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CONTENTS

574	**The Present Status of the Red Sea Coral Reefs between Haql and Yanbu, Saudi Aarabia** Mohammed Saleh Bakur Hariri	**3852-3859**
575	**Households' Access to Insecticide Treated Nets (ITN) and Malaria Morbidity in Rural Nigeria: A Two-Stage Least Square Approach** Foluso Fadekemi Ajayi and Abayomi Samuel Oyekale	**3860-3866**
576	**Nutritional Outlooks of *Moringa oleifera* and African Malnutrition Challenges: A Case Study of Nigeria** Abayomi Samuel Oyekale	**3867-3872**
577	**Households' Willingness to Pay (WTP) for the National Health Insurance Scheme (NHIS): The Case of Ojo Local Government Area of Lagos State, Nigeria** O.F. Omonira and A.S. Oyekale	**3873-3877**
578	**A Truncated Poisson Modeling of Visitors' Use-Values of Addis Ababa Lions Zoological Park, Ethiopia** Goshu Mekonnen Andualem and Abayomi Samuel Oyekale	**3878-3884**
579	**Factors Influencing Households' Preferences for Traditional and Modern Health Care Services in Debre Birhan, Ethiopia** Goshu Mekonnen Andualem and Abayomi Samuel Oyekale	**3885-3891**
580	**Linkages Between Non-Income Poverty, Growth and Inequality in Nigeria: A Two Stage Least Square Approach** Abayomi Samuel Oyekale	**3892-3901**
581	**Osteopontin In Patients With Primary Knee Osteoarthritis: Relation To Disease Severity** Hanan Elsebaie, Hebatallah A. Elchamy, Eman A.Kaddah , Ramy G.Abdelfattah	**3902-3909**
582	**Evaluation and study of the correlation between the human capital strategy and organizational performance** Masoumeh Jahani, Mohammadtaghi Abedian	**3910-3917**
583	**Thoughts of death and destruction in the Persian Poets (The approach of the idea of Nizami Ganjavi's poem Khosrow and Shirin)** Abbas soltany gerdfaramarzy	**3918-3920**
584	**The Place of Child Victimization in Iran Penal Law and International Documents based on the Applications of Physical Persecution in the Family** Moloukossadat Mousavi Mirak	**3921-3923**
585	**Prevalence of Disabilities among preschool children in one selected village of Beni-suif Governorate** Abeer Mohamed E. Eldeeb, Basma Rabie Abdel sadik , Mohammed Meabed	**3924-3930**
586	**Fuzzy AG-Subgroups** I. Ahmed, Amanullah, and M. Shah	**3931-3936**

587	**Kidney Injury Molecule -1 (KIM-1): an early novel biomarker for Acute Kidney Injury (AKI) in critically – ill patients** Gamal F. EL Naggar , Hesham A. El Srogy, Sameh M. Fathy.	**3937-3943**
588	**SVC Application for Stability Improvement of Multi Machine Power System** Mojtaba Shirvani, Ahmad Memaripour, Mostafa Abdollahi, Asadollah Salimi	**3944-3948**
589	**Subsistence Farming and Food Security in Cameroon: A Macroeconomic Approach** AMBAGNA Jean Joël; KANE Gilles Quentin, OYEKALE, Abayomi Samuel	**3949-3954**
590	**Efficiency of Groundnuts/Maize Intercropped Farms in Zoetele, South Cameroon: A Data Envelopement Approach** Gilles Quentin Kane, Sikod Fondo and Abayomi Samuel Oyekale	**3955-3962**
591	**The Role of Balanced Scorecard Implementation on Financial Performance Transparency** Arezo Torabi Moghaddam	**3963-3970**
592	**Theater Therapy and its Integration with Improvisation** Salva Shamseddini Lory, Soghra Yousefi, Armindokht Ahmadi, Rahim Naseri, Fatemeh Torfi	**3971-3978**
593	**The study of relationship between earning management through real activities and cash flow operation in companies accepted in Tehran Stock Exchange** Foad Eshghi , Mohammad Khorasani Amoli, Fatemeh Chaman Sedigheh Mansouri	**3979-3985**
594	**Effect of the Expousre to Low Dose of Ionizing radiation on KAU Hospital Medical Stuff by Using Early Response of Biological Dosimetry** Refaat I. F. EL-Fayoumi , Mohammed H. Saiem Al-Dahr, and Salah M kamal	**3986-3994**
595	**New exact solutions of Boiti-Leon-Manna-Pempinelli equation using extended F-expansion method** A.S. Alofi and M.A. Abdelkawy	**3995-4002**

The Present Status of the Red Sea Coral Reefs between Haql and Yanbu, Saudi Aarabia

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Abstract. The coral reefs statuses of the Saudi Arabia Red Sea and Gulf of Aqaba coasts have not been assessed since 1990. A comprehensive field survey, funded by King Abdulaziz City for Science and Technology, was carried out to check the present status of the coral reefs along the northern Red Sea and Gulf of Aqaba coasts. The coral reefs and reef-associated communities were investigated in situ in the field and the results were compared with the previous studies. The study revealed that most reefs in the study area (from Haql to Yanbu) are in good to excellent condition in terms of the ratio of live to dead coral cover. There was little to no direct human impact (e.g. destructive fishing, anchor damage, coral mining or pollution) on the great majority of reefs, other than reefs in urban areas subject to land reclamation, urban run-off and pollution or littering. Most damaged reefs occur in the immediate vicinity of the major coastal cities and towns especially off AlQof, AlWajh and Yanbu. At most sites outside these areas, levels of injury and death of corals were low. No evidence of mass bleaching or other forms of major coral mortality were found during surveys. Most reefs appeared to be in good condition.
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Keywords: Corals, Reefs, Red Sea, Saudi Arabia.

1. Introduction

The Red Sea is one of the most important repositories of marine biodiversity in the world. Its relative isolation has given rise to an extraordinary range of ecosystems, biological diversity and endemism, particularly among reef fishes and reef-associated organisms. The coral reefs of the Red Sea are comprised of over 200 species of *Scleractinia* corals, representing the highest diversity in any section of the Indian Ocean. The warm water and absence of fresh water run-off provide suitable conditions for coral reef formation adjacent to the coastline. In the northern Red Sea the coast is fringed by an almost continuous band of coral reef, which physically protects the shoreline. Further south the shelf becomes much broader and shallower and the fringing reefs gradually disappear and are replaced with shallow, muddy shorelines. Coral reefs become more numerous in the offshore parts of this coast. Although many reef areas in the Red Sea are still in a pristine state, threats are increasing rapidly and reefs are being damaged by coastal development and other human activities (DeVantier and Pilcher, 2000). Major threats include: land-filling and dredging for coastal expansion; destructive fishing methods; damage by the recreational SCUBA diving industry, shipping and maritime activities, sewage and other pollution discharges; lack of public awareness, and insufficient implementation of legal instruments that affect reef conservation.

Several research studies have been carried out in Saudi Arabian waters, spanning much of the eastern Red Sea (Mergner, 1984, Sheppard *et al.,* 1992). The first major broad-scale surveys of coastal and marine habitat types and biodiversity of the Red Sea coast were undertaken (Ormond *et al.,* 1984a-c), which identified ~70 key sites for conservation, and also recommended establishment of five larger multiple-use marine protected areas (MPAs) in the Gulf of Aqaba, the Tiran Island chain, AlWajh Bank, the Outer Farasan Bank and part of the Farasan Islands. Reef types and composition of the coral fauna of the Saudi Arabian Red Sea were assessed in the early-mid 1980s (Sheppard & Sheppard, 1985, 1991, and Antonius *et al.,* 1990), producing a comprehensive coral species inventory for the Saudi Arabian Red Sea. Subsequently, a monitoring program was conducted during 1987-1988, investigating coral reef health and surrounding water quality along the Saudi Arabian Red Sea coast (Awad, 2000). In 1997, the distribution and composition of coastal and marine habitats of the central-northern Red Sea, from north of Jeddah to Haql in the Gulf of Aqaba were assessed in a 2 years study conducted jointly by the National Commission for Wildlife Conservation and Development (NCWCD) and Japanese International Co-operation Agency (JICA). This study produced detailed site bio-inventories for corals, fish, other benthos, algae, sea-grasses, coastal vegetation and birds, and assessed the distribution and abundance of marine mammals and turtles. Combined with socio-economic assessments of patterns of human use and detailed habitat mapping prepared from aerial photos

and satellite images, the data were used to define key reefs and larger reef areas of high conservation significance for MPA planning (NCWCD-JICA, 2000, and DeVantier and Pilcher, 2000). Further south in the Farasan Islands Marine Protected Area (FIMPA), abundances of live coral, dead coral, and coral-feeding crown-of-thorns starfish *Acanthaster planci* and snails *Drupella spp.* were assessed in 1999 (Al-Yami & Rouphael, 2000). Since 1990 no detailed *in situ* studies have been carried out to investigate the status of coral reefs along the Saudi Red Sea coast. Therefore, the present study is initiated –as part of Triple-Phase project funded by King Abdulaziz City for Science and Technology in Ryiadh- to reveal the present status of coral reefs and reef-associated communities in northern Saudi Red Sea coast between Haql and Yanbu.

The study area

Saudi Arabia's Red Sea coastline extends about 1800 km from Jordan to Yemen. The width of the continental shelf is less than 1 km in the Gulf of Aqaba and several tens of kilometers in the Farasan Bank. The climate is extremely arid and much of the biological productivity is confined to a narrow coastal strip, where coral reefs, mangroves and seagrass communities predominate. Average rainfall is less than 70 mm/year along the broad coastal Tihama plains of the Red Sea. Inland, above the coastal escarpment, it may exceed 200 mm/year (DeVantier and Pilcher, 2000).

The study area (Fig. 1) lies between latitudes 34° 56'N (Haql city) and 37° 56'N (Yanbu city) along the Saudi Arabian Red Sea coast. It comprises two distinctive zones each one has its unique characteristics, Gulf of Aqaba and the northern Red Sea proper. Generally, the study area exhibits markedly different bio-physical conditions where the coast and islands support a variety of coastal and marine habitats, related largely to oceanographic regime, degree of exposure, and topographic features, particularly the distribution of suitable topography for development of coral reefs, mangrove stands and seagrass beds. The area has a complex tectonic history of uplift and subsidence, related to the rift development of the Red Sea from the movements of the Arabian and African tectonic plates. The present series of living coral reefs are the latest in a chronological sequence of raised (uplifted) and submerged reefs that have developed at various times over the past several hundred millenia. In many cases the present reefs are developed on earlier reef structures. Detailed descriptions of the geology, physical environment, climate, hydrology, oceanography and habitats of the Red Sea are given by Fishelson (1971), Ormond *et al.* (1984a), Edwards and Head (1987), Crossland *et al.*, 1987, IUCN/UNEP 1988, Sheppard and Sheppard (1985, 1991), Behairy *et al.* (1992) and Sheppard *et al.* (1992).

2. Material and Methods

In the framework of the scientific research project entitled "Coastal Resource Mapping, Yanbu-Haql, Red Sea Coastal Zone, Saudi Arabia" (Project APR-28-163 funded by King Abdulaziz City for Science and Technology KACST), the coral reefs and reef-associated communities were investigated at 31 locations along the coast of Tabuk Governorate. The location names and positions are shown in Fig. (1).

The presence of fish, coral reefs, marine invertebrates and vegetation at each location were recorded as follows:

Coral reefs

The survey methods chosen originated from a variety of methods (Phinn and Neil, 1998, McMahon *et al.,* 2002, Ford *et al.,* 2003, Joyce, 2003, Joyce *et al.,* 2004, and Mumby *et al.,* 2004) and conforming to the Reef Check Organization (RCO) protocol www.reefcheck.org (Hodgson *et al.,* 2004). The transect line method recommended by the RCO was used in the coral reefs field survey at 5 m and 10 m depths. For the transect line, a standard 100 m measuring tape was extended at each surveyed depth. The transect is then divided into four 20m-segments that are separated by 5 m belt zones. The grid consisted of 40 half meter grid cells in a five by five grid constructed from thin ropes. The grid was positioned, so that its diagonal was parallel to the transect line and the grid centre point placed on the 10 m mark of the transect line.

Percentage benthic cover was determined from *in situ* assessment. Percent cover of different corals cover types for the transect was calculated by counting the occurrences of a coral cover class on the transect line (Greig-Smith, 1983 and Hodgson *et al.,* 2004). The bottom constituents were classified basing on the RCO recommendations into Hard Corals (HC), Soft Corals (SC), Recently Killed Corals (RKC), Algae (NIA), Sponges (SP), Rocks (RC), Rubbles (RB), Sands (SD), Silts (SI), and Others (OT).

Fish, invertebrates and vegetation

A standard 100 m measuring tape was used to lay a transect belt of 100 long and 7 m wide between the depths of 4 m and 11 m. Inside the belt, the fish and invertebrates species were recorded and classified *in situ*.

3. Results

Corals

The coral communities of the study area are represented by 76 species of reef-building stony corals of the *Scleractinia*. They are composed predominantly, both in terms of composition and cover, by the families *Acroporidae*, *Faviidae* and *Poritidae*. A diverse mix of soft corals (*Alcyonarea*),

hydrozoan fire corals (*Anthomedusae*), gorgonians (*Gorgonacea*), black corals (*Antipatharia*), octacorals (*Pennatulacea*), sea anemones (*Zoantharia*), horn corals (*Melithaeidae*), hydroids, (*Hydroida*) and *Zoanthiniaria* are also present. The field investigation showed that, at 5 m depth, living cover of reef-building corals at individual reefs ranged from 8% (Beer AlMashi and Umluj) to 80%, (10 km south of Dubah) whereas soft corals ranged from 1% (10 km south of Dubah) to 54% cover (Yanbu cement factory) (Table 1).

Table 1. The percentages of the different components of coral reef ecosystem in the study area between Haql and Yanbu cities.

Site	Name	HC %	SC %	RKC %	NIA %	SP %	RC %	RB %	SD %	SI %	OT %	IV Sp.	Algae Sp.	Fish Sp.
1	Haql	19	2	0	0	0	21	0	58	0	0	11	2	103
2	AlHomaydah	43	8	3	0	0	44	0	2	0	0	14	2	124
3	Beer AlMashi	8	6	0	0	0	10	0	76	0	0	9	1	116
4	Sowayhal	NA												72
5	Meqna	60	14	0	0	1	1	0	24	0	0	14	2	150
6	Qeyal	NA												62
7	AlSorah	NA												37
8	AlBayedah	46	13	0	13	0	8	0	20	0	0	7	2	110
9	New Dubah Corniche	28	15	0	0	0	1	0	56	0	0	6	2	116
10	10 km south of Dubah	80	1	4	0	1	13	0	1	0	0	9	2	124
11	AlQof	28	18	6	0	0	42	0	6	0	0	10	2	131
12	Zobaydah-AlQof	35	17	3	0	1	39	2	3	0	0	11	1	94
13	Zobaydah	65	19	0	0	0	16	0	0	0	0	11	1	140
14	AlDomeghah	63	29	0	0	0	6	0	2	0	0	10	3	120
15	AlDomeghah-Haramel	53	23	0	0	0	12	0	12	0	0	11	3	106
16	Haramel	46	9	0	0	0	23	0	22	0	0	8	2	94
17	North of Wajh	55	23	3	0	0	19	0	0	0	0	10	7	99
18	AlWajh Desalination Plant	63	13	5	0	0	19	0	0	0	0	12	1	132
19	South of Ghawash	45	10	5	2	1	36	0	1	0	0	6	2	90
20	South of AlMeraisi	NA												22
21	South of AlKhorj	NA												12
22	AlKhowara	NA												8
23	AlNosbah	NA												76
24	Umluj	8	4	3	3	0	44	1	37	0	0	10	7	67
25	AlShabaan	59	15	3	0	1	22	0	0	0	0	15	4	124
26	Alhasi	32	40	0	0	0	6	1	17	0	4	10	4	99
27	AlMikharef	NA												61
28	Yanbu Cement Factory north	37	54	4	0	0	5	0	0	0	0	11	1	144
29	Yanbu Cement Factory sourth	NA										16	2	62
30	Yanbu north	53	31	1	0	0	4	0	11	0	0	12	4	123
31	Yanbu Creek	16	18	1	4	1	39	0	21	0	0	14	4	111
	Min.	8	1	0	0	0	1	0	0	0	0	6	1	8
	Max.	80	54	6	13	1	44	2	76	0	4	16	7	150
	Avg.	43	17	2	1	0	20	0	17	0	0	11	3	94

Fish

The field investigations showed that fish community of the study area is represented by 338 species from 62 families (Table 1). The minimum occurrence of fish families was found at AlKhowara (8 fish species from 3 families) while the maximum occurrence was found at Meqna (150 species from 33 families); the overall areal average is 94 species. Of the 62 fish families recorded in the area the most abundant fish family is *Pomacentridae* (30 species) followed by family *Labridae* (24 species) whereas 35 families are represented by one or two species. The most abundant fish species were *Chromis viridis, Pomacentrus aquilus, Plectroglyphidodon lacrymatus* (recorded at 21 sites), *Labroides dimidiatus, Chaetodon fasciatus, Heniochus intermedius* (recorded at 22 sites), *Parupeneus forsskali, Dascyllus aruanus, Chromis dimidiate, Thalassoma*

Klunzingeri (recorded at 23 sites), *Dascyllus trimaculatus, Chaetodon auriga* (recorded at 24 sites) and *Amblyglyphidodon leucogaste, Amblyglyphidodon flavilatus, Larabicus quadrilineatus* (recorded at 25 sites).

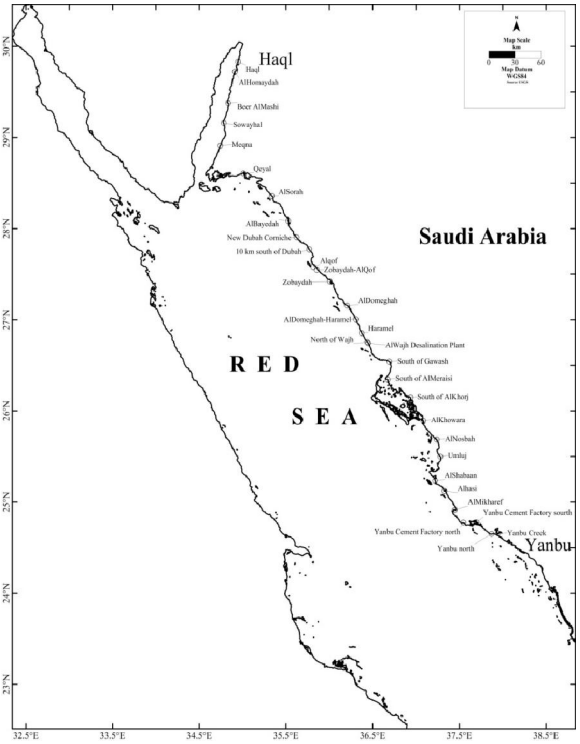

Fig. 1: The area of study and the locations of *in situ* reef check.

Invertebrates

The reef-associated invertebrates (sponges, crustaceans, polychaetes, mollusks and echinoderms) in the study area are relatively few. The occurrence of the invertebrates is minimum at sites 9 and 19 (6 species) and maximum at site 29 (16 species) with an overall areal average of 11 species (Table 1). The areal occurrence of reef-associated invertebrates showed more or less homogenous distribution pattern where 74% of the area hosts from 10 to 16 per site of reef-associated invertebrates species, and 26% hosts 6 to 9 species.

Algae

The four types of marine algae (Red, brown, green and blue-green) are present in the study area. The total number of algae species ranged between 1 (occurred at 22% of the area and 7 species (occurred at 6% of the area) with 70% of the area is occupied by 1 to 3 algal species (Table 1). Red algae are present at 9 locations, brown algae at 18 locations, green algae at 25 locations and blue-green algae at 8 locations. The relative abundance of algae is in the order green>brown>Red≈Blue-green.

Sea grasses

Seagrasses in the study area are scarce. A zone of continuous occurrence of seagrasses beds is located between Ghawash and AlNosbah. Isolated seagrasses beds are found at Sowayhal, AlSorah, 10 km south of Dubah and between Zobaydah and AlQof. Only four species of seagrasses occur in the area these are *Halophila stipulacea, Thalassia hemperichii,* and *Syringodium isoetifolium*, *Cymodocea sp.*

4. Discussion

Reef Distribution

The central-northern area from Haql in the Gulf of Aqaba to Yanbu supports a near-continuous coral reef tract composed of a wide range of reef types. The area supports relatively complex reef geomorphology, being comprised of mainland and island fringing reefs, various forms of patch reef, coral pinnacles and 'ribbon' barrier reefs (Ormond *et al.,* 1984a) provided a comprehensive review of the geomorphology and distribution of these reef types). Mainland fringing reefs are distributed along much of the study area coastline, and are often developed in the entrances and sides of sharms, a characteristic reef-form largely restricted to the Red Sea. Extensive mainland fringing reefs occur around Ras Baridi (60 km north of Yanbu), Umluj, AlWajh-Duba and in the Gulf of Aqaba, the latter often being narrow (<30 m width), developed as 'contours' on the relatively steep sub-littoral topography (Fishelson, 1980). Island fringing reefs are commonly developed in the Tiran area and from Duba - AlWajh Bank - Umluj.

Circular/elongate patch reefs are also widespread in offshore waters (< 50 m depth). Some patch reefs support sand-coral islands (cays), while others are submerged and resemble coral carpets as also described by Riegl & Piller, 1999. Both forms are common in the AlWajh Bank and south from Umluj. 'Reticulate' patch reefs, composed of interconnected networks of reef matrix separated by sand, and forming intricate reticulate patterns, are particularly well developed in shallow waters (< 10 m depth) of the Tiran area and southern AlWajh Bank. Pinnacles (individual corals and coral 'bommies' surrounded by sand) are present in shallow waters (< 10 m depth), particularly in the Al-Wajh Bank and Tiran areas (DeVantier and Pilcher, 2000).

Most reefs of the study area, at 5 m and 10 m depths, were in good to excellent condition. The percentages of living to dead corals ranged between 73% and 100%, with 86% of the surveyed locations lying in the range from 90% to 100%. The lowest percentages were found at

Umluj (73%) and AlQof (82%).In the Red Sea, Angelo *et al.* (2012) found that increased growth is the underlying physiological process associated with disease, wounding and stress-related colour changes in reef-building corals. There was little to no direct human impact (e.g. destructive fishing, anchor damage, coral mining or pollution) on the great majority of reefs, other than reefs in urban areas subject to land reclamation, urban run-off or littering. Coral communities on some reefs (ca. 10 % of those surveyed) thad also been adversely affected to greater or lesser extent by coral bleaching or predation. Bleaching was patchily distributed and highly variable in intensity, being most intense on reefs near Umluj. Predation by echinoderms and snails had no noticeable effect on coral cover or community composition on most reefs, where starfish and snail populations were at very low levels.

High cover of living corals was associated with reefs of relatively high exposure to wave energy and high water clarity. High coral cover was usually present on the shallow reef slopes of exposed fringing, patch and barrier reefs. With some important exceptions, reefs in low wave energy environments and reefs with low water clarity usually had lower living coral cover than their shallow, more exposed counterparts.

Species diversity of *Scleractinia* stony corals at individual sites in the study area ranged from 6–44 spp. (regional average = 25 spp.). Notably, there was only minor variability in species composition among the assemblages, with the entire region exhibiting a high degree of homogeneity in terms of coral community composition, both latitudinally and longitudinally. However, Riegl *et al.,* 2012 pointed to potentially increasing community homogenization and decline in average size of coral colonies throughout the Red Sea, after having remained constant from 1988 to 1997. These are phenomena that have also been observed in other peripheral seas. Reefs with moderate to high species diversity and abundance and living coral cover were widely distributed, with no clear latitudinal or longitudinal trends. Such reefs have high significance for replenishment, because of their potential as sources of large numbers of propagules of coral and of other reef-associated taxa.

Conservation Value

The area from Yanbu (northern Red Sea) to Haql (Gulf of Aqaba) is one of the most important coral reef areas for marine protected areas management on a global scale. Most of the region is presently unaffected by local human impact, other than in the vicinity of coastal cities and towns such as Umluj and Yanbu where reef fishing, land reclamation, urban run-off and coastal littering has occurred. Major additional threats include ship wrecks and oil spills and global impacts from future climate change (bleaching and reduction in reef-building capacity from projected changes in ocean alkalinity). Reefs in some areas of the region appear to be naturally buffered against the worst effects of coral bleaching, because of the prevalence of cool water upwelling. Reefs of high conservation value in terms of representativeness-uniqueness and 'quality' (i.e. high species diversity, high coral cover, and importance as reservoirs of biodiversity and replenishment) are widely distributed, from the Gulf of Aqaba and Tiran areas in the north, Duba-AlWajh, the AlWajh Bank, Umluj-Ras Baridi, and Yanbu. The following sub-regions are of special conservation importance:

- The Gulf of Aqaba: For the high levels of coral cover and species diversity, including species that are rare or apparently absent from other parts of the region (e.g. *Cantharellus doerderleini, Caulastrea tumida*). The high diversity is particularly significant given the restricted reef area, cool sea temperatures, and given that the Gulf of Aqaba is at the north western-most extent of reef development in the entire Indo-Pacific region.
- The Tiran Area: Extending from the mainland coast north of Duba to the entrance to the Gulf of Aqaba, for the wide variety of different biotopes and reef types, forming unique reef complexes with high zoogeographic significance. These reef complexes support a high species diversity including Red Sea endemic corals.
- The AlWajh Bank: For the greatest range of reef types (and other marine and coastal habitats) in the region. As with the Tiran area, reefs of the Al-Wajh Bank support Red Sea endemic corals, undescribed coral species and species with apparently restricted distributions. Its size and diversity of reef habitats, and likely high level of ecological connectedness in terms of larval dispersal in ocean currents, both within the Bank and to other parts of the Red Sea, afford it great conservation significance.

Coral Diversity

Red Sea: 111 coral species were identified in the study area (Sheppard & Sheppard (1985) identified 116), the most distinctive being those from exposed locations dominated by species of *Acropora* and those from sheltered locations dominated by species of Porites (Antonius *et al.,* 1990). Reefs around Yanbu were notable in supporting both a higher coral diversity and number of assemblage types than had previously been reported from the Red Sea (MEPA/IUCN 1987,

Sheppard & Sheppard (1991) and Sheppard (1997).

Some surveys have expanded this list substantially, with approximately 260 species of reef-building *Scleractinia* that were reported to occur in Saudi Arabian Red Sea waters (Veron 2000). Several additional species had been described from the Red Sea in the 19th century, but had either been synonymised or lost from recent species lists (e.g. the branching *Acropora variolosa* (Klunzinger, 1879), *Favites vasta* (Klunzinger, 1879) and *Echinopora forskaliana* (Milne Edwards and Haime, 1849) (Wallace, 1999, Veron, 2000). A further 16 species synonymised by Sheppard & Sheppard (1991) are considered as valid species in the Red Sea (Veron, 2000, DeVantier and Pilcher, 2000).

Coral Cover

There is considerable variability in cover of stony and soft corals in response to reef-specific characteristics and disturbance histories, and species-specific tolerances to stress, particularly exposure, levels of sedimentation, turbidity and illumination. Living cover of stony corals ranged from 8 % to 80 %, with an average of ca. 45 %. Approximately 45 % of sites had high living stony coral cover (>50 %), particularly at 5m shallow reef slopes, where large mono- and multi-specific stands of *Acropora*, *Porites* and *Millepora* were often conspicuous. At 10 m shallow reef slopes living cover of stony corals ranged from 18 % to 74 %, with an average of ca. 42 %. About 33 % of sites had high living stony coral cover (>50 %). Compared with the surveys conducted in 1998-99 in the central-northern Red Sea, where living cover of stony corals ranged from < 10 % to > 75 %, having an average of ca. 35 % (DeVantier and Pilcher, 2000) and 17 % of sites had high living stony coral cover (>50 %). It seems that the living stony corals cover is increased relatively showing some signs of improvements.

Dead standing corals was relatively minor components of cover (< 6 % at 5 m depth and < 5 % at 10 m depth) at most sites (averages ca. 2 % and 1 %, relatively). Highest levels of dead coral (4 % to 6 %) occurred off AlQof (site 11) Alwajh Desalination Plant (site 18) and Yanbu Cement factory site 28). Cantin *et al.* (2010) found that Three-dimensional computed tomography analyses of the massive coral *Diploastrea heliopora* in the Red Sea reveal that skeletal growth of apparently healthy colonies has declined by 30% since 1998. Cover of soft corals in the study area, at 5 m depth, ranged from 1 % to 55 % (average ca. 17 %). At 10 m soft corals cover ranged from 2 % to 64 % with an average of 22 %.

In 1997 cover of soft corals in the central-northern Red Sea ranged up to 50 %, but usually was < 30 % (average ca. 9 %). Large beds of *Xenia spp*. and stands of *Sinularia cf. capitalis* covering 100 m^2, were a characteristic feature of some area, the latter species forming large tree- like colonies to 2 m height and contributing substantially to reef accretion (Reinicke, 1997, Schuhmacher, 1997).

Although some reefs with high living coral cover occurred in sheltered habitats, particularly subsurface patch reefs of the Al-Wajh Bank, high cover of stony corals, soft corals and crustose coralline algae were all commonest on shallow reefs of high exposure with steep slopes and high water clarity.

Damage and Coral Mortality

Overall, most reefs (ca. 91 %) of the study area were in good to excellent condition in terms of the ratio of live to dead coral cover. In 1998-99 (DeVantier and Pilcher, 2000) reported a value of 90 % for the healthy condition of corals reefs in the central Northern Red sea. There was little to no direct human impact (e.g. destructive fishing, anchor damage, coral mining or pollution) on the great majority of reefs, other than reefs in urban areas subject to land reclamation, urban run-off and pollution or littering. Most damaged reefs occur in the immediate vicinity of the major coastal cities and towns especially off AlQof, AlWajh and Yanbu.

At most sites outside these areas, levels of injury and death of corals were low (< 6 % cover of dead corals).

No evidence of mass bleaching or other forms of major coral mortality were found during surveys. Most reefs appeared to be in good condition.

