})\sum_{i=1}^{k}\log(1 + \frac{\gamma x_i}{\bar{\sigma}}), \quad 2.4$$

where k is the number of POT. Finally, we should say something about the theoretical status of the approximations involved. The asymptotic theory of ML for the GEV model is valid provided $\gamma > -0.5$ (see Smith, 1985). Cases with $\gamma \leq -0.5$ correspond to an extremely short upper tail and hardly ever occurs in environmental applications. A more serious problem is that even when, $\gamma > -0.5$, the asymptotic theory may give rather poor results with small sample sizes.

The Kolmogorov−Smirnov test (K-S test) is a nonparametric test for the equality of continuous one-dimensional df that can be used to compare a sample with a reference df (one-sample K-S test). The Kolmogorov−Smirnov statistic quantifies a distance between the empirical df of the sample and the reference df. Assume we have the hypothesis-testing situation $H_0 : F = \hat{F}$ for all x, where $\hat{F}$ is a completely specified continuous df. The differences between F and $\hat{F}$ should be small for all x, except for sampling variation, if the null hypothesis is true. For the usual two-sided goodness-of-fit alternative $H_1 : F \neq \hat{F}$, for some x. Large absolute values of these deviations tend to discredit the hypothesis. All computations are achieve by Matlab package, where we have four functions $[H, P, KSSTAT, CV]$. Namely, H is equal to 0 or 1, P is the p−value, $KSSTAT$ is the maximum difference between the data and fitting curve and CV is a critical value. Therefore

• We accept H_0, if $H = 0$, $KSSTAT \leq CV$ and $P >$ level of significant,

• We reject H_0, if $H = 1$, $KSSTAT > CV$ and $P \leq$ level of significant.

Sub-sample bootstrap technique

Although the bootstrap has been widely used in many areas, the method has its limitation in extremes. It was shown in some cases that a full-sample bootstrap does not work for extremes. Namely, assume $X_j^*, j = 1, 2, ..., m$, where $m = m(n) \to \infty$, as $n \to \infty$, are conditionally iid rv's with

$$P(X_1^* = X_j \mid \underline{X}_n) = \frac{1}{n}, \qquad j = 1, 2, ..., n,$$

where $\underline{X}_n = (X_1, X_2, ..., X_n)$ is a random sample of size n from the unknown df F. Hence $X_1^*, ..., X^*$ is a re-sample of size m from the empirical df $F_n(x) = \dfrac{1}{n} \sum_{i=1}^{n} \#\{X_i \le x\}$. Furthermore, let

$$H_{n,m}(x) = P(\frac{M_m - b_m}{a_m} \le x \mid \underline{X}_n) = F_n^m(a_m x + b_m)$$

be the bootstrap df of $\dfrac{M_m - b_m}{a_m}$. A full-sample bootstrap is the case when $m = n$. In contrast, a sub-sample bootstrap is the case when $m < n$. If the df of BM converges to the limit G_γ, which is defined in (2.1), Athreya and Fukuchi (1997) showed that the bootstrap df $H_{n,m}$ is weakly consistent estimate for G_γ, if $m = \circ(n)$ and it is strongly consistent, if $m = o(\dfrac{n}{\log n})$. Otherwise, $H_{n,m}$ fails to approximate G_γ. For the maximum order statistics under power normalization, this result is extended by Nigm (2006). More recently, Barakat et al. (2011) extended the same result to the generalized order statistics. Actually, this result suggests an efficiency estimate for the GEVD by using the BM method, even if the data do not consist of blocks (in this case the bootstrap replicates of size m, from F_n, are treated as blocks). For applying the suggested technique, we have to choose a suitable value of m (i.e., the size of bootstrap replicates or the blocks size). Actually, the suitable choice of the value m is the cornerstone of this technique. However, this value should be small enough to satisfy the stipulation $m = o(\dfrac{n}{\log n})$ and in the same time should be large enough to satisfy the stipulation $m \to \infty$, as $n \to \infty$. To determine a suitable value of m, we first simulate data with the same size as the realistic data, from the known GEVD $G_{\gamma_0}(.; \mu_0, \sigma_0)$. Then put $\dfrac{n}{\log n}$ in the form $a(10)^b + c$, where a, b and c are integers such that $1 \le a < 10$, $0 \le c \le (10)^{b-1}$. Thus in view of the above two stipulations, we can take $m \approx \hat{m} = a(10)^{b-1}$. Consequently, to choose such suitable value of $\hat{m}$, we select a value from an appropriate discrete neighborhood of $\hat{m}$ (see Example 2.1) that gives the best estimate $\hat{\gamma}_0$ for the shape parameter γ_0. The estimate $\hat{\gamma}_0$ is obtained by withdrawing, from each of the originals samples, a large number of bootstrap replicates (each of size m) and determined the corresponding maxima. Then, we used these maxima, as a sample drawn from the parametric G_{γ_0}, to estimate the shape parameter γ_0, by using the ML method.

Example 2.1. Suppose we have $n = 20000$, then $a = 2, b = 3$ and $c = 19.490588$. Consequently, $\hat{m} = 200$. In this case we can select a suitable value of m from the discrete neighborhood $\{100, 150, 200, 250, 300\}$ that gives the best estimate $\hat{\gamma}_0$ comparing the other values in the neighborhood, provided that this value does not equal 100 or 300. Otherwise, we should enlarge this neighborhood.

Data Treatments And Simulation Study

This section aims to answer the three questions. The first question is: Did the bootstrap improve the estimation of the parameters of the extreme models? The second question is: How can we choose a suitable POT number for every pollutant? The third equation is: How can we to choose the sub-sample m?

To answer the first question, we use the observed maxima values over 365 blocks (daily maximum through one year) for each pollutant and estimate the shape, scale and location parameters of G_γ in (2.1) (see, Table 1). Applying the full-bootstrap 50000 times for the data and again estimate the same parameters for each pollutant (see, Table 2). For fitting the real data, concerning $SO_2, PM10$ and O_3, we use the K-S test and calculate its functions $H, P, KSSTAT$ and CV, with and without bootstrap (see, Table 3). In the case of without bootstrap Table 3 shows that, we have not goodness of fit for SO_2 and $PM10$ in Zagazig and 10th of Ramadan cities, respectively, where $H = 1$, $KSSTAT > CV$ and $P \le$ level of significant. On the other hand, in the case of with bootstrap we have goodness fit for the both pollutants in the two cities. Moreover, the maximum distances between fitting curve and the data ($KSSTAT$) in the case of with bootstrap are less than those distances in the case of without bootstrap, see Figures 1-5 (Figures 1-5 compare

between the empirical GEVD and $G_{\gamma_0}(.;\mu_0,\sigma_0)$ curves, for all pollutants after bootstrap). Therefore, the bootstrap works to improve the parameters estimation.

To answer the second question, we generate 2000 random samples, each of them has the same size n (say) as the realistic data of the pollutant under consideration, from the GPD $W_{\gamma_0}^c(.;\sigma_0^*)$, see Table 4a and 4b (as we have shown previously in Section 2). Note that the size of the generated samples actually is less than $365\times24=8760$, for SO_2 and $MP10$, or $365\times48=17520$, for O_3, this is due to the inactivation and maintenance of the monitor devices in some hours at some days. In view of the imposed stipulations on the threshold u (and consequently on the number of POT k) in Section 2, we vary the number of POT k over the values $[\frac{n}{20}],[\frac{n}{19}],...,[\frac{n}{4}]$, where $[\theta]$ is the integer part of θ, see Table 4. Actually, we only wrote 7 values of k in Table 4a and 4b, including $[\frac{n}{20}]$ and the best value. Then, we look for the value of k (or u), which gives the best estimate $\hat{\gamma}_0$ of the shape parameter (its true value γ_0 is known), where the estimate $\hat{\gamma}_0$ here is the mean value of 2000 estimates, which are calculated as we have shown in Section 2. When two values of k give the same best mean estimate, we favor between them by the coefficient of variations (C.V). For example, in the case of SO_2, in 10th of Ramadan in Table 4a and 4b, we see that the values $k=2047$ and $k=2132$ give the same best estimate $\hat{\gamma}_0=0.0987$ (the true value is $\gamma_0=0.1$). Since, the second value corresponds the C.V=1.389, which is less than the C.V=1.4044 concerning the first

value, we then choose the second value, i.e., the suitable number of POT is $k^{\Sigma}=2132$. In this case, the corresponding threshold u is the upper quantile of order $[\lambda n]=[0.7500586n]=6397$ (note that $\lambda; \frac{n-k^{\hat{a}}}{n}=\frac{8530-2132}{8530}$). Now, by using the determined suitable threshold values, from Table 4, we can apply the POT method on the realistic data for each pollutant to determine its extreme value model, see Table 6. Finally, apply the full bootstrap technique (50000 times) to improve the obtained estimates, see Table 7. To answer the third question, we generate 2000 random samples, each of them has the same size n as the realistic data of the pollutant under consideration, from the GEVD $G_{\gamma_0}(.;\mu_0,\sigma_0)$, see Table 5. Determine, for each pollutant the value $\hat{m}=a(10)^{b-1}$ (as we have shown in Section 2). We can see that $\hat{m}=90$, for the SO_2 and $PM10$, i.e., for the first four rows of Table 5, while $\hat{m}=170$, for the O_3, i.e., for the last row of Table 5. Thus, for the first four rows, by checking the discrete neighborhood $\{60,70,80,90,100,110,120\}$, we find that the best value of m (according to the given method in Section 2) is the lower value 60. Thus, we consider a new discrete neighborhood, $\{20,30,50,60\}$, which yields the value $m=30$. In Similar way, for the last row of Table 5, we checked the the discrete neighborhoods $\{110,130,150,170,190,210\}$, $\{60,70,80,90,100,110\}$ and $\{20,30,50,60\}$.

The last neighborhood gives the value $m=30$. Therefore, for all pollutants the value 30 is more suitable value of m. Take this value and apply the sub-sample bootstrap technique on the realistic data to get a more suitable extreme value models for these pollutants (as we have shown in Section 2), see Table 8.