Predation by echinderms had no noticeable effect on coral cover or community composition on most reefs in the study area, where starfish and snail populations were at very low levels. Unlike the study area, starfish and snails were implicated in coral mortality in the southern Saudi Red Sea and Farasan Islands (Rouphael & Al Yami, 1999).

Fish Communities

An overall number of 338 species from 62 families were recorded in the study area. The areal occurrence ranged from 8 species at AlKhowara (site 22) to 150 species at Meqna (site 5). The most common family was *Pomacentridae* from which 32 fish species where recorded while the least common families were *Rhinobatidae, Torpedinidae, Centriscidae* and *Antennariidae* (only 1 species of each was recorded). Previous studies documented species composition and abundance of reef fishes in the Red Sea. Recent diversity estimates vary greatly. Randall (1983) lists 325 species, although this was not a comprehensive systematic account, rather a pictorial account of common taxa. Ormond & Edwards (1987) record 508 species, substantially

less than Botros (1971) with 776 species, Dor (1984) with 1,000 species or Goren and Dor (1994) with 1248 species. Differences among these various estimates are in part due to distinctions in the definition of 'reef fish', with the more conservative estimates being based on a stricter interpretation of the definition. Although many Red Sea reef fishes have distribution ranges that extend outside the Red Sea, to the Gulf of Aden, Arabian Sea and greater Indian Ocean and Indo-Pacific regions, others are presently considered 'endemic' to the Red Sea (Klauswitz, 1989). Levels of endemism vary among different groups of fishes, being particularly notable in the *Chaetodontidae*. These endemics and other Arabian and western Indian Ocean species give a characteristic structure to Red Sea reef fish assemblages in comparison with their central Indo-Pacific and eastern Pacific counterparts. Major threats to diversity and abundance of fishes in the Red Sea include increasing fishing pressure, and development pressures near coastal towns and cities (Krupp & Almarri, 2000).

5. Conclusion

The present study revealed that most reefs (ca. 91 %) of the study area (from Haql to Yanbu) were in good to excellent condition in terms of the ratio of live to dead coral cover. There was little to no direct human impact (e.g. destructive fishing, anchor damage, coral mining or pollution) on the great majority of reefs, other than reefs in urban areas subject to land reclamation, urban run-off and pollution or littering. Most damaged reefs occur in the immediate vicinity of the major coastal cities and towns especially off AlQof, AlWajh and Yanbu. At most sites outside these areas, levels of injury and death of corals were low (< 6 % cover of dead corals). No evidence of mass bleaching or other forms of major coral mortality were found during surveys. Most reefs appeared to be in good condition.

Local threats to Saudi Arabia's coral reefs originate primarily through industrial development and maritime transport. With these are associated risks of oil spills, land-filling, pollutant discharges, effluents from desalination activities and a number of other major impacts. Most acute damage to reefs is localised and restricted to offshore islands (in the Gulf) and around major urban areas (in the Red Sea). The local threats include:

1. Oil Pollution
2. Industrial Development
3. Maritime Transportation
4. Commercial and Residential Development
5. Land-filling
6. Dredging
7. Water Pollution
8. Desalination
9. Recreation and Tourism Activities
10. Bleaching (as a result of increase in seawater temperature)
11. Changes in seawater chemistry

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Households' Access to Insecticide Treated Nets (ITN) and Malaria Morbidity in Rural Nigeria: A Two-Stage Least Square Approach

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Abstract: The burdens of malaria on economic development of many tropical countries cannot be overemphasized. Introduction of ITN is a major effort by international bodies to reduce the problem. This study analysed the inter-relationship between access to ITN and malaria morbidity. Data from the 2008 Demographic and Health Survey (DHS) were used and analyses were carried out using descriptive statistics and Two Stage Least Square. Results show that presence of pregnant women in the household, household size, north east, south east, and south south regions, number of children 5 years and under, age of household head, sex of household head, educational status, listening to radio, read newspaper, occupation, electricity, one room for sleeping in the household and marital status significantly influence access to ITN ($p<0.10$), while presence of a pregnant woman and number of children five years and under increased reported malaria morbidity. It was concluded that access to ITN may not translate into reduction of malaria morbidity, depending on the usage and exposure of household members to mosquito bites outside the nets. Efforts at reducing malaria morbidity should therefore focus on media interventions in providing complete information on malaria prevention.
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Keyword: ITN, malaria, morbidity, mosquito

1. Introduction

The burden of malaria is a major threat to economic development in many developing countries. Human domestic and production activities including agriculture have been recognized as one of the reasons for increased intensity of malaria morbidity. This is as a result of their encouraging breeding of mosquitoes that carry malaria parasites (Asenso-Okyere et al 2009). In Nigeria, FMoH and NMCP (2009) noted that about 110 million medically diagnosed cases of malaria are recently reported annually. Malaria is also responsible for about 60 percents of outpatient hospital visits and about 30 percent hospitalization. It was further asserted that malaria is responsible for death of about 300,000 children annually, while contributing about 11 percent mortality among mothers, 25 percent mortality among infants, and 30 percent mortality among children less than five years of age. Economic cost of malaria is to the tune of ₦132 billion which form costs associated with treatment costs, prevention and loss of work time, among others (FMoH and NMCP 2009).

Malaria has been called the major disease of the poor. It is an aspect of ill health that negatively affects adult productivity and hampers accumulation of human capital in younger generations (Asenso-Okyere et al 2009). Malaria causes illness (morbidity), disability, or death and these can affect labour or resource use productivity. Because of current labour shortages in farm labour in many Nigerian rural areas, morbidity as a result of malaria infection and caretaking role by family members adversely affect agricultural productivity and production. It had been said that malaria reoccurrence in agrarian households would cause a decline in farm output and farm income, and cause food insecurity and increase in poverty (ESPD 2005). A United Nation's research report observed that smallholder farmers in Africa shoulder the heaviest burden of malaria because their margin of survival is very small due to several limitations associated with available health service delivery systems. It was emphasized that if there is a brief period of illness that brings about delays in crop planting or harvesting, severe economic consequences may result (UN Millennium Project 2005).

Egan (2001) also added that because malaria strikes during the rainy/harvest season, when workers' productivity needs to be at its peak, the disease can endanger agricultural production leading to transient or chronic food insecurity and reduction in farm incomes. Another potential impact is reduction in farm investments as a result of high expenditures on malaria treatment and prevention. Therefore, farm households may have to spend their

savings, sell productive assets or borrow money to pay for the treatment costs which are often repeated as morbidity reoccurs among some other household members (Asenso-Okyere et al 2009).

Malaria prevention and control have received the attention of international communities. It should be noted that over the years, there have been several global initiatives to control malaria. The Roll Back Malaria and the Abuja Declaration amongst others were attempts to coordinate policy makers' efforts and provide more resources to reduce the malaria burden in the world. The strategies used aimed at primary prevention through vector control or use of personal preventive methods such as bed nets, mosquito repellants, chemoprophylaxis and effective case management and medication.

The use of insecticide treated nets (ITNs) is presently considered the most cost effective method of malaria prevention in area where malaria is intense (Gikandi et al 2008; Noor et al 2007). Insecticide treated mosquito nets play a very important role in the prevention of malaria. Trials in Africa show that treated mosquito nets reduce the number of deaths among children aged less than five years by about 20 percent. Treating mosquito net with an insecticide will kill mosquitoes and other disease-spreading insects when they make contact with the net. An insecticide treated mosquito net also acts as an insect repellent, reducing the number of mosquitoes in the surrounding area. This helps to control the population of malaria-spreading mosquitoes and protects people from their infectious bites.

The pyrethroid insecticides that are used to treat mosquito nets have an excito-repellent effect that adds a chemical barrier to the physical barrier. This further reduces human vector contacts and increases the protective efficacy of the mosquito nets. If the vector population is reduced in this way, ITNs provide protection for all the people in the community, including those who do not themselves sleep under the nets (Binka et al 1998; Hawley et al. 2003). Studies have also shown that relatively modest coverage (around 60 percent) of all adults and children can achieve equitable community wide benefits. ITNs thus work in this case as a vector control intervention for reducing malaria transmission. ITNs have been shown to avert around 50 percent of malaria cases. This makes its protective efficacy to be significantly higher than that of untreated nets (Clarke 2007). ITNs were recently added as a malaria control policy in Nigeria and the government wishes to scale up its use.

In 1998, the World Health Organisation (WHO) launched the Roll Back malaria and one of its primary objectives was to increase ITN coverage to over 60 percent by 2005. This was later revised to 80 percent coverage by 2015. However, most African countries recorded low levels of ITN coverage (Abdulla et al 2002; Nathan et al 2004; Onwujekwe et al 2003 and Schellenberg et al 2002). Hence, it was important to assess factors influencing access to ITN and its implication on malaria morbidity.

Widespread distribution and use of insecticide-treated nets (ITNs) for the control of malaria has been a challenge facing Nigeria. The Africa Malaria Report shows that many countries are quite far from reaching the target of 60% ITNs coverage in sub-Saharan African countries by the year 2005, which was set in Abuja by the African Heads of State for the provision of ITNs to children under five and to pregnant women. Malaria, being the number one public health problem in Nigeria requires effective preventive efforts. Therefore, based on expected efficacy and efficiency, ITNs reduce the need for malaria treatments and the pressure on health services.

Ensuring high coverage of ITNs, especially in rural areas remains a topical issue in Nigeria. The public health care system was initially used to distribute ITNs in Nigeria, but the coverage was quite low. Commercial sector distribution and social marketing of ITNs is being promoted in some states in Nigeria, but the coverage remains low. Community-based distribution has not been tried on a large scale, but it could possibly be added to existing strategies to successfully distribute and scale-up ITNs in rural areas (Onwujekwe et al 2005). Increasing the coverage of ITNs among vulnerable populations is perhaps one of the most important mechanisms for effective malaria control (Chuma et al 2010).

The foregoing raises two research questions which this study seeks to answer. First, what are the factors influencing accessibility of ITNs? Second, what are the implications of access to ITNs on malaria morbidity? Provision of answers to this question will assist policy makers in designing adequate mechanisms for addressing malaria in Nigeria.

2. Materials and Methods

Data and sampling procedures

Survey-based 2008 Demographic and Health Survey (DHS) secondary data were used for this study. The women's questionnaire was used in addition to the household questionnaire. The primary sampling unit (PSU) referred to as a cluster for the 2008 NDHS is defined on the basis of EAs from the 2006 EA census frame. The 2008 DHS samples were selected using a stratified two-stage cluster design consisting of 888 clusters, 286 in the urban and 602 in the rural areas. A representative sample of 36,800 households was selected for the 2008 DHS survey, with a minimum target of 950 completed interviews

per state. In each state, the number of households was distributed proportionately among its urban and rural areas.

Methods of Data Analysis

Descriptive Statistical Analysis

They include: percentage, frequency distribution and mean. These tools was used to profile the socio-demographic characteristics of the households

Logistic Regression Analysis

The binary logistic regression model was employed to identify factors that influence access to ITNs. The binary logistic regression model is stated as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \text{--------,} + \beta_k X_k \qquad (1)$$

Z_i is the binary variable that defines access to ITNs with value of 1 if yes and 0 otherwise. $ß_0$ is the intercept (constant), and $ß_1$, $ß_2$, to $ß_k$ are the regression coefficients of the predictor variables, X_1, X_2, and X_k respectively. The logistic regression model is widely used to analyse data with dichotomous dependent variables. Hence it was considered a perfect model to use in this study because the dependent variable is dichotomous in nature. This method allows for maximum likelihood even when there is a single response to category, reduces the amount of computation required and directly estimates the probability of an event occurring, hence considered commendable for this study.

It was necessary to create dummy variables to use the selected demographic and enabling variables of this study in the logistic regression model. All variables that had several categories were regrouped to facilitate easy processing of the results. For each of the mentioned independent variables, one of the original categories was assigned the value of 0 and was taken to be the reference category in the analysis. This reference category was the one expected to have a minimal likelihood of the event. The probability of access to ITN were analysed in relation to the selected reference category. The rest of the categories were assigned dummy variables taking on the value of 1 for the respective categories and 0 for the reference category. The independent variables include number of household members, number of children 5 and under, sex of household head, age of household head, regions, North East (yes = 1, 0 otherwise), North West (yes = 1, 0 otherwise), South East (yes = 1, 0 otherwise), South South (yes = 1, 0 otherwise), South West (yes = 1, 0 otherwise), educational status of household head (years of education), read newspaper or magazine (1 for yes 0 otherwise), listen to radio (1 if yes, 0 otherwise), watch television (1 if yes, 0 otherwise), covered by health insurance (yes =1, 0 otherwise), occupation (agric employee=1, 0 otherwise), having pregnant women (yes= 1, 0 otherwise), type of cooking fuel (1 if wood, 0 otherwise), flooring materials 1 (1 if earth, 0 otherwise), flooring materials 2 (1 if sand, 0 otherwise), flooring materials 3 (1 if cement, 0 otherwise), flooring materials 4 (1 if carpet, 0 otherwise), number of rooms used for sleeping 1 (1 if one, 0 otherwise), number of rooms used for sleeping 2 (1 if two, 0 otherwise), sick people in the household (1 if yes, 0 otherwise), household access to electricity (1 if yes, 0 otherwise), marital status (1 if married, 0 otherwise), type of fire for cooking (1 if open fire, 0 otherwise).

Table 1: Socio-economic factors of the respondents

Educational Level	Frequency	%
No education	6,339	46.16
Primary	3,535	25.74
Secondary	2,868	20.89
Higher	990	7.21
Male	12,025	86.37
Female	1,898	13.63
15-30	2942	21.2
31-45	6015	43.4
46-60	3575	25.8
61-75	1124	8.1
76-90	198	1.4
>90	14	0.1

Source: DHS, 2008

Two stage Least Square Regression Model

This econometric approach was used to determine the implication of access to ITNs on malaria morbidity. The model is specified as:

$$Y_i = ß_0 + ß_1 Z_i + ß_2 X_2 + ß_3 X_3 + \ldots, ß_K X_K + U_i \qquad (2)$$

Y_i specifies malaria morbidity which was specified as 1 if yes and zero otherwise, $X_{1i,}$,.....,X_{ki} denote household characteristics, $= ß0$,$ß1$..... ....$ß\ k$ are the parameter coefficients, *Ui* is the error term captures measurement error or omitted factors.

The above model is estimated using the Two Stage Least Squares (TSLS) in two stages. At the first-stage, regress Zi (access to ITNs) on the included exogenous variables and the instrumental variable (wealth index) using Logit regression. The predicted values are computed from this regression. Call these $\hat{x}$. Second-stage involves regression of Y_i on the predicted values of the endogenous variable Z_i and the included exogenous variable using logistic regression. The instrument used satisfies the necessary and sufficient condition. The necessary condition implies that the instrument must correlate with the endogenous variable in the equation and sufficient condition that the instrument must not correlate with the endogenous variable in the

structural equation. Pair-wise correlation was used to test for the condition of the instrument.

3. Results and Discussions

Socio Economic and Demographic Characteristics of Households

This study presents information on selected socio-economic and demographic characteristics of households in rural Nigeria. Table 1 shows that 41.16% household head in rural Nigeria have no education, 25.74% had primary education, 20.89% had secondary education, while just minority had higher education (7.21%). The table also indicates 86.37% of rural households in Nigeria were headed by men, while 13.63% were headed by women. Also, age group 31-45 years had the highest percentage of 43.4%, while age group for the greater than 90 years had the lowest percentage. The average age of the household head in rural Nigeria was 43 years.

Factors Influencing Access to ITNs

Table 2: Logistic regression result of factors influencing access to ITN

Variables	Coefficients	Standard error	Marginal effects
Constant	-3.230282	0.3058944	
Pregnancy	0.1405137*	0.0805342	0.0109754*
Household size	0.0356648*	0.0145457	0.0026736*
No of children 5 & under	0.0767332**	0.0323422	0.0057522**
North East region	0.2647132**	0.105003	0.0211686**
North West region	0.0469051	0.1048574	0.0035482
South East region	0.4517435**	0.1194123	0.00396181**
South south region	0.5352944***	0.1048184	0.0472135***
South west region	-0.1434803	0.1325832	-0.010252
Sex of hh	-0.1602343*	0.1005032	-0.0131127*
Age of hh	-0.009312***	0.0031003	-0.006981***
Pry edu	0.4498552***	0.856677	0.0370663***
Sec. Edu	0.6145683***	0.0939357	0.537659***
Higher edu	0.9786426***	0.1159372	0.104106***
Listen to radio	0.1847302***	0.0717711	0.013727***
Read newspaper	0.219324**	0.096524	0.0177437**
Watch tv	0.0955269	0.082737	0.0072875
Health insurance	-0.0716642	0.2727809	-0.0052161
Occupation	-0.2283824***	0.0697977	-0.0173097***
Wood cooking fuel	-0.1808867	0.1346643	-0.0143999
Earth flooring material	0.1134846	0.2114385	0.0084679
Cement flooring material	0.2940763	0.2086683	0.022947
Carpet flooring material	0.2243488	0.2233116	0.0182128
Open fire	0.3485725**	0.1547794	0.0231109**
Marital status	0.2191825*	0.1305854	0.0152198*
Sick person in household	0.0762923	0.1528991	0.0058902
Electricity	0.1705894**	0.0746421	0.0132285**
One room for sleeping	-0.242436***	0.0902644	-0.174081***
Two rooms for sleeping	-0.1037864	0.765927	-0.0076705
Log likelihood = -4029.6737 Number of obs = 13626 LR chi2(28) = 485.44 Prob > chi2 = 0.0000 Psedu R 2 =0.0568			

Source: DHS, 2008

***, ** and * represent significance at 1%, 5% and 10% probability levels respectively

The logistic regression result of factors influencing access to ITN is shown in table 2. An additional insight was also provided by analysing the marginal effects which was calculated as the partial derivatives of the non linear probability function evaluated at each variable sample mean.

Most of the explanatory variables were discovered to influence access to ITN. Pregnant women in the household, household size, north east,

south east, and south south regions, number of children 5 years and under, age of household head, sex of household head, educational status, listening to radio, read newspaper, occupation, electricity, one room for sleeping in the household and marital status were found to be statistically significant ($p<0.10$). Other studies have also reported the number of very young children in the household as a determinant of bed net ownership (Tanner *et al*; 1998; Yeneneh *et al*; 1993).

Virginia *et al* (2007) also reported age, household size, occupation, ethnicity and education as a determinant of ITN ownership. Nuwaha (2001) also found gender to be a significant factor. It has also been demonstrated that when women are pregnant, they fall into a high risk malaria group, and therefore they receive greater exposure to health services and gain a higher level of awareness of the disease and ways of preventing it (Rashed *et al*., 1999).

Variables with negative value imply a negative relationship between the explanatory variables and dependent variable. For instance, age of household head was negative and significant which implies that as age increases the probability of household access to ITN decreases. South West region, sex of household head, occupation, using wood as cooking fuel and age of household head have negative influence on the probability of access to ITNs.

Variables with positive coefficient imply a positive relationship of the explanatory variables and dependent variable. The coefficient of number of children 5 years and under is positive which implies that as the number increases, probability of access to ITN also increases. The result of marginal effects showed that 1% increase in pregnant women in the household, number of children 5 years and under, household size will increase the probability of access to ITN by 1%, 0.6%, 0.3% respectively. However, a unit increase in age of household head will decrease the probability of access to ITN by 0.7%.

Table 3: Two Stage Least Squares Regression results of implication of factors influencing access to ITN on Malaria morbidity

Variables	2SLS	OLS
Constant	0.27145	0.27308
	(0.0976)	(0.0975)
ITN	0.09310	0.00913
	(0.0253)	(0.0339)
Pregnancy	0.08669***	0.08805***
	(0.0277)	(0.0274)
Household size	-0.05217***	-0.05186***
	(0.0050)	(0.0049)
No of children 5 & under	0.12536***	0.12609***
	(0.0113)	(0.0110)
North East region	0.11901***	0.12134***
	(0.0334)	(0.3249)
North West region	0.02718	0.02790
	(0.0317)	(0.0316)
South East region	0.18802***	0.19315***
	(0.0459)	(0.0428)
South south region	0.02175	0.02770
	(0.0422)	(0.0373)
South west region	-0.08206**	-0.08345***
	(0.0412)	(0.0409)
Sex of hh	0.180096***	0.17849***
	(0.0355)	(0.0351)
Age of hh	-0.00655***	-0.00662***
	(0.00097)	(0.0009)
Pry edu	-0.05660**	-0.05348**
	(0.02828)	(0.0263)
Sec. Edu	-0.05522	-0.05029
	(0.03523)	(0.0307)
Higher edu	-0.11476**	-0.10338**
	(0.05894)	(0.0454)

Listen to radio	0.04459**	0.04604**
	(0.02276)	(0.0222)
Read newspaper	0.05508	0.05853
	(0.04111)	(0.0395)
Watch tv	0.04177	0.04300
	(0.02923)	(0.0289)
Health insurance	0.01018	0.00922
	(0.1152)	(0.1151)
Occupation	-0.12271***	-0.12467***
	(0.0234)	(0.0225)
Wood cooking fuel	0.02081	0.01919
	(0.0476)	(0.0473)
Earth flooring material	0.0629	0.06398
	(0.0632)	(0.0631)
Cement flooring material	0.08110	0.08379
	(0.0643)	(0.0636)
Carpet flooring material	0.07588	0.07797
	(0.0725)	(0.0722)
Open fire	-0.04316	-0.03936
	(0.0573)	(0.0559)
Marital status	-0.10014**	-0.09775**
	(0.0433)	(0.0426)
Electricity	-0.03892	-0.03705
	(0.0508)	(0.0295)
One room for sleeping	0.12781***	0.12559***
	(0.0272)	(0.0251)
Two rooms for sleeping	-0.02716	-0.02812
	(0.0304)	(0.0975)
No of obs =13626		
F(28, 13597)=22.74		
Prob>F=0.000		
R-squared=0.0447		
Adj R-squared=0.0428		
RootMSE=1.1389		

Source : DHS, 2008 ***, ** and * represent significance at 1%, 5% and 10% probability levels respectively (Standard errors are in parentheses)

Access to ITNs and Malaria Morbidity

Table 3 presents the result of the implication of factors influencing access to ITNs on malaria morbidity under two different estimation procedures: 2SLS and OLS, for comparison. Hausman test was carried out and revealed that the 2SLS is not significantly different from OLS. Variables that significantly has implication on malaria morbidity are pregnant women, household size, number of children 5 years and under, sex of household head, age of household head, occupation, one room for sleeping in the household, north east, south east and South west regions, marital status, listening to radio and education.

However, reading newspaper, watching television, covered by health insurance, access to ITN, flooring materials, type of cooking fuel, household access to electricity, having more than two rooms for sleeping, and south south and northwest region were found to be insignificant and this implies that they do not have implication on malaria morbidity.

Insignificant relationship between access to ITNs and malaria morbidity could indicate low coverage of ITNs. It could also imply that household ownership of ITNs may not necessarily imply their usage.

Variables with negative value imply a negative relationship between the explanatory variables and dependent variable. For instance, a negative coefficient of household size means that the higher the number of household members, the lower the malaria morbidity. Variables with positive coefficient imply a positive relationship of the explanatory variables and dependent variable. For instance, the higher the number of children 5 years and under, the higher the malaria morbidity. Also, increasing the number of pregnant women in the

household increases the probability of malaria morbidity. These results can be explained from the fact that children are highly susceptible to malaria, having got little immunity against disease infections. Similarly, when women are pregnant, their immunity to malaria seems to reduce. Therefore, the results are in line with a priori expectations.

4. Conclusion

Most malaria control programs undertake a range of activities designed to promote access to ITNs. This is justified on the basis that malaria is on the increase and the demonstrated effectiveness of ITN use in reducing malaria but the success of these interventions depends largely on the extent to which factors that influence access are addressed. In this study, we reported factors that influence access to ITN and its implication on malaria morbidity. In terms of malaria control policy, the role of information campaign in promoting access to ITNs should not be underestimated. The result of this study indicates that listening to radio and reading newspaper will increase the probability of access to ITN. The reason is that information is considered a prerequisite for promoting good interactions between the health system, individuals and communities. It empowers individuals to make well informed decisions about health services use. To ensure utilization of ITNs by households, there should be massive education campaigns that should address how to properly use ITNs and their importance in malaria prevention.

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Nutritional Outlooks of *Moringa oleifera* and African Malnutrition Challenges: A Case Study of Nigeria

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Abstract: Securing adequate nutrition for the growing population is a major development agenda being pursued by many African policy makers. However, hunger and malnutrition are still among the major economic and human development challenges in many African countries. In Nigeria, the growing dimension of the nation's food problem cumulatively impacts many development indicators. This paper therefore sought to provide an outlook of *Moringa oleifera's* nutritional composition in relation to Nigerian current food challenges. It was argued that Moringa provides some nutritionalpotentials for reducing the rate of vitamin A deficiency among Nigerian children. It is also cost-effective given its ease of propagation, resistance to droughtand high vegetative growth. The onus rests on Nigerian farmers and individuals to explore these opportunities, while government provides the necessary supports to ensure availability of viable seeds and other technical assistance.

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Keywords: *Moringa oleifera*, hunger malnutrition, Africa, Nigeria

1. Overview of African Hunger and Malnutrition Outlook

A major challenge facing many African policy makers is how to utilize scarce available resources in a manner that sets sustainable platforms for reducing hunger and malnutrition (FAO, 2010). Hunger results from inability to have enough food to eat and it is a pervasive problem that undermines people's health, productivity and survival (Smith *et al*, 2006). When food consumed is of inadequate quality and quantity to provide the body's requirements of energy, protein, fat, and vitamins, malnutrition sets in. These issues are pathetic because food is the basic need of man and its essentiality for mankind survival cannot be over-emphasized. A hungry person is not only angry but may in desperation get involved in some vices that can be inimical to society's peaceful coexistence. These and lots more reasons have made policy makers around the world to make provision of adequate and sufficient food a highly prioritized development agenda. This is reflected in both the goals of World Food Summit and Millennium Development Goal (MDG). Specifically, between 1990–92 and 2015, the World Food Summit seeks to reduce the number of undernourished people by half, while the Millennium Development Goal 1 (target 1c) seeks to reduce by halve between 1990 and 2015 the proportion of people suffering from hunger.

The online business dictionary defined food as "edible or potable substance (usually of animal or plant origin), consisting of nourishing and nutritive components such as carbohydrates, fats, proteins, essential mineral and vitamins, which (when ingested and assimilated through digestion) sustains life, generates energy, and provides growth, maintenance, and health of the body" (Business Dictionary, undated).This definition emphasizes that food is not just meant to fill the stomach, but after digestion it should be able to supply the needed nutrients that are required for healthy growth. Closely related to this is the definition of food security which is a situation where "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (World Bank, 1986; World Food Summit, 1996). International acceptability of this definition is based on its emphasis on income, access and utilization as the strong pillars upon which the notion of food security rests. The essence of eating food is to survive on the nutrients therefrom. Therefore, if food is not nutritious, its primary purpose of sustaining man would have been totally defeated.

Some authors distinguished between food and nutrition security. The nutrition aspect focuses on caring practices, health services and healthy environments.This emphasizes what is more precisely called 'nutrition security', which can be defined as provision of "adequate nutritional status in terms of protein, energy, vitamins, and minerals for all household members at all times" (Benson, 2004).That is why policy makers all over the world are very keen on how to provide food of adequate nutrients to the people as a major economic development priority. But it is pathetic to note that

hunger and malnutrition are responsible for higher proportion of child mortality in many African countries. Also, in many developing countries, more and more people are annually intricately trapped in the webs of malnutrition and hunger. In Africa, hunger remains the bane of underdevelopment whichever way the die is cast. This is more pronounced among children that are less than five years old (Oyekale and Oyekale, 2009).

The implications of malnutrition for human development vary with the group of people affected at every point in time. Specifically, severe health consequences can result if children and pregnant women are among the victims of malnutrition. Shah (2010) noted that out of 9 million people that annually die of hunger and malnutrition in the world, about 5 million are children. Estimates by the Food and Agriculture Organization shows that 239 million people in sub-Saharan Africa were undernourished in 2010 with 925 million people hungry worldwide. Africa has the second largest number of people that are stricken with hunger with 239 million after Asia and the Pacific with 578 million. Further analysis shows that in 2010, estimated 30 percent of SSA population was undernourished as compared to 16 percent in Asia and the Pacific (FAO 2010).

No doubt, disparities exist in hunger and malnutrition statistics across different regions. However, one clear point is that the entire region is endemic to poverty, hunger and under-nutrition. The gravity of malnutrition in sub-Saharan Africa can be vividly understood from the fact that 33 percent of the population is undernourished as against 17 percent in developing countries. At regional levels, within SSA, FAO (2004) submitted that 55 per cent of population in Central Africa was malnourished. The average number of food emergencies in Africa per year almost tripled since the mid-1980s. This raises serious concern for the future given several uncertainties in the form of drought, flooding, political instability, communal crises and HIV&AIDS that have challenged every effort at attaining stable equilibrium in food production and supply in many SSA countries. Also, poverty is highly endemic in SSA where 47 percent of the population lived on $1.25 a day or less in 2008 (United Nations 2012).

Nutritional problems confronting Africa today are generally manifesting as micronutrient deficiency and protein-energy malnutrition. Micronutrient deficiency is now a public health problem with significant socioeconomic importance. It is not only a health problem that affects low-income countries but constitutes significant health challenge in some developed countries. The segments of the population that are always affected are already vulnerable to several income and consumption shocks. These include women, children, the middle-aged and the elderly (Tulchinsky, 2010). Micronutrient deficiency often leads to some major health crises some with global coverage.

Specifically, vitamin A deficiency (VAD) which is widespread among young children in many developing countries with globally affected children being about 127 million children (van Jaarsveld*et al.*, 2005; West 2002). VAD is able to limit human growth, weaken body immunity, cause xerophthalmia leading to blindness, and increase child mortality (Sommer and West, 1996). Many countries therefore embrace distribution of vitamin A supplements, fortifying food and engaging in other food-based strategies that are aimed at enhancing vitamin A composition of foods. Recently, Moringa is being promoted as major source of food nutrients across many African countries. This new wave may mark total victory over undernutrition given the high nutritional composition of the vegetable.