Table 1: Zagazig and 10th of Ramadan for GEVD

ML parameters estimation									
	SO_2			PM_{10}			O_3		
	γ_0	μ_0	σ_0	γ_0	μ_0	σ_0	γ_0	μ_0	σ_0
Zagazig	0.16	21.9	11.72	0.099	196.78	66.01			
10th of Ramadan	0.11	81.24	39.49	0.22	249.75	67	-0.087	54.9	9.6

Table 2: Zagazig and 10th of Ramadan for GEVD, after bootstrap

	\multicolumn ML parameters estimation								
	SO_2			PM_{10}			O_3		
	γ_0	μ_0	σ_0	γ_0	μ_0	σ_0	γ_0	μ_0	σ_0
Zagazig	0.15	21.6	11.6	0.094	197	67.5			
10th of Ramadan	0.1	81.3	39.4	0.21	249.8	65.9	-0.1	54.98	9.5

Table 3: Kolmogorov-Smirnov test for the data with and without bootstrap

Data of SO_2 in Zagazig					
	H	P	$KSSTAT$	CV	Decision
without bootstrap	1	0.0446	0.0656	0.0644	reject the null hypothesis
with bootstrap	0	0.0709	0.0605	0.0644	accept the null hypothesis

Data of SO_2 in 10th of Ramadan					
	H	P	$KSSTAT$	CV	Decision
without bootstrap	0	0.2962	0.0507	0.0706	accept the null hypothesis
with bootstrap	0	0.3065	0.0502	0.0706	accept the null hypothesis

Data of $PM10$ in Zagazig					
	H	P	$KSSTAT$	CV	Decision
without bootstrap	0	0.4389	0.0450	0.0706	accept the null hypothesis
with bootstrap	0	0.4614	0.0442	0.0706	accept the null hypothesis

Data of $PM10$ in 10th of Ramadan					
	H	P	$KSSTAT$	CV	Decision
without bootstrap	1	0.0305	0.0752	0.0706	reject the null hypothesis
with bootstrap	0	0.0548	0.0697	0.0706	accept the null hypothesis

Data of O_3 in 10th of Ramadan					
	H	P	$KSSTAT$	CV	Decision
without bootstrap	0	0.1845	0.0565	0.0707	accept the null hypothesis
with bootstrap	0	0.2537	0.0528	0.0707	accept the null hypothesis

Table 4: Simulation study for choosing a suitable number of POT (k). Note that k* is the best value

SO_2 in Zagazig: GPD with $\gamma_0 = 0.15$, $\sigma_0^* = 8.48$, $c = 0.226$, $n = 8633$							
k	431	1033	1549	1721	1979	2056*	2151
$\hat{\gamma}_0$	0.144	0.1504	0.1506	0.1505	0.1504	0.1502	0.1505
C.V	0.624	0.538	0.738	0.565	0.544	0.4144	0.336
$\hat{\sigma}_0^*$	13.45	11.67	10.99	10.8	10.59	10.5	10.45

SO_2 in $10^t h$ of Ramadan: GPD with $\gamma_0 = 0.1$, $\sigma_0^* = 31.5$, $c = 2.5$, $n = 8530$							
k	432	1027	1549	1707	1962	2047	2132*
$\hat{\gamma}_0$	0.0934	0.098	0.0982	0.0985	0.0986	0.0987	0.0987
C.V	4.69	2.322	2.708	1.585	1.4156	1.4044	1.389
$\hat{\sigma}_0^*$	42.7	38.68	37.67	37.02	36.5	36.35	36.21

$PM10$ in Zagazig: GPD with $\gamma_0 = 0.094$, $\sigma_0^* = 49.2$, $c = 2$, $n = 8540$							
k	460	970	1480	1735	1990	2075	2160*
$\hat{\gamma}_0$	0.0857	0.0891	0.0901	0.0911	0.0913	0.0914	0.0914
C.V	4.94	3.84	4.12	3.77	3.3	2.95	2.93

$\hat{\sigma}_0^*$	65.22	60.66	58.63	57.36	56.6	56.39	56.187

$PM10$ in $10^t h$ of Ramadan: GPD with $\gamma_0 = 0.21$, $\sigma_0^* = 14.8$, $c = 3.6$, $n = 8720$

k	440	962	1484	1745	2006^*	2093	2180
$\hat{\gamma}_0$	0.2047	0.2092	0.2092	0.2097	0.2098	0.2096	0.2097
C.V	1.33	0.5372	0.4247	0.3832	0.3727	0.3736	0.3239
$\hat{\sigma}_0^*$	27.92	23.52	21.48	20.74	20.33	20.14	19.8

O_3 : GPD with $\gamma_0 = -0.1$, $\sigma_0^* = 14.25$, $c = 7.46$, $n = 17000$

k	850	2040	3060	3400	3910	4080	4250^*
$\hat{\gamma}_0$	- 0.1053	-0.1026	-0.102	-0.1018	-0.1018	-0.1018	-0.1017
C.V	0.68	0.52	0.36	0.23	0.2003	0.2333	0.2427
$\hat{\sigma}_0^*$	10.6	11.56	12.03	12.266	12.32	12.38	12.43

Table 5: Simulation study for chosen m sub-sample bootstrap. Note that m^* is the best value

SO_2 in Zagazig: GEVD with $\gamma_0 = 0.15$, $\sigma_0 = 11.69$, $\mu_0 = 21.6$, $n = 8633$

m	$\hat{\gamma}_0$	C.V
20	0.147	0.352
30^*	0.152	0.374
50	0.1402	0.421
60	0.1355	0.507

SO_2 in 10th of Ramadan: GEVD with $\gamma_0 = 0.1$, $\sigma_0 = 39.4$, $\mu_0 = 81.3$, $n = 8530$

m	$\hat{\gamma}_0$	C.V
20	0.0844	0.742
30^*	0.0994	0.517
50	0.0925	0.622
60	0.087	0.76

$MP10$ in Zagazig: GEVD with $\gamma_0 = 0.094$, $\sigma_0 = 67.5$, $\mu_0 = 197$, $n = 8640$

m	$\hat{\gamma}_0$	C.V
20	0.0854	0.5911
30^*	0.0987	0.7977
50	0.0782	1.741
60	0.074	0.941

$MP10$ in 10th of Ramadan: GEVD with $\gamma_0 = 0.21$, $\sigma_0 = 65.9$, $\mu_0 = 249.8$, $n = 8720$

m	$\hat{\gamma}_0$	C.V
20	0.2017	0.2987
30^*	0.2064	0.2890
50	0.1906	0.3552
60	0.1909	0.3652

O_3 : GEVD with $\gamma_0 = -0.1$, $\sigma_0 = 9.5$, $\mu_0 = 54.98$, $n = 17000$

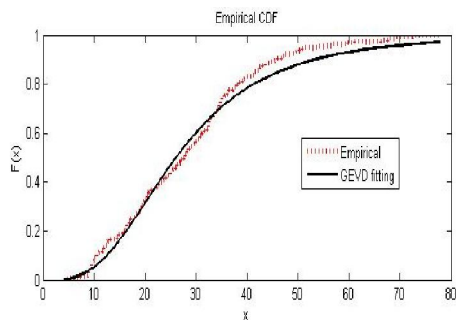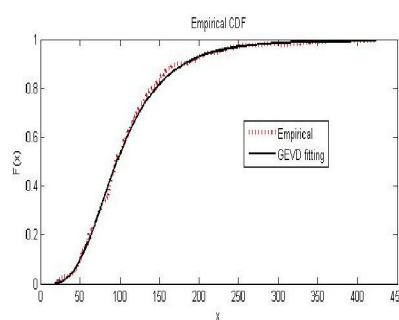| m	$\hat{\gamma}_0$	C.V
20	-0.1122	0.4165
30^*	-0.1077	0.4033
50	-0.1168	0.3807
60	-0.1178	0.4212

Figure 1: SO2 in Zagazig

Figure 2: SO2 in 10th of Ramadan
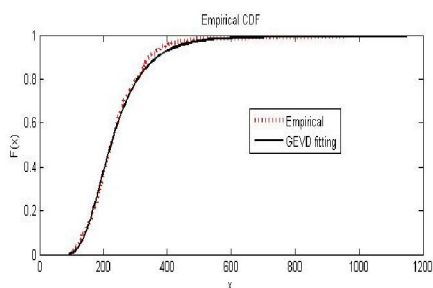
Figure 3: PM10 in Zagazig
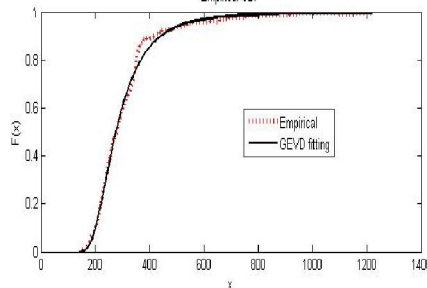
Figure 4: PM10 in 10th of Ramadan
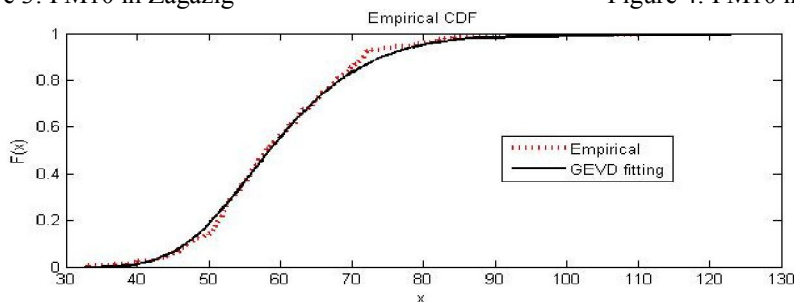
Figure 5: O3 in 10th of Ramadan after bootstrap

Table 6: Zagazig and 10th of Ramadan for GPD

	SO_2		PM_{10}		O_3	
ML parameters estimation						
	γ	σ	γ	σ	γ	σ
Zagazig	0.164	7.16	0.047	57.64		
10th of Ramadan	0.046	33.44	0.13	68.27	-.08	38.8

Table 7: Zagazig and 10th of Ramadan for GPD after bootstrap

	SO_2		PM_{10}		O_3	
ML parameters estimation						
	γ	σ	γ	σ	γ	σ
Zagazig	0.157	7.13	0.052	57.3		
10th of Ramadan	0.062	32.4	0.14	67.9	-0.087	8.89

Table 8: Zagazig and 10th of Ramadan for GEVD

ML parameters estimation by sub-sample						
SO_2						
	γ	C.V	μ	C.V	σ	C.V
Zagazig	0.176	0.253	26.39	0.0134	7.34	0.0463
10th of Ramadan	0.119	0.258	108.9	0.187	32.02	0.0489
$PM10$						
	γ	C.V	μ	C.V	σ	C.V
Zagazig	0.117	0.3728	264.41	0.0121	55.05	0.043
10th of Ramadan	0.26	0.17	340.67	0.0124	70.587	0.088
O_3						
	γ	C.V	μ	C.V	σ	C.V
10th of Ramadan	-0.08	0.739	64.36	0.0056	6.8	0.044

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The role of Chorioptic mange infestation in aggravating the infection rates of Staphylococcal dermatitis and Edematous skin disease in Egyptian buffaloes

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Abstract: Chorioptes mange is a skin disease affects both domestic and wild ruminants. A total of 341 Egyptian buffaloes, aged from 2 to 10 years old were examined clinically to determine incidence rate, clinical finding, age susceptibility of Chorioptic mange besides measuring cell mediated immune response of Chorioptic mite infested buffaloes. Incidence of Chorioptic mange was recorded in 252 out of 341 (73.9 %) Egyptian buffaloes raised in Alexandria city, Egypt. With higher incidence at age group 6-9 years old. Microscopic examinations of skin scraping revealed chorioptic mite at all stages. Chorioptic mange infestation reduced the milk yield. Infested buffaloes with Chorioptic mange had lower lymphocyte transformation index which were 22.52±6.77 as compared with non-infested buffaloes 32.45 ± 4 .49. Chorioptes pruritus and injury in lower leg region found to be in concurrent with staphylococcal dermatitis and edematous skin disease infection. 252 infested buffaloes with Chorioptes, 92 and 71 of them suffered from Staphylococcal dermatitis and edematous skin diseases, respectively, 53 buffaloes showed both infections. 89 non-infested buffaloes with Chorioptes, 8 of them showed edematous skin disease and no staphylococcal dermatitis infection. This confirms our hypothesis that Chorioptic mite plays an important role in initiating staphylococcal dermatitis and edematous skin disease infection.
[Amir Hamed Abd-Elrahman and Mahmoud Tanekhy **The role of Chorioptic mange infestation in aggravating the infection rates of Staphylococcal dermatitis and Edematous skin disease in Egyptian buffaloes]** Life Science Journal, 2012; 9(1): 133-141] (ISSN: 1097-8135). http://www.lifesciencesite.com.

Keywords: Chorioptic mite, Staphylococcal dermatitis, Edematous skin disease, Egyptian buffalo.

1. Introduction

Mange is a contagious skin disease, characterized by crusty, pruritic dermatitis and hair loss and caused by a variety of parasitic mites burrowing in or living on the skin (**1**). Chorioptes species comprises five putative species of obligate ectoparasitic mites that cause Chorioptic mange in domestic and wild mammals. Three of the species, collected rarely from wild animals, are poorly known and may not be valid entities, but *Chorioptes bovis* and *Chorioptes texanus*, primarily from domestic animals, have withstood modern biogenetic scrutiny and are accepted species (**2 and 3**). Chorioptic mange, also called 'barn itch,' may be the most common form of mange in cattle and horses. It can cause irritation, localized dermatitis, and self-trauma due to pruritus, and is currently considered to be the most common form of cattle mange in many countries in the Northern Hemisphere. Chorioptic mites are able to feed and survive on host-produced epidermal debris at the skin surface, without necessarily attacking the living parts of the host's skin. Infestations tend to concentrate on the lower portions of the host, especially the feet and legs, but may include the udder/scrotum, tailhead, and perineum. In some cases, *C. texanus* infests the host's ears (**4, 5 and 6**). *C. bovis* causes lesions characterized by an exudative dermatitis on the lower legs and scrota of rams and has been stated that scrotal mange affects ram fertility (**7**). Both *C. bovis* and *C. texanus* have been reported to infest dairy and beef cattle in Japan (**8**) and *C. bovis* in a wild Japanese serow (**9**). *C. texanus* was also observed in goats from Malaysia (**10**).

Edematous skin diseases affect mainly buffaloes caused by *Corynebacterium ovis* transmitted through skin injuries characterized by painful nodules and ulcer along the course of lymphatic vessels associated with oedema and enlargement of lymph node (**11, 12 and 13**).

Staphylococcal scalded-skin syndrome refers to a spectrum of blistering skin diseases caused by *Staphylococcus aureus[S. aureus]* exfoliative toxins (ETs) (**14 and 15**). These toxins cause intraepidermal splitting through the granular layer by specific cleavage of desmoglein 1, a desmosomal cadherin protein that mediates cell-cell adhesion of keratinocytes in the granular layer (**16**). *S. aureus* infections are known as triggers for skin inflammation and can modulate immune responses. These effects can be due to either direct invasion by the bacteria or by bacterial products (**17 and 18**).

2. Materials and Methods
A. Animals:

A total of 341 Egyptian buffaloes, aged from 2 to 10 years old were examined clinically to determine incidence rate, clinical finding, age susceptibility of Chorioptic mange and cell mediated immune response of Chorioptic mange infested buffaloes. The animals belong to breeding buffalo's farm at Alexandria Governorate, Egypt.

B. Crust collection and examination:

Crusts were collected and fixed in 70% methanol. Mites in scrapings were collected from the edges of active lesions were counted as described before **(19).** Scrapings were done using a sharp spoon from an area approximately 3×3 cm, scraped on each animal. Mites were extracted from these samples and mounted on slides. Diagnosis of the mites to the genus Chorioptes was made according to the key of Fain **(20).**

C. Bacterial diagnosis:

Isolation and identification of *S. aureus and C. ovis* was done as described before **(21, 22).**

D. Cell mediated immunity

Lymphocyte transformation procedure and conditions as published **(23).**

F. Treatment:

Treatment of mange was done by spray dipping or vat dipping; topical application of non-systemic acaricides; and oral, topical, or injectable formulations of systemic drugs. Spray dipping is time consuming but useful for small herds, whereas vat dipping is efficient but fairly expensive and difficult to manage. Dipping solutions as 0.1% phoxim, 0.075% diazinon, and 0.025-0.050% amitraz can be used. Only hot lime-sulfur is registered for use on lactating dairy cows. Injectable formulations of avermectins (ivermectin and doramectin) and milbemycins (moxidectin) are approved for control of mange at dilution 200 µg/kg (not in lactating dairy cattle). Although one treatment is effective, cattle should be isolated for 2 wk after treatment **(12 and 13).**

3. Results
3.1. Incidence of Chorioptic mite among Egyptian buffaloes:

Table (1) and figure (1) showed that, Chorioptic mite infestation reported in 252 animals from 341 Egyptian dairy buffaloes raised in some Egyptian buffalo farms by incidence rate 73.90%.

3.2. Age susceptibility of Chorioptic mite to Egyptian buffaloes:

Table (2) and figure (2) showed the difference in age susceptibility of Chorioptic mite in Egyptian buffaloes. Numbers of infested buffaloes were 52, 69 and 131 in age groups 2-3 years, 4-6 years and 7-10 years respectively.

3.3. Clinical infestation of Egyptian buffaloes by Chorioptic mite with parasitological examination:

Lower legs lesions, characterized by dermatitis, alopecia, accumulation of crust and fissuring with corrugated skin. Irritation and self-trauma due to pruritus and lameness were observed in different cases. Back, tail base, sacral and perineal regions characterized by accumulation of crust with irritation and trauma due to itching as shown in plate (1).

3.4. Effect of Chorioptic mite infestation on daily milk yield:

Table (3) and figure (3) reported that, average daily milk yield of infested buffaloes was 6.45± 0.46 liters as compared with non-infested buffaloes 7.75±0.78 liters.

3.5. Cell mediated immune response:

Table (4) and figure (4) show that infested buffaloes with Chorioptic mite had lower lymphocyte transformation index which was 22.52±6.77 while non infested buffaloes was 32.45 ± 4 .49.

3.6. The role of Chorioptic mite in lower leg regions in the initiation of staphylococcal dermatitis and edematous skin disease infection.

Table (5) and figure (5) explains the role of Chorioptic mite pruritus and injury in lower leg region in initiation of staphylococcal dermatitis and edematous skin disease infection. 252 infested buffaloes with Chorioptic mange, 92 and 71 of them showed signs of staphylococcal dermatitis and edematous skin disease, respectively, 53 buffaloes showed both infections. 89 non infested buffaloes with Chorioptic mange, 8 of them showed edematous skin disease and no infection with staphylococcal dermatitis.

Staphylococcal dermatitis in lower leg region found to be characterized clinically by lameness, dermatitis of the skin in the form of redness, corrugation and thickening of the skin as shown in plate (3). On the other hand, Edematous skin disease characterized clinically by fever, enlarged mainly hind limb and opened nodule as shown in plate (4).

Table (1): Incidence of Chorioptic mite among Egyptian buffaloes:

No. of examined buffaloes	Infested buffaloes		Non infested buffaloes	
341	No.	%	No.	%
	252	73.90	89	26.09

$Chi^2 = 4.55$ *   *Significant at (P= 0.05)
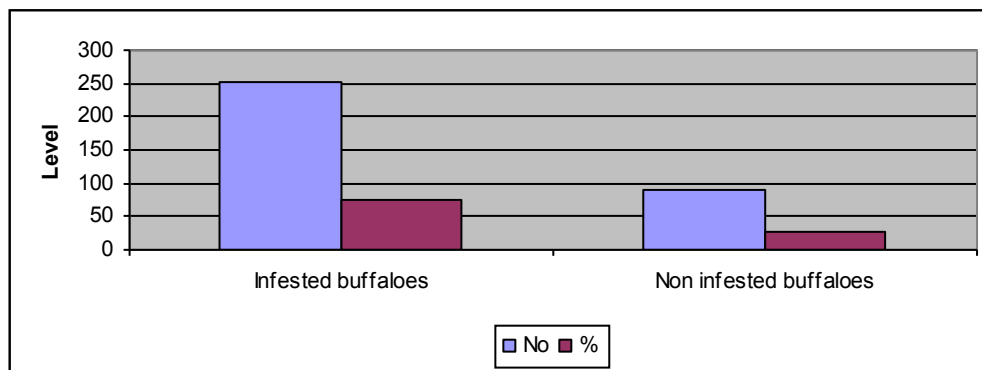
Figure (1): Incidence rate of Chorioptic mite among Egyptian buffaloes

Table (2): Age susceptibility of Chorioptic mite to Egyptian buffaloes:

Age (year)	No of infested buffaloes	% of infestation from total number (341)
2-3	52	15.24
4-6	69	20.23
7-10	131	38.41
Total	252	73.90

$Chi^2 = 6.55$ *   *Significant at (P= 0.05)
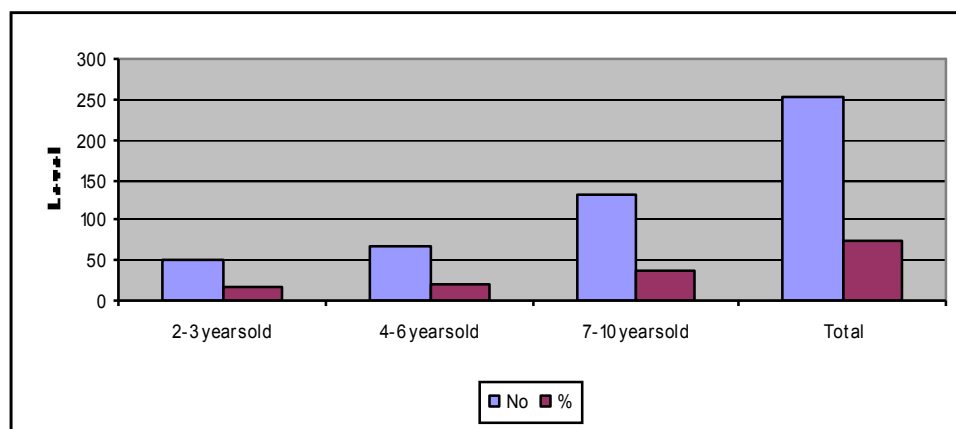
Figure (2): Age susceptibility of Chorioptic mite to Egyptian buffaloes

Plate (1)

| Alopecia, crust on back region | Crust on lower leg region |

Plate (2) Microscopic examinations of skin scraping samples from affected areas revealed numerous Chorioptic mite of all developmental stages.
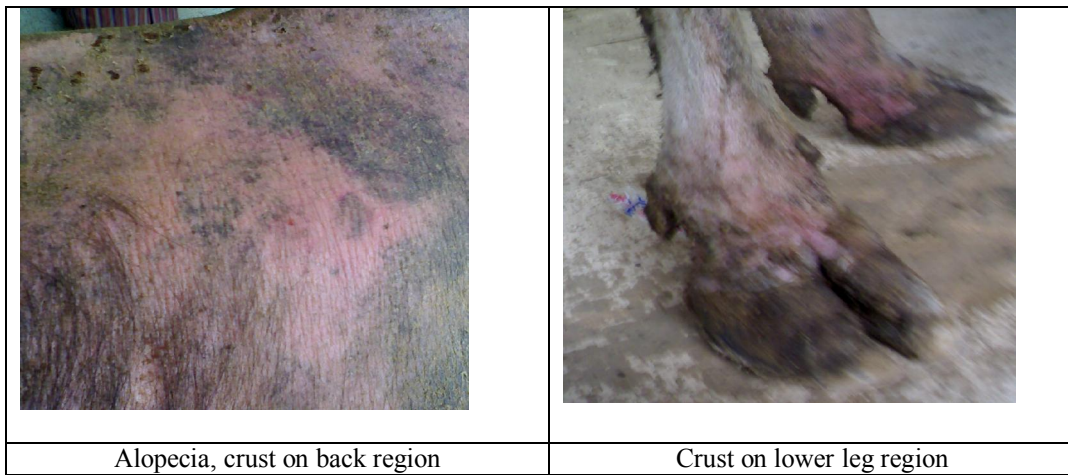

All developmental stages of mites, from the egg to adult stages, were observed from samples collected from affected Egyptian buffaloes (plate 2). Morphologically, pedicels of the mites were short and unjointed. Tarsal suckers occurred on the pedicels of all legs in the adult male and on the first, second, and fourth pair of legs in the adult female.