2. Nigerian Food and Nutrition Outlook

The Nigerian agriculture is a dominant sector employing more than 70 percent of the labour force, contributing more than 40 percent of the Gross Domestic Product (GDP), generating foreign exchange earnings, supplying raw materials for industrial growth and providing several environmental functions for climatic regulation. Over the past few decades, several production constraints have limited performance of its role as the food supplier for more than estimated 150 million people in the country. It is important to emphasize that food insecurity in Nigeria is unacceptably high given enormous natural and human resources the country is endowed with. It should be emphasized that cumulative impacts of agricultural sector neglect due to discovery of oil and failure of several economic policies to achieve the set objectives were responsible for the Nigeria's worsened food crisis.

There are also enough evidences indicating that after the national independence in 1960, past administrations had made several efforts at transforming the agricultural sector in a manner that makes the country self-food sufficient. In the 1970s, for instance, Nigeria started the National Accelerated Food Production Programme (NAFPP) as the first well planned and conceived food crop production programme for small scale farmer (Okigbo, 1982). The NAFPP concept was articulated and launched in 1972 but the pilot projects began in 1974. The aim was to make Nigeria self-sufficient in six basic staple food crops which were maize, rice, millet, sorghum, wheat and cassava by using individual farmers to produce and multiply improved seeds for wider

distribution to farmers. The programme's great potential for increasing the yield of the six crops can be obviously assessed from the outputs of the pilot projects where yields of maize and rice respectively increased by 115 and 100 percents when compared with the local breeds that were planted in Oyo State. The main reason for replacing the NAFPP with Operation Feed the Nations (OFN) which only succeeded as a slogan was the change in government (Okigbo, 1982). That is a good example of the extent to which workable agricultural policy intents have been twisted and distorted by political instability.

Precisely, food crisis in Nigeria assumed a dimension of alarming proportion since the mid-1980s. Specifically, the commencement of the Structural Adjustment Program (SAP) in 1986 marked the beginning of sorrows among many Nigerian rural and urban households. The situation was so bad that food rationing and different unimaginable survival strategies literally turned "SAP" to the most popular household name. With drastic reduction in purchasing power of incomes due to increased food prices, the nutritious dishes of the previous years were largely desired by many Nigerian poor households with great nostalgia. As economic crisis culminated into national austerity, food consumption and malnutrition drastically worsened. Available data show that in Borno/Yobe states, SAP accounted for 27 percent and 33 percent decreases in energy and protein intakesrespectively in 1987 (Igbedioh, 1993).

All the same, Nigeria formally accepted the desirability of food security as a goal that should be pursued at the national, sub-regional, regional and global levels during the 1996 World Food Summit. However, more than a decade after the above laudable declaration, persistent stagnation of agricultural production remains a major threat to ensuring food security. Malnutrition and food problems in Nigeria are highly responsive to seasons with more concentration in northern part of the country. Northern Nigeria is not only hot spot for malnutrition, especially among under-five children for its erratic rainfall or weather vagaries, but also for political instability resulting from several religious crises. Edeh (2012) reported that based on United Nations Children's Emergency Fund (UNICEF) 2011 projection, about 1.1 million children will suffer from severe acute malnutrition in 2012 in eight countries comprising Chad, Niger, Mali, Burkina Faso, Mauritania, Northern Senegal, Northern Cameroon and northern Nigeria. It was noted that "poor nutrition jeopardizes children's survival, health, growth and development which slow down national progress towards developmental goals. The prevalence of global acute malnutrition (GAM) was found between 5 to 15 percent in all surveys across all states and when the situation is beyond 10%, it is regarded as emergency situation. Without any intervention, severe acute malnutrition has up to 60% mortality risk and children with severe acute malnutrition are nine time likely to die from any causes than those who are not".

Malnutrition rates among children and women of reproductive age in Nigeria are high. These also vary significantly across rural-urban locations, geopolitical zones, and agro-ecological zones, thereby constituting a significant public health challenge (Ajieroh, 2011).Under-five mortality rate is still high in Nigeria due to some deficiency in vital food nutrients. In many instances, acute shortages of essential nutrients in breastfeeding mothers' nutrition manifest in nutritional deficiencies in children with severe long-term health and developmental consequences.

Nigeria now has vision 20:2020 that seeks to provide a development pathway to be taken in order to position the country among twenty most developed countries in the world by 2020. Government had emphasized agricultural development as a paramount goal for achieving sustainable economic growth and development. This is very vital because in order to feed the teeming Nigerian population, provide raw materials for agro-based industries, and earn good foreign exchange from exportation of the surpluses of agricultural produce, Nigeria cannot afford to undervalue the vast agricultural potentials. It had been noted that due to poor agronomic practices, poor crop types (varieties), pests and diseases, low soil fertility, average crop yields per hectare on Nigerian farms for the various crops are abysmally low, when compared to the potentials for the various crops in agro-ecological zones. This, coupled with inadequate households' incomes is hindering the potentials of the country's vast agricultural crops to ensure nutritional adequacy. It is therefore imperative to explore the food utilization pillar of food security by analyzing the great potentials loaded in *Moringa oleifera*(henceforth referred to as Moringa), which if well explored can help to reduce malnutrition in Nigeria, especially among children and women performing some reproductive responsibilities.

3. Outlook of Moringa's Nutritional Composition

There are quite a lot of leafy vegetables that are very popular in Nigerian diets. Due to rich crop combination and favourable climate, there are numerous vegetables that are grown in each agro-ecological zone. Some of these vegetables have over the decades served several nutritional functions. Over and above these, a lot of these vegetables perform some medicinal functions that include boosting

digestive functions, blood purification, tapeworm expulsion, blood pressure regulation and relief from headache (Ayodele, 2005; Durugbo*et al.,* 2012). In addition, Nigerian leafy vegetables are the cheapest sources of protein, vitamins, minerals and some essential amino acid.

It is also important to emphasize that while some of these vegetables grow wildly in some environments, cultivation of vegetable like pumpkin leaves, chochorus, celosia etc. can be extremely demanding in terms of labour and soil nutrient inputs. The growth and performance of many leafy vegetables are also directly influenced by seasonal variability in rainfall and other agro-climatic variables. Recent instances of climatic change have limited performance of some Nigerian leafy vegetables, making them unaffordable to the poor at some periods of the year.This is one of the advantages that Moringa has over several vegetables in Nigeria. Awareness of its propagation and nutritional values is just increasing in many Nigerian rural and urban areas, although it is often claimed to have been in use in some northern parts of the country for many decades.

Typically grown in semi-dry lands, desert or tropical soil, it can thrive very well in every ecological zone in Nigeria irrespective of any already identified crop production constraints. It is able to withstand drought because the roots are able to store some moisture for prolonged periods of time as a peculiar characteristic of plants belonging to the family Moringaceae(Fahey, 2005). This implies that rainfall instability may not have pronounced impacts on Moringa productivity as it would have on other leafy vegetables. Therefore, with climatic change and its associated impacts on crop production, Moringa as a nutritious vegetable can be exempted, and it would not require wetland to guarantee its optimum performance during dry season.

Another vital advantage of Moringa is ability to be propagated both sexually and asexually. Very rare Nigerian vegetables possess this characteristic. The implication is that Moringa seeds can be planted to have it grown as well as stem cuttings. Propagation by stem guarantees survival due to ability of the stem to withstand any severe environmental stress. It also implies rapid and ease of multiplication because plants grow faster from stems than from seeds. Vegetative propagation will also reduce pest and disease infestation that would have undermined survival and development of seedlings.Moringa begins its development as a seedling to forming canopies as a big tree in just few months. The speed of growth surpasses every cash crop that is known in Nigeria be it cocoa or kolanut.

Another vital advantage of Moringa vegetable is the large volume of leaves it possesses within a very short period of time. These leaves can be harvested at any point in time during the year, making it available as food even during planting season when many rural households normally run out of food. Although nutritional composition of Moringa may vary with season and age of leaves, it is still better than the best to expect from some other major vegetables and food crops. Moringa has gotten no part of it nutritionally worthless. The stem, leaves and seeds all have important functions to perform in meeting some nutritional requirements of man. This also makes it poverty alleviating crop and emphasizes the fact that it is truly a “miracle tree”. The leaves can be dried and grinded for storage, while some eat it raw. Fresh leaves of Moringa can be cooked just like any other vegetables. It can be added to food like porridge, rice, and beans to add some exceptional nutrients to family diets. Moringa seeds have peculiar sweet taste and they are very nutritious as well.

The nutritional compositions of Moringa are amazingly great. Precisely, it is commonly said that Moringa leaves contain more vitamin A than carrots, more calcium than milk, more iron than spinach, more vitamin C than oranges, and more potassium than bananas,” Protein quality of Moringa leaves compares favourably with that of milk and eggs (Fahey, 2005). Vitamin A composition in Moringa is vital for addressing many health challenges among Nigerian children.Moringatree contains many nutrients such as essential vitamins, essential minerals, amino acids, beta-carotene, anti-oxidants, anti-inflammatory nutrients, phytochemicals and it also contains both omega-3 and omega-6 fatty acids.

Moringa can reverse the statistical documentations of child mortality in the world because Vitamin A deficiency is a common and widespread nutritional disorder. Prevention and control of vitamin A deficiency is one of the priorities of the World Health Organization (WHO) and UNICEF in their efforts towards addressing malnutrition in many developing countries (WHO, 1989; UNICEF, 1990). High level of vitamin A deficiency had also been identified as a major causal factor for young child morbidity and mortality (Martorell, 1989). If well utilized, cost of vitamin A vaccines that are regularly given to children in Nigeria will be reduced. This is vital because it had been projected that inability to provide adequate vitamin A will result into more than 80,000 child death annually in Nigeria (Micronutrient Initiatives, undated). Therefore, losses to nation in form of human capital reduction would reduce and intellectual capability of the children can be enhanced by Moringa.

A very vital source of vitamin A among Nigerian rural children is palm oil (Adelekan*et al*, 1997), which many urban households may have replaced with vegetable oil.Carrot which is another source of vitamin A may not be accessible to some rural children if not cultivated by the households and it is sometimes expensive and seasonal in urban areas. Moringa can therefore serve as very cheap source of vitamin A. Babu (2000) submitted that in Malawians diets, Moringa not only contains more vitamin A, Calcium and vitamin C than cowpea leaves, turnip leaves, amaranthus leaves, beans, egg and milk, the cost is also by far cheaper. Vitamin A from Moringa was found to be so cheap to the extent that similar quantities from beans would cost 150 times, about 71 times for milk and about 15 times for eggs.

The calcium in Moringa can help to reduce bone dysfunctions among Nigerian children. Issa (2012) submitted that calcium deficiency can lead osteoporosis, reduced bone mass, hypertension and colon cancer among others. The implication is that regular intake of Moringa reduces the risk of having the afore-listed health conditions. Similarly, iron, potassium, and vitamin C that are generously found in Moringa are essential for several aspects of human body's metabolism. The leaves and pods of Moringa can also facilitate breast milk production among breast feeding mothers.This is vital for child's growth and development because some mothers give excuse of low milk production to reduce the length of time for breastfeeding.

The protein and energy compositions of Moringa offer great opportunity to address protein-energy malnutrition in Nigeria. The cheapness of protein and energy from Moringa if compared to other food stuffs makes it economical to utilize. Moringa seeds can also serve the purpose of water purification by extracting Pb(II), Co(II), Cu(II), Cd(II) and Ag(I) from water at a very low cost and very high efficiency. Removal of impurities from water implies better health for rural people due to expected reduction in incidences of water-borne diseases. It also reduces use of alum and its associated cost for water purification.

4. Conclusion and future outlook

Malnutrition and hunger pose serious challenges to socio-economic development in Nigeria. Moringa offers some solutions due to its very high nutritive value, ease of growth and ability to withstand drought. Vitamin A deficiency among children and protein-energy malnutrition can be easily addressed by essential nutrients that are contained in Moringa. The onus rests on policy makers to promote utilization of Moringa as food in the urban and rural areas. Initiatives for setting up large scale plantations of Moringa at the state and local government levels should be paramount in the agendas of the governments. This will provide a platform for ensuring that Moringa products are readily available for people's use. Also, awareness creation through several public and private media houses will facilitate the speed of information dissemination about nutritional worth of Moringa.

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Households' Willingness to Pay (WTP) for the National Health Insurance Scheme (NHIS): The Case of Ojo Local Government Area of Lagos State, Nigeria

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Abstract: Ensuring adequate access to healthcare services by the people is a paramount goal of health care delivery policies in Nigeria. One of such initiatives is the National Health Insurance Scheme (NHIS) that the government is test-running for ensuring adequate understanding of its modus operandi and likely constraints. This study examines household's willingness to pay for National Health Insurance Scheme in Ojo Local Government area of Lagos State. Data were collected from 120 households using structured questionnaires that were administered by personal interviews. Descriptive statistics and Probit regression were used for data analysis. Results show that majority of the households made use of orthodox form of medicine though healthcare facilities were largely perceived to be non-functional. Probit regression results showed that expectations of tax reduction, monthly income, marital status and household size, gender and impression of paying much more significantly influenced WTP ($p<0.05$). It was concluded that National Health Insurance Scheme is a laudable programme but its commencement would be facilitated by ensuring adequate quality of healthcare services and moiré awareness creation.
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Keywords: NHIS, healthcare, awareness, Lagos state

1. Introduction

Health issues in Nigeria are paramount on the concurrent legislative list of the Federal Constitution. Hence, the absolute responsibilities for it fall on the Federal, State and Local Governments (CBN, 2000). The first national health policy was adopted in 1985, with a goal of bringing about a comprehensive health care system based on primary health care, which is extensive, preventive, protective, restorative, rehabilitative and affordable to every citizen. It was also to serve as a strategy to achieve health for all by the year 2000. Also, various strategies have been adopted to improve the health status of the people, particularly with respect to reducing infant and maternal mortality. However, health service delivery worsened in the early 1990s due to lack of appropriate financial commitment that resulted in shortage of drugs, vaccines and other essential medical equipments. The government had initially provided "Free health care" for its citizens funded by its earnings from oil exports and general tax revenue. However, the global slump in oil prices in the 1980s greatly affected Nigeria's major source of income. Government could therefore no longer afford to provide free health care for its citizens. They however, subsequently introduced several cost recovery mechanism like user charges and drugs revolving funds. Furthermore, the introduction of the Structural Adjustment Programme in 1986 adversely affected the health sector allocation (NHIS Handbook, 2004).

In government's quest to ensure that every Nigerian has access to good health care services, the National Health Insurance Scheme (NHIS) has been proposed. NHIS has been on the drawing board since 1962 (Katibi *et al*, 2003). Under this program, workers in the private and public sectors are to contribute 5 percent of their basic salary, with counterpart contribution of another 5 percent by the employers. With the renewed interest and efforts at full commencement of the Scheme, this study focuses on analyzing the willingness of the households to participate in the proposed Scheme. This is to ensure that policy makers have some foresights into the potentials of the proposed Scheme in meeting the health needs of the people.

Some studies had been carried out on health insurance schemes and other health-related services in some African countries. Bonu *et al* (2003) investigated the WTP for user fees in health facilities in Tanzania. The survey demonstrated that 12% of respondents were not willing to pay any amount of money for the services, while 34% were willing to pay TSh 100-999 and 12% were willing to pay at least TSh16,000. The poor, older (>46 years) and women were significantly less likely to be willing to pay. Almost one quarter of the poorest 40% of the population was not willing to pay. The authors

concluded that uniform user charges may be regressive, adversely affecting the poor, women and elderly.

Frick *et al* (2003) examined the willingness to pay for azithromycin treatment for trachoma in Tanzania. About 40% stated they would not be willing to pay any amount of money. It was discovered that lack of willingness was associated with lower maternal education and proxy indicators for lower cash availability. The authors concluded that community distribution of antibiotic for trachoma control needs to be free.

Muela *et al* (2000) carried a qualitative study in Tanzania to investigate the reasons people may be unwilling to spend money on biomedical services when they spend large sums on traditional medicines and healing. Two points were made: first, when people believe they have "out of the order" illnesses (those caused by witchcraft or spirits) they feel they must consult traditional practitioners; for "normal illness" (e.g. malaria, diarrhea) they seek biomedical treatment. Second, when traditional practitioners are needed, there is great social pressure and financial support from family to pay for this, unlike the situation when biomedical services are needed.

Mubyazi *et al* (2000) conducted a similar study in Tanzania looking at the payment mechanisms for the poor and the vulnerable groups in Korogwe District Tanzania. The result showed that 70-80% of community leaders and focus group participants and 100% of health workers (private and government) interviewed supported the policy of cost sharing. Males were significantly more likely to have their own savings to use for payments than females were. Most community leaders and government officials were aware that waivers could be granted for "the poor" but patients were less likely to know about this. Patients had mixed opinions on whether user fees improved the quality; about half said all services improved, a quarter said all services worsened, and a quarter said some services improved and some worsened. Authors stress the need for formulation of an acceptable definition of "poor" for waivers.

Shrestha *et al* (2004) conducted a study that looks specifically at willingness to pay for cataract surgery in Nepal. Seventy-eight patients with cataract (one or both eyes) were interviewed to determine WTP for cataract surgery. The description of the methods is inadequate to determine how patients were selected for interview or exactly what they were asked. Only half of those with cataract were willing to pay for surgery. Among these, half were willing to pay more than $13 and half less. Factors associated with unwillingness to pay included poverty, and unilateral cataract. Also, females were willing to pay less than male.

Hengjin *et al* (2003) conducted a similar survey in Burkina Faso. The survey looked at the Willingness to pay for community based insurance in that country. The purpose of the survey was to study WTP for a proposed community-based health insurance (CBI) scheme in order to provide information about the relationship between the premium that is required to cover the costs of the scheme and expected insurance enrolment levels. In addition, factors that influence WTP were to be identified. Data were collected from a household survey using a two-stage cluster sampling approach, with each household having the same probability of being selected. Interviews were conflicted with 2414 individuals and 705 household heads. The take- it- or leave- it (TIOLI) and the bidding game were used to elicit WTP. At the end of the survey, it was discovered that the average individual was willing was influenced by household and individuals' ability to pay, household and individuals characteristics, such as age, sex and education.

The main objective of this study is to examine the household's willingness to pay for National Health Insurance Scheme (NHIS). This will be achieved with the following specific objectives: to establish households' use of orthodox medicine in relation to their socio-economic characteristics; to examine households' perception of the functionality of the existing health care facilities; to determine the awareness level of households on NHIS; and to determine the factors responsible for households willingness to pay for the Scheme.

2. Materials and Methods

Area of study

Ojo Local government is located at the western part of Lagos State along the Lagos-Badagry expressway. The area falls under the Badagry division, which is one of the five divisions making up Lagos administratively. Ojo has a land size of 54 square kilometers out of the 3577 square kilometers of Lagos State. The state is located on the southwestern part of Nigeria on the narrow coastal plain of the Bight of Benin. It lies approximately on longitude $2^{0}42^{1}$E and $3^{0}22^{1}$ East respectively and between latitude $6^{0}22^{1}$N and $6^{0}02^{1}$N. The rate of population growth is 300, 000 persons per annum. In the built up urban areas of metropolitan Lagos, the average density is 20, 000 people per square kilometer. It is a wetland region and has two climatic seasons; dry (November – March) and wet (April-October). Ojo Local Government characterized by a large central market where all people resident around there make their food shopping. The market is

situated along the expressway, which extends deep into the street.

Data collection and sampling procedures

The study made use of primary data. Simple random sampling was employed for the research survey. The Local Government Area was divided into 5 zones; they include Okokomaiko zone, Igbo-elerin zone, Sabo zone, Abule Aka zone and Alaba zone. Because of lack of authentic population figures for the zones, 30 households were interviewed from each of the 5 zones. However, insufficient information and poor response left us with only 122 households to work with. Data were collected on the socio-economic characteristics of the households, their perception about the functionality of the health facilities and factors affecting their WTP for NHIS.

Methods of data analysis

The method of data analysis used in this study includes the use of descriptive statistics such as frequency distribution, mean, percentages and tables. Probit regression model estimation was used to estimate the determinants of WTP for NHIS.

Probit Model Analysis

It is an alternative log-linear approach for handling categorical dependent variables. Its assumptions are consistent with having a categorical dependent variable assumed to be a proxy for a true underlying continuous normal distribution. A typical use of probit is to analyze dose-response data in medical studies. Like log logistic regression, this study focused on a transformation of the probability that Y, the dependent variable equals 1 if the respondent is willing to pay for NHIS and 0 otherwise. The estimated model can be stated as:

The following were the independent variables: savings (₦), number of dependants, other source of income (yes = 1, 0 otherwise), other financial demands (yes = 1, 0 otherwise), tax reduction (yes = 1, 0 otherwise), impression of paying much more (yes = 1, 0 otherwise), income (₦), age of the household head, gender (male = 1, 0 otherwise), marital status (married = 1, 0 otherwise) and household size.

3. Results and Discussion

Households' use of health services

Table 1 shows that 65 percent of the households had family doctors while 35 percent did not. This shows existing concerted efforts by the people to access health facilities. It also reveals their awareness of the health benefits in modern medicines as against orthodox traditional ways of treating diseases. The table also shows that 57.5 percent of the households in the study area visited hospital when there was incidence of illness. This shows that a considerable number of the total households in the study area made use of hospital when ill. However, 26.6 percent visited hospitals for medical checkup while 15.0 percent were there for medical advice. Also, 86.7 percent of the households in the study area visited the hospital whenever the need arose while 10.0 percent indicated to have visiting hospital twice per week while 1.7 percent visited once in a week and two weeks. It also shows that 52.5 percent of the respondents made use of government hospitals while 47.5 percent utilized the services of private hospitals.

Table 1: Distribution of households on usage of medical services

Family Doctor	Freq	%
No	42	35
Yes	78	65
Reasons for visiting hospital		
Illness	69	57.5
Medical Check up	32	26.6
Medical Advice	18	15.0
Illness & medical check up	1	0.8
Frequency in hospital		
Once a week	2	1.7
Twice a week	12	10.0
Once in two weeks	2	1.7
Whenever need arises	104	86.7
Type of hospital		
Government hospital	63	52.5
Private Hospital	57	47.5

Source: Field Survey, 2006

Households' perception of the functionality of healthcare facilities

This section is aimed at establishing households' perception of the functionality of the healthcare facilities in the communities. Table 2 below shows the different levels of perception of the households that were interviewed. Likert scale was used to rank their perception level. The results show that 4.2 percent of the households indicated that the health facilities were still in good working condition and functioning, while the number of households that held the view that the healthcare facilities were in poor state is very high, this recorded 50.8 percent of the households. This implies that majority of the households in the study area believed that health facilities were in poor state. They also held the view that government has not done anything to improve the poor state of the health facilities in their communities. The results of awareness level of the households about National Health Insurance Scheme

(NHIS) are also presented in table 2. It shows that only 37.5 percent of the households were on the high awareness level strongly aware about the NHIS, which is about 37.5 percent of the total respondents. 27 households are observed not to be aware at all which is 22.5 percent of the respondents, while 48 household which is 40 percent of the total respondents are aware, but they are partially aware of the programme. This implies that the awareness level about NHIS in the study area is quite high.

Table 2: Perception scale of households about functionality of health centers and NHIS Awareness

Functionality	Frequency	%
10 – 20 (Low)	5	4.2
21 – 30 (Moderate)	54	45.0
> 30 (High)	61	50.8
Awareness		
10 – 20 (Low level)	27	22.5
21 – 30 (Moderate level)	48	40.0
> 30 (High level)	45	37.5

Source: Field survey, 2006.

Factors influencing households' WTP for NHIS

Probit model was used to determine the willingness to pay (WTP) for the NHIS. Households' savings, number of dependants, other source of income, meeting other demands, tax reduction, monthly income (salary), age of household head, gender, marital status and household size, all are the independent variable. The dependent variable is the willingness to pay (WTP). The model produced a good fit of the data as shown by statistical significance of the computed Chi Square ($p<0.01$).

Reduction of tax, monthly income, marital status and household size were statistically significant ($p<0.05$), while gender and "impression of paying much more" were statistically significant ($p<0.01$). The positive relationship between tax reduction and the willingness to pay indicates that household will be willing to pay for NHIS if tax was reduced from 5 percent to a lower percentage. They were of opinion that if the tax was reduced, their income would be enough to meet their immediate needs and still have enough for savings. However, the negative relationship between households' impression of paying much more than the usual healthcare service, and their WTP implies that majority of the households did not think that NHIS would cost more than the previous form of healthcare services which they were using. However, this impression did not affect their willingness to pay for NHIS.

Households' monthly salary had positive effect on WTP. It was found that majority of the respondents in the study area did not have other sources of income. It was recorded that only 3 respondents earn close to ₦40, 000 on the average. This implies that majority of the households here are low-income earners with an average salary of about ₦15, 000. It was however concluded that households with low-income may not be willing to pay for NHIS because of insufficiency of their income to meet other financial demands.

The parameter of gender had negative relationship with households' WTP. This implies that female headed households had higher probability of WTP for NHIS. The parameter of marital status had negative relationship with households WTP. This implies that married households had lower probability of WTP. The positive relationship between household size and the WTP for NHIS implies that the more people in a household the higher their willingness to pay. It was deduced from the study that a household with 4 children under 18 years will be willing to pay for the programme than a household without or with just one child. This means that a household will want more people to be covered under this programme so as not to be cheated. However, a household with just one child might not be willing to pay for the programme.

Table 3: Probit results of the determinants of households' WTP for NHIS

Variables	Coefficient	*t*- value
Constant	0.305	.359
Savings	0.007	.613
Dependants	0.062	.935
Income	-0.238	-.798
Other demands	0.219	.635
Tax reduction	0.735*	1.941
Pay more	-0.850***	-2.755
Salary	1.025**	2.152
Age	-0.027	-1.099
Gender	-0.788**	-2.516
Marital status	-1.090**	-1.996
Household size	0.229**	2.057

Diagnostic tests: Log likelihood function = -62.27487; Restricted log likelihood = -84.41636; Chi-squared = 44.28296; Overall significance level = 0.001

4. Recommendations and Conclusion

The study examines household's willingness to pay for National Health Insurance Scheme in Ojo Local Government area of Lagos State. It reveals that majority of the households made use of orthodox form of medicine. This study also reveals that majority of the households perceived that healthcare facilities in their respective communities were non-functional. Not many households were aware about the programme and tax reduction, monthly income,

marital status and household size, gender and impression of paying much more significantly influenced WTP ($p<0.05$).

In view of the growing cost of health services in the century, this study recommends that the government should try as much as possible to ensure functional tax system whereby the rich compensates the poor. This will encourage the low-income earners to be willing to pay for the NHIS. Another issue to be considered is the area of the health facilities available in our hospitals. The government should ensure that there is total overhauling of the health care centers. Obsolete medical equipments should be replaced with modern ones. This will go a long way in influencing households' WTP for NHIS. The level of awareness should also be increased through mass media and other public enlightenment programmes.

In conclusion, the National Health Insurance Scheme is a laudable programme put in place by the Federal Government to ensure that the quality of healthcare services is improved for the citizenry and also ensure equitable distribution at an affordable cost. However, the government should ensure that there is continuity and consistency as the programme kick starts.

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A Truncated Poisson Modeling of Visitors' Use-Values of Addis Ababa Lions Zoological Park, Ethiopia

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Abstract: Environmental resources provide economic benefits to man though these are sometimes difficult to value due to missing markets. This study estimated total economic use values of Addis Ababa Zoo Park using the Individual Travel Cost Method (ITCM). Data were collected from 158 visitors using structured questionnaires to estimate the value of viewing. Data were analyzed with descriptive statistics and truncated Poisson model. The results show that travel cost, monthly income and number of dependents significantly influenced demand for recreational site ($p<0.10$). Potential annual use value of the park was estimated at Birr11,767,287 per annum. The findings are critical in assisting policy makers to fashion out adequate investment profile for ensuring appropriate pricing of the wildlife.

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Keywords: Poisson regression, travel cost method (TCM), use value, Addis Ababa.

1. Introduction

Natural and environmental resources provide a complex set of values to individuals and benefits to the society. Protected areas, for example, offer scenic panoramas and radiant sunsets, exhilaration of white-water canoeing, the total serenity of wilderness trek, educational and spiritual values. There are different types of protected areas which are designed to give different services to the public. These include national parks, zoological gardens, cultural and historical parks, scenic or natural parks, amusement parks, children parks, sport parks, botanical gardens and nurseries. Both national parks and zoological parks are mainly used for protecting wildlife, but they serve different goals. In the national parks or sanctuaries, wildlife lives within a natural forest and there is no limitation on their movement from place to place whether in search for food or mates. On the other hand, since zoological parks are mostly found in towns, wildlife animals are forced to be incarcerated and dependent on humans for survival. Zoological parks are useful in protecting wildlife from dangers and increasing their number through breeding and close monitoring. Besides, zoological gardens create wildlife conservation awareness to the public and are very important for research and educational purposes (Carson, 2000; Bateman *et al.*, 2001; Tarfasa, 2007; Yalemzewd, 2007).

Zoological parks and botanical gardens have other advantages beside their primary activity of preserving and conserving wildlife. First, they serve as sources of income. For example, bird watching or birding in North America contributes more than $20 billion each year (Fish and Ervice, 1982). Second, they create job opportunities for the local community. Finally, establishment of zoos and botanical gardens motivate other investments such as gas stations, hotels and parking services in the neighborhood. Despite all these benefits, the conservation activities done by the recreational authorities and the society's contribution are limited. A majority of people in developing countries would like a better natural environment, less air pollution, more peace and serenity, cleaner beaches, more nature reserves and greener electricity production.

Unfortunately, those same people also need better roads and railways, more new homes to be built and low taxes to pay. Besides, many human activities are competing with the environment; for example, an increasing demand for agricultural land due to population growth puts pressure on wildlife, while an increase in number of industries results in water, noise and air pollution. Nevertheless, most people are not willing to compensate for the loss of environmental resources and even, if people are willing to pay for the benefit they derive from environmental services, getting the appropriate price for environmental resources is a bit difficult due to the absence of appropriate markets. It is the failure of the market system to allocate and price resources and environmental services correctly that creates the need for environmental valuation in order to guide policy makers (Byrne *et al.,*2003; Bowker and Leeworthy, 1998; Shaw, 1992).

Although Ethiopia is among the world leaders in terms of richness and endemism of mammalian species, the economic values of these

resources are still unknown. Because of absence of markets for these resources, their economic contributions to the development of the economy are undervalued. This has affected the sector negatively through limited conservation activities done by the responsible bodies. The wildlife population in Ethiopia has diminished over the last century, both in amount and distribution through hunting and land clearance for farming. Land degradation due to overgrazing is also intense and a vital contributing factor (Cameron, 1996; Cameron and Trivedi, 1998; Gizaw, 2007; Phillips, 1998; Shaw 1992; Mesfin 2010).

This study analyzed the economic values of wildlife resources inAddis Ababa Lions' Zoo Park. This study can be justified for some reasons. First, the zoological garden is a potential tourist destination because it is situated in Africa's administrative center. Therefore, it has potentials to generate high income and support for the tourism sector if appropriate valuation is employed. Second, this study seeks to contribute to a policy design for appropriately managing the Park through budgetary allocations by estimating the willingness to pay. This will also assist in adjusting the entrance fees in a manner that reflects economic and social costs/benefits.

The general objective of the study is to examine the total economic value of wildlife at Addis Ababa Lions Zoo Park and its contributions to national economic activity. The specific objectives are to determine the optimum entrance fee to the park and assess the socio-economic and demographic characteristics that influence people's willingness to pay for use value. In the remaining parts of the paper, methodology, results and discussions and conclusion were presented.

2. Materials and Methods

Sources of data

Data were collected from 150 visitors to assess consumers' economic surpluses for the direct use value The sample individuals were obtained from those visitors on the site during the survey. The respondents were randomly selected in the Park for interview after obtaining the consent of the authority of the zoo. The enumerators were in the Park in the morning till evening, and data collection took about 2 weeks including week-ends. Although interferences of the enumerators would have constituted some disturbance to the respondents, these were reduced by targeting the interviews with them while relaxing after going through the garden.

Individual Travel Cost Method

The travel cost method was used to estimate the recreational use value of the Park.In a model of single-site travel cost method (TCM), it is assumed that an individual's utility can be expressed as:

$U = U(X, L, y).1$ (1)

Where U is the individual's utility, X is the aggregate consumption, L is leisure and y is number of trips. The study further assume weak complementarity of trips with quality at the site, q. In other words, $\frac{\partial U}{\partial q} = 0$ when $y = 0$ (when a person does not visit the site, his or her utility is not affected by its quality), and y is increasing in q. The individual chooses X, L and y to maximize utility subject to the budget constraint:

$W \times [T - L - y(t_1 + t_2)] = X + P_y \times y$ .2

where Wis the wage rate, T is total time, t_1 is travel time to the site, t_2 is travel time to home, f is the access fee (if any) and P_y is the full price of travel. This model further assumes that travel time and time spent at the site are exogenous, that there is no utility or disutility from traveling to the site, and that each trip to the site is undertaken for no other purpose than visiting the site. It also assumes that individuals perceive and respond to changes in travel costs in the same way they would to changes in a fee for being admitted to the site. Finally, the model assumes that work hours are not flexible. This yields the demand function for trips:

$y^* = y^*(P_y)$ .3

Where $P_y = \frac{1}{4} \times hourlywage(t_1 + t_2) + travelcostisthefullpriceofatrip.$[1] .4

In this study, it is assumed that the demand function for trip is semi log because when compared with other functional forms like linear, quadratic and log-log forms it is highly efficient according to many studies. Englin (1995) compared linear, quadratic and semi log forms and got semi log is better in explaining the TCM demand function. Haab and McConnell (2003) deduce that semi log and log-log functional forms are preferred to other types of model specifications since they reduce heteroscadesticity and multicoolinrearity problems, and gives efficient and consistent estimates.

To estimate the demand equation, it is necessary to ask a sample of visitors to report the number of trips they took in a specified period, cost per trip, wage and other individual characteristics that might affect the demand for visits to the site. Once the demand function has been estimated, the consumer surplus provides an approximation of the

[1] $\frac{1}{4} \times hourly\ wage\ (t_1 + t_2)$ is the opportunity cost of travel time. The study takes ¼ of wage rate since many visitors visit the park during weekends and as a result the opportunity cost of time is small.

welfare associated with visiting the site. Formally, based on the demand function equation, the consumer surplus is equal to the area below the trip demand function and above the travel cost function. Estimation of the demand function and consumer surplus for the actual visitors is done using the count data model.

The non-negative and integer nature of trip demand suites the count data model to estimate recreational benefits. The application of count data model to assess recreation site demand by adopting on-site survey encounters the problems of asking the frequency of visits and truncated non-user samples. So, the study follow Shaw's (1988) on-site Poisson model to correct for these two evaluation problems. Moreover the study employed semi log functional form to estimate the recreational demand of the site. The total travel cost and other socio-economic variables are included in the model as independent variable. Total travel cost contains transportation costs of visitors, converting round-trip distance from home to destination site into ETB and opportunity cost of time. Without estimating travel time for a recreation site, the consumer surplus of benefits will be underestimated. The functional relationship is presented below:

$$Ln\,(y) = \beta_0 + \beta_1 T\ cost + \beta_2 Income + \beta_3 travel\ distance + \beta_4 SUP + \beta_5 \text{group} + \beta_6 \text{RSW} + \beta_7 \text{age} + \in_i \quad .5$$

Where, $Ln\,(y)$ = the expected number of trips (in logarithm) which is the dependent variable. *T cost* is the sum of travel cost and time cost of travel including a return in ETB, *Income* is monthly income of visitors in ETB, *travel distance* is the total travel distance in kilometers, including a return, *RSW* is the relationship with wildlife as dummy variable (1= relationship with wildlife, 0= no relationship with wildlife), *age* is visitors age, group is the travel characteristics as dummy variable (1=group, 0=single), *SUP* is the number of people that the respondent supports, β_0 is the constant term, $\in_i$ is the residual term which has a normal distribution with mean zero and variance δ^2

The primary aim of travel cost method is finding the use value of recreational demand benefits and computation of consumer surplus for each recreational trip. The appropriate recreational demand function is derived from the regression result between the expected number of trips and travel cost.

Estimation of the Demand for the Recreational Experience and Welfare Calculation

The study used the estimated coefficient of travel cost to calculate the welfare measures. Basically there are two steps to arrive at the final welfare of the visitor. The first step is estimating the demand relationship for the recreational benefit. This is done by relating the number of visit with the travel cost.

The linear semi log travel cost model hypothesis is:

$$\ln\,(y_i) = \beta_0 - \beta_1 Travel\ cost_i + \in_i \quad .6$$

Where y_i= individual i's annual visits to Addis zoo park, $Travel\ cost_i$ = Travel cost for individual i measured in ETB, β_1 is the constant term, β_0 is the coefficient of the travel cost

$\in_i$= residual and which has a normal distribution with mean zero and variance δ^2

3. Results and Discussions

Descriptive analysis visitors' characteristics and park attributes

Based on the survey data, demographic and travel characteristics of the visitors are presented in Table 1.

Table 1: Distribution of the visitors' demographic and travel characteristics

Variables		Frequency (n = 158)	Percent (100%)
Sex	Male	88	55.7
	Female	70	44.3
Marital status	Married	33	59.5
	Unmarried	125	40.5
Education level	Below Degree	83	52.6
	Degree and above	75	47.4
Preferred day of visit	Weekdays	21	13.3
	Weekends	125	79.1
	Public holiday	12	7.6

The results in table 1 show that 55.7% of the visitors were male and 44.3% were female. In the past, women were mostly engaged in domestic chores and hardly got the opportunity to attend school. The rise in the number of females in the recreational areas as visitors is an indicator of change in the society's attitude toward the gender division of different activities. Broadly speaking, couples spend most of their leisure time in recreational areas. This study also shows that 59.5% of the visitors are related or married, whereas single and divorced visitors together account 40.5%.Level of education among the sampled respondents is almost similarly distributed. About 47.4% of respondents have at least a first degree and above while 52.6% of the respondents have lower level of education.

Table 1 also reveals that 79.1% of the respondents preferred to visit Addis Zoo Park during weekends and 13.3% and 7.6% of the respondents preferred to visit during week days and holidays, respectively. This shows that many visitors prefer to visit the park during their leisure time to working time. This finding supports our previous conclusion in the methodology section on the opportunity cost of time as one fourth of the wage rate.

Since many visitors have preferred to visit the site during their leisure time the study takes the lower bound, which is one fourth of the wage rate, as an opportunity cost of time. Table 2 shows that almost three quarters of the respondents made small number of trips to Addis Zoo Park with 74.1% and high number of trips account only 5.1%.The table also shows that 55.7% of the visitors visit the site with their families and relatives and 44.3% were lonely visitors. Relatively high number of lonely visitors made a small number of trips as compared with visitors who were traveling in a group. For example 37.4% of the lonely visitors made small number of trips but group visitors made only 36.7%. On the contrary, 3.2% of the group visitors made many trips while lonely visitors made only 1.9% of the total respondent. This indicates that when people travel to recreational areas with a group then there will be a tendency to make more trips than lonely visits.

Table 2: Cross tabulation of visitors travel characteristics and number of trips

Number of trips (per year)	Visiting alone or in group		Total(%)
	Alone (%)	In group (%)	
Small number of trips (1-23)	37.4	36.7	74.1
Medium number of trips (24-49)	5.1	15.8	20.9
High number of trips (50-80)	1.9	3.2	5.1
Total (%)	44.3	55.7	100

Table 3: Cross tabulation of visitors level of satisfaction and number of trips

Number of trips (per year)	Satisfaction level			Total(%)
	Better than expected (%)	As expected (%)	Worse than expected (%)	
Small number of trips (1-23)	10.8	54.4	8.9	74.1
Medium number of trips (24-49)	1.9	18.4	0.6	20.9
High number of trips (50-80)	1.2	3.8	0.0	5.1
Total (%)	13.9	76.6	9.5	100

As depicted in table 3, many visitors were satisfied with the environment and the service delivery in the park. 90.55% of the visitors reported that they were satisfied with their stay in the park. 9.5% of the visitors responded that the park services were worse than their expectations and they only made small number of visits. More number of visits were made by those visitors that were satisfied with the park services. Table 4 identifies aspects of the park which attracted the visitors, and the respective number of trips made.

Table 4: Cross tabulation of attracting part of the park and number of trips

Number of trips (per year)		Attracting part of the park (AP)			Total (%)
		Existence of endemic wildlife (%)	Its green environment (%)	Its recreational service (%)	
Small number of trips (1-23)	Within AP	74.6	72.2	71.4	
	From Total	59.5	8.2	6.4	74.1
Medium number of trips (24-49)	Within AP	19.8	27.8	21.4	
	From Total	15.8	3.2	1.9	20.9
High number of trips (50-80)	Within AP	5.6	0	7.1	
	From Total	4.4	0	0.6	5.1
Total (%)		79.7	11.4	8.9	100

Addis Ababa lion Zoo Park is the only recreational zoo park in Ethiopia, the only wildlife reserving area in Addis Ababa and a home to some endemic animals. The lions in Addis Ababa zoo are the only traits in Ethiopia which attracts many national and foreign visitors. The existence of endemic wildlife attracts many visitors as shown in table 4 with 79.7%out of which 74.6% of the respondents made small number of visits. This indicates that even if they are attracted by the existence of endemic animals in the park, the small number of endemic animals found in the park is also the main reason for the respondents' disappointment.

Results of Truncated Poisson Regression

The econometric model presented in this section attempts to make some analysis and make inferences based on the information obtained from the sampled visitors. The robust regression result from truncated Poisson model is presented in table 5 below.

Table 5: A maximum likelihood estimation of the truncated Poisson regression

Explanatory variable	Expected coefficient Sign	Truncated Poisson coefficient	p-value	Marginal Effect	Mean Value
Distance Travel	-	-0.003 (0.006)	0.647	-0.006	10.332
Sup	-	-0.112 (0.049)	0.023**	-0.227	1.114
Age	-	0.007 (0.012)	0.528	0.015	27.563
Income	+	0.0001 (0.0001)	0.082*	0.0002	1632.089
Total travel cost (T cost)	-	-0.026 (0.006)	0.000***	-0.052	22.624
RSW	+	0.034 (0.152)	0.824	0.069	0.158
Group travel	+	0.064 (0.122)	0.602	0.129	0.563
Constant		1.044 (0.299)	0.000	-	-

*** 1 percent level of significance, ** 5 percent level of significance, * 10 percent level of significance (numbers in parenthesis are standard errors)

The truncated Poisson model is selected as an appropriate model that fits our data because of the absence of over dispersion problem. Over dispersion occurs when the variance is larger than the mean for the data. This may be due to few respondents making a large number of trips while most respondents making only a few. The mean of the visitation which is 2.533 is higher than the variance of the visitation 0.847, an indication of absence of the over dispersion problem. Furthermore test of over dispersion was made and the result shows that the dispersion coefficient alpha (ά) is $9.99e^{-24}$ and the p-value fails to reject the null hypothesis that says the value of alpha equal to zero or there is no over dispersion problem. Moreover, log-likelihood ratio test and the pseudo-R^2 value are used to test the significance of the model. The pseudo R^2 for truncated Poisson model is 10.87. The log-likelihood ratio (LR) test is formally more preferred to test the significance of the model. The calculated LR Chi Square (50.82) is statistically significant ($p<0.01$). Therefore, null hypothesis that all parameters are zero can be rejected.

The demand function of the independent variables includes travel cost, travel distance, income, SUP, RSW and age. It is expected that travel cost, travel distance, SUP and age are negatively correlated with the number of visits; and income, group and RSW positively correlated with the number of visits. The most important coefficients in this study for the purpose of gaining consumer surplus measures is the travel cost. The travel cost is the sum of all travel cost expenses including the travel time cost. The travel cost coefficients have registered the expected signs, negative sign, and is significant at 1 per cent significance level. The travel cost coefficients are consistent with the demand theory, which stipulates that when the price of travel increases then the number of visits will decrease.The negative sign is expected because as the costs of travel to the site increase, one is expected to take fewer trips per annum, ceteris paribus (given a fixed level of income). An increase in the travel cost by one birr will decrease the number of visits made to the site approximately by 5%. This means that people living closer to the site made many trips while those living far from the site made fewer trips.

Visitors' monthly income is also considered as one of the main variables that affects the number of visits positively. This seems reasonable, because when the income of an individual increases then the individual might be willing to substitute wage for leisure. On the other hand it is natural that people are willing to pay more for normal goods when their income increases. As described in table 4.9, the coefficient for income is significant at 10% significant level. As the income of the visitors' increases by one birr then the number of visits are expected to increase by 0.01%. However, the marginal effect of income on number of visits is very small which is due to the reason that the entrance fee to the park is very small, which is two birr. As shown in the appendix section, many visitors who made many trips are those who come from places near the site and therefore, they value their on-site expenses including entrance fee for their decision to visit or not. The onsite expenses are very small including the entrance fee which weakens income as the main determinant variable on the number of visits. As visitors income increases to higher level people also prefer clean and attractive environment during their time of visits. But as it illustrated in the appendix section almost 50% of high income group visitors are dissatisfied because of the environment and they made very small number of trips. For reasons outlined above, monthly income of visitors is an important variable but has a very small effect on the decision to make more or fewer trips.

Similarly, the variable SUP also registered the expected sign and significant level. The variable SUP is significant at 5% significant level. As the number of people an individual is supporting increases then the number of visits that he/ she makes will decrease and this is also consistent with the

theory of demand. When a visitor decides to support one more individuals at the margin then his willingness to visit the park will decrease by an approximate value of 22%. The first thing to note about this result is that, the magnitude is very large which could be because of two reasons. First when an individual supports his household members, he is devoting his income that might be used for visits and as a result the number of visit will decrease since the two goods are very competitive. Second, most importantly when an individual supports his household members, he is also scarifying his leisure time. This indicates that the variable SUP affects the number of visits from two directions.

The estimate of the RSW, distance travel and group coefficient produced the expected sign, but the estimated effect of the variable age did not. However, all these variables are not significantly different from zero.

The estimated demand function for Addis Ababa lions Zoo Park can be expressed as:

$$y = e^{1.04-0.52TC} \quad .7$$

The second step in the estimation of the welfare of an individual for a trip is finding the area under the estimated demand function which gives the recreational benefit flowing to each individual. The area of this demand function is estimated by integrating the inverse demand function between zero and the average number of visit. The result from this estimation gives the recreational value for average number of visits. Table 6 gives the result of the above estimation.

Table 6 Result of recreational value estimation and consumer surplus

Recreational value for average visit	Recreation value per trip	Average consumer surplus per trip
52.375 ETB	20.95 ETB	10 ETB

Source: Own computation

As shown in table 6, the recreational value for the average visit for truncated Poisson model is 52.375 ETB. Therefore the recreational value of the site per visit per person is estimated to be approximately 21 ETB. The annual report of Addis Zoo Park shows that the total number of visits to Addis Ababa lions Zoo Park in the last 12 months is 560,347 visits. Therefore, the annual on site recreational value can be calculated as 21 ETB x560,347 visit, which gives 11, 767,287 ETB

The last task in the measurement of welfare is finding consumer surplus. Consumer surplus is a widely accepted measure of net social benefit. It represents the difference between an individual's willingness to pay and actual expenditure for a good and service. With count data models, the procedure most often used is to calculate per trip consumer surplus (Creel and Loomis 1990). Per trip measure can be multiplied by the estimated number of trips in a year to obtain the aggregate consumer surplus of access to a given site or sites, in general or for a specific activity. The method establishes a relationship between the costs (the price) incurred by travelers to a site and the number of trips taken. This relationship is further exploited to derive Marshallian Consumer Surplus (CS) for access to the park for recreation experiences, by integrating the area under the demand recreation curve and above average travel cost 22 ETB. The result for average consumer surplus per visit as depicted in the table 6 is 10 ETB. Aggregate consumer surplus is obtained by multiplying the per trip consumer surplus of the visitors for the total number of 560,347 visits for the last 12 months, which is approximated to 5,603,470 ETB.

4. Conclusion and Policy Implications

This study analyzed the total economic value of Addis Ababa Zoo Park. This has been necessitated because of the economic importance of the development of tourism. Specifically, the tourism industry provides a number of economic returns in the form of foreign exchange earnings, employment generation, individual income and government revenues. In this regard, the potentials for using wildlife as an instrument for economic growth and development are quite enormous. However, these have not been fully explored both in Ethiopia and in other developing countries. Although some developments have been recently witnessed in the sector, wildlife is still largely considered from the limited aesthetic and touristic functions. In this respect, valuation can show, and quantify, the actual and potential contribution of wildlife to national economic growth, employment and income, to local livelihoods, to commercial profits and to industrial activities; and has shown how this information can be used to influence and mainstream development decisions and economic indicators.

This study attempted to measure the use value of wildlife through the employment of the travel cost method. The use value of wildlife estimated from data collected through the TCM, which helped to find the current recreational benefit of the park. The regression results showed that travel

cost, monthly income and SUP are important determinants for the recreational demand of the site.

The TCM is used extensively to value non-commercial outdoor recreational sites which have nominal access fees to inform decisions to invest in public recreation sites. Using travel cost method, the study attempted to quantify the benefits associated with the non-consumptive use of Addis Ababa Zoo Park. To increase number of visitors to the park while there is lack of awareness among visitors on the importance of wildlife, the results of the study could be useful to park management in setting appropriate conservation fee.

For TCM, an on-site truncated Poisson model of TCM is adopted to evaluate the use value of wildlife by calculating the consumer surplus. As estimated by the count data model, the study found the mean consumer surplus per trip to be 10 ETB. This demonstrates the magnitude of benefit provision by visitors and some proportion of revenue foregone at current pricing rates. This surplus represents only one category of total recreational value but it is sufficient to overturn approximate estimates of the opportunity cost. And the total recreational value of the park is approximately estimated to be 11, 767,287ETB per annum and the total recreational benefit or consumer surplus is estimated to be 5,603,470 ETB per annum.

The implication of the findings is important as a guideline to assist the park management or decision-makers in order to meet the sustainable use of wildlife through conservation activities. The result of this study may also be incorporated in the economic analysis for determining the viability of conserving wildlife of the park in the long run. However, future research is necessary to fully examine the robustness of the welfare values derived from the park to be used for management decision in the long run. Furthermore, the estimated benefits obtained from this study can be transferred to other similar parks for the purpose of policy or management decisions to affect the target resources.

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Factors Influencing Households' Preferences for Traditional and Modern Health Care Services in Debre Birhan, Ethiopia

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Abstract: Ethiopia's health care system is unable to effectively cope with the significant health problems facing the country. This this investigates household's preferences modern and traditional health services. Data were collected from 600 households that were randomly selected for interview using well structured pre-tested questionnaire. The Multinomial Logit regression was used to analyze households' preferences. Result predicted that the higher the household size, the older the patient, the further the modern health care providers and the dearer the cost of treatment, the more attractive the traditional HCIs be.It was recommended that rather than discriminating against traditional healers, governments should endeavour to set up mechanisms for enhancing their efficiency.
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Keywords: care preference, traditional healers, modern health providers, Ethiopia

1. Introduction

For the development of any economy, availability of human, financial and natural capital in quantity and quality is very crucial. Among those capital assets, human capital is considered as a strong pillar for economic development. Therefore, existence of healthy human capital is an asset of inestimable value. That is why it is often said that health is wealth. In response to this, many countries have givenhigh priorities to health sector development (Dor and van der Gaag, 1988). However, it had been argued that policy makers should be worried about health condition of their citizens not because of its potential economic development impacts, but due its being a fundamental basic human right. As a result, provision of medical care service has become a top rating agenda of all governments.

However, Ethiopia's health care system is among the least developed in sub-Saharan Africa and is not, at present, able to effectively cope with the significant health problems facing the country. The government has chosen to strengthen primary health care as a strategic approach to address a major gap in the country's health care system. The main problem, however, is how to provide health care services to every society given the myriads of economic development challenges that the country faces. One of the major issues in expansion of health care facilities is ability to match the physical infrastructure with adequately trained health personnel. The low availability of health care professionals with modern medical training, together with lack of funds for medical services, leads to the preponderancy of less reliable traditional healers that use home-based therapies to heal common ailments. As a result, for many developing countries, traditional medicine has become the sole alternative treatment for all diseases.

The World Health Organization (WHO) defines traditional medicine as health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied individually or in combination to treat, diagnose and prevent illnesses and maintain well-being (WHO, 2001). It is known that many countries in African, Asia and Latin America use traditional medicine (TM) to meet some of their primary health care needs. In Africa, up to 80% of the population uses traditional medicine for primary health care (WHO, 2003). Traditional medicine, also known as complementary and alternative medicine, refers to the sum total of all knowledge and practices used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observations handed down from generation to generation (WHO, 2001).

The importance of traditional medicines for human being both now and in the past is enormous. In most cases, traditional medicines are used as "first aid or stop-gap measure" before the patient is referred to modern health facilities. But for a number of African countries traditional medicine is the only affordable and accessible health care. Traditional medical practitioners include bonesetters (wogesha in amharic),midwifery (yelmid awalajs in amharic), plant herbalists (medhanit awakis or kitel betashs) herbalists, as well as 'debtera', 'tenquay' (witch

doctors), and spiritual healers such as 'weqaby' and 'kalicha' (Papadopoulo and Gebrehiwot, 2002). Approaches that are used to diagnose, treat or prevent illness include spiritual therapies, charms containing a written scrip(kitab in Amharic), holy water (tsebel inAmharic), among others. In most cases, common health problems that can be tackled by traditional health practitioners ranges from ordinary headaches, diarrhea and vomiting to life-threatening diseases such as cancer and diseases associated with HIV&AIDS.

The use of traditional medicine (especially of medicinal plants) in Ethiopia dates back to the time of the Axumite kingdom (Fekadu, 2005).However, modern medicine came into the country during the last quarter of the nineteenth century with the arrival of missionary doctors, nurses, and midwives (Ofcansky and Berry ed., 1991). Although Ethiopia practiced traditional and modern health services long time ago, the sector is delivering poor services to the people and the society had been affected by different communicable infectious diseases and nutritional deficiencies. Shortage and high turnover of human resource and inadequacy of essential drugs and supplies had been adversely affecting the development of the sector. However, there has been encouraging improvements in the coverage and utilization of the health service since the last two decades. But relative to other developing countries only little success was achieved in coping with the acute and endemic diseases that debilitated large segments of the population. Like all other important sectors, the health sector has suffered from the chronic economic problems the country faced for decades. The number of modern health care institutions in Ethiopia are very few in number and the quality of health services suffers from poor infrastructure, lack of critical medical equipments, low number of knowledgeable healthcare human resource, and sporadic pharmaceutical supplies.

A study of the pharmaceutical drug use showed that 35% of the patients did not obtain the prescribed drugs due to lack of money (MOH, 2003). The cost of treatment in the private sector was too expensive than that of the government facilities. The high cost of medical care coupled with its limited coverage made the private health care (HCs) less attractive. However, most traditional medicines are delivered either free or with a relatively low cost, which contributes to the use of rural based healers for community primary health care need. The traditional medicine, once again, remained active participant in health service market of the country especially in rural areas. In spite of the significant role that Traditional HCs play in national health sector, the contribution of traditional HCs to the national economy is undervalued and not fully recognized.

Despite its existence and continued use over many countries, and its popularity and extensive use during the last decade, traditional medicine has not been officially recognized in most countries. Consequently, education, training and research in this area have not been accorded due attention and support. The quantity and quality as well as the safety and efficacy of data on traditional medicine are far from sufficient to meet the criteria needed to support its use worldwide.

Some pharmacists have argued that some of the traditional medicines and drugs used in traditional medicines are very dangerous for health and it has been affecting our people since long time ago. According to Rockos, “taenicides” are widely known to be toxic. For instance, over dosage of Hagenia abyssinica results in blindness and changes in central nervous system function (Rockos, 1969). Traditional healers may create delay in the treatment of communicable diseases such as TB if they fail to refer patients to modern health care services early. Moreover, a number of harmful practices have been traced to healers, including female genital mutilation, uvulectomy, and milk tooth extraction (Yimer, Bijune and Alene, 2005). Therefore, a study on the associated costs of traditional medicine is very necessary so as to reduce the negative cost related with false healers.

Generally, studies that have been conducted on households’ demand for HCs are very few and even those studies undertaken so far are solely concerned with urban population that accounts for only about 15% of the population. Consequently, only little is known about the health care demand of rural households, especially about how they make choice of health care providers (Traditional vs modern HCs) and valuation of the traditional HCs (the benefit and the cost related with THC). To the knowledge of the researchers, no studies were conducted on valuation of traditional health care services in Ethiopia. Hence this study is in response to this information gaps by taking North Showa as a particular study area.

The general objective of the study is to examine household’s preferences for traditional and modern health care services. The specific objectives are to identify the desirable quality of each HCs (as perceived by the patients); and analyze factors explaining households’ preferences for modern and traditional health care institutions; and make policy recommendations based on the key findings from the study.

2. Materials and Methods

Data and Sampling Procedures

The main objective of the survey was to collect information on household's preferences for health care services in North Shwa. The study used well structure pre-tested data that were collected from personal interviews of households. The simple random sampling method was used to select respondent from their houses. In all, 600 questionnaires were administered and used for this study.

Multinomial Logit Model

Due to the nature of the data, Multinomial Logit Model was considered to be the most appropriate. The dependent variable is the choice of specific HC service providers. The alternative health care providers (or the HCs to be chosen) are Government /Public, Private, and Traditional HCIs. The traditional institutions refer to all traditional treatments provided by traditional health practitioner. It also includes the use of herbs, holly men, and holy water (or tsebel in Amharic). The basic and important assumption here is that each individual patient seeks treatment and knows the available health institutions with their respective expected cost, waiting time and distance (Ii, 1996). The independent variables (X) include different attributes of both the individual and the health care providers.

The estimated equations can be presented as:

$Yi=\beta0+\beta1age+\beta2sex+\beta3Educ+\beta4\ Dist+\beta5mcost+\beta6wtime+\beta7psv+\beta8wlth+\beta9hhs+\beta10sfty$

Where, Yi is health care provide choice with Traditional = 0, Private = 1 and government =2.

Table 1: List and description of explanatory variables

Variable Name	Description
Age	A continuous variable for the age of the patient
Sex	A dummy variable for the sex of the patient (1= male; 0= female)
Edu (Education)	A continuous variable for the years of education
Dist (Distance)	A continuous variable for the distance of the institution chosen from the home of the patient
Mcost (Monetary cost)	A continuous variable for the total monetary cost that the patient pays for the treatment
Wtime (Waiting Time)	A continuous variable for the time that the patient stays at the health institution before getting treatment
Psv (Perceived severity of illness)	A dummy variable for the value that the patient attaches for the severity of their illness as they perceive it (1= for serious; 0= otherwise)
Wlth (Wealth)	A continuous variable for households' wealth index
Hhs (households size)	A continuous variable for the total number of the member of the household
Sf (safety)	A dummy variable for the value that the patient attaches for the safety of services delivered by medical institutions as they perceive it (1= excellent; 0= otherwise)

3. Results and Discussions

Demographic characteristics of the respondents

Table 2: Demographic characteristics of respondents

Demographic characteristics		Number	%	Mean	Min.	Max.
Sex of the household	Male	540	90.00	-	-	-
	Female	60	10.00	-	-	-
Age of the household heads		-		49	24	72
Marital status of the household head	Married	430	71.67	-	-	-
	Unmarried	160	26.67	-	-	-
Household size				4	1	15
HH monthly income				800	300	7000
Education level of household heads				6	0	17
Religion of the household heads	Christian	430	71.67		-	-
	Muslim	102	17.00		-	-
	Other	68	11.33		-	-

Source: Survey result, 2012

Table 2 shows that 90% of the respondents were males. This indicates that most of the household heads in rural areas are males. The table also depicts that the average educational status of the respondents is 6 years of schooling. Majority (71.67%) were married, while 71.67% were also Christians. Average

age of household heads is 49 years. The average household size is 4, although household with maximum number of household members has 15 persons. Average monthly income is Bir 800, while the maximum that was recorded is Bir 7000.