A single long seta at the tarsus of legs III and the length of legs II being about twice as long as legs IV in adult male mites were observed. Based on these observations, the mites were identified as the genus Chorioptes.

| Different eggs | Larvae of Chorioptic mite |

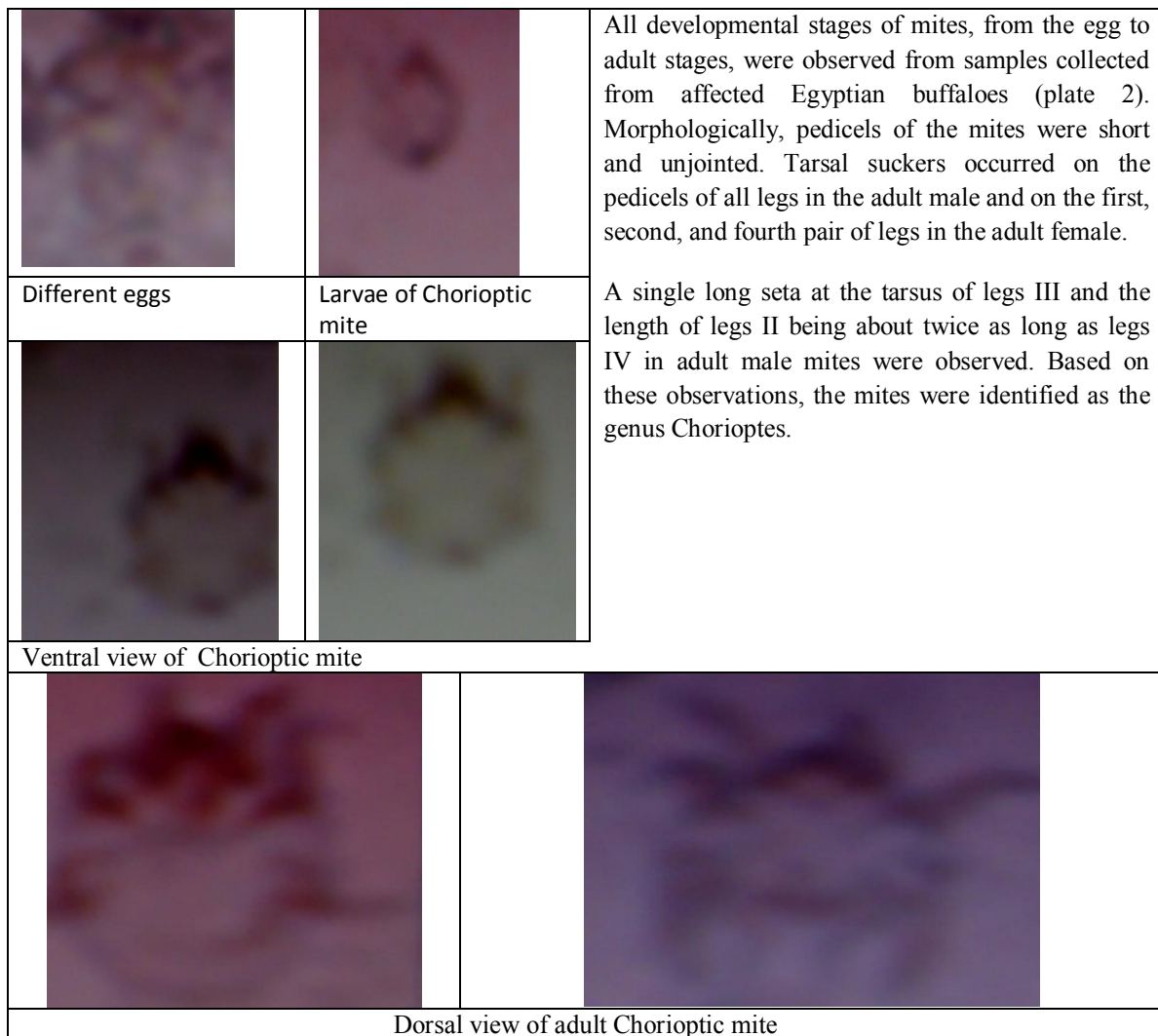Ventral view of Chorioptic mite

Dorsal view of adult Chorioptic mite

Table (3): Average daily milk yield of infested and non infested Egyptian buffaloes.

Animals	Average daily milk yield for 20 days
Infested buffaloes	6.45 liters
Non infested buffaloes	7.75 liters

Means within the same column of different litters are significantly different at (P < 0.01).

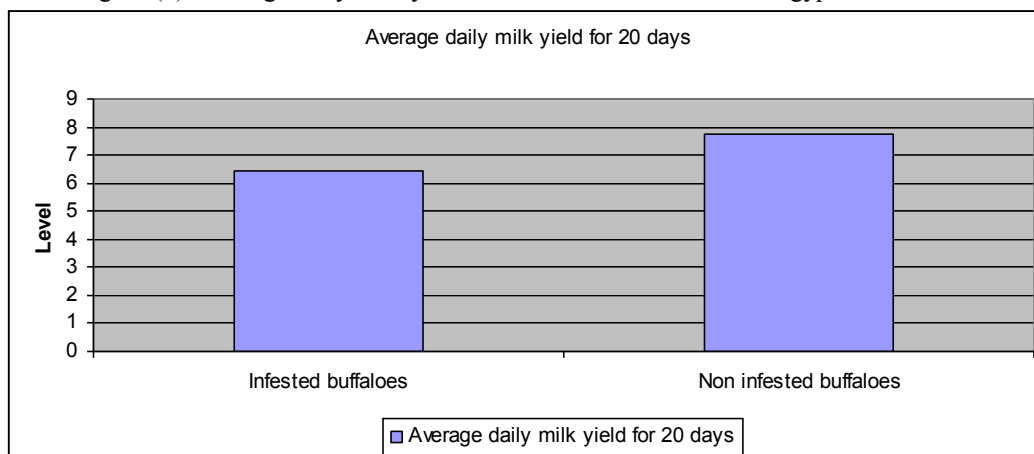Figure (3): Average daily milk yield of infested and non infested Egyptian buffaloes.

Table (4): Cell mediated immune response of Chorioptic mite infested buffaloes as compared with non infested buffaloes as measured by lymphocyte transformation test.

Groups	Lymphocyte transformation index
	$\overline{X} \pm S.D$
Infested buffaloes	A 22.52±6.77
Non infested buffaloes	B 32.45 ± 4 .49

Means within the same column of different litters are significantly different at (P < 0.01).

Figure (4): Cell mediated immune response of Chorioptic mite infested buffaloes as compared with non infested buffaloes as measured by lymphocyte transformation test.

Plate (3)

| Redness and dermatitis on leg region | Chorioptic mite and staphylococcal dermatitis causing crust, corrugations and thickening |

Plate (4)

| Double size limbs of edematous skin disease | Nodules along lymphatic of lower limbs |

Nodules gives pus

Table (5): The role of Chorioptic mite in lower leg regions in the initiation of Staphylococcal dermatitis and edematous skin disease infection

Infectious diseases	Buffaloes infested with Chorioptic mange No = 252		Buffaloes non infested with Chorioptic mange No = 89	
	Infected	Non infected	Infected	Non infected
Staphylococcal dermatitis	92	160	–	89
Edematous skin disease	71	181	8	81
Both diseases	53	199	–	89

$Chi^2 = 6.55*$ *Significant at (P= 0.05)