Traditional health care practitioners

Table 3 shows the patronage of the households with different types of traditional healers. The table indicates important information related to traditional health care services. As it is depicted in the above table, all types of traditional health care service practitioners do not have any recognition from government authority. This would have two implications. First, it might encourage illegal and false healers and affect patients adversely. Second, it encourages tax evasion practices and which may under estimate GDP of the country. The other important finding is the existence of high variations between the total amount of money collected and their expectation. This is a good indication for under valuation of traditional health sector.

Table 3: Traditional health practitioners' patronages, expected charges and government recorgnition

	Traditional health care givers					
	Bonesetter	Midwifery	Plant herbalists	Witch doctor	Spiritual healers	Others
Number of practitioner	13	14	8	3	31	31
Number of people treated	32	32	210	51	> 3000	200
Number of people cured	25	32		51	>2000	200
Number of people died	0	0	0	0	0	0
Recognition	No	No	3	No	No	No
Expected mean amount of birr	4000	10000	25000	--	0	50 000
Total birr collected	70	800	7000	--	0	5000

Source: Survey result, 2012

Preferred health care services by rural households

In developing countries, patients have three health care service alternatives. These are the traditional, private and modern health care services. In rural areas, traditional health care services are becoming an important alternative health care service provider. The distribution of different health care services as perceived by the respondents is presented in table 4.

Table 4: Distribution of health care services

Healthcare services	Distribution (%)
Traditional	40
Private	7
Government	53

Source: Survey result, 2012

Distribution of patients by their respective reasons for choosing a health institution

Traditional health care services and government (public) health care services together, constitute more than 90% of medical accessibility. The contribution of private sector is too small in rural areas as it is perceived by the respondents. This may be due to the fact that many private health institutions are always too expensive and unaffordable by the people.

The choices to different health care services depend on different factors. Some of the factors that make patients to choose a health care provider are provided in table 5. The table shows that traditional health care services are closest to people relative to others health care institutions. The result shows that average distance of patient's home to traditional, public and private health care services are 1.1km, 5km and 20 km respectively. Low waiting time is the main reason for patients to be attracted to private health care institutions, even if their high service charge discourages the large segment of the society. With respect to cost, traditional health care providers, where most of its services are provided at zero prices, attracts many patients. But the less safety medical treatment and the absence of recognition decreased its importance.

Table 5: Reasons for choosing different health care services

Reasons	Health care services		
	Public (%)	Private (%)	Traditional (%)
Proximity	25	8	66
Low waiting time	7.16	72	20
High quality	32.6	50	17
Low service charge	33.3	5	62
Flexible payment system	0	3	97
Safety	52	35	12
Recognition	100	100	0
Accessibility	17	5	78
High speed	2	57	41
Cure capacity	33	17	50

Source: Survey, 2012

Attitude towards traditional health care

All traditional health care services are not benefiting the society. Some traditional medicines are very dangerous for health. Therefore, such activities are condemned by the society even if some people are benefiting from their services. Table 6 shows the respondents attitude toward different traditional health care services.As it is shown in the above table, many respondents reported that Witch doctor and traditional midwifery are the two condemned health care service providers. On the other hand, two types of traditional health care services; Bonesetter and plant herbalists are the two important traditional health sectors which are supported by many respondents.

Table 6: respondent's attitude toward traditional health care services

Traditional health care services	Supported health care services	Condemned health care services
Bonesetter	504	96
Midwifery	60	540
Plant herbalists	440	160
Witch doctor	15	585
Spiritual healers	596	4

Source: Survey result, 2012

Econometric Results

The econometric model presented in this section attempts to make some analysis and make inferences based on the information obtained from the sampled respondents. These econometric methods are employed to determine factors affecting the preference of households to different health care services and to estimate mean WTP of the respondents.

Choice to health care services

As mentioned and specified in the methodology section of this paper, multinomial logit model was employed to analyze the determinants of relative demand for HCIs. There are two common approaches for interpreting regression results of such categorical models: the log-odds approach and the relative risk approach. Since the latter is only the natural exponent of the former, both approaches lead top the same conclusion and hence the choice of the approaches depends on the taste and preference of the researcher. In this study, the log-odds ratio will be used to interpret the results. The regression result of the model is given in Table 7. To make the output more convenient for the discussion, Traditional HCI was set as base outcome. Therefore, the result of each outcome will be interpreted in relative to the base outcome. At the end, the impact of each variables on intra modern HCIs is evaluated. Before going to the demand analysis of each HCI, it would be good to evaluate how significant the fitted model is. The model summary presented Table 7 shows that the null hypothesis of all regression coefficients are equal to zero can be rejected at 1 percent significance level. In the following sections, we will look at the demand of HCIs relative to one another.

Table 7: The log-odds for Private and Government HCIs relative to Traditional HCIsMultinomial Logistic Regression Results

Variables	Private HCI		Government HCI	
	coefficient	P>Z	coefficient	P>Z
Age	-0.084	0.000***	0.001	0.000***
Sex	-0.723	0.511	-0.003	0.212
Education	0.882	0.001***	0.458	0.000***
Distance	-0.007	0.006***	-0.56	0.000***
Medical cost	-0.064	0.000***	-0.056	0.000***
Waiting time	-0.003	0.001***	-0.987	0.006***
Perceived severity of illness	0.067	0.101	0.523	0.901
Wealth)	0.009	0.082*	0.023	0.000***
households size	-0.002	0.0081***	-0.128	0.600
Safety perception	0.005	0.231	0.036	0.050**
Constant	2.001	0.004	0.962	0.342

(Traditional HCI is the base outcome)

Note: *** = statistically significant at 1%, ** = statistically significant at 5%, *** = statistically significant at 10%.

Source: Survey result, 2012

Demand of Traditional HCIs relative to Private HCIs

In this framework, it can be seen from the regression result that age of the patient, sex of the patient, distance to the HCI, monetary cost of the service, household size and waiting time at the HCI are expected to reduce the multinomial odds of Private HCI relative to Traditional HCI. More specifically, if the patient's age increase by one unit

(year), the log of the ratio of the two probabilities, P(PHCI)/P(THCI), will be decreased by 0.084 unit while holding all other variables in the model constant. Put differently, holding all other variables in the model constant, the multinomial log-odds for Traditional HCI relative to privet HCI would be expected to increase by 0.084 units for a unit increase in age of the patient.

In the same way, we can see that the multinomial logit of educated patients relative to less educated patients is 0.882 units higher for the choice of Private HCI to Traditional HCI, given all other predictor variables in the model are held constant. Similarly, a unit increase in distance, monetary cost of treatment, a unit increase in the household size, sex of the patient and waiting time related to Private HCI would be expected to decrease the multinomial log-odds of Private HCIs by 0.007, 0.064, 0.002, 0.723 and 0.003 units, respectively, in favor of Traditional HCI. This implies that the further the Private HCI or the longer the waiting time or the higher the cost of treatment at Private HCIs or an increase in household size, the higher the preference to Traditional HCIs. Interestingly, the estimated coefficients of these four variables are statistically significant at 1 percent level. However, the other remaining variables such as education of the patient, perceived severity of illness, safety of the medical instrument and wealth of the household are expected to increase the multinomial odds for Private HCI relative to Traditional HCI. But the coefficients of all these variables are insignificant except that of education which is significant at 1 percent level.

Demand of Traditional HCIs relative to Government HCIs

The regression output for demand of Government HCI relative to Traditional HCIs is shown in columns 4 and 5 of Table 7. It showsthat the two demographic variables (household size and sex) are expected to reduce the multinomial log-odds of Government HCI in favor of Traditional HCI. This implies that the higher the household size, the more attractive the Traditional HCIs would be. Likewise, the female patients have higher likelihood of using Traditional HCIs. Furthermore, it can be seen from the table that, a unit increase in distance to Government HCI or waiting time at Government HCIs or monetary cost of treatment at Government HCIs would be expected to decrease its multinomial logit by 0.56, 0.056 and 0.987 units, respectively, in favor of Traditional HCI. More interestingly, the coefficients of all variables except sex of the patient and household size are significant at 1 percent level. On the other hand, all other variables such as age and education status of the patient, safety mode of medicine, perceived severity of illness and household wealth, however, are expected to increase the multinomial logits of Government HCI relative to Traditional HCI; i.e., the higher the value of these variables, the lower the preference to Traditional HCIs. Again, the coefficients of all these variables are significant at least at 5 percent significant level except perceived severity of illness

4. Conclusion and Recommendations

Improving the health status of the society is becoming the main policy agenda of many countries. Ethiopian government is implementing different macro and micro health policies. But the main constraint for the success of those policies is the lack of the integration between health care institutions and those policies. Those policies do not give due attention for traditional health care institutions. Therefore, the main objective of this study was to identify household's preference to different health care institutions and their WTP for the improvement of those heath care facilities.To investigate household's preference to public, private and traditional health care institutions the study used Multinomial logit model. The Multinomial Logit estimation result predicted that the older the patient gets, the more he/she will prefer Traditional HCI to both the modern HCIs; the dearer the cost of treatment at modern institutions, the higher the preference for Traditional health care services; the farther the modern health care providers, the more attractive the Traditional HCIs are; the wealthier the household, the more they prefer modern HCIs; and the higher the perceived severity of illness, the more preference for modern HCIs.

Based on the descriptive and econometrics analysis, the study recommends that traditional health care institution can work as side by side with modern health care services as an alternative health care institution. Any effort to suppress traditional heath care institutions may hide false healers. Therefore, government should encourage true healers by giving training so as to improve their quality service delivery. To prompt modern health care institutions increasing their accessibility, introducing flexible payment system such as health insurance and increasing the number of qualified medical people so as to decrease waiting time. Improving modern health care institutions may be difficult without the participation of the society. Therefore, government should collect the prescribed amount of money from the society so as to improve the quality and number of health care institutions.

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Linkages Between Non-Income Poverty, Growth and Inequality in Nigeria: A Two Stage Least Square Approach

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Abstract: Poverty alleviation is a major indicator to decide whether economic growth is of benefit to the poor in a society. This study therefore addressed the extent of non-income poverty alleviation between 1999 and 2008, using the Demographic and Health Survey (DHS) data. The fuzzy method and two stage least square approaches were used to analyze the data. The results show that between 1999 and 2003, non-income welfare highly improved in Nigeria, but this could not be sustained in 2008. The rural areas were found to be more deprived in essential basic social services, while the northern part has highest non-income poverty incidences. The two-stage least square regression results show that growth in composite welfare indicators, literacy, household size and number of trained youth significantly reduced poverty incidences ($p<0.10$), while unemployment rate, number of robbery cases and annual allocation from the federation accounts significantly increased it. It was recommended that government should ensure pro-poor spending on basic social services like improved water, sanitation, education, and employment schemes.

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1. Introduction

The Nigerian economy had over the over the past four decades experienced diverse economic crises of varying dimension and intensity (CBN, 2002). The prolonged weak growth in the economy can be attributed to policy failure, poor governance, as well as considerable social and political instability. Presently, economic stagnation, rising poverty levels, and rapid decline in efficiency of public institutions are among the major development challenges that the country faces. In addition, at almost every level of governance, corruption is seriously undermining the effectiveness of various poverty reduction and development programmes. Also, adverse macroeconomic shocks that inhibit economic growth, and inability of some proposed policy reforms and programmes to tactically ensure equitable distribution of wealth are very paramount factors that have contributed to increasing poverty and inequality (Aigbokhan, 2000).

Furthermore, the economic recession of the early 1980s was the beginning of economic downturn for the nation. This led to worsened economic fortunes and negative growth of the GDP that was as low as an average of -3.23 percent between 1981 and 1984. The recession also hampered growth of major sectors of the economy. During the 1981-1984 period, the GDP from agricultural sector grew at the rate of -1.33 percent. Other pertinent problems that resulted from the recession include increase in unemployment rate, galloping inflation, high incidence of poverty, worsened balance of payment and increase in fiscal deficits. The country therefore started to seek financial assistance in terms of borrowing and not quite long, the debt profile of the country soared.

The Structural Adjustment Programme (SAP) was therefore implemented in the mid-1986 to address stagnating economic growth and decline in people's welfare. The major components of SAP included market-determined exchange rate and interest rates, liberalized financial sector, trade liberalization and commercialization and privatization of a number of public enterprises. Aigbokhan (2008) submitted that although Nigeria witnessed growth of GDP during SAP with average growth of 3.98 between 1985 and 1989, the expected impact of the programme on poverty had been limited. It should be noted that between 1985 and 1992, national income inequality slightly declined. Also, poverty incidence slightly reduced in all sectors of the economy due to positive economic growth that had been induced by the policies of those years. Akanji (2002) however noted that despite the drop in poverty level in 1992, high population growth resulted in an increase of about 5 million in the population in poverty over the period 1985-1992. The estimated number of the poor therefore rose from 18 million in 1980 to 35 million in 1985 and to 39 million in 1992.

When the country returned to democratically elected government on 29th May, 1999, poverty

situation is believed to have worsened. Akanji (2002) submitted that by the end of 1999, estimated number of the poor rose to 74.2 million, given a 70.6 percent poverty incidence. It should be noted that fluctuations in the per capita household expenditure over the period determined this pattern of poverty movement. Precisely, after normalizing for inflation, per capita expenditure for 1996 was not only lower than for other years but also less than half of 1980 figure. The figures (in1996 prices) were ₦2400 for 1980, ₦ 1270 for 1985, ₦ 1780 for 1992 and ₦ 1050 for 1996. The estimate for 1999 rose by 10.8% to ₦ 1163 due to improved workers salary.

In 2004, government adopted the National Economic Empowerment and Development Strategies (NEEDS) as the home grown official Poverty Reduction Strategy Paper (PRSP). The NEEDS package recognized institutional reform as a prerequisite for economic growth and development. This was a vital departure from earlier government reform efforts. Furthermore, the NEEDS strategy considers economic growth as prerequisite for poverty reduction with a projection of between 5-7 percent annual real gross domestic product (GDP) growth rate in 2004 to 2007, while the non-oil GDP is expected to grow at between 7.3 and 9.5 percent. If achieved, by some projections, these goals are expected to produce 5 percent annual reduction in poverty incidence. Also, the NEEDS aimed at attaining average per capita consumption growth of 2 percent per annum, creation of 7 million jobs between 2004 and 2007, increase in immunization coverage to 60 percent by 2007, increase access to safe drinking water to an average of 70 percent and adult literacy rate of at least 65 percent by 2007.

It should be further stressed that the Millennium Development Goals (MDGs) document specifies different goals that should be achieved by 2015. Achieving these goals requires that poverty assessment should be confronted from different indicators of households' welfare. This is very important because there is now a growing literature supporting the multidimensional nature of poverty. Organization for Economic Cooperation and Development (OECD) (2006) submitted that the Development Assistance Committee (DAC) guidelines on poverty reduction emphasized the inter-linkages between the multiple deprivations that poverty takes. Therefore, our understanding of these inter-linkages will help to develop more effective pro-poor growth strategies and integrate these better into national poverty reduction strategies. It will also ensure that policies to address the multiple dimensions of poverty go hand-in-hand. This study therefore seeks to fulfill the objective of determining the state-level development programmes and other factors that influence non-income poverty incidence reduction in Nigeria. In the remaining parts of the paper, methodology, results and discussion and recommendations are presented in that order.

2. Materials and Methods

The Data

The study made use of survey based secondary data and time series secondary data. The survey based secondary data consists of data from three different surveys of the DHS for 1999, 2003 and 2008. The 1999 National Demographic Sample survey was designed as probability sampling of eligible respondents within all regular households in the entire country. The sampling frame used for selecting the Primary Sampling Units (PSUs) was the Enumeration Areas (EAs) into which the country was delineated for the 1991 National Population Census. The frame contains 212,079 EAs that are mutually exclusive and collectively exhaustive of the territorial land area of Nigeria. The 36 states and Federal Capital Territory (FCT) of the country were grouped into five Survey Statistical regions. The 212,079 EAs were classified into rural and urban strata, where urban EA (U) is defined as an EA within a locality having population of 20,000 and above, while rural EA (R) is an EA within a locality with population less than 20,000 persons. A total of 7919 households were interviewed comprising 5319 from rural areas and 2600 from urban areas.

In the DHS for 2003, the sample frame was the list of enumeration areas (EAs) developed for the 1991 Population Census. Administratively, at the time the survey was planned, Nigeria was divided into 36 states and the Federal Capital Territory (FCT) of Abuja. Each state was subdivided into local government area (LGA) units and each LGA was divided into localities. In addition to these administrative units, for implementation of the 1991 Population Census, each locality was subdivided into enumeration areas (EAs). The list of approximately 212,080 EAs, with household and population information (from the 1991census) for each EA, was evaluated as a potential sampling frame for the 2003 NDHS. The EAs are grouped by states, by LGAs within a state, and by localities within an LGA, stratified separately by urban and rural areas. Any locality with less than 20,000 population constitutes a rural area. Also available from the 1991 census were maps showing the location of the EAs. A total of 7684 households were sampled.

In 2008, the sampling frame that was used for the 2008 DHS was the 2006 Population and Housing Census of the Federal Republic of Nigeria conducted in 2006. This was provided by the National Population Commission (NPC).

Administratively, Nigeria is divided into states. Each state is subdivided into local government areas (LGAs), and each LGA is divided into localities. In addition to these administrative units, during the 2006 Population Census, each locality was subdivided into convenient areas called census enumeration areas (EAs). The primary sampling unit (PSU), referred to as a cluster for the 2008 NDHS, is defined on the basis of EAs from the 2006 EA census frame. The 2008 NDHS sample was selected using a stratified two-stage cluster design consisting of 888 clusters, 286 in the urban and 602 in the rural areas1. A representative sample of 36,800 households was selected for the 2008 NDHS survey, with a minimum target of 950 completed interviews per state. In each state, the number of households was distributed proportionately among its urban and rural areas.

The time series secondary data were obtained from the publication of the national Bureau of Statistics (NBS) (NBS, 2009). The data are state-level aggregated data on immunization coverage (%), HIV prevalence (%), unemployment rate (%), number of youths trained in state employment generation schemes, telephone penetration rate (%), annual budgetary allocations to the states (billion naira), literacy rate (%) and number of reported robbery cases. In addition, average age of household heads and average household size were computed from the DHS for each of the years.

Computation of Non-Income Welfare Indices

Bossert *et al* (2009) submitted that in measuring multidimensional poverty, it is necessary to first aggregate the information regarding the different functioning failures of each individual into a measure of poverty at the individual level, and second to aggregate the latter across individuals to obtain a measure of poverty for the entire society. In this study, as part of objective one, indices of multidimensional non-income wealth indices (CWI) were computed using the Fuzzy Set theory originally developed by Zadeh (1965). This approach had been widely applied to poverty analysis by authors like Cerioli and Zani (1990), Martinetti (2000), Costa (2002), Dagum (2002), Costa (2003), Deutsch and Silber (2005) and Berenger (2010) among others. Berenger (2010) noted that in terms of integrating the vague and complex nature of poverty, fuzzy sets theory is very advantageous. Therefore, instead of dividing the population between poor and non poor, fuzzy approach takes into account a continuum of situations between these two extremes. Zadeh (1965) characterized a fuzzy set as a class with a continuum of grades of membership. Therefore, in a population A of n households [$A = a_1, a_2, a_3, \ldots\ldots a_n$], the subset of poor households B includes any household $a_i \in B$. These households present some degree of deprivation in some of the m poverty attributes (X).

Table 1: Fuzzy Assigned Weights for the Selected Welfare Attributes

Attribute	Coding	1999 Weight	2003 Weight	2008 Weight
Source of Drinking Water	Improved source =1 Unimproved =0	0.164	0.361	0.263
Toilet	Improved method =1 Unimproved =0	0.138	0.146	0.310
Floor *of the house*	Improved material =1 Unimproved =0	0.204	0.175	0.220
Room (s) per person	One or more per person =1 Less than one per person =0	0.673	0.455	0.382
Electricity	Yes =1, No = 0	0.339	0.289	0.341
Radio	Yes =1, No = 0	0.204	0.136	0.138
Television	Yes =1, No = 0	0.582	0.515	0.452
Refrigerator	Yes =1, No = 0	0.805	0.756	0.862
Telephone	Yes =1, No = 0	1.740	1.257	0.342
Formal Education	Yes =1, No = 0	0.247	0.247	0.222
Car	Yes =1, No = 0	1.107	1.017	1.125
Iron	Yes =1, No = 0	0.602	0.512	0.541
Fan	Yes =1, No = 0	0.498	0.432	0.434
Bicycle	Yes =1, No = 0	0.622	0.479	0.624
Motorcycle	Yes =1, No = 0	0.867	0.805	0.600

The welfare attributes considered in this study are based on the DHS data. Following Costa (2002), the degree of being poor by the i-th household (i=1,….,n) with respect to a particular attribute (j) given that (j = 1,……,m) is defined as: $\mu_B [X_j (a_i)] = x_{ij}$, $0 \leq x_{ij} \leq 1$. Specifically, $x_{ij} = 0$ when the household does not possess welfare

enhancing attribute and x_{ij} = 1 when the household possesses it. Betti *et al* (2005) noted that putting together categorical indicators of deprivation for individual items to construct composite indices requires decisions about assigning numerical values to the ordered categories and the weighting and scaling of the measures. Individual items indicating non-monetary deprivation often take the form of simple 'yes/no' dichotomies. In this case x_{ij} is 0 or 1.

However, some items may involve more than two ordered categories, reflecting different degrees of deprivation. Consider the general case of c = 1 to C ordered categories of some deprivation indicator, with c = 1 representing the most deprived and c = C the least deprived situation. Let c_i be the category to which individual *i* belongs. Cerioli and Zani (1990), assuming that the rank of the categories represents an equally-spaced metric variable, assigned to the individual a deprivation score as:

$x_{ij} = (C-ci)/(C-1)$ 1

where $1 \leq c_i \leq C$. Therefore, x_{ij} needs not to be compulsorily 0 or 1, but $0 \leq x_{ij} \leq 1$ when there are many categories of the jth indicator and the household possesses the attribute with intensity. Details of the welfare attributes that were used is contained in table 1.

The multidimensional welfare index of a household, $\mu_B(a_i)$, which shows the level of welfare and membership to set B is defined as the weighted average of x_{ij},

$$\mu_B(a_i) = \sum_{j=1}^{m} x_{ij} w_j / \sum_{j=1}^{m} w_j \qquad 2$$

w_i is the weight attached to the j-th attribute.

The intensity of deprivation with respect to X_j is measured by the weight w_j. It is an inverse function of the degree of deprivation and the smaller the number of households and the amount of their deprivation, the greater the weight. In practice, a weight that fulfils the above property had been proposed by Cerioli and Zani (1990). This can be expressed as:

$$w_j = \log[\sum_{i=1}^{n} g(a_i) / \sum_{i=1}^{n} x_{ij} g(a_i)] \geq 0 \qquad 3$$

Ideally, $g(a_i)/\sum_{i=1}^{n} g(a_i) > 0$ and $g(a_i)/\sum_{i=1}^{n} g(a_i)$ is the relative frequency represented by the sample observation a_i in the total population. Therefore when x_{ij}=0, the welfare attribute should be removed.

Two Stage Least Square (2SLS) Method

Two Stage Least Square (2SLS) method was used to analyze the impact of growth and inequality of CWI on the state-level changes of non-income poverty incidence computed for 1999/2003 and 2003/2008. The conventional ordinary least square (OLS) regression is invalid because while growth in aggregate (overall) CWI influences change in poverty incidences, growth itself can be influenced by a host of other factors. Therefore, the endogeneity problem with respect to the growth variable is to be resolved by the use of instrumental variables. Between 2003 and 2008, changes in poverty incidences was modeled with change in Gini-coefficient, literacy and fertilizer inputs being used as the instrumental variables, having established their high correlation with growth variable and very low correlation with poverty change. The estimated models has growth rate in CWI (%), northern states dummy (yes = 1, 0 otherwise), immunization coverage (%), HIV prevalence rate (%), unemployment rate (%), number of trained youths, telephone penetration (%), annual allocation (billion Naira), change in Gini coefficient, average age (years), number of robbery cases, literacy rate (%) and average household size as the explanatory variables. The model can be stated as:.

$$\Delta P_{it} = \alpha_1 + \alpha_2 G_{it} + \alpha_3 \Delta I_{it} + \beta_j \sum_{j=1}^{10} X_{it} + e_{it} \qquad 4$$

$$\Delta P_{it} = \theta_1 + \theta_2 G_{it} + \pi_j \sum_{j=1}^{10} X_{it} + f_{it} \qquad 5$$

Where ΔP_{it} is the change in poverty in ith state in period t, ΔI_{it} is the change in Gini inequality index of ith state in period t and Xit are the other exogenous variables. The endogeneity of G_{it} poses problem to the model if estimated by Ordinary Least Square (OLS) method. In order to resolve this problem, the 2SLS method was used to estimate the equations. The first stage is to present a reduced form equation for the determinants of G_{it}, such that instrumental variables that are correlated with it but uncorrelated with ΔP_{it} are identified. Equation 4 was estimated for the ΔP_{it} in 1999/2003 where ΔL_{it} is not correlated with growth, but equation 5 was estimated for ΔP_{it} in 2003/2008 because was one of the instrumental variables having being confirmed to be uncorrelated with ΔP_{it}.

$$G_{it} = \sigma_1 + \sigma_2 I_{it} + \varpi_j \sum_{j=1}^{2} X_{it} + h_{it} \qquad 6$$

The reduced form equation is expressed as:

$$G_{it} = \sigma_1 + aDi + \varpi_j \sum_{j=1}^{2} X_{it} + z_{it} \quad 7$$

The estimated equations were

$$\Delta P_{it} = \alpha_1 + \alpha_2 G_{it} + \alpha_3 \Delta I_{it} + \beta_j \sum_{j=1}^{10} X_{it} + e_{it} \quad 8$$

$$\Delta P_{it} = \theta_1 + \theta_2 G_{it} + \pi_j \sum_{j=1}^{10} X_{it} + f_{it} \quad 9$$

3. Results and Discussions

Construction of Composite Welfare Indices and Access by the Poor

We used fuzzy set method to construct composite welfare indices (CWI) for each of the households using the selected fifteen welfare attributes. This was necessitated by inability to find comparable welfare indices in the three datasets. Precisely, the 1999 DHS survey did not incorporate asset index variable, while the 2003 and 2008 datasets did. Using the available constructed asset indices will limit the analysis to two years (2003 and 2008). However, because major economic reforms of the democratic government started since late 1999, it is important to include the 1999 survey dataset in order to have a reasonable trend of analysis. Similarly, we were faced with the concern of how comparable the asset indices in the 2003 and 2008 datasets are. This is due to the different array of household assets that the two datasets contain with 2008 data having wider coverage. To therefore ensure comparability across time, we constructed composite welfare indices that integrate similarly coded attributes using the fuzzy set method.

At the first stage, attributes that were common to all the three datasets were carefully selected. The selected attributes are sources of drinking water {for which our definition of improved sources is derived from UNICEF (2010) as households' pipe connections, public standpipes, borehole, protected dug wells, protected springs and rainwater, while unimproved sources are unprotected wells, unprotected springs, vendor-provided water, bottled water and tanker truck provided water}, sanitation (with improved sanitation defined as connections to public sewers, connection to septic systems, pour-flush latrines, simple pit latrines and ventilated improved pit latrines, unimproved sources are bucket latrines, public latrines and open latrines), main floor material (with finished type classified as improved while rudimentary types are unimproved sources) , rooms per person, electricity, ownership of radio, ownership of television, ownership of refrigerator, ownership of telephone, attainment of formal education, ownership of motor car, ownership of electric iron, ownership of electric fan, ownership of bicycle and ownership of motorcycle. The definition of poverty for each attribute and the weight of the attributes are provided in table 1. The table also shows that across the years covered by the surveys, attributes with highest weights are ownership of mobile phone (in 1999 and 2003 only), motor cars, motorcycle and refrigerator.

CWI Spatial Distribution

Table 2 shows some descriptive statistics of the constructed CWI across the states, geo-political zones (GPZ) and urban/rural sectors. It shows that at the national level, in 1999, average CWI for all the households is 0.214. This increased to 0.325 in 2003 before it slightly declined to 0.307 in 2008. These findings are confirmations to the progress made in ensuring poverty reduction in all its ramifications as a result of several economic reforms embarked upon by the Nigerian government since the country returned to democratic governance since 29th May 1999. Okonjo-Iweala and Osafo-Kwaako (2007) specifically noted that with macroeconomic stability that resulted from the economic reforms, economic growth rates have averaged about 7.1 percent annually for the period 2003 to 2006, and attention was also given to pro-poor expenditures within the budget in order to improve the country's performance in some Millennium Development Goals indicators. Also worthy to mention is the fact that several authors (Dijkstra, 2011; Iyoha and Oriakhi, 2007) have found that the 2005 debt relief that was granted to Nigeria by the Paris Club had a modestly positive effect on economic growth and poverty reduction, especially through the stock and conditionality channels. It was noted that this will lead to a greater achievement of the MDGs in the future.

Table 2 further shows that at the state level, highest average CWI in 1999 are found in Lagos (0.386), Delta (0.310), Anambra (0.302) and Osun (0.297), while the lowest are in Sokoto (0.058), Jigawa (0.074), Kebbi (0.085) and Zamfara (0.095), all from northern Nigeria. In 2003, Lagos, FCT, Rivers and Kwara states have the highest average CWI of 0.560, 0.488, 0.460 and 0.445, respectively, while the lowest average CWI are in Jigawa, Kebbi, Sokoto, Bayelsa and Ebonyi states with 0.138, 0.140, 0.152, 0.169 and 0.173, respectively. In the 2008, Lagos, FCT, Anambra and Abia have the highest average CWI of 0.534, 0.497, 0.490 and 0.463, respectively, with the lowest being in Yobe (0.158), Jigawa (0.163), Bauchi (0.169), Zamfara (0.178) and Taraba (0.184).