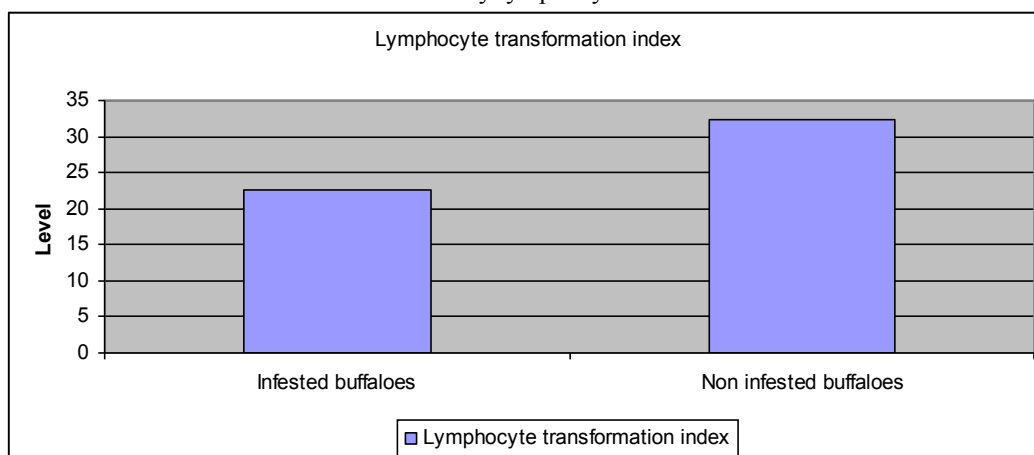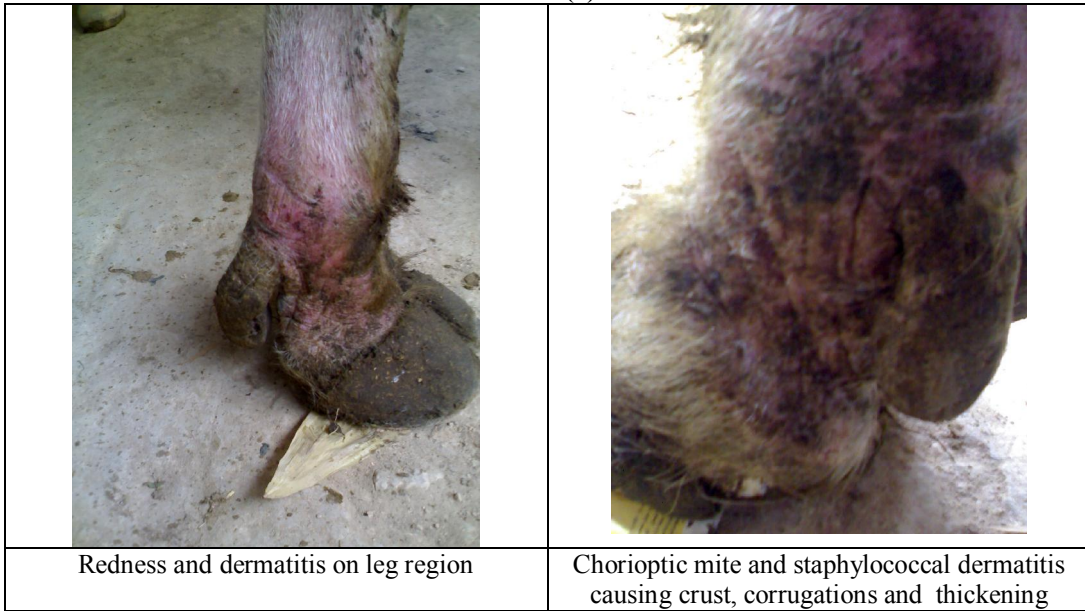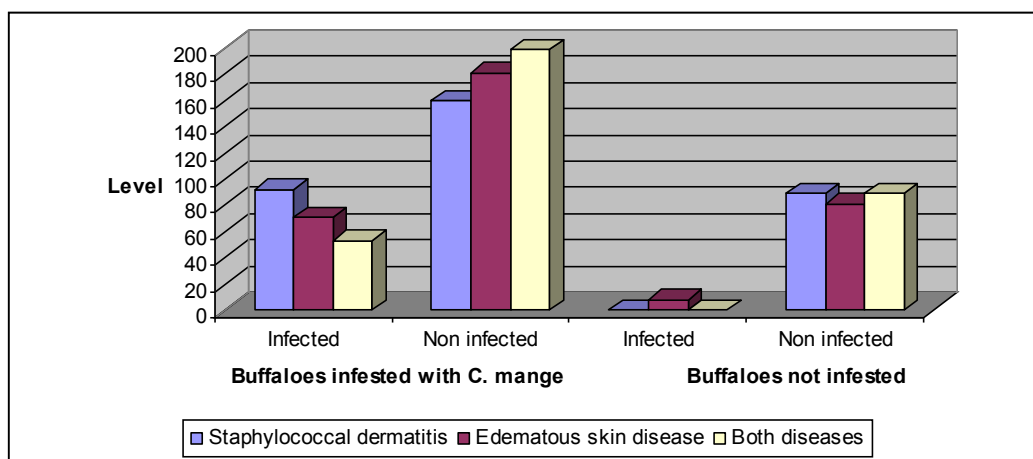Figure (5): The role of Chorioptic mite in lower leg region in the initiation of Staphylococcal dermatitis and edematous skin disease infection.

4. Discussion

Chorioptes mites cause a mild form of skin disease in both domestic and wild ruminants. In July 2006, dermatitis characterized by alopecia, marked lichenification, accumulation of crust, and fissuring was recognized in 14 out of 200 Holstein dairy cattle raised in the cattle farm of the National Institute of Animal Science in Cheonan, Republic of Korea (**24**). *C. texanus* has so far been isolated from both domestic and wildlife animals including goats in Texas, reindeer in Canada, cattle in Brazil, Israel, Germany, and USA and elks in Poland (**3**). In the Southeast Asian countries, *C. texanus* has been reported to infest cattle and goats from Japan (**8**) and Malaysia (**10**). *C. bovis* has been reported to infest the feet of horses, sheep, and goats in the Netherlands (**25**) and in a wild Japanese serow (**9**). *C. texanus* has been found on the body of domestic goats in Texas (**26**).

Incidence of Chorioptic mite was reported in 252 out of 341 Egyptian dairy buffaloes raised in some Egyptian buffalo farms by rate 73.90% as shown in table (1) and figure (1). These result explained significant difference between infested and non infested buffaloes at (P=0.05). Table (2) and figure (2) showed significant difference in age

susceptibility of Chorioptic mite to Egyptian buffaloes at (P=0.05). Numbers of infested buffaloes were 52, 69 and 131 in age groups 2-3 years, 4-6 years and 7-10 years respectively. These results explain that, old ages buffaloes higher susceptible than young ages.

Clinical infestation of Egyptian buffaloes by Chorioptic mite characterized by dermatitis, alopecia, accumulation of crust and fissuring with corrugated skin in lower legs regions, irritation and self-trauma due to pruritus and lamness in many cases. Back, tail base, sacral and perineal regions characterized by accumulation of crust with irritation and trauma due to itching as shown in plate (1). These findings are nearly similar to those found in Korean area (**24**). Skin lesions were distributed mainly over the tail base, and sacral and perineal regions. The observed clinical signs of Chorioptic mites were; crusty lesions in the root of the tail and the grooves on either side, and tend to be localized with moderate pruritus. Initially starting with a varnished surface, later the affected area is covered with fine, dry scales which can spread towards the perineum, escutcheon, inner sides of the thighs, and fetlocks (**19**).

It has been reported that irritation and itching caused by Chorioptic mite become intense when

lesions extend in size and coalesce to form crusts and heavy scabs that can spread even to the sacral region and the udder **(27)**.

Plate (2) shown that microscopic examinations of skin scraping samples from affected areas revealed Chorioptic mites of all developmental stages. Morphologically, pedicels of the mites were short and unjointed. Tarsal suckers occurred on the pedicels of all legs in the adult male and on the first, second, and fourth pair of legs in the adult female. A single long seta at the tarsus of legs III and the length of legs II being about twice as long as legs IV in adult male mites were observed. Based on these observations, the mites were identified as the genus Chorioptes.

Chorioptic mite infestation reduce milk yield as shown in table (3) and figure (3) where average daily milk yield of infested buffaloes was 6.45 ± 0.46 liters as compared with non infested buffaloes 7.75 ± 0.78 liters. These results revealed significant difference in daily milk yield between infested and non infested buffaloes at **(P < 0.01).** This reduction confirmed the indirect effect of mange on milk production **(24)** and **(27).**

In regard to the immune status of infested buffaloes, Table (4) and figure (4) showed that infested buffaloes with Chorioptic mite had lower lymphocyte transformation index which were 22.52 ± 6.77 as compared with non infested buffaloes 32.45 ± 4.49. These results explain the higher susceptibility of infested buffaloes to other infections.

This study considered the first record about the correlation between Chorioptic mite infestation and infection by staphylococcal dermatitis and edematous skin disease. Skin injuries from Chorioptic mite are considered the main route of entry of *C. ovis* and *S. aureus*. Among 252 infested buffaloes with Chorioptic mite, 92 and 71 of them suffered from S. dermatitis and edematous skin disease, respectively, 53 buffaloes showed both infections. 89 non-infested buffaloes with Chorioptic mite, 8 of them showed edematous skin disease and no staphylococcal dermatitis infection as shown in table (5) and figure (5). So Chorioptic mite plays an important role in enhancement staphylococcal dermatitis and edematous skin disease infection.

Staphylococcal dermatitis in lower leg region characterized clinically by lameness, dermatitis of the skin in the form of redness, corrugations and thickening of the skin as shown in plate (3). Staphylococcal scalded-skin syndrome refers to a spectrum of blistering skin diseases caused by *S. aureus* exfoliative toxins (ETs) **(14 and 15)**. These toxins cause intraepidermal splitting through the granular layer by specific cleavage of desmoglein 1, a desmosomal cadherin protein that mediates cell-cell adhesion of keratinocytes in the granular layer **(16)**.

S. aureus infections are known triggers for skin inflammation and can modulate immune responses. These effects can be due to either direct invasion by the bacteria or by bacterial products (**17 and 18).**

Edematous skin disease characterized clinically by fever, enlarged mainly hind limb and opened nodule as shown in plate (4). Edematous skin disease transmitted through skin injuries characterized clinically by painful nodules and ulcer along the course of lymphatic, the nodules soften then ulcerate, development of edematous swelling in dewlap, sides of abdomen, prescapular and poplotial regions and limbs are oedematous and reach double size (**11, 12 and 13).**

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1/5/2012

Factors Modulating School Myopia

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Abstract: To examine the correlation between visual acuity and refractive error of elementary school students with (1) parental vision status; (2) dietary history; (3) visual habits; and (4)in- and out-door activities. 694 (of 731) students from one urban elementary school participated in the study.They underwent visual acuity test and distance retinoscopy together with completion of a multi-item questionnaire with the help of their parents and teachers. There was a decrease in the number of students with 1.0 or better vision from over 50% in Grade 1 to around 20% in Grade 6. At the same time, those with 0.2 or worse vision increased from Grades 1 to 6. No difference was noted between males and females in refractive error. And in parallel to the change in visual acuity, there was a decrease in students with -1D or less and an increase in students with -1D or more of refractive error from Grades 1 to 6. These visual parameters were also associated with mother's(but not father's) refractive error, ingestion of table grapes, near work, and indoor exercises, but not with outdoor activities on weekdays, weekends, or during vacation time. In the absence of efficacious myopia control at present, progression of school myopia maybe minimized through practice of visual hygiene and reduction of indoor hours.

Keywords: school myopia, parental vision, visual hygiene, nutrition

1. Introduction

School myopia is a perennial problem in Taiwan. The Dept of Health reported that in 1986, 1990, 1995, 2000, 2006, and 2011 the respective prevalence of myopia in the first Graders was 3, 6.5, 12.8, 20.4, 19.6, 21.5%, and in the 6th Graders, 27.5, 35.2, 55.8, 60.6, 61.8, and 65.8 [1]. It was increasing clear that the onset of school myopia had become younger and that which was accompanied by increasing severity [2-3]. In fact, the prevalence of myopia was found to be 3.0, 4.2, 4.7, and 12.2% at ages 3, 4, 5, and 6 years, respectively [4]. In the past two decades, the prevention of myopia and its progression has principally been based on medically induced cycloplegia, specifically the use of atropine [5-9]. In one study in Taiwan, multifocal spectacles have been deemed ineffective [6]. The atropine efficacy studies have been done with relatively small numbers of participants usually on a short-term basis of between 1-2 years - except a 5 year study on 20 high myopes [8]. And the results indeed show limited reduction of myopia the progression, but not total cessation.

If the most efficacious treatment to date, i.e., the cycloplegic or atropine therapy, still cannot eliminate school myopia, then other contributing factors must continue to facilitate the increase in ocular axial length, i.e., the underlying cause of the increase in myopia [3,6,10-12]. Studies originating from Taiwan have already shown hereditary and familial components in the development of school myopia [13-15] upon which the environmental factors interact. And it is already well-known that extended outdoor activities can be protective [16-18]. On the other hand, extensive near work, also a major promoter of school myopia [19], has not received intense scrutiny. The same applies to the dietary history which in fact has not been closely examined at all.