It should be noted that the World Bank sponsored Nigeria Community Based Poverty Reduction Project (which is a very viable avenue for ensuring rural communities' access to basic

education, portable water, electricity and health) became effective in September 2001 with beneficiary states for the first phase comprising Abia, Ekiti, Cross River, Kebbi, Kogi, and Yobe state. At the second phase, additional six other states comprising Delta, Ebonyi, Gombe, Kwara, Osun and Zamfara States have been included with four of them being supported by the Africa Development Bank (AfDB).

Table 2: Means and Standard Deviations of CWI

Year/	1999				2003				2008			
State/Zone	Freq	%	Mean	Std Dev	Freq	%	Mean	Std Dev	Freq	%	Mean	Std Dev
Akwa Ibom	641	8.38	0.250	0.158	183	2.53	0.341	0.191	928	2.72	0.398	0.214
Anambra	189	2.47	0.302	0.174	255	3.53	0.456	0.230	837	2.46	0.490	0.203
Bauchi	154	2.01	0.121	0.157	370	5.12	0.177	0.165	922	2.71	0.169	0.152
Edo	189	2.47	0.229	0.189	151	2.09	0.467	0.231	883	2.59	0.445	0.220
Benue	340	4.45	0.193	0.155	292	4.04	0.260	0.178	890	2.61	0.209	0.171
Borno	148	1.94	0.145	0.156	231	3.20	0.341	0.220	955	2.80	0.215	0.191
Cross Rivers	113	1.48	0.172	0.179	130	1.80	0.304	0.203	817	2.40	0.250	0.201
Adamawa	142	1.86	0.138	0.142	189	2.62	0.290	0.194	906	2.66	0.227	0.186
Imo	197	2.58	0.292	0.177	232	3.21	0.464	0.220	770	2.26	0.417	0.224
Kaduna	291	3.81	0.203	0.153	361	5.00	0.335	0.224	951	2.79	0.342	0.220
Kano	476	6.22	0.179	0.143	369	5.11	0.380	0.215	1,178	3.46	0.304	0.215
Katsina	307	4.01	0.162	0.145	246	3.40	0.291	0.190	977	2.87	0.211	0.160
Kwara	112	1.46	0.250	0.172	149	2.06	0.445	0.223	827	2.43	0.317	0.241
Lagos	401	5.24	0.386	0.171	383	5.30	0.560	0.191	1,304	3.83	0.534	0.174
Niger	208	2.72	0.243	0.183	211	2.92	0.302	0.203	904	2.65	0.319	0.226
Ogun	275	3.60	0.261	0.168	181	2.51	0.307	0.220	948	2.78	0.333	0.200
Ondo	173	2.26	0.235	0.172	142	1.97	0.246	0.195	953	2.80	0.324	0.228
Oyo	407	5.32	0.233	0.187	272	3.76	0.261	0.225	975	2.86	0.351	0.208
Plateau	200	2.62	0.183	0.154	194	2.69	0.329	0.215	930	2.73	0.227	0.175
Rivers	198	2.59	0.242	0.163	280	3.88	0.460	0.235	932	2.74	0.396	0.226
Sokoto	160	2.09	0.058	0.058	144	1.99	0.152	0.160	952	2.79	0.186	0.185
Abia	131	1.71	0.263	0.169	165	2.28	0.361	0.211	791	2.32	0.463	0.200
Delta	190	2.48	0.310	0.211	205	2.84	0.390	0.219	930	2.73	0.384	0.216
Enugu	146	1.91	0.126	0.103	233	3.22	0.330	0.241	835	2.45	0.322	0.220
Jigawa	160	2.09	0.074	0.052	176	2.44	0.138	0.096	930	2.73	0.163	0.152
Kebbi	163	2.13	0.085	0.073	130	1.80	0.140	0.135	900	2.64	0.214	0.184
Kogi	230	3.01	0.275	0.176	183	2.53	0.358	0.221	983	2.89	0.346	0.207
Osun	211	2.76	0.297	0.201	172	2.38	0.305	0.182	970	2.85	0.363	0.223
Taraba	175	2.29	0.227	0.194	141	1.95	0.211	0.132	902	2.65	0.184	0.168
Yobe	157	2.05	0.131	0.134	128	1.77	0.320	0.200	878	2.58	0.158	0.158
Bayelsa	58	0.76	0.232	0.159	61	0.84	0.169	0.132	899	2.64	0.255	0.185
Ebonyi	143	1.87	0.124	0.107	150	2.08	0.173	0.104	898	2.64	0.270	0.198
Ekiti	106	1.39	0.176	0.129	105	1.45	0.285	0.186	940	2.76	0.354	0.208
Gombe	101	1.32	0.122	0.132	132	1.83	0.234	0.192	895	2.63	0.197	0.174
Nassarawa	79	1.03	0.192	0.154	89	1.23	0.273	0.164	863	2.53	0.309	0.192
Zamfara	201	2.63	0.095	0.111	150	2.08	0.220	0.149	854	2.51	0.178	0.199
FCT	75	0.98	0.287	0.193	40	0.55	0.488	0.184	863	2.53	0.497	0.231
NC	1244	16.27	0.226	0.172	1,158	16.03	0.327	0.212	6,260	18.37	0.317	0.224
NE	877	11.47	0.151	0.161	1,191	16.48	0.253	0.196	5,458	16.02	0.192	0.174
NW	1758	22.99	0.141	0.135	1,576	21.81	0.273	0.209	6,742	19.79	0.232	0.200
SE	806	10.54	0.230	0.172	1,035	14.33	0.373	0.235	4,131	12.13	0.389	0.226
SS	1389	18.16	0.247	0.175	1,010	13.98	0.388	0.229	5,389	15.82	0.357	0.223
SW	1573	20.57	0.282	0.189	1,255	17.37	0.365	0.240	6,090	17.87	0.386	0.220
Urban	2,482	32.46	0.321	0.188	2,931	40.57	0.438	0.224	10,724	31.48	0.466	0.211
Rural	5,165	67.54	0.162	0.143	4,294	59.43	0.248	0.192	23,346	68.52	0.235	0.190
Total	7647	7,647	0.214	0.176	7,225	100	0.325	0.225	34,070	100	0.307	0.224

Table 3: CWI Poverty Incidence and Gini-Inequality Indices in Nigeria

	Non-Income Poverty Incidence					Inequality Indices				
States	1999	2003	2008	Change 1999/2003	Change 2003/2008	1999	2003	2008	1999/2003 Growth	2003/2008 Growth
Akwa Ibom	33.85	44.26	29.2	10.41	-15.06	0.3485	0.3048	0.3077	-12.54	0.93
Anambra	26.99	22.75	14.58	-4.24	-8.17	0.3257	0.2815	0.2356	-13.57	-16.30
Bauchi	81.82	81.89	80.91	0.07	-0.98	0.5600	0.4578	0.4397	-18.26	-3.96
Edo	46.03	23.18	23.22	-22.85	0.04	0.4593	0.2782	0.2835	-39.43	1.92
Benue	49.71	59.24	70.78	9.53	11.54	0.4077	0.3770	0.4258	-7.54	12.94
Borno	75	47.19	70.68	-27.81	23.49	0.4905	0.3618	0.4631	-26.25	28.00
Cross Rivers	66.37	54.62	60.59	-11.75	5.97	0.5085	0.3627	0.4407	-28.67	21.50
Adamawa	67.6	57.15	64.02	-10.45	6.87	0.5104	0.3625	0.4367	-28.97	20.48
Imo	27.41	22.42	26.88	-4.99	4.46	0.3391	0.2667	0.3033	-21.34	13.70
Kaduna	56.01	50.69	43.32	-5.32	-7.37	0.3836	0.3569	0.3575	-6.97	0.15
Kano	57.56	36.32	51.7	-21.24	15.38	0.4064	0.3129	0.3836	-23.01	22.58
Katsina	65.15	58.95	70.62	-6.2	11.67	0.4470	0.3579	0.3969	-19.95	10.92

Kwara	36.6	27.51	48.61	-9.09	21.1	0.3728	0.2827	0.4310	-24.17	52.45
Lagos	8.48	4.96	7.21	-3.52	2.25	0.2440	0.1933	0.1801	-20.78	-6.85
Niger	40.39	50.71	48.56	10.32	-2.15	0.4064	0.3715	0.3926	-8.59	5.68
Ogun	32	49.17	41.46	17.17	-7.71	0.3605	0.4013	0.3419	11.34	-14.81
Ondo	38.15	66.2	47.21	28.05	-18.99	0.4066	0.4258	0.3998	4.72	-6.11
Oyo	45.7	61.77	38.46	16.07	-23.31	0.4454	0.4684	0.3390	5.17	-27.63
Plateau	58	50.51	66.02	-7.49	15.51	0.4249	0.3622	0.4032	-14.75	11.32
Rivers	35.35	23.93	30.04	-11.42	6.11	0.3782	0.2908	0.3265	-23.13	12.29
Sokoto	95.63	83.34	77.21	-12.29	-6.13	0.4564	0.5199	0.4974	13.92	-4.32
Abia	33.59	42.42	16.18	8.83	-26.24	0.3570	0.3205	0.2464	-10.20	-23.12
Delta	33.16	35.61	31.39	2.45	-4.22	0.3865	0.3154	0.3209	-18.41	1.73
Enugu	73.29	50.21	46.94	-23.08	-3.27	0.3955	0.3947	0.3783	-0.22	-4.14
Jigawa	95.63	90.34	81.07	-5.29	-9.27	0.3780	0.3830	0.4538	1.33	18.48
Kebbi	89.57	87.69	69.44	-1.88	-18.25	0.4300	0.4633	0.4451	7.74	-3.92
Kogi	32.18	44.27	38.15	12.09	-6.12	0.3603	0.3436	0.3387	-4.64	-1.42
Osun	32.7	48.83	38.35	16.13	-10.48	0.3778	0.3332	0.3514	-11.79	5.44
Taraba	49.14	75.89	74.72	26.75	-1.17	0.4609	0.3271	0.4706	-29.02	43.85
Yobe	73.25	50	79.38	-23.25	29.38	0.4743	0.3422	0.5075	-27.85	48.28
Bayelsa	43.11	86.89	57.29	43.78	-29.6	0.3800	0.4031	0.3980	6.07	-1.27
Ebonyi	72.73	80	56.8	7.27	-23.2	0.4628	0.3450	0.4047	-25.47	17.31
Ekiti	55.66	55.24	39.15	-0.42	-16.09	0.3947	0.3599	0.3348	-8.81	-6.96
Gombe	77.22	71.97	73.52	-5.25	1.55	0.5080	0.4157	0.4551	-18.18	9.47
Nassarawa	59.49	53.93	45.88	-5.56	-8.05	0.3980	0.3248	0.3437	-18.38	5.80
Zamfara	87.06	74	82.32	-13.06	8.32	0.5269	0.3588	0.5118	-31.91	42.65
FCT	25.33	10	17.73	-15.33	7.73	0.3565	0.2037	0.2665	-42.86	30.79
NC	44.21	47.67	48.07	3.46	0.4	0.4045	0.3593	0.3962	-11.18	10.27
NE	69.78	66	73.84	-3.78	7.84	0.5154	0.4122	0.4663	-20.02	13.12
NW	71.9	61.3	67.16	-10.6	5.86	0.4687	0.4089	0.4503	-12.76	10.11
SE	44.67	40.29	32.9	-4.38	-7.39	0.4102	0.3490	0.3308	-14.92	-5.22
SS	38.66	37.63	38.19	-1.03	0.56	0.3966	0.3317	0.3574	-16.36	7.75
SW	31.91	40.8	33.69	8.89	-7.11	0.3764	0.3737	0.3278	-0.72	-12.29
Urban	23.17	26.57	18.79	3.4	-7.78	0.3290	0.2908	0.2591	-11.61	-10.89
Rural	62.92	66	64.34	3.08	-1.66	0.4574	0.4075	0.4325	-10.91	6.13
Total	-	-	-	-	-	0.4436	0.3844	0.4087	-13.35	6.32

Furthermore, using the median as the poverty line in each year, we were able to compute the non-income poverty incidences as presented in table 3. The table shows that in 1999, Sokoto (95.63 percent), Jigawa (95.63 percent), Kebbi (89.57 percent), Zamfara (87.06 percent), Bauchi (81.82 percent), Gombe (77.22 percent), Borno (75.00 percent), Enugu (73.29 percent), Yobe (73.25 percent) and Ebonyi (72.73 percent) have the highest values, whereas Lagos (8.48), FCT (25.33 percent), Anambra (26.99 percent), Imo (27.41 percent), Ogun (32.00 percent), Kogi (32.18 percent) and Osun (32.17 percent) have the least values. The table further shows that in 2003, non-income poverty incidences are highest in Jigawa (90.34 percent), Kebbi (87.69 percent), Bayelsa (86.89 percent), Sokoto (83.34 percent), Bauchi (81.89 percent), Ebonyi (80.00 percent), Taraba (75.89 percent) and Zamfara (74.00 percent), while Lagos (4.96 percent), FCT (10.00 percent), Imo (22.42 percent), Anambra (22.75 percent), Edo (23.18 percent), Rivers (23.93 percent) and Kwara (27.51 percent) have the least values. Similarly, in 2008, Zamfara (82.32 percent), Jigawa (81.07 percent), Bauchi (80.91 percent), Yobe (79.38 percent), Sokoto (77.21 percent), Taraba (74.72 percent and Gombe (73.52 percent) have the highest non-income poverty incidences, while Lagos (7.21 percent), Anambra (14.58 percent), Abia (16.18 percent), FCT (17.73 percent), Edo (23.22 percent), Imo (26.88 percent) and Akwa Ibom (29.20 percent) have the least values. These results, when put by the side of the monetary poverty incidences for the states in 2004 reveal that states like Jigawa, Kebbi, Bauchi, Yobe, Zamfara, Gombe, Sokoto and Adamawa have highest values and many of these have consistently showed very high non-income poverty incidence in the years covered by the data (Oyekale et al ., 2006).

The table also shows that CWI inequality at the national level is highest in 1999 with Gini coefficient of 0.4436. This value declined to 0.3844 in 2003 before slightly increasing to 0.4087 in 2008. This finding is also similar to the conclusion of Aigbokhan (2008) using expenditure data in the 2004 survey that although Nigeria had recently witnessed some growth during the past one decade or so, the speed of poverty reduction is rather a bit low due to presence of inequality.

In 1999, highest values of Gini inequality indices are recorded in Bauchi (0.5600), Zamfara (0.5269) and Adamawa (0.5104) and lowest in Lagos, Anambra and Imo states with 0.2440, 0.3257 and 0.3391, respectively. In 2003, CWI inequality is highest in Sokoto (0.5199), Oyo (0.4684), Kebbi (0.4633) and Bauchi (0.4578), while it is lowest in Lagos (0.1933), FCT (0.2037), Imo (0.2667) and Edo (0.2782). In 2008, Zamfara (0.5118), Yobe (0.5075), Sokoto (0.4974) and Taraba (0.4706) have the highest CWI inequality. The results generally reveal that poverty incidences are statistical significantly correlated with inequality ($p < 0.01$) with pair-wise correlation of 0.760, 0.821 and 0.959 in 1999, 2003 and 2008, respectively. This clearly shows that states with high non-income poverty incidences also tend to display a very high Gini-coefficient.

Between 1999 and 2003, table 3 shows that changes in non-income poverty incidences across the states reveal decline by 27.81 percent in Borno, 23.25 percent in Yobe, 23.08 percent in Enugu, 22.85 percent in Edo, and 21.24 percent in Kano, whereas, Bayelsa, Ondo, Taraba, Ogun, Osun and Oyo recorded increases of 43.78 percent, 28.05 percent, 26.75 percent, 17.17 percent, 16.13 percent and 16.07 percent, respectively. Between 2003 and 2008, states that recorded decline in poverty are Bayelsa (29.6 percent), Abia (26.24 percent), Oyo (23.31 percent), Ebonyi (23.2 percent), Ondo (18.99 percent) and Kebbi (18.25 percent), while increases were recorded in Yobe (29.38 percent), Borno (23.49 percent), Kwara (21.10 percent) and Plateau (15.51 percent). It should also be noted that states with consistent reduction in poverty incidences are Nassarawa, Kebbi, Jigawa, Enugu, Sokoto, Kaduna and Anambra, while it is only in Benue state that poverty consistently increased.

Growth, Inequality and Non-Income Poverty Incidence Linkages

The impact of growth rates of CWI and changes in inequality on changes in non-income poverty incidences was addressed with a two-stage regression. The OLS and 2SLS results for the periods 1999/2003 and 2003/2008 are presented in table 4. The results for the 2SLS show that the Wald Chi Square statistics are 56.19 and 66.42 for 1999/2003 and 2003/2008 respectively being statistically significant ($p<0.01$). Out of the variables that were included in the 1999/2003 model, growth rate of CWI, number of trained youths, average of annual allocation from the federation account, average age and literacy rate show statistical significance ($p<0.10$), while in 2003/2008, growth rates of CWI, unemployment rate, telephone penetration, literacy rate and average household size are statistically significant. Change in Gini inequality variable was excluded from the 2003/3008 model because it is highly correlated with growth and uncorrelated with non-income poverty incidence change and thus used as one of the instrumental variables.

Table 4: OLS and Two Stage Least Square Regression of the Impact of Growth and Inequality on Non-Income Poverty Change (1999-2008)

Variables	1999-2003 (OLS)		1999-2003 (2SLS)		2003-2008 (OLS)		2003-2008 (2SLS)	
	Coeff	T value	Coeff	T value	Coeff	T value	Coeff	T value
Growth rate in CWI	-0.1475***	-2.87	-0.1463**	-2.03	-0.1288	-1.53	-0.1924**	-2.01
Northern states dummy	-4.3971	-0.54	-4.4351	-0.66	2.9022	0.31	2.7458	0.39
Immunization	0.00008	1.15	0.00008	1.43	0.00002	0.23	0.00001	0.17
HIV prevalence	0.00003	0.59	0.00003	0.74	0.00007	1.00	0.00006	1.14
Unemployment rate	-0.2870	-1.21	-0.2880	-1.48	1.0194***	2.68	0.9844***	3.37
Trained Youths	-0.0363	-1.41	-0.0362*	-1.79	-0.0016	-0.10	-0.001	-0.09
Telephone Penetration	1.4305	0.87	1.4324	1.10	-0.5340	-1.24	-0.5178	-1.57
Annual Allocation	0.3808**	2.20	0.3814***	2.75	-0.1132	-0.77	-0.1029	-0.92
Change in Gini coefficient	0.2049	1.10	0.2055	1.37	-	-	-	-
Average age (years)	2.2419**	2.05	2.2389***	2.56	0.9297	-0.59	-0.9239	-0.77
Robbery cases	-0.0537	-1.13	-0.0538	-1.42	0.1116*	1.73	0.1047**	2.10
Literacy	-0.3838**	-2.04	-0.3835***	-2.57	-	-	-	-
Average household size	-	-	-	-	-13.8188	-1.91	-13.9495***	-2.53
Constant	-48.6607	-0.86	-48.5612	-1.08	64.3886	0.59	67.1998	0.80
F Value	3.12***				2.58**			
Wald Chi Square			56.19****				66.42***	
Adj R -Squared	0.4338				0.6388			
No of observations	37		37		37		37	

*** significance at 1%, significance at 5%**, * significance at 10%

The results show that a percentage increase in the growth rate of CWI reduced non-income poverty incidence by 0.1463 percent and 0.1924 percent in 1999/2003 and 2003/2008 respectively. Therefore, growth resulted into reduction in non-income poverty incidences in 2003/2008 than in 1999/2003. This finding is similar to that of Oyekale *et al* (2006), Aigbokhan (2008) and Oyekale *et al* (2011) for monetary poverty in Nigeria and Boccanfuso *et al* (2009) for non-monetary poverty incidence in Senegal using Shapley decomposition approach. Meier (1989) asserted that whether absolute poverty is measured by low income, low life expectancy or illiteracy, there is a strong negative correlation between poverty and growth.

Unemployment rate variable shows statistical significance ($p<0.01$) in the 2003/2008 and implies that increasing unemployment rate by one percent will increase non-income poverty incidence by 0.9844. This is expected because unemployment constitutes some welfare losses to the households. Todaro (1985) affirmed that provision of gainful employment must be an essential ingredient in any poverty reduction development strategy. Osinubi (2005) reported that based on some Federal Office of Statistics and Central Bank of Nigeria data, poverty incidence in Nigeria declined between 1987 and 1991 due to steady decline in unemployment rate. Closely related to this are the parameters of the number of trained youths that both have negative sign in the two results, but only shows statistical significance ($p<0.10$) in the 1999/2003 results. This implies that in 1999/2003, increasing the number of trained youth by one unit will reduce non-income poverty incidence by 0.0362. It should be noted that the parameter is very small compared to what was obtained for the unemployment rate. The implication of this finding is that the number of training conducted for youth in recent time does not have impact on poverty reduction. This may be as result of poor targeting and inability to complement training with adequate financial supports to set up.

Telephone penetration statistical significantly ($p<0.10$) reduces poverty by -0.5178 in the 2003/2008 period. This is expected because telephone penetration seems to rapidly dissolve every barrier to economic integration, which is very vital for economic development. Obayelu and Ogunlade (2006) provided some empirical results to buttress this finding Unexpectedly, a unit increase in the average annual allocation to the states from the Federation Account in 1999/2003 period increases poverty significantly ($p<0.01$) by 0.3814 unit. In the 2003/2008 period, the parameter is with negative sign but statistically insignificant ($p>0.10$). Klump and Bonschab (2004) already noted that it requires pro-poor spending for government expenditure to result into poverty reduction.

The variable of change in Gini coefficient is with positive sign in the 1999/2003 model, but shows no statistical significance ($p>0.10$). Average age variable is statistically significant ($p<0.05$) in the 1999/2003 model. It implies that as average age of the household head increases by one year, non-income poverty incidence will increase by 2.2389. Aigbokhan (2008) also found that because of the life cycle implication of wealth acquisition, above a particular point, expenditure will decline with age. Robbery cases variable shows statistical significance ($p<0.05$) in the 2003/2008 model and implies that an increase in the number of robbery cases by one unit will increase non-income poverty by 0.1047. Odumosu (1999) noted that when poverty is coupled with high levels of economic and social aspirations, the stage is set for criminal activities - particularly official corruption, robbery and dealing in illegal goods and services. It was emphasized that people who are thwarted in attaining desired social and economic goals legally may seek to obtain them illegally. Therefore, incidence of robbery and traffic in illegal goods tends to be high among members of minority groups who feel the burden of both economic and social discrimination. This is a consequence of widening poverty and inequality gaps. In 1999/2003, a percentage increase in literacy rate significantly reduces non-income poverty incidence by 0.3835 ($p<0.05$). Klump and Bonschab (2004) already indicated that spending on education provides a vital platform for releasing people from the hooks of poverty. Several other authors (Aigbokhan, 2008; Oyekale *et al*, 2006) have documented the impact of education in ensuring monetary poverty reduction in Nigeria. In the 2003/2008 model, average household size variable is also show statistical significance ($p<0.05$). This implies that as household size increases, non-income poverty reduces. This is contrary to what had been found by Aigbokhan (2008) for monetary poverty in Nigeria.

4. Recommendations

This study assessed non-income pro-poor growth in Nigeria using the 1999, 2003 and 2008 survey based Demographic and Health Survey (DHS) secondary data. The fuzzy set method was used to construct composite welfare indicators for the households, which were subjected to further pro-poor distributional and parametric regression approaches. The major findings and their policy implications are discussed as follows:

Welfare among rural dwellers is lower than what obtains in the urban areas. There is therefore the need to ensure better access for the poor (majority of

which are in the rural areas) to basic social services. Government's efforts at making some progress towards some Millennium Development Goals should be more intensified and better focused. Investment in provision of safe water and better sanitation should form a major priority, and the inputs of private sector will be vital. It was also found that access to telephone services increased over the years, but the rural poor are more deprived.

The regression analysis also shows that increase in state-level literacy rate significantly reduced non-income poverty incidence. There is therefore the need to ensure progressive educational development in Nigeria. Efforts to ensure better access by poor households to education should therefore form the hallmark of education policies and programmes. Composite average welfare indicator in Nigeria increased between 1999 and 2003, but slightly declined in 2008. However, non-income poverty and inequality are more of northern states phenomenon with Jigawa and Sokoto states standing out by falling among the top 10 in all the years. Other northern states with very high non-income poverty incidences are Zamfara, Bauchi, Kebbi, Yobe, and Taraba. It was also found that non-income poverty incidences are highly correlated with its inequality. It is therefore imperative for government to properly target some northern states where poverty is highly endemic for specific marginal reforms. This is very essential because such states constitute major set back for enhancing development indicators in Nigeria. They may also serve as vital barrier to achievement of rapid economic growth in the present democratic setting.

We found that increasing unemployment rate by one percent will increase non-income poverty incidence. Government therefore to ensure putting in place appropriate programmes to reduce unemployment. This is also vital for addressing insecurity in the form of number of robbery cases in the states which was found to increase poverty. Channeling such efforts at the youths using some recent opportunities in the agricultural production can be of help because it was found that as the number of people engaged in farming increases, growth of CWI among the poor increased.

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OSTEOPONTIN IN PATIENTS WITH PRIMARY KNEE OSTEOARTHRITIS: RELATION TO DISEASE SEVERITY

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Abstract: Background: Osteopontin; a small integrin-binding ligand; has been proved to be an important factor in bone mineralization, remodeling and metabolism. Upregulation of osteopontin was noticed in knee osteoarthritis. It may be involved in the molecular pathogenesis of the disease, contributing to progressive degeneration of articular cartilage. **Aim:** To measure plasma and synovial fluid osteopontin in patients with primary knee osteoarthritis in order to assess its relation to disease severity. **Patients and Methods:** This study included thirty patients (aged 44-66 years) diagnosed as having primary knee osteoarthritis according to the checklist of American College of Rheumatology criteria. Ten age and sex matched apparently healthy controls were also enrolled in this study. Full history taking, thorough clinical examination, routine laboratory investigations,and plasma osteopontin (OPN) level measurement were done for all patients and controls. While Synovial fluid OPN levels were measured in cases with knee effusion. Disease severity was assessed using Kellgren/ Lawrence (K/L) radiological score. **Results:** Statistically Significantly elevated levels of both plasma and synovial fluid OPN were found in patients compared to controls ($P<0.001$&$P<0.05$ respectively). Synovial fluid OPN levels were statistically significantly higher than paired plasma samples ($P<0.001$). A significant positive correlation was found between plasma OPN and synovial fluid OPN levels and both of them showed positive correlation with disease severity grades as assessed by K/L radiological score. **In Conclusion:** Both plasma and synovial fluid OPN levels were increased in primary knee O.A patients and both of them correlated with more severe OA. Measurements of plasma and/or synovial fluid levels of osteopontin could possibly serve as a biochemical parameter for determining disease severity and predicting the progression of osteoarthritic disease process.

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Keywords: osteoarthritis, Kellgren/Lawrence score, osteopontin.

1. Introduction

Osteoarthritis (OA) is a disorder of the hyaline joints characterized by wear, softening and thinning of the articular cartilage and diminished compliance of the subchondral bone (Bijlsma et al., 2011).

There is a great potential in the use of biochemical markers of arthritis to diagnose the disease at an earlier stage, assess its severity and monitor the effect of any treatment ***(Garnero et al., 2002).*** Markers of cartilage degradation have been assessed extensively and show a moderate to good relation with clinical and radiographic variables of osteoarthritis but not enough is known about markers of bone metabolism, like bone morphogenetic proteins and osteopontin which might have an important role in pathophysiology of the disease ***(Honsawek et al., 2009).*** However, no maker has gained complete acceptance for clinical monitoring of osteoarthritis.

Osteopontin, (OPN) a member of the SIBLING (small integrin-binding ligand N-linked glycosylated protein) family, is present in extracellular fluids. It is abundant in the extracellular matrix of mineralized tissues such as bone, where it mediates important cell–matrix and cell–cell interactions ***(O'Regan et al., 2000).***Its expression during chondrocyte maturation is one of the important events involved in cartilage-to-bone transitions in fracture repair ***(Gravallese, 2003).***

Scatena et al., 2007 stated that OPN was a multifunctional molecule highly expressed in chronic inflammatory and autoimmune diseases, Being a secreted adhesive molecule, OPN was found to aid in the recruitment of monocytes-macrophages and to regulate cytokine production in macrophages, dendritic cells, and T-cells. OPN has been classified as a T-helper 1 cytokine. Furthermore, OPN is cleaved by at least 2 classes of proteases: thrombin and matrix-metalloproteases (MMPs). Most importantly, fragments generated by cleavage not only maintain OPN adhesive functions but also expose new active domains that may impart new activities.

Several studies proved that OPN was involved in different physiologic and pathologic events in liver (Ramaiah and Rittling 2008), skeletal muscle myoblasts (Uaesoontrachoon *et al.* (2008), the vascular system (Waller *et al.*, 2010), in cellular transformation and cancer (Weber 2011) and in mineralized tissues (McKee *et al.*, 2011).

Patients with ankylosing spondylitis had high levels of OPN. However, the plasma OPN level in such patients showed correlation with bone remodeling markers rather than with inflammation (Choi *et al.,* 2008). In addition, OPN was expressed by rheumatoid arthritis fibroblast –like synoviocytes (FLS) . It affected FLS and B lymphocyte interactions

by supporting the adhesion of B lymphocytes to FLS and enhancing the production of IL-6 (Take *et al.*, 2009).

Up regulation of OPN in O.A. was noticed by enhanced expression of osteopontin mRNA in human OA cartilage. Osteopontin may be involved in the molecular pathogenesis of osteoarthritis, contributing to progressive degeneration of articular cartilage (Standal et al., 2004).