In the present study, we have therefore examined the following possible contributing factors: (1) parental refractive status; (2) dietary history; (3) visual habits; and (4) in- and out-door activities by analyzing detailed multiple-item questionnaire completed by the participants and the results reported here.

2. Methodology

As a school-wide vision screening, 731 students from one elementary school in the City of Taichung,

with the consent of their parents, participated in the study. 37 did not complete the questionnaire and were excluded from the final data analysis. The number of total cases analyzed was 694 (Table 1). All students were in good health with only one physically/ mentally impaired student in each Grade and one each with an illness in the 3rd, 4th and 5th Grades.

Table 1: Number of participating students, Grades 1-6; total=694

	Grade 1		Grade 2		Grade 3	
Gender	M	F	M	F	M	F
No	52	43	58	49	66	51
Total	96		107		117	
	Grade 4		Grade 5		Grade 6	
Gender	M	F	M	F	M	F
No	66	70	75	64	51	49
Total	136		139		100	

Visual parameters: All students underwent visual acuity testing using the Snellen E charts at a distance of 6 m. To facilitate the examination process, screening with an autorefractor (Speedy-1, Nicon, Japan) was done first and the data used as the starting point of retinoscopy. Distance retinoscopy was employed to minimize accommodation. It is well-known that non-cycloplegic auto-refraction of children tends to result in over-estimations of myopia [20]. For random sampling prevalence studies involving relatively small numbers of subjects, cycloplegia is crucial [21]. However, in large-scale eye screening such as that in the present study, this is impractical. Not only the limitation in manpower, the dark irises of Taiwanese children would require high doses of cycloplegics and the short-acting tropicamide often used in the surveys in Taiwan [22] appears inadequate, so the dose-timing and the over-dosing for cycloplegic refraction remain a difficulty. In this study, we have used non-cycloplegic auto-refraction [23] supplemented with fogged retinoscopy [24] and retinoscopy with a distant fixation target [20] and have determined that the over-estimate by auto-refraction was less than 5%. Both techniques therefore can be used in mass screening. These tests were performed and finished in 5% school days aided by 3rd and 4th optometry students under faculty supervision in addition to experienced clinicians.

Questionnaire: All participants were given a multi-page questionnaire to be completed with the assistance of their parents and teachers. The questions included (A) the visual status of parents: normal vision or otherwise owing to hyperopia/ myopia/ astigmatism/ amblyopia/ visual handicap – based on self-reported prescription power of current optical correction as well as vision status; (B) dietary history including the intake quantity and frequency of food items such as meats, fruits, vegetables, grains, and beverages as well as nutritional supplements; (C) visual habits including the duration and types of near work and physical activities plus the characteristics of visual environments; and (D) outdoor UV protection: the types and occasion.

Statistical analysis

The data were analyzed with, Independent-Sampling t-test, Point bi-serial correlation, Spearman correlation, and Partial correlation with the SPSS 17 package.

3. Results
3.1 Visual parameters

The results of visual acuity are shown in Table 2; There was a significant difference of those with 1.0 vision between Grades 2-3 with OD: t=3.444, p=0.001; and OS: t=3.224, p=0.001. In general, there was a decrease in the number of students with 1.0 or better vision from Grades 1 to 6, from over 50% to around 20%. In contrast, those with 0.2 or worse increased from Grades 1 to 6.

And the refractive error is summarized in Table 3; The "<-1D" groups included hypeopic values. The results indicated no difference between males and females. And in parallel to the change in visual acuity (Table 2), there was a decrease in students with less than -1D and an increase in students with -1D or more of refractive error from Grades 1 through 6.

Table 2: Change in visual acuity from Grades 1-6

		OD			
Visual Acuity		≤0.1	0.2-0.5	0.6-0.9	≥1.0
Grade 1	Number	2	13	27	53
	Percentage	2.11%	13.68%	28.42%	55.79%
Grade 2	Number	3	18	31	55
	Percentage	2.80%	16.82%	28.97%	51.40%
Grade 3	Number	6	26	36	49
	Percentage	5.13%	22.22%	30.77%	41.88%
Grade 4	Number	10	50	29	47
	Percentage	7.35%	36.76%	21.32%	34.56%
Grade 5	Number	18	46	29	46
	Percentage	12.95%	33.09%	20.86%	33.09%
Grade 6	Number	17	45	18	20
	Percentage	17.00%	45.00%	18.00%	20.00%
		OS			
Visual Acuity		≤0.1	0.2-0.5	0.6-0.9	≥1.0
Grade 1	Number	2	12	28	53
	Percentage	2.11%	12.63%	29.47%	55.79%
Grade 2	Number	1	14	34	58
	Percentage	0.93%	13.08%	31.78%	54.21%
Grade 3	Number	10	26	33	48
	Percentage	8.55%	22.22%	28.21%	41.03%
Grade 4	Number	7	40	37	52
	Percentage	5.15%	29.41%	27.21%	38.24%
Grade 5	Number	16	42	34	47
	Percentage	11.51%	30.22%	24.46%	33.81%
Grade 6	Number	13	38	27	22
	Percentage	13.00%	38.00%	27.00%	22.00%

Table 3: Refractive error based on distance retinoscopy (SE=spherical equivalent) in Grades 1-6

OD

Grade	Sex		SE <-1D	-1D ~ -6D	>-6D
Grade 1	M	Number (Percentage)	44 (84.6%)	8 (15.4%)	0 (0%)
	F	Number (Percentage)	38 (88.4%)	5 (11.6%)	0 (0%)
	Total	Number (Percentage)	82 (86.3%)	13 (13.7%)	0 (0%)
Grade 2	M	Number (Percentage)	47 (81.0%)	11 (19.0%)	0 (0%)
	F	Number (Percentage)	37 (75.5%)	12 (24.5%)	0 (0%)
	Total	Number (Percentage)	84 (78.5%)	23 (21.5%)	0 (0%)
Grade 3	M	Number (Percentage)	39 (59.1%)	27 (40.9%)	0 (0%)
	F	Number (Percentage)	31 (60.8%)	20 (39.2%)	0 (0%)
	Total	Number (Percentage)	70 (59.8%)	47 (40.2%)	0 (0%)
Grade 4	M	Number (Percentage)	28 (42.4%)	37 (56.1%)	0 (0%)
	F	Number (Percentage)	42 (60.0%)	27 (38.6%)	1 (1.4%)
	Total	Number (Percentage)	70 (51.5%)	64 (47.1%)	2 (1.4%)
Grade 5	M	Number (Percentage)	39 (52.0%)	34 (45.3%)	2 (2.7%)
	F	Number (Percentage)	31 (48.4%)	32 (50.0%)	1 (1.6%)
	Total	Number (Percentage)	70 (50.4%)	66 (47.5%)	3 (2.1%)
Grade 6	M	Number (Percentage)	24 (47.1%)	25 (49.0%)	2 (3.9%)
	F	Number (Percentage)	19 (38.8%)	28 (57.1%)	2 (4.1%)
	Total	Number (Percentage)	43 (43.0%)	53 (53.0%)	4 (4%)

OS

Grade	Sex		SE <-1D	-1D ~ -6D	>-6D
Grade 1	M	Number (Percentage)	43 (82.7%)	9 (17.3%)	0 (0%)
	F	Number (Percentage)	39 (90.7%)	4 (9.3%)	0 (0%)
	Total	Number (Percentage)	82 (86.3%)	13 (13.7%)	0 (0%)
Grade 2	M	Number (Percentage)	45 (77.6%)	13 (22.4%)	0 (0%)
	F	Number (Percentage)	35 (71.4%)	14 (28.6%)	0 (0%)
	Total	Number (Percentage)	80 (74.8%)	27 (25.2%)	0 (0%)
Grade 3	M	Number (Percentage)	38 (57.6%)	28 (42.4%)	0 (0%)
	F	Number (Percentage)	27 (52.9%)	23 (45.1%)	1 (2.0%)
	Total	Number (Percentage)	65 (55.6%)	51 (43.6%)	1 (0.8%)
Grade 4	M	Number (Percentage)	30 (45.5%)	35 (53.0%)	1 (1.5%)
	F	Number (Percentage)	38 (54.3%)	31 (44.3%)	1 (1.4%)
	Total	Number (Percentage)	68 (50%)	66 (48.6%)	2 (1.4%)
Grade 5	M	Number (Percentage)	36 (48.0%)	38 (50.7%)	1 (1.5%)
	F	Number (Percentage)	26 (40.6%)	36 (56.3%)	2 (3.1%)
	Total	Number (Percentage)	62 (44.6%)	74 (53.2%)	3 (2.2%)
Grade 6	M	Number (Percentage)	17 (33.3%)	31 (60.8%)	3 (5.9%)
	F	Number (Percentage)	19 (38.8%)	28 (57.1%)	2 (4.1%)
	Total	Number (Percentage)	36 (36.0%)	59 (59.0%)	5 (5.0%)

3.2 Questionnaire analysis

(A)Visual status of parents: There is a significant correlation between mother's subnormal vision and the student's lower visual acuity values and higher spherical equivalents. In contrast, no such correlation with father's vision.

Table 4A: Parental visual status based on current refractive error and vision

	Father	Mother
Normal	266 (38.3%)	238 (34.3%)
Hyperopic	32 (4.6%)	28 (4.03%)
Myopic	360 (51.9%)	399 (57.5%)
Astigmatic	27 (3.9%)	24 (3.5%)
Myopic+astigmatic	74 (10.7%)	79 (11.3%)
Amblyopic	7 (1.01%)	3 (0.43%)
Visually handicapped	2 (0.29%)	2 (0.29%)

Table 4B: Correlation between parental vision and the refractive status of the offspring

		VA (OD)	VA (OS)	SE (OD)	SE (OS)
Father's vision	Correlation	.288	.286	.251	.247
	Significance	.191	.201	.453	.484
Mother's vision	Correlation	.618*	.611*	.603*	.591*
	Significance	.000	.001	.001	.002

VA: visual acuity；SE: spherical equivalent
*significant correlation with p= 0 to 0.002.

(B)Dietary history: After adjusting for gender, grade, and age, no correlation was found between visual acuity/spherical equivalent and the intake of (i) meats; (ii) vegetables and grains; (iii) poultry and fish; or (iv) frequency of beverage intake and (v) sugar contents of the beverages. Unexpectedly, from 29 categories of food items, one - the frequency of ingesting table grapes (never, <once/week, 1-2 times/week, 3-4 times/week, or daily) -showed a strong positive correlation with visual acuity (r=0.574; p=0.011) and spherical equivalent (r=0.485; p=0.042).

(C)Visual habits: The analysis was adjusted for gender, grade, and age. Correlation between visual

acuity/spherical equivalent with various physical and environmental factors is shown below: It shows a strong negative correlation of the visual parameters with reading. In contrast, proper visual hygiene (e.g., reading distance, rests) was associated with a positive correlation(Table 5). The weak association with indoor physical activities remains to be further investigated.

There was, however, no correlation between visual acuity/spherical equivalent and (i) weekday after-school static or physical activities; (ii) duration of TV watching at all times; (iii) duration of outdoor activities at all times; (iv) illumination of desks; (v) room illumination for TV watching; (vi) illumination for computer use; (vii) heights of reading desk and chair; (viii) heights of computer desk and chair; (ix) rest after 30-min TV viewing; or (x) activities before sleep.

Table 5: Summary of correlation analyses; N.C.= no correlation

Items	Visual acuity	Spherical equivalent
Textbook reading/ writing, weekdays (<30 min to >3 hrs)	r= -0.578; p=0.010	r= -0.493; p=0.033
Leisure reading, weekdays (<30 min to >3 hrs)	r= -0.612; p=0.003	r= -0.518; p=0.017
Reading: weekends /vacations (<30 min to >3 hrs)	r= -0.556; p=0.012	r= -0.556; p=0.012
Indoor physical exercises, weekdays (<30 min to >3 hrs)	r=0.475; p=0.047	N.C.
Weekend/vacation indoor physical exercises (<30 min to >3 hrs)	r=0.485; p=0.042	N.C.
Duration of computer use (<30 min to >3 hrs)	N.C. weekdays, weekends, and vacations	r= -0.504; p=0.019, vacations
Reading distance > 30cm (never to always, 5 rating levels)	r=0.582; p=0.009	r=0.540; p=0.010
Rest after 30-min reading (never to always, 5 rating levels)	r=0.630; p=0.000	r=0.508; p=0.013
Use of different Rx for daily and near activities (never to always, 5 rating levels)	r=0.830; p=0.000	r=0.786; p=0.000
Hours of sleep (<6 to >10 hrs,5 grades)	r=0.692; p=0.000	r=0.492; p=0.034
Distance from TV (from inadequate to excellent, 5 rating levels)	N.C.	r=0.491; p=0.036

(D)Outdoor protection: After adjusting for gender, grade, and age, no correlation was found between visual acuity and (i) sunglasses wear or (ii) lenses with anti-UV coating or UVresistant contact lenses. Also, no correlation between the spherical equivalent and (i) sunglasses wear or (ii) use of broad-rimmed hats or sun parasols.

On the other hand, correlation was found between visual acuity and (i) positively with the wear of regular spectacles (r=0.911; p=0.00) and (ii) negatively with the use of hats/parasols (r= -0.477; p=0.045). Also between spherical equivalent and (i) the wear of regular spectacles (r=0.915; p=0.000) or (ii) UV-resistant lenses (r=0.660; p=0.000).

The common element appears to be outdoor wear of daily spectacles in the preservation of visual acuity and refractive error.

4. Discussion

Cycloplegic therapy remains the only choice for slowing myopia progression at present [5-9, 25] even though long-term efficacy and side-effects are both still unclear. In fact, the acceptance of this therapy in Taiwan is not absolute at all [26]. A re-examination of hereditary and environmental factors is therefore necessary. There are in fact some previous unknown albeit notable results in the present study:

(1) A correlation of visual parameters with the mother's, but not the father's, visual status (Table 4B). This is in part in agreement with a recent study from Taiwan which reported a parental association [18] and with another from Singapore, the increasing odds of myopia development if both parents were myopic [27].

(2) Table grapes, among an exhaustive list of food items (29 categories), appeared to associate with less change in the visual parameters. This is probably the only nutritional correlation reported to date.

(3) Among the several environmental elements, such as TV watching and room lighting, outdoor activities also did not affect the visual parameters. It should be qualified that the elementary school at which the present study was performed was located in an urban setting. This result is in harmony with that reported in Ref [22] –also done in an urban area. The outdoor activities in the rural areas[16, 18] where much lower myopia prevalence was observed maybe owing to activities quite different from that in the urban schools.

Since the cycloplegics cannot totally remove myopia, other factors, i.e., those related to visual hygiene must be re-examined and the results put in practice. For example, from Table 5, it maybe advantageous for the students to adhere to the

common sense approach to (i) reduce the time spent on reading and writing, take a break after every 30 min, and read at >30 cm; (ii) wear glasses outdoors; and (iii) exercise indoors and get enough sleep. In addition, reading with a near aid (perhaps other than multi-focal lenses [6]) appears beneficial. It remains unknown how effective these measures, when combined, will reduce the potential of myopization. Perhaps in the near future, good visual hygiene with optical aids that avoid, e.g., peripheral hyperopic defocusing caused by conventional lenses [28] can replace or be worn in conjunction with cycloplegic therapy at an early stage [26]. It is, however, abundantly clear that after two decades, a truly effective myopia therapy still awaits development.

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Expression Changes of Genes Related to Chromosome Remodeling Caused by Implantation with Low-energy N+ Beam in Rice

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Abstract: In order to investigate expression changes of genes related to chromosome remodeling induced by implantation with low-energy N+ beam in rice, the differentially expressed genes related to chromosome remodeling in treated samples ($6 \times 10^{17} N^+/cm^2$), were screened using Agilent gene chip. The results showed that, in the treated samples, 1 out of 30 genes related to histone deacetylase was up-regulated. Expressions of 48 genes related to histone acetyltransferases (HATs), two SNF2-related domain containing proteins and one SWIM Zn-finger domain containing protein were up-regulated, one SWIB/MDM2 domain containing protein and one TAFII55 protein conserved region domain containing protein were down-regulated, expression of 3 GCN5-related N-acetyltransferase domain containing proteins were significantly different, in which one was up-regulated and two down-regulated. There are several conserved protein domains related to chromosome remodeling on the Microarray, Expressions of 2 of 38 bromodomain related genes were changed of which one is up-regulated and the other down-regulated. Expressions of 2 of 7 chromodomain related genes and 8 of 36 SET related genes were up-regulated. Besides, one expression of 14 LSD1 type domain containing protein was significantly up-regulated. These findings suggest that the expression changes of genes related to chromosome remodeling may regulate the expression of certain genes responding to ion implantation, and induce the biological effect of the rice implanted by ion beam.

1. Introduction

Higher plant cell differentiation and development was controlled by the activation or silence of specific genes on the time and space, this expression pattern changes required chromatin structure reconstruction of the DNA promoters and other regulatory regions. Chromatin reconstruction led to gene activation or silence through promoting the "open" or "off" of chromatin configuration (Huang, 2008). Chromatin remodeling is achieved through ATP dependent physical modifications and covalent chemical reactions. ATP dependent chromatin remodeling factors use the energy of ATP hydrolysis to introduce superhelical torsion into DNA and to alter the rotational phasing of the DNA on the surface of the histone octamer, thus to increase the accessibility of the nucleosomal DNA to transcription factors and restriction enzymes(YA, 2011). Covalent chemical reactions dependent chromatin remodeling is the various chemical post-translational modification of histone amino-terminal, it is an important epigenetic regulation for chromatin structure and gene activity (Ng, 2000). The level of chromatin structure modification have an effect on genes expression, it is an important genetic

basis for epigenetic phenomenon.

There are two gene clusters related to chromosome remodeling. Su(var) (suppresses variegation) proteins induce chromatin silence, including histone deacetylases (HDACs), protein phosphatases (PPTases), S-adenosylmethionine synthetase, heterochromatin protein HP1 and so on. On the contrary, E(var) (enhances variegation) proteins enhance the activity of nucleosome, including ATP-dependent nucleosome remodeling elements, such as SWI/SNF，brahma complex and so on. Gene products of Su (var) and E (var) also include some conserved protein domains, such as bromo-, chromo, SET, and all that (Li, 2010).

In recent years, it has become an important means to research plant genetics and breeding, growth and development, stress response and other biological effects using low energy N+ beam to induce plant seeds (Zuo, 2003). In this study, the germination rate, dry weight, average vigor index of rice seeds have significantly improved by adopting the above method. Total mixed RNAs from the promoted-growth rice seedlings were isolated, hybridized with the Agilent GeneChip, which is genome expression chip. The data analysis showed that, in the treated samples (low

energy N⁺ beam induced), the expressions of genes related to chromosome remodeling were significantly improved in comparison to untreated samples. We analyzed the different expression of genes related to chromosome remodeling between treated samples and untreated samples, to investigate the inherent connection between their expressions and phenotype changes of the treated rice.

2. Plant materials

Dry seeds of rice cultivar Xindao-18 (*Oryza sativa L. ssp. japonica*) were used in ion implantation. After being implantation of the ion beam, all seeds were planted on sterile medium with 0.8% agar (Sigma) in a climate chamber under the dark at 28℃ for 96-hours. Then the seedlings were randomly divided into two groups, one group was used to RNA isolation, while the other was used to evaluate seed vigor index from the 10-days-old seedlings grown in a climate chamber under a 12-hr dark/12-hr light cycle at 28℃.

3. Methods

Implantation of low-energy N⁺ ion beam and investigation of simplified seed vigor index

The low-energy ion beam implantation of seeds was performed with Ion Beam Bioengineering Facility (UIL.0.512, TNV. Russia). For implantation, germs of seeds (62 days after harvesting) were upward to the coming-energetic ion beam and endosperms of seeds were downwardly immersed into the polyfoam fixed in the sample discs and then put into target chamber of the facility. When the vacuum situation of target chamber was below 10^{-2} Pa, the seeds in sample disc were implanted with low-energy (40 KeV) N⁺ with the ion fluencies: 6×10^{17} N⁺/cm². The control seeds incubated under normal condition. After implantation, all seeds were planted on sterile medium with 0.8% agar (Sigma) in a climate chamber under the dark at 28℃. Two hundred seeds were implanted in each experiment, with three replicates. The germination rate (from one hundred seeds) was investigated from the 10-days-old seedlings, and the seedlings were oven dried at 80℃ for 12h to investigate the dry weight.

Germination rate = Number of the seedlings/total seeds×100%

Simplified seed vigor index =Drought weight of the seedlings ×Germination rate

Data were pooled from three independent experiments.

RNA extraction

Total mixed RNAs from the promoted-growth rice seedlings were isolated using RNA plant reagents (Tiangen Biotech) and purified by use of the RNeasy Plant Kit (Qiagen). The yield and purity of RNA were determined spectrophotometrically (Nanodrop ND1000). Thirty uniform rice seedlings were used to extract the total RNA to construct the RNA pool of a biological replicate. So, at least 6 total RNA pools were constructed, including 3 control samples, 3 samples implanted by ion implantation.

Agilent GeneChip hybridization and data analysis

The Agilent GeneChip hybridization (Agilent Rice Oligo Microarray (4×44K) Genome Array) and raw data analysis were carried out by the *ShanghaiBio Company Ltd.,* including the procedures for cDNA and cRNA synthesis, cRNA Cy3 fluorescence labeling (GE healthcare PA13105), hybridization (Agilent G2545A), washing, scanning (Agilent G2565BA Microarray Scanner System), data collection and normalization. This experiment was performed three times, resulting in three biological replication samples for ion fluence for the significant statistics.