The synthesis and degradation of cartilage matrix and the cartilage homeostasis is regulated by chondrocytes via mechanisms that depend, in part, upon the interaction of chondrocytes with the extracellular matrix (ECM) proteins. These include collagens, proteoglycans, and noncollagen-proteins such as fibronectin (FN) and osteopontin (OPN), (Hunter et al., 2009). In addition, OPN was thought to be involved in destruction of cartilage matrix by inducing the production of collagenases in articular chondrocytes (Gao et al., 2010).

AIM OF THE STUDY:

To measure plasma and synovial fluid osteopontin in patients with primary knee osteoarthritis in order to assess its relation to disease severity.

2.PATIENTS AND METHODS

This study included thirty symptomatic patients who attended the Physical medicine, Rheumatology and Rehabilitation Outpatient Clinic of Ain Shams University Hospital and were diagnosed as having primary knee O.A according to the checklist of American College of Rheumatology criteria for the classification of knee osteoarthritis ***(Altman et al., 1986)*** as shown in table (1).

Table (1): Checklist of American College of Rheumatology criteria for the classification of idiopathic knee osteoarthritis (Altman et al., 1986):

Clinical and laboratory	Clinical and radiographic	Clinical ‡
Knee pain	Knee pain	Knee pain
+ at least 5 of 9:	+ at least 1 of 3:	+ at least 3 of 6:
- Age > 50 years	-Age > 50 years	- Age > 50 years
- Stiffness < 30 mins	-Stiffness < 30 mins	- Stiffness < 30 mins
- Crepitus	- Crepitus	-Crepitus
- Bony Tenderness	+ Osteophytes	-Bony Tenderness
- Bony enlargement		- Bony enlargement
- No palpable warmth		- No palpable warmt
- ESR <40 mm/hour		
- RF <1:40		
- SF OA		
92% sensitive	91% sensitive	95% sensitive
75% specific	86% specific	69% specific

ESR = erythrocyte sedimentation rate (Westergren); RF=rheumatoid factor

SF OA = synovial fluid signs of OA (clear, viscous, or white blood cell count <2,000 /mm3).

Ten healthy individuals matched for age and sex with patients were also enrolled in this study as a control group.

Patients with secondary OA, other types of arthritis such as Rheumatoid arthritis, Systemic lupus erythrematosis, Psoriatic arthritis, gout, pseudo gout, and infectious arthritis. Also, patients suffering from osteoporosis, systemic inflammatory or autoimmune disease or malignancy were excluded.

All patients were **subjected to:**

Full medical history: Sex, age, Occupation, Menstrual history , with special emphasis on history of knee pain**,** morning stiffness, jelling phenomenon, joint swelling, other joint affection, constitutional symptoms and extra-articular manifestations. Past history suggestive of secondary of knee OA.

Thorough clinical examination: Weight and height (BMI was calculated). Local examination of knee joint for tenderness, warmth, swelling, effusion, crepitus, Palpable osteophytes, deformities, Synovial hypertrophy, range of motion, muscle wasting, ligament laxity and patella-femoral compression test. Also examination of small joints of hands and feet, shoulders, hip joints, and ankle joints as a screening for primary generalized O.A and gait examination.

3.Laboratory investigations:

A. Routine laboratory investigations:

- -Complete blood count using coulter counter.
- -Erythrocyte sedimentation rate (ESR) by the Westergren method.
- Serum CRP using enzyme linked immunosorbant assay (ELISA) and considering concentrations lower than 10 mg/L within normal levels.

B. Measuring of full length OPN levels in plasma and synovial fluid samples:

Blood samples were collected from all patients, centrifuged, and stored at − 80 °C until assayed .

- Synovial fluid was aspirated using lateral approach technique from the affected knees of 10 patients who had knee effusion , centrifuged and stored immediately at −80°C until analyzed.
- Double-blind quantitative detection of osteopontin level in plasma and synovial fluid was performed using enzyme-linked immune sorbent assay (ELISA) (Kit name is Quantikine used for Human Osteopontin (OPN) Immunoassay. Catalog Number DOST00, SOST00P, DOST00) using the following procedure:

Micro-titer plates were coated with capture rabbit polyclonal antibody. Both plasma and synovial fluid samples were diluted at 1:10 with dilution buffer. then added to the plates(100 ul/well) and incubated for 1 h at 37 ^{0}C. The wells were then washed seven times with washing buffer and incubated for 30 min at 4 °C with a horseradish peroxidase-labeled mouse monoclonal detection antibody for human OPN. After extensive

washes, 100 ul of tetramethylbenzidine buffer (used as a substrate) was added to each well, and the plate was incubated for 30 min at room temperature in the dark. Finally, the reaction was stopped with the stop solution. A plate reader (Bio-rad, Hercules, CA, USA) was used to quantify the signal at 450 nm. OPN concentrations were calculated by the standard curve. The sensitivity of this assay was 3.3 ng/ml.

4. Knee Radiography:

Standardized plain X-ray weight-bearing antero-posterior radiographs of the knee were performed and evaluated according to the Kellgren and Lawrence (K/L) severity grading scale for knee OA. (Kellgren and Lawrence, 1957).

Statistical Analysis:

Statistical analysis was performed using Statistical package for Social Sciences Software (SPSS) version 15.0.1 . Quantitative variables (clinical and laboratory parameters) were presented as the mean ±SD. Student(t) test was used to compare means of two studied groups. ANOVA test was used to compare more than two groups. Relationships between parameters were analyzed using Pearson Correlation Coefficient. *P* value less than 0.05 was considered significant

3.Results:

This study was conducted on 30 patients with primary knee OA; aged 44 to 66 years with a mean±SD of 52.7±5.3 years, 25 females (83%) and 5 males (17%). Their BMI ranged from 25.6 to 35.0 Kg/m ² with a mean±SD of 32.0±2.34 Kg/m ². Their Disease duration ranged from 3 to 15 years with a mean ±SD of 6.35±2.98 years. Ten apparently healthy controls were also enrolled in this study; aged 32 to 62 years with a mean±SD of 52.2±9.51 years , 8 females (80%) and 2 males (20%).Their BMI ranged from 27.0 to 33.0 Kg/m ² with a mean± SD of 30.9±1.9 Kg/m ².

Comparison between patients and controls as regards age and BMI showed no statistical significant difference (P>0.05).

Table (2): The frequency of clinical manifestations of knee OA in the patient group :

Clinical manifestation	NO	%
Morning stiffness	20	66.7%
Pain	30	100%
Crepitus	30	100%
Palpable osteophytes	7	23.4%
Patello-femoral test	20	66.7%
Effusion	10	33.3%
Tenderness	30	100%
Synovial hypertrophy	2	6.7%
Quadriceps atrophy	20	66.7%

No: Number, **%:** percentage

ESR and CRP were normal in all patients and controls.

Evaluation of Plasma OPN levels:

Plasma OPN levels in control group ranged from 11ng/ml to 22ng/ml with a mean level of 15.6 ±3.41ng/ml while plasma OPN levels in O.A group ranged from 44 ng/ml to 207ng/ml with a mean level of 171.37±15.96 ng/ml. Comparison between patient and control groups as regards plasma OPN levels revealed a highly statistically significant difference (P>0.001) as shown in fig(1).

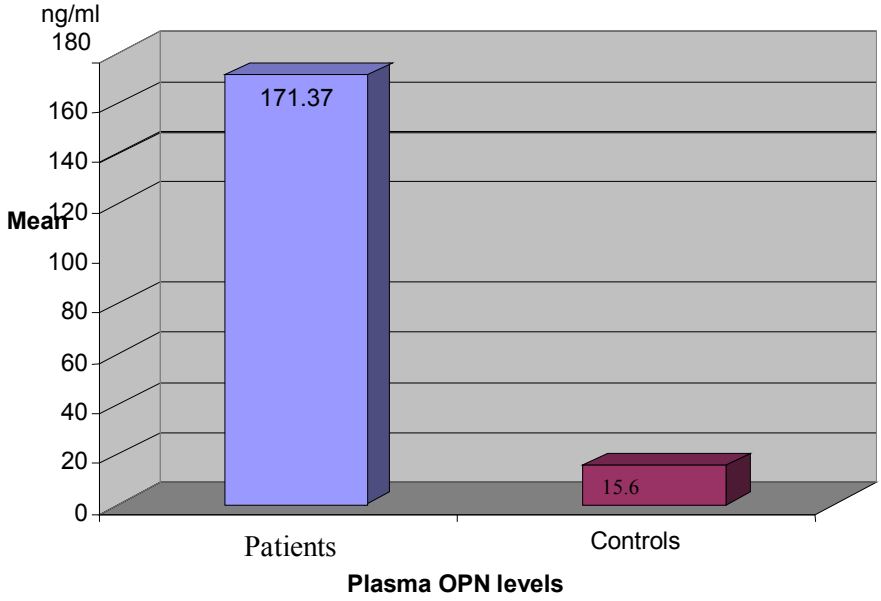

Fig. (1): Comparison between patient and control groups as regards plasma OPN levels.

Plasma OPN levels in patients with knee effusion showed a mean±SD of 174.5±16.24 while in patients without knee effusion its mean±SD was 169.8±16.01. This difference was statistically non significant (P>0.05).

Comparison of both plasma and synovial fluid OPN levels with different radiological grading is shown in tables (4 &5) & fig. (6).

Assessment of radiological findings showed:

Table (3): radiological findings of patients according to K-L score:

		Number	Percentage
K-L grading score	Grade 1	0	00.0%
	Grade 2	6	20.0%
	Grade 3	19	63.3%
	Grade 4	5	16.7%

K-L score: kellgren-lawrence classification

Table (4): Comparison of plasma and synovial fluid OPN levels with different radiological gradings:

	Grade 2	Grade 3	Grade 4	F*	P	Sig.
	Mean± SD	Mean± SD	Mean± SD			
Plasma OPN (ng/ml)	150.17± 4.79	170.92±5.92	198.50± 8.11	85.42	<0.001	HS
Synovial OPN (ng/ml)	215.00 ± 2.83	228.00±11.73	243.00±1.41	30.94	<0.05	S

S = Significant, **HS = highly significant, ***p***= level of significance, * ANOVA test

Table (5): Post Hoc Test for pair wise comparison between different K/L grades as regards plasma and synovial OPN levels:

Dependent Variable	(I) K-L grading	(J) K-L grading	*P*	Sig.
Plasma OPN	Grade 2	Grade 3	<0.001	HS
		Grade 4	<0.001	HS
	Grade 3	Grade 2	<0.001	HS
		Grade 4	<0.001	HS
	Grade 4	Grade 2	<0.001	HS
		Grade 3	<0.001	HS
Synovial OPN	Grade 2	Grade 3	>0.05	NS
		Grade 4	<0.05	S
	Grade 3	Grade 2	>0.05	NS
		Grade 4	>0.05	NS
	Grade 4	Grade 2	<0.05	S
		Grade 3	>0.05	NS

S = Significant, **HS = highly significant, ***p***= level of significance, NS= non significant.

To detect any overlap between different K/L grades as regards plasma and synovial fluid OPN levels, Post Hoc curve was performed.

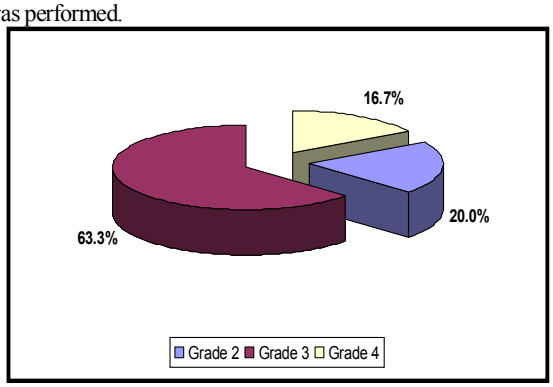

Fig. (2): The frequency of radiological grading among O.A patients

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Fig. (5): Plain X-ray AP view of a right knee joint showing K/L grade 4.

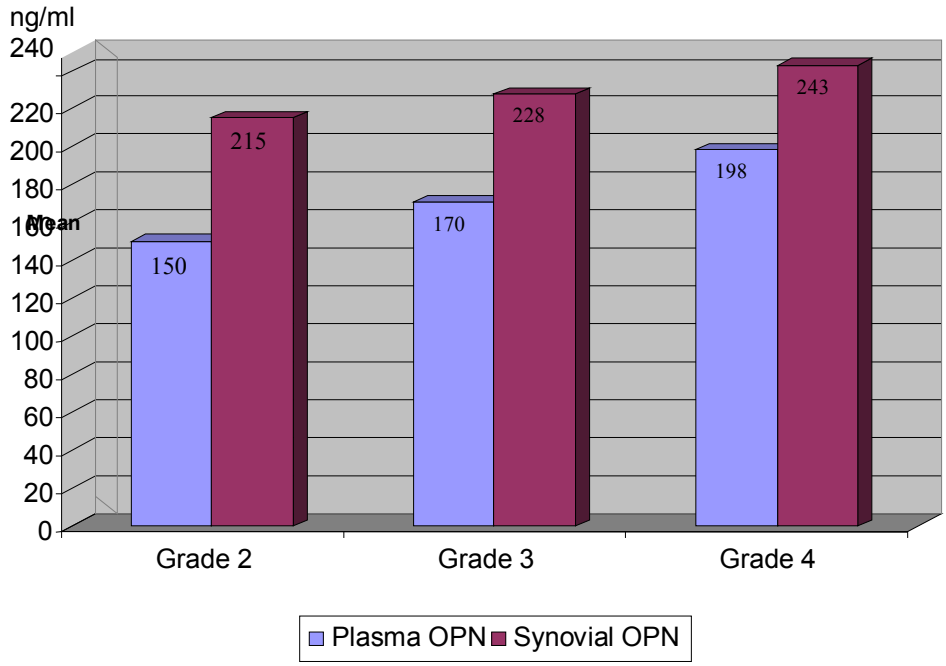

Fig.(6): Comparison between patients with different K-L grades as regards plasma and synovial OPN levels.

Correlating plasma OPN levels to age and BMI of the patients , and disease duration of OA revealed non-significant correlations (P>0.05.). Correlating both plasma and synovial fluid OPN levels to K/L grading showed statistically significantly positive correlations (P <0.001 and P<0.05 respectively) as shown in table (6) and figs.(7&8). Correlation between plasma and synovial fluid OPN levels revealed statistically significant correlation (p<0.05) as shown in table (7) and figure (9).

Table (6):Correlations between both plasma and synovial fluid OPN levels and K/L grading:

		Plasma OPN	Synovial OPN
K/L grading	r	.923	.727
	P	<0.001	<0.05
	Sig	**HS**	**S**

r: Pearson correlation test, **S** = Significant, **HS** = highly significant, ***P*** = level of significance.

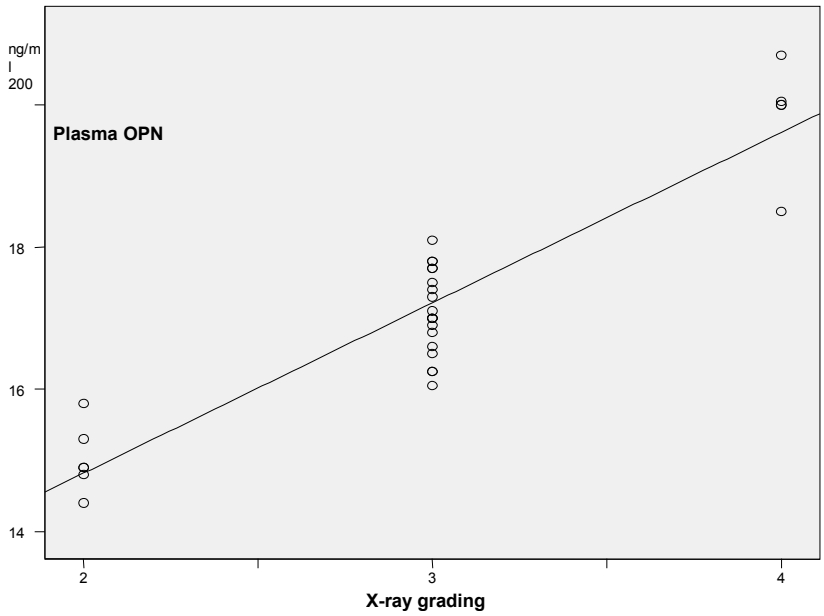

Fig.(7): Correlation between plasma levels of OPN and K/L grading.

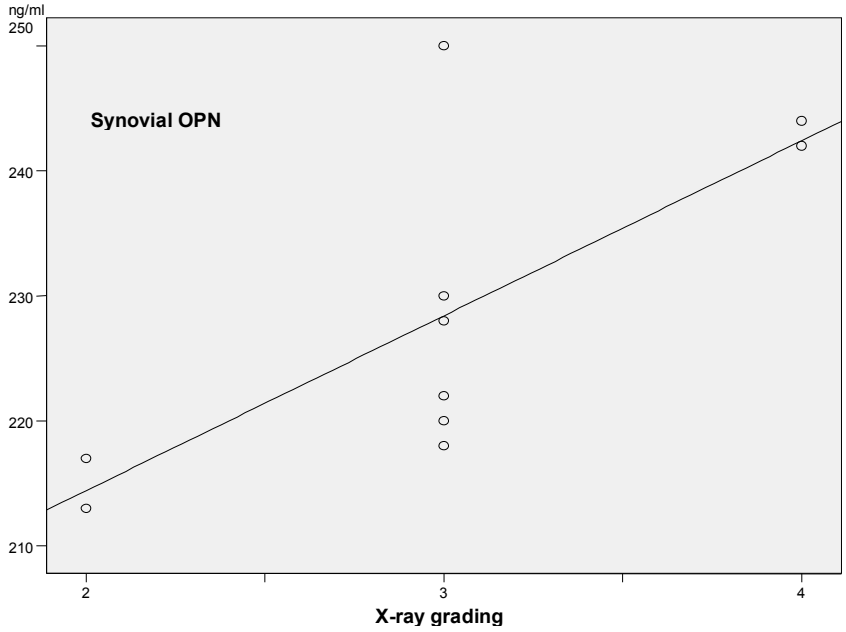

Fig. (8): Correlation between synovial fluid levels of OPN and K/L grading.

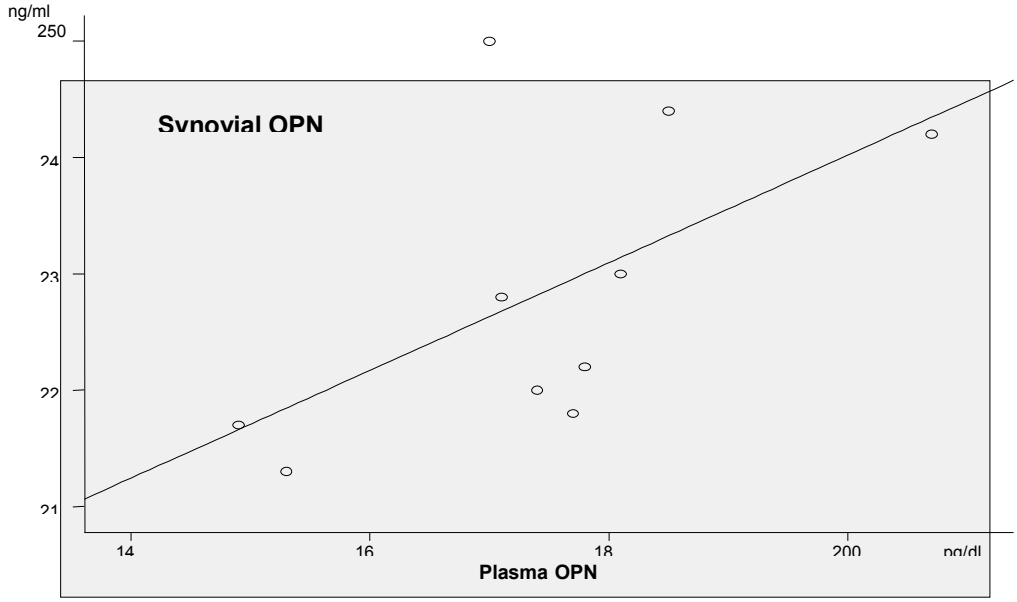

Fig. (9): Correlation between plasma and synovial fluid OPN levels.

Table (7): Correlation between plasma and synovial fluid OPN levels:

		Synovial OPN
Plasma OPN	r	.585
	P	<0.05
	Sig	S

r: Pearson correlation test, **S** = Significant, ***P*** = level of significance

4.Discussion

In osteoarthritis, the presence of bone marrow lesions (BMLs) adjacent to the subchondral plate on magnetic resonance images has been strongly associated with disease progression and pain. The defects related to BMLs appear to be sclerotic due to increased bone volume fraction and increased trabecular thickness. The mineral density in these defects, however, is reduced and may render

this area to be mechanically compromised, and thus susceptible to attrition ***(Hunter et al., 2009).***

OPN; a non collagenous extracellular matrix (ECM) protein; has been proved to contribute directly to the regulation of bone mineralization and growth (Alford and Hankenson, 2006). Furthermore, it has been implicated as an important factor in bone remodeling and metabolism(Choi *et al.,*2008).

It has been suggested that osteopontin (OPN), fibronectin (FN), as well as other ECM proteins in the pericellular environment of the chondrocytes such as collagen, and proteoglycan play a role in specific induction and repression of chondrocyte gene ***(Saito et al., 1999). Attur et al.,*** **2000** added that FN and soluble ECM proteins such as vitronectin and OPN are ligands for integrins . They noticed that addition of fragments or recombinant extra domain regions of these ECM proteins to cartilage up-regulated inflammatory mediators and induced chondrolysis via the ligation of the chondrocyte to integrin. Rosenthal *et al.,* 2007 reported that OPN was found in increased quantities in the pericellular matrix of osteoarthritic cartilage.

On the other hand, Matsui *et al.,* 2009 suggested that OPN was required for cartilage homeostasis and reported that OPN deficiency; and not increase; was associated with more severe OA in mice.

Thus the aim of this study was to measure the plasma and synovial fluid osteopontin levels in patients with primary knee osteoarthritis, in order to assess its relation to disease severity.

This study proved a significant increase in plasma OPN levels in patients with primary knee OA in comparison to control group. These results were in agreement with Honsawek *et al.,* 2009, who suggested enhanced systemic production of OPN in the primary knee osteoarthritis and added that overexpression of OPN may be involved in the molecular pathogenesis of osteoarthritis and contribute to progressive degeneration of articular cartilage. Wang and Denhardt, 2008 explained that Upregulation of OPN was found to induce production of proinflammatory chemokines and cytokines including IL1B, TNF ccl2 and cxcl and activation of nuclear factor kappa P pathway. It is already well known that these cytokines are closely associated with functional alterations in synovium, cartilage and subchondral bone. These proinflammatory mediators appear to be first produced by the synovial membrane, and then diffuse into the cartilage through the synovial fluid. They activate the chondrocytes, which in turn produce catabolic factors such as proteases and multiple pro-inflammatory cytokines ***(Standal et al., 2004).***

In our study, there was no statistical significant correlation between plasma OPN levels, age, disease duration and BM of patients..

It has been noticed in this study that OPN levels in synovial fluid were statistically significantly higher with respect to paired plasma samples. These findings were supported by Honsawek *et al.,* 2009. Moreover, Gao et al., 2010 studied OPN expression in both synovial fluid and articular cartilage and reported that synovial fluid OPN levels in O.A patients were higher compared to controls and that expression of OPN was highly up-regulated in human OA cartilage, as compared with normal cartilage. Previous studies have demonstrated; by immuno-histochemical staining; the expression of OPN in fibroblast-like synoviocytes (FLS) and articular chondrocytes (Pullig et al., 2000, Ohshima et al., 2002). So, the source of elevated OPN in the synovial fluid of OA patients is presumably to be the local tissues such as the synovial membrane and articular cartilage. It was also suggested that cell adhesion, migration or inflammation could be involved in the release of OPN (Standal et al., 2004). However in OA, the degenerative changes of articular cartilage were likely to be the facilitating factors in the release of OPN ; residing in extracellular matrix, into the synovial fluid simply by exposing the subchondral bone to the synovial fluid, so that bone may be a source of synovial fluid OPN ***(Gao et al., 2010).***

Regarding correlation studies, a significant positive correlation was found between plasma OPN and synovial fluid OPN levels. Similar results were reported by ***Honsawek et al., 2009.***

According to our study, both plasma and synovial fluid full length OPN levels were significantly correlated with the severity of primary knee O.A determined by K/L radiological grading. Our findings are in agreement with ***Honsawek et al., 2009. Also, Gao et al., 2010*** proved that synovial fluid OPN levels showed a positive correlation with articular cartilage OPN expression which in turn correlated with disease severity. Therefore, determining the levels of OPN in synovial fluid, may be indirectly predictive of the degree of cartilaginous damage and disease severity and this emphasis our results. In a recent study by ***Hasegawa et al., 2011*** stated that a thrombin cleaved OPN (OPN N-half) was the one significantly higher in synovial fluid of OA knees than in controls and a statistically significant correlation was found between its elevated synovial fluid levels and disease severity by Kellgren-Lawrence grades 1, 2, 3, and 4 ($r = 0.274$, $p < 0.001$). They also added that Immunohistochemistry of the synovium showed stronger reactivity for this thrombin -cleaved OPN in samples from subjects with advanced OA, denoting local expression of thrombin-cleaved OPN which increased with greater OA severity. Interestingly enough, they reported contradictory results about concentrations of full-length OPN in synovial fluid of OA knees which were according to their study; not statistically different from those of

controls ($p > 0.05$). Explaining those contradictory results, they stated that the thrombin-cleaved form of OPN was the proinflammatory form which correlated well with various inflammatory diseases. .Another possible reason for differences in those results might be different molecular fragility of OPN types. Our results disagree also with Matsu *et al.,* 2009 who noticed that OPN deficiency; and not increasecaused more severe OA changes in OPN-deficient mice. They explained their results by suggesting that OPN might be required for cartilage homeostasis, so its deficiency and not increase was associated with more severe OA. Another explanation may be acceptable differences between their in vitro findings based on experimental animals and others' in vivo findings such like ours.

In Conclusion :

Both plasma and synovial fluid OPN levels were increased in primary knee OA patients and both of them correlated with more severe OA. Measurements of plasma and/or synovial fluid levels of OPN could possibly serve as a biochemical parameter for determining disease severity and may be predictive of prognosis with respect to the progression of osteoarthritic disease process.

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11/11/2012

Evaluation and study of the correlation between the human capital strategy and organizational performance

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Abstract: This applied article collects descriptive information by Delphi survey method as well as investigating the significant correlation or lack of correlation in main hypothesis which has subsidiary hypothesis. In this paper, the correlation among the variables affecting the performance of Parsian Bank has been examined. The main hypothesis of this study is the existence of a significant correlation between the human capital strategy and performance of Parsian Bank. Subsidiary hypotheses include a significant correlation between the variables of manpower supply system, incentive system, human resources development system, and human resources maintenance system with the performance of Parsian Bank. Sampling was done randomly and by using Cochran's formula and based on the calculation 127 people were selected for questioning. In this paper, the Student's t-test has been used in order to determine the significant correlation between the performance of Parsian Bank and independent variables. Moreover, the hypothesis test by Pearson correlation coefficient method and the Student's t-test has been used in order to determine the existence or lack of defined variables. In this paper, the model coefficients are estimated using the factor analysis method and VPLS software. Model presented in this paper indicated that to which priorities and what extent the focus of Parsian Bank activities for increased performance should be allocated, respectively. Finally, the regression model for performance function of Parsian Bank is presented.
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Keywords: Human capital strategy, Improvement of organization, organizational performance evaluation

1. Introduction

Raising the issue of human capital strategy improves the human resource management researchers' perception of the relationships between the organizational strategies, human capital, strategic human resource management and the performance of company and changes the focus on operational management and human resources to focus on strategic human resource management by various methods. Nowadays, analysis of operational management of human resources (i.e. evaluating the individual actions of human resource management such as selecting and recruiting, training and development, and service compensation and ...) has been changed to the strategic management of human resources. The concept of synergy or being complete measures of human resources is important in strategic management of human resources [1]. Creating the coordination between the strategy of organization on the one hand and various systems of human resources on the hand is emphasized in strategic management of human resources. In fact, the human resources strategy plays the role of intermediary between the organizational strategy and operation of human resources and changes the orientation of organization, presented in its strategy, to objective guidelines. Strategic human resource management emphasizes on organizational performance as a dependent variable, but the individual functions are not considered. However, the traditional management generally focuses on individual outcomes such as the task performance, absenteeism, Job satisfaction and staff service-leaving. In this regard, understanding the processes and mechanisms, through which the human resource management practices affects the organizational performance, is one of the key issues which has been still remained vague. On the other hand, despite adopting a comprehensive and unified strategy, most of the organizations use a set of related strategies each which is designed at separate level. In most of large organizations, which have diverse activities, these critical levels of strategy are:

1. Firm strategy,
2. Business strategy (Business unit),
3. Applied strategies (task).

Important point, which should be considered in designing these strategies, is the necessity for coordination among them. So that each of the strategic level should have an appropriate coordination with its higher-level strategy otherwise the organization will not be able to achieve its objectives efficiently [2]. Accordingly, it seems that given the importance of organizational strategy (in various functions) and their direct effect on its performance, the coordination between the human capital strategies and organizational performance is one of the issues which could significantly impact the effectiveness of human resource management

practices on organizational performance. Therefore, the main objective of this study is to evaluate the effect of coordination between the Capital Human strategy and organizational performance. In defining the strategy, the experts have presented the definitions which guide this paper. For instance, Hunger and Wheelen, translated by Arabi and Izadi, 1381, have stated that the strategy is a comprehensive and plenary plan which shows the way through which the organization can achieve its mission and objectives [3]. Daft, translated by Parsaeian and Arabi, 1377: Strategy means a plan for creating a mutual relationship with environmental factors which are often contradictory in order to meet the organizational objectives. Some of the managers consider that the objective is synonyms with the strategy, but based on his view, the goal determines that to where the organization wants to go and the strategy determines the way of achieving it [4]. David, translated by Arabi and Parsaeian, 1380, and Mintzberg, translated by Saebi, 1383: Strategic vision considers the issues at the mental, conceptual or theoretical level. Thus the strategy is also expressed as subjectively and conceptually and can never be considered objectively and operationally. This issue rejects all views, which consider the strategy as a tool to achieve the long-term objectives, because based on this view, the strategy is a "general orientation of organizational movement to achieve a desired state at the mental and conceptual level" [5]. John and Harrison, Translated by Ghasemi, 1380: Analysis of internal and external environment, determining the strategic direction and creating the strategy to achieve its objectives and implementing it [6].

The important point is that there is a common issue in all provided definitions and it states that the strategic management is related to codification (Planning or selection), implementation and evaluation (Control) of strategy. The significant point is that each strategy is related to strategies of other levels and also to strengths and competitive competencies of business unit and is compatible with the organizational level as a set of coordinated unit as well as responding the environmental conditions [7].

2. Theoretical principles and research background

In this section, the theoretical principles and research background are presented, respectively.

2-1 - Theoretical principles

The concepts of strategy date back to 340 BC. The oldest work in this regard is the views of Chinese General, San Tzu. In this book, he has described the way of using the concepts of strategy for overcoming thee. But, the strategic planning in today form was started in 1960s. Second World War was a platform to adopt several strategic decisions for involved countries. After ending the war, the United States Department of Defense compiled these experiences in the format of "Strategic Planning" method and included it in senior officers' educational program. These ideas entered the business and became the origin for important developments while applying by military senior officers in industry. In 1962, Alfred Chandler, Professor of Harvard University, published the results of his own studies on large American companies and described the process of senior managers' strategic decision-makings. Chandler indicated in this research that how the way of strategic decision-making could lead to superiority in business environment. Three Year later, Kent Andrews, another professor of Harvard University, published an article based on Chandler's idea and raised the necessity for organizations attention to their own strength and weakness. He provided SWOT Analysis Method by the help of collaborators and introduced it as a tool to access the best match between the internal and external conditions of organization [8]. At the same year, Igor Ansof idea applied Chandler's ideas for company planning and achieved significant successes. These achievements attracted the attention of managers, organizations and academic circles to this approach. 1960s and 1970s can be considered as the mostly developed and flourished ones for the classical approaches of strategy. In this era, several tool and methodology such as BCG analysis, GAP analysis, and SWOT analysis were introduced. Numerous articles about the dissemination strategy and these concepts found a way to academic courses. 1980s began with important developments in economic structure of world. During this decade, the economic pole of world transferred from America to East Asia, particularly Japan, and the business environment was faced with fast and consecutive changes of technological and economic factors. In these conditions, the classical approaches, which have been designed for the relatively sustainable environments, could not respond any longer. In 1990s, the strategy theorists came back with completely different ideas and before anything, ask about the classical approaches. Henry Mintzberg denied the basis of "strategic planning" by proposing the differentiation between the analytical processes (Like what is done in planning) and the mental synthesis (What builds the strategies) and stated that basically, the process of planning could not create the strategy [9].

Based on the articles, Hamel and Prahalad introduced the creation of new paradigm as the infrastructure of success-maker strategies and proposed "Making the organization strategic" instead of "strategic planning". These views were accepted and welcomed by professional circles due to the

effectiveness at the operation scene and being compatible with environmental conditions of business, despite the fact that they obtained no considerable success in academic because of difference in ideas and lack of views which could be accepted by the all ones. Jeanne Liedtka, professor in Darden University, also can be considered as one of the experts in new approaches of strategy. As she acquired valuable experiences being present in professional circles and industry consultation circle as well as doing the academic activities, in the late 1990s proposed a model for "Strategic Thinking" which was widely welcomed. Each of these views is considered as the development origin in strategic approaches. This development requires the compliance of this approach with new era conditions [10].

2-2 – ResearchBackground

Abbaspour, 1381, new approaches in functions of human resource management [11], Soltani, 1384 , Managers' strategic thinking, infrastructure of development and growth of organizations [12], Vafaei, 1384, strategic management [13], Khalili, 1385, Ideology and strategy; ratio measurement of strategic thinking and ideologic attitude concepts [14], Bagheri and Delpasand, 1387, Designing and compiling a strategic planning pattern at mission-centered and network universities [15], Peter Senge, 1990, relationship of issues and topics with a general pattern of special events and details [16], Jeanne M. Liedtka, 1998, strategic thinking can be thought [17], Collins et al, 2006, High-Performance Leadership at the Organization Level [18], Acur and Englyst, 2006, Assessment of strategy formulation [19], Baraldi et al., 2007, Using the IMP approach instead of developing the managerial check lists and decision-making rules [20], Vila and Masifern, 2007, Strategic Thinking: Strategy as a Shared Framework in the Mind of Managers [21].

Table (1) Time comparison of conducted research

No.	Researcher's name	Year	Research subject
1	Peter Senge	1990	Relationship of issues and topics with a general pattern with special events and details
2	Jeanne M. Liedtka	1998	strategic thinking can be thought
3	Collins et al.	2000	Performance Leadership at the Organization Level
4	Abbaspour	2002	new approaches in functions of human resource management
7	Soltani	2005	Managers' strategic thinking, infrastructure of development and growth of organizations
8	Vafaei	2005	Strategic Management
9	Acur and Englyst	2006	Assessment of strategy formulation
10	Khalili	2006	Ideology and strategy; ratio measurement of strategic thinking and ideologic attitude concepts
12	Baraldi et.al.	2007	Using the IMP approach instead of developing the managerial check lists and decision-making rules
13	Vila and Masifern	2007	Strategic Thinking: Strategy as a Shared Framework in the Mind of Managers
14	Bagheri and Delpasand	2008	Designing and compiling a strategic planning pattern at mission-centered and network universities

2-2-1 Need for research

In dynamic and competitive environment of today organizations, the change and development are parts of organizational improvement process. Even if a single unit of change in the independent variables changes the organizational development, the organizational development will be achieved. Human capital strategy can have a key role in organizational development by determining the effective strategies and considering the human capital as knowledge tool. Enhancing the organizational performance is one of the most important problems of industries and various economic units. This paper attempts to study the relationship between the strategy of human capital (with 4 independent variables including the manpower supply system, incentive system, human resources development system, Human resources maintenance system) and the organizational performance (in the form of dependent variable ROA).

3 - Research Methodology

The method of research in this paper is applied based on the objective, and descriptive based on collecting data and information, and is from the branch of Delphi survey which aims to achieve a consensus of experts who are familiar with the subject of paper.

3-1 – Method of research

This article first collected the literature about the Human capital strategy by preparing the paper plan and then proposed a questionnaire for statistical population by designing a proposed conceptual plan. Finally, it concluded and proposed the recommendations after distributing and collecting the

questionnaires and views of HR and managers based on the analysis of data from it. The major tasks and activities carried out in this article include determining the article hypotheses, statistical population, sampling method and data analysis, determining the validity and reliability of questionnaire, testing the hypotheses of article which their definition and procedures are presented as follows.

Fundamental objectives of this research are;

1- Identifying the factors affecting the organizational performance in Parsian Bank

2- Determining the current status of organization (Parsian Bank) in terms of identified indicators of human capital strategy in Parsian Bank.

3-2 - Research Hypotheses

For developing the main hypothesis, this question is raised whether the human capital strategy has an effect on organizational performance. In response to this question, the research assumptions are determined as follows. Dependent variable is the performance of Parsian Bank with ROA indicator and the defined independent variables include the manpower supply system, incentive system, human resources development system, Human resources maintenance system.

3-2-1 Main Hypothesis

Human capital strategy has a significant correlation with the between with the performance of Parsian Bank.

3-2-2 Subsidiary hypothesis

1. There is a significant correlation between the manpower supply system and the performance of Parsian Bank.
2. There is a significant correlation between the incentive system and the performance of Parsian Bank.
3. There is a significant correlation between the human resources development system and the performance of Parsian Bank.
4. There is a significant correlation between the human resources maintenance system and the performance of Parsian Bank.

3-3- Statistical population, sample and sampling method

Statistical population of this study consists of 190 Parsian Bank employees. The sampling method was randomized and the number of samples was estimated 127 by using Cochran's formula.

$$n_{cochran} = \frac{\frac{P(1-p)\,z^2_{1-\alpha/2}}{d^2}}{1+1/N\left(\frac{P(1-p)\,z^2_{1-\alpha/2}}{d^2}-1\right)} = \frac{\frac{0.5*0.5*(1.96)^2}{(0.05)^2}}{1+1/190\left(\frac{0.5*0.5*(1.96)^2}{(0.05)^2}-1\right)} = \frac{384.16}{3.0166} \cong 127$$

In which,

P = 0.5: Possibility of a trait occurrence in the population is considered 0.5 due to unavailability,

$Z_{1-\alpha/2} = 1.96$ ($\alpha = 0.05$),

d = 0.05: Maximum acceptable error,

N = 190: Population size,

$n_{cochran}$: Sample size.

Since it is predicted that some respondents do not complete their questionnaires, 10 people were added to the number of statistical sample and this increased the total number of questionnaires to 137, of which 128 questionnaires were completed**.**

3-4 - Data Analysis Methods

In the main hypothesis, the correlation of performance of Parsian Bank, as a dependent variable, with human capital strategy, as an independent variable, has been tested by student's t statistic. Moreover, in subsidiary hypotheses correlation of performance of Parsian Bank, as a dependent variable, with (the manpower supply system, incentive system, human resources development system, human resources maintenance system), as the independent variables, was assessed by Pearson statistic. Finally, we conclude by advanced method of factor analysis by using the software VPLS, Coefficient of determination R and model coefficients.

3-5 - Data collection tools, Validity and reliability of questionnaire

As noted, the questionnaire is as the data collection tool in this study. In this study, the information is collected by implementing the questionnaire with closed questions (Seven options). The designed questionnaire was first distributed among the preliminary sample (30 individuals) of statistical sample and after survey its defects were removed and it was corrected by using the experts' views. In the next step, two final standardized questionnaires were distributed and collected in order to measure the human resources empowerment and effectiveness of organization after the validity determination.

The validity of a study means the accuracy of indicators and criteria which have been produced for desired phenomenon. In order to measure the empowerment, Spreitzer questionnaire has been used [22], which is developed for measuring the

psychological empowerment and by using Thomas and Volt Haas empowerment model [23]. Neefe questionnaire has been used in order to measure the organizational learning [24]. Since both questionnaires are standard, their validity has been confirmed in numerous external and internal studies.

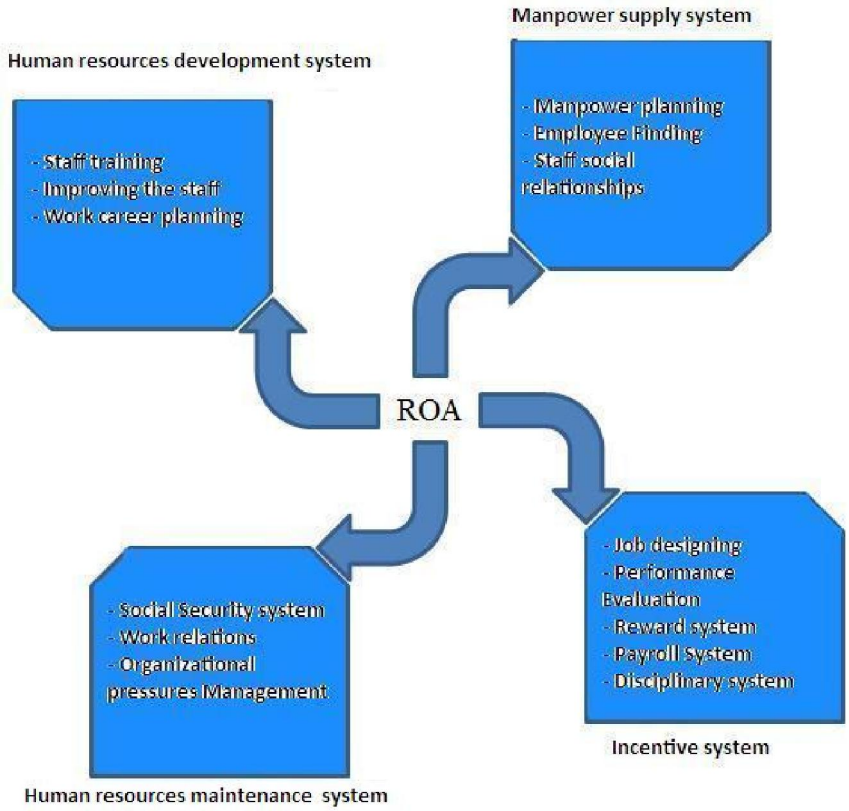
Reliability means having the reproducibility, stability and consistency in the assessment tool and tested that to what extent the measurement tool tests the needed concept strongly at any time. Since both questionnaires are standard, their validity has been confirmed in numerous external and internal studies. Also for more certainty in this study for reliability test, Cronbach's alpha is calculated by SPSS15 software. The formula for calculating this coefficient is as follows: $\alpha = (\frac{j}{j-1})(1-\frac{\sum s_j^2}{s^2})$

In which, α is the estimated test validity, j: number of test questions, s_j^2: Variance of subset j, and s^2 is the total variance of test. This value is calculated higher than 75% for both questionnaires.

4 - Research findings

The conceptual model of correlation between the dependent and independent variables are indicated as follows. Student's t-test is used for main hypothesis and Pearson Test used for the subsidiary hypotheses and finally the advanced method of factor analysis is implemented by using the software VPLS.

Figure (1) - Conceptual model of correlation between the human capital strategy and organizational performance



4 - 1 Results of Student's T-test in main hypothesis

H_0: Human capital Strategy has a significant correlation with performance of Parsian Bank.

H_1: Human capital Strategy has no significant correlation with performance of Parsian Bank.

Table (2) - Results of Student's T-test in main hypothesis

Secondary variables	Correlation coefficient	Sig	Test Results
Human capital Strategy → Organizational performance	0.625	0.000	A direct and significant correlation

Given that the correlation coefficient is estimated equal to 0.625, it can be concluded that H_1 is rejected and the opposite hypothesis (H_0), which indicates that the human capital strategy of Parsian Bank has a direct and significant correlation with bank performance, is confirmed.

4 - 2 Results of Pearson coefficient in subsidiary hypotheses

In the following table, the results of research sub-hypothesis test are presented.

Table (3) - Results of Pearson coefficient in subsidiary hypotheses

Secondary variables	Correlation coefficient	Sig	Test Results
Manpower supply system → Organizational performance	0.563	0.000	A direct and significant correlation
Incentive system → Organizational performance	0.448	0.000	A direct and significant correlation
human resources development system→ Organizational performance	0.512	0.000	A direct and significant correlation
Human resources maintenance system → Organizational performance	0.474	0.000	A direct and significant correlation

1. The correlation coefficient of manpower supply system is equal to 0.563 and Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the manpower supply system and performance of Parsian Bank at confidence level 95%.
2. Correlation coefficient of incentive system is equal to 0.448 and the Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the incentive system and performance of Parsian Bank at confidence level 95%.
3. Correlation coefficient of human resources development system is equal to 0.512 and the Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the human resources development system and Performance Parsian Bank at Confidence level 95%.
4. Correlation coefficient of human resources maintenance system is equal to 0.474 and the Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the Human resources maintenance system and Performance Parsian Bank at Confidence level 95%.

4 -3- Factor analysis method based on applying the software VPLS

In this section, the factor analysis method based on applying the software VPLS is used in order to analyze and evaluate the more-important factors, to estimate the coefficients of independent variables, and determine the effectiveness of each independent variables on each other.

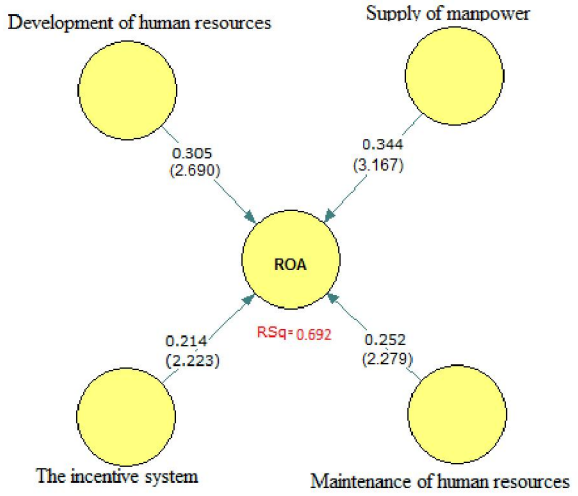


Figure (2) – Correlation between the independent and dependent variables (VPLS)

As the above graph presents, the coefficient of determination is equal to (R =0.692) and this indicates that each of the dimensions (manpower supply system, incentive system, human resources development system, and human resources maintenance system) explain almost 69% of necessary changes in dependent variable.

Value of student's T estimate for each coefficients of model is higher than confidence level 95% (1.96), thus it can be concluded that the sub-hypotheses of research are confirmed as follows.

1. By one unit increase in manpower supply system, the performance of Parsian Bank will be increased to 0.344.
2. By one unit increase in incentive system, the performance of Parsian Bank will be increased to 0.252.

3. By one unit increase in human resources development system, the performance of Parsian Bank will be increased to 0.305.
4. By one unit increase in human resources maintenance system, the performance of Parsian Bank will be increased to 0.214.

Table (4)- Estimating the coefficients of model

Structural Model-Bootstrap			
	Entire sample estimate	**Standard error**	**T-Statistic**
Manpower supply system ↦ ROA	3.1668	0.1086	0.3440
The incentive system ↦ ROA	2.2787	0.1106	0.2520
Development of human resources ↦ ROA	2.6901	0.1146	0.3050
Human resources maintenance system ↦ ROA	2.2227	0.0963	0.2140

5 - Conclusion

In this study, the correlation between the variables affecting the performance of Parsian Bank has been tested. The main hypothesis of this study is the correlation between the variables affecting the performance of Parsian Bank. The subsidiary hypotheses include a significant correlation between the variables of manpower supply system, incentive system, human resources development system and human resources maintenance system with performance of Parsian Bank.

Given that the correlation coefficient of main hypothesis is estimated equal to 0.625, it can be concluded that the H_1 is rejected and the opposite hypothesis (H_0), which expresses that the human capital strategy of Parsian Bank has a direct and significant correlation with performance of Bank, is confirmed.

Correlation coefficient of manpower supply system is equal to 0.563 and Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the manpower supply system and performance of Parsian Bank at confidence level 95%. Correlation coefficient of incentive system is equal to 0.448 and the Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the incentive system and performance of Parsian Bank at confidence level 95%. Correlation coefficient of human resources development system is equal to 0.512 and the Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the human resources development system and performance Parsian Bank at confidence level 95%. Correlation coefficient of human resources maintenance system is equal to 0.474 and the Sig statistic equal to 0.000. This suggests that there is a direct and significant correlation between the human resources maintenance system and performance Parsian Bank at confidence level 95%.

As presented in graph VPLS (figure 3), the coefficient of determination is equal to (R=0.692) and this indicates that the dimensions of (manpower supply system, implementing time of incentive system, human resources development system, and human resources maintenance system) explain almost 69% of necessary changes in dependent variable.

By one unit increase in manpower supply system, the performance of Parsian Bank will be increased to 0.344. By one unit increase in incentive system, the performance of Parsian Bank will be increased to 0.252. By one unit increase in human resources development system, the performance of Parsian Bank will be increased to 0.305. By one unit increase in human resources maintenance system, the performance of Parsian Bank will be increased to 0.214.

Suggestions for planning the increased performance in Parsian Bank

One of the main results in this paper is to determine the values of correlation coefficient between the dependent and independent variables. It is suggested that by research approach in this paper the scholars and other researchers determine the structural equations in increasing the empowerment of desired organizations and determine and computationize the empowerment function of organization by considering defined variables.

Proposed model in this paper is presented to calculate the value of Parsian Bank performance.

$$Y = a + 0.344\, x_1 + 0.252\, x_2 + 0.305\, x_3 + 0.214\, x_4$$

In which,

- Variables x in the model represent manpower supply system, Implementation time of incentive system, human resources development system, and human resources maintenance system, respectively.
- a represents constant value in regression equation.
- Model parameters represent the influence coefficient of independent variables in the model.
- Obviously, given the influence coefficients and availability of independent variables and facilities of organization in resource allocation, the senior managers of Parsian Bank can

multiplex the budget through the human resource strategy in order to make the increased performance of Parsian Bank operational.

- **Suggestions for other researchers**

1. Use a mathematical model in developing and allocating the budgets related to organizational performance improvement.
2. Determine the other enablers through future research based on Durbin- Watson statistic.
3. Determine the empowerment function based on the effective models by stepwise regression statistic as the final model of empowerment.

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Thoughts of death and destruction in the Persian Poets (The approach of the idea of Nizami Ganjavi's poem Khosrow and Shirin)

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Abstract: Abo Mohammad Elias Ben Youssef Nizami, is the great Iranian poet and scholar, in the thirteenth century AD. He lived in the Aran soil and land located along the Aras River to the Kor River. Nizamies name is tied up with "Khamseh" (Five Treasures) that shines in the chest of literature of Iran. Undoubtedly, among them "Khosrow and Shirin" is a specific luminosity. In fact, Nizami was the poet, alongside descriptions of attractive love, attempts of amative man for getting to enjoy, away by virtuous girl, wrath and reconciliations, the coquetries and needs ... who was never far away from the thought of death and makes heroes' pleasure story into a Tragic Tragedy by the death. With regard to the point that Nizami is a moralist poet, he never expresses a concept without a moral theme, and this question is raised in the mind that whether expression of death is Nizamie's concern in the moral theme or not. This article will attempt to consider Nizamie's Ethics perspective toward the manifest destiny of mankind.
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Keywords : Nizami, morality, death, love, Khosrow and Shirin

1. Introduction

The meaning of death is dead and it means "against life", in Arab language (Ibn Manzur, 1993). According to some philosophers death means "motionless or static"(Tryhy, Fakhr al-Din, 1996) About the meaning of death, Althqyq says: "denial of death is life, and life of everything is because of its existential properties (Mostafavi, 1982).

Undoubtedly, death is the most mysterious and important event in the life of every man; constantly, it has engaged him as a philosophical concern. Human effort, since the beginning until now, to overcome this mysterious principle, has caused the emergence of myths and epics in the history of the world. Gilgamesh, the most ancient myth in the world, with over five thousand years historical background, is the epic of life and death. This epic shows the oldest philosophical thought (Thinking about the mystery of life and death)(Shmysa, S., 1990).

Undoubtedly, the world famous epics and myths such as Greece and Iran and Other nations represent humans' aspiration to overcome the death and destruction across the world of existence. Seeking living water ,The tree of life, soft drinks without death, Khezr water, ein al- Hayat (living springs), Nahr al-hyat (living river), springs of livingand other beliefs, which are prevalent among religions and nations and literature of various countries, explain excavations of mankind to obtain eternal life and escape death. Spiritual traveling "Ardavyraf" to another world and acquisition of knowledge about the fate of the dead in the world of up and in Hell , limbo, and Paradise worlds ,is Human attempt to caught the clutches of Death , for their awareness from the mystery of death and humans destiny in another world , and reducing the fear of death as it is followed at the Levitation books (Meraj Nameh) and Seir-O- Alebad ela Almead, Laters, and we can mention Dante's Divine comedy as famous example in the West culture.

Indian thought of reincarnation in which, humans and animals and other things are converted to each other in a continuous cycle and Iranian thought Penetration that Hallaj was its promoter in which, human and God, or creation and creative come to unity and solidarity and represent them in the body of unity; in fact, it is an attempt to escape or overcome the death or reduce its fear. But humans could not and never can overcome on this certain phenomenon, with all the efforts and deliberation that have done.

2. Material and Methods

The research is a descriptive and library based study in which the eminent chosen elements are traced in the above mentioned work to show how Nizamie's beliefs are reflections of some archetypal tendencies which are shared by all mankind since primitive man to modern.

3. Discussions and Results

"In the face of these events, we can trace three methods of viewpoints in the Persian literature and among the top poets in the language. First one is the Death admirer viewpoint that leaves life and romance and seeks the death. Rumi is the greatest

representative of this idea. Second, escape from death viewpoint which looks with censure and hate at the death and tries to escape from the clutches of death until in this unwanted worldly life, the right to take the life and leave another world life. Khayyam is one of the most important representatives of this group. Third creating oriented viewpoint that while acceptance of death as a reality, enjoy life and its blessings, and others will benefit too. Saadi could be taken into account as the perfect representative of this group "(Falah, M., 2008).

Nizamie's target is not to create fear by expression of death, rather, he wants the reader or listener to understand time of short survival, prepare him/her for the world of after death, do good deeds and avoid of indecent and reprehensible acts. He is likened to the happiness of good acts and advises people to be happy and remember God and obtain that happiness with helping the poor.

اگر صد سال مانی ور یکی روز / بباید رفت ازین کاخ دل افروز
پس آن بهتر که خود را شاد داری / در آن شادی خدارا یاد داری....
بیاموزم تورا گر کار بندی / که بی گریه زمانی خوش بخندی
مالی چو خندان گردی از فرخنده فالی / بخندان تنگدستی را به

Of course, this Nizami idea is taken from the teachings of Islam according which death is the end of sufferings and pleasures of this world and achievement of the ideal and desirable world.

God's holy book, the Quran, Surah Al-Imran verse 158 states: "Every soul from you will taste flavor of death and Your rewards will come to you in full in the day of Judgment; so, in that day ,everyone who is far from fire and taken into the paradise, such a person has achieved great success and this worldly life is nothing but pride and deceit stuff of feel " (Ganjavi, Nizami., 2007).

Nizami in another part of him poem, while describing the strange death of Kuhkan Farhad (Mount devastating), describes this world as a hypocritical oppressor that so many people are deceived by its glamor and their blood is wasted. He introduces the id and life as two slaves of a master, namely, the human existence, and defines the spirits as a bastard who will meet her life fall. He says the secret of immortality in this world is to kickbacks pleasures of this world. Also he tells If humans have a breath without love, they are assumed as dead and his existence is not different with a dead. But if you are like Farhad whose breath was blazing Love, our dead would be more valuable than our life and it cause our immortality (Ibid)

بباید عشق را فرهاد بودن / پس آنگاهی به مردن شاد بودن

Nizami, in description of death of Shirin in Khosrow's grave, (because shirin, by suicide itself, expresses his loyalty to Khosro) says blessed to such a dying and says we should die so in love (Ibid):

..زهی شیرین و شیرین مردن او / زهی جان دادن و جان بردن او
چنین واجب کند در عشق مردن / به جانان جان چنین باید سپردن

The Nizamie's view is that love brings life and value to this world and the worldly life and Hereafter.

When Nizami remembers death of king that pepole have heard of their glory stories such as Keyghobad and fereidon in the parts of his poem, he can double the impact of his Language. He makes hope in the hearts of the oppressed, and fear in the hearts of officers. Also Nizami implicitly puts the words in the mouth of his story characters to learn of the death of the great figures who claimed to be God and escape from the clutches of this world By suavity toward others:

که بردارد عمارت زین عماری/ کسی یابد ز دوران رستگاری
که با چندان چراغش کس نبیند/مسیحاوار در دیری نشیند
به خوشخوئی توان زین دیو رستن/جهان دیو است و وقت دیو بستن
بهشت دیگران کن خوی خود را/مکن دوزخ به خود بر خوی بد را
همین جا و همان آنجا در بهشتی / چو دارد خوی تو مردم سرشتی
چوبرنطعی چنین جز خون نریزد/زمین نطعیست ریگش چون نریزد
سیاوشی نرست از زیر این طشت/بسا خونا که شد برخاک این دشت
فریدونی بود یا کیقبادی / هر آن ذره که آرد تند بادی

Although, Nizami described khusraw death tragically and pathetically, he, in fact, puts it forward as instrument of edification and implicitly tells his audience that from KHusraw death who was powerful and the owner of splendor and his place was magnificent palaces should take edification that eventually, how he died in inability perfection (Ibid).

Voluntary death and optional dying has a mystical concept. It is in such a death that the mankind gets rid of greed and lust and sensual desires. This kind of death, namely voluntary death or death before natural or destined death, has training and psychological and moral aspects. From the perspective of Sofia and mystics, sensation is the source of ethical misconduct such as pride, envy, avarice, anger, malice, greed and like them and it is the origin of evil actions and sins; therefore, this human ignoble adjectives should be removed by austerity and killing the sins by repentance. So, basis of the moral education and spiritual development has been established on struggle with ego and inhibition of instincts of carnal and except for this is not the way in order to achieve happiness and human excellence. Therefore, In the Islamic narratives

struggle with ego is called as "Jihad Akbar" (great holy war) and Sufie's works is full of various teachings about understanding of the self and ego. Mystics believe that Inhibition of rebellious ego and killing instincts is the biggest struggle that follower should act and If this is done seriously based on its principles and necessary conditions, it causes a change in the identity of the man and the mystic finds spiritual purification and existence and it is believed as Means of famous narrative " موتوا قَبلَ أَنْ تَموتوا " (to die before you realize death) (Allama Majlessi, M. B.,). Nezami, in the end of the poem Khosrow and Shirin, while describing the death of Shirin in the Khosrow grave, refers to the theme exactly and takes into account putting the heart , in way of education and refinement , in suffering as chivalry and magnanimity that causes human ignore his soul while death. He says someone who chooses a voluntary death can die easily in the moment of death (Ganjavi, N., 2007)

جوانمردان که دل در رنج بستند / ز جان دادن ز جان رستند
زجان دادن کسی جان برد خواهی /که پیش از مردن خود مردخواهد

Nizami concludes that trust in the world and its charming aspects is resulted in annihilation and destruction as well as death of human's spiritual will and power. Eventually, he recobnizes repentance and suffering as the instruments of immortality (ibid):

نمانی گر به ماندن خو بگیری / بمیران خویشتن را تا نمیری

4. Conclusion

From Nizamie's perspective, every human is a member of the community and piece of being. He can, with belief and acceptance of death and belief in the Hereafter and through feeling of oneness with the whole world and existence and human society, fertilize their intrinsic ability and start to nurture and use their personal ability. According to the idea of this group, man position is beyond the personal death and tied to society. This group to overcome of death thought, take refuge to making inner and live abilities and they have a creatively or creating oriented look on the whole world. With full awareness of people toward their own communities, he uses the death concept as a device for edification of unjust