To screen the differentially expressed transcripts of genes related to chromosome remodeling between the implanted samples and the controls, we collect the expression signals, sorted the differentially expressed transcripts data in Excel. Based on the statistics analysis, a transcript was considered significantly up-or down regulated if it met all of the following criteria: 1) showed statistically significant differential expression at adjusted p value < 0.05; 2) had a cut-off value a 1.5-fold change; 3) had "present" calls on all of the three replicates samples for the controls and/or the implantation.

4. Results

Simplified vigor index

The results (Table1) showed that implantation of the N⁺ beam (6×10^{17} N⁺/cm²) enhanced the vigor index (P ＜0.05). In order to investigate the important molecular mechanism in encouraged rice seedlings responding to ion-beam implantation, we isolated the total mixed RNA from the samples underlying the exposure with ion-beam implantation influx: 6×10^{17} N⁺/cm² for the Agilent GeneChip hybridization. (Simplified vigor index was investigated using the 10-day rice seedlings in each independent experiment replicates. Fluence referring to 6×10^{17} N⁺/cm²; STD, standard deviation.)

Differentially expressed transcripts of HDAC1

OsHDAC1 encodes a histone deacetylase. The higher the degree of histone acetylation for gene promoter is, the greater the activity of gene expression is. *OsHDAC1* play an important role in regulating gene expression on the epigenetic through control histone deacetylation of gene promoter. There are 30 genes related to histone deacetylase on the Microarray, one of them is differentially expressed and up-regulated in the treated samples (Table2).

Differentially expressed transcripts of HATs

Histone acetyltransferases (HATs) have been shown as positive regulators in eukaryotic transcription. The histone acetyltransferases are divided into five families.

These include the Gcn5-related acetyltranserases (GNATs), the MYST-related HATs, p300/CBP HATs, the general transcription factor HATs, which include the TFIID subunit TAF250, and the nuclear hormone-related HATs SRC1 and ACTR (SRC3) (Torchia, 1998). There are 48 genes related to histone deacetylase on the Microarray, 8 of them are differentially expressed in the treated samples (Table3).

Differentially expressed transcripts of genes about conserved protein domains related to chromosome remodeling

Bromodomains, evolutionarily conserved functional domains, can specifically interact with acetyl-lysine peptides to regulate histone acetylation through inhibiting HATs activity at specific sites involving in changes in chromatin structure and transcriptional regulation (Chen, 2001). The Chromatin Organization Modifier (Chromo) domain is defined as a 30~70 amino acid residue protein module found in many proteins involved in the assembly of protein complexes on chromatin. Chromo domains promote protein binding to methylated lysines in the tail region of histone H3. Chromo domains can function individually or in tandem, as with CHD1, to recognize specific methylated Histone tails (Jacobs, 2002). SET (Su (var),

Enhancer of zeste, and Trithorax) domain protein family members share the conserved SET domain. They participate in protein methylation, chromosome structure adjustment, and gene expression regulation, and play important roles in plant development (Zhang, 2009). There are several conserved protein domains related to chromosome remodeling on the Microarray, 2 of 38 bromodomain related genes have significant differences expression, one is up-regulated and the other down-regulated. Expressions of 2 of 7 chromodomain related genes and 8 of 36 SET related genes are significantly up-regulated (Table4).

Differentially expressed transcripts of LSD1

LSD1-like proteins are a family of plant-specific transcription factors that contain a specific class of C2C2 type zinc finger domain. Two members of this family have been identified and proved to control plant programmed cell death (PCD) in *Arabidopsis*. Southern blot indicated that *OsLSD1* is a single-copy gene in rice. Furthermore, the *OsLSD1* gene was expressed constitutively in rice root, stem and leaf (Wang, 2005). There are 14 genes related to LSD1 on the Microarray, of which one is differentially expressed and up-regulated in the treated samples (Table5).

Table1. Simplified vigor index of implanted seeds

Samples	Germination rate (Mean% ±STD)	Vigor index (Mean ±STD)	P-value to T-test
Controls	81.85±2.31	9.55±1.69	
Fluence	88.89±0.00	14.52±1.36	0.017

Table2. Differentially expressed transcripts of *HDAC1* in rice seedlings germinating from the implanted seeds

ProbeName	Description	P-value	FC	Regulation
Os06g0583400	Histone deacetylase HDAC1	0.004	2.02	up

Table3. Differentially expressed transcripts of *HATs* in rice seedlings germinating from the implanted seeds

ProbeName	Description	p-value	FC	Regulation
Os03g0747600	GCN5-related N-acetyltransferase domain containing protein	0.042	1.60	up
Os09g0488000	GCN5-related N-acetyltransferase domain containing protein	0.030	1.78	down
Os11g0525800	GCN5-related N-acetyltransferase domain containing protein	0.023	1.60	down
Os09g0133000	SWIB/MDM2 domain containing protein	0.042	1.52	down
Os09g0480300	SWIM Zn-finger domain containing protein	0.031	1.84	up
Os02g0114000	SNF2-related domain containing protein	0.022	1.80	up
Os04g0629300	SNF2-related domain containing protein	0.037	1.84	up
Os01g0648500	TAFII55 protein conserved region domain containing protein	0.014	1.83	down

Table4. Differentially expressed transcripts of genes about conserved protein domains related to chromosome remodeling

ProbeName	Description	P-value	FC	Regulation
Os02g0699900	Bromodomain transcription factor containing protein	0.002	1.77	down
Os02g0742000	Bromo adjacent region domain containing protein	0.004	1.72	up

Os07g0497000	Chromodomain helicase-DNA-binding protein Mi-2 homolog (dMi-2).	0.012	1.86	up
Os07g0660200	Chromodomain-helicase-DNA-binding protein, CHD-1-related.	0.001	1.47	up
Os08g0180100	Nuclear protein SET domain containing protein.	0.012	2.02	up
Os05g0490700	SET domain protein SDG111	0.017	1.86	up
Os09g0556700	Nuclear protein SET domain containing protein	0.031	1.56	up
Os02g0708600	Nuclear protein SET domain containing protein	0.008	1.53	up
Os02g0725200	Nuclear protein SET domain containing protein	0.008	1.51	up
Os04g0423600	Nuclear protein SET domain containing protein	0.001	1.48	up
Os09g0134500	Trithorax-like protein 1	0.013	1.52	up
Os12g0613200	Trithorax protein.	0.017	1.45	up

Table5. Differentially expressed transcripts of *LSD1* in rice seedlings germinating from the implanted seeds

ProbeName	Description	P-value	FC	Regulation
Os08g0223700	Zn-finger, LSD1 type domain containing protein	0.034	1.55	up

5. Discussion and Conclusion

Histone deacetylases (HDACs), as negative regulators in eukaryotic transcription, modulate chromatin structure and transcription. These results demonstrate that OsHDAC1 overexpression in transgenic cells both yields enzymatically active HDAC complexes and induces changes in histone acetylation *in vivo*. Its overexpression leads to a range of novel phenotypes, involving seedling root growth (Chung, 2009) and growth rate increased and plant architecture altered, which suggests that OsHDAC1 functions in the genome-wide programming of gene expression (Jang, 2003). In this experiment, the up-regulation of *OsHDAC1* may be one of the reasons for significant increase of the seeds vigor index.

In most cases, histone acetyltransferase exist as a member of multisubunit complex. Gcn5, as part of the SAGA, ADA or HAT–A2 complexes, acetylates nucleosomes *in vitro* (Sendra, 2000). The Gcn5-related N-acetyltransferases (GNAT) as positive regulators in eukaryotic transcription, catalyze the transfer of the acetyl from the CoA donor to a primary amine of the acceptor. The SWI/SNF family of complexes utilizes the energy of ATP hydrolysis to remodel chromatin structures, thereby allowing transcription factors to gain access to DNA. SWIB domain is a conservative structure protein found in BAFb (one component of The SWI/SNF family of complexes). The SWIB and the MDM2 domains are homologous and share a common fold (Bennett-Lovsey, 2002). Zinc finger proteins are the most abundant transcription factors in eukaryotic genome, it play a key role in regulating plant defense gene expression and resistance reactions. SWIM (SWI2/SNF2 and MuDR) zinc-binding domain, which is found in a variety of prokaryotic and eukaryotic proteins (Laity, 2001). SNF2-related domain is found in proteins involved in a variety of

processes including transcription regulation, DNA repair, DNA recombination, and chromatin unwinding (Eisen, 1995). SNF2 functions as the ATPase component of the SNF2/SWI multisubunit complex, which utilizes energy derived from ATP hydrolysis to disrupt histone-DNA interactions, resulting in the increased accessibility of DNA to transcription factors. The general transcription factor, TFIID, consists of the TATA-binding protein (TBP) associated with a series of TBP-associated factors (TAFs) that together participate in the assembly of the transcription preinitiation complex. TAF(II)55, as the TFIID component, binding to TAF(II)250 inhibits its AT activity. Importantly, the addition of recombinant TAF(II)55 to *in vitro* transcription assay inhibits transcription of TAF(II)250-dependent MHC class I. Thus, TAF(II)55 is capable of regulating function of TAF(II)250 by modulating its AT activity (Gegonne, 2001).

Bromodomains are evolutionarily conserved functional domains and can specifically interact with acetyl-lysine peptides to regulate histone acetylation through inhibiting HATs activity at specific sites. Bromodomain may be associated with acetylation of gene activation too, because almost all transcription-related HATs contain Bromodomain (Chen, 2001). Chromodomain helicase-DNA-binding protein (Mi-2/CHD) is subfamily of Chromatin-remodeling complexes (CRCs), which mediate ATP-dependent alterations of DNA–histone contacts and provide essential links between signaling pathways and the chromatin-based control of transcription, replication, repair, and recombination (Tomasz J. Sarnowski, 2005). EST expression data analysis showed that the expression of rice SET structural genes were the most abundant in callus, secondly in bud, which indicates that SET domain

genes may have a very close relationship with rice development (Zhang, 2009).

Zinc finger LSD1 plays a negative role in regulating plant PCD and hypersensitive response, as a positive factor in callus differentiation. Plants over-expressing LSD1 show increased content of chlorophyll b and enhanced resistance to virulent rice blast fungus. Callus over-expressing LSD1 shows accelerated differentiation and plant regeneration (Wang, 2005).

It can influence each other between the different modifications of histone, that is, one modification can often accelerate or inhibit the another modification (Wang, 2001). Different modifications can induce a special chromatin state in the manner of combine or order. Chromatin structure often changes due to the modification of various complexes, affecting DNA replication, recombination, repair, transcriptional control and so on (Huang, 2008).

Low-energy ion beam implantation is characterized as limited physiological damages, wide mutation spectrum in present generation, and the partial of phenotypic variation in the present generation can be inhered to offspring. However, many phenotypic variations did not genetically occur in the following generation, such as M4, M5 generation. As a review (Li, 2007) showed that ion beam implantation can induce DNA methylation, normal chromosome segregation, and early segregation. So we thought that low-energy ion beam implantation can induce epigenetic inherence and phenotypic variation in implanted present generation (M1). However, little information was attempted to investigate the likely molecular mechanism on epigenetic inherence caused by implantation of ion beam. This study should provide new insights into the further understanding of molecular mechanism on ion-beam implantation biological effects.

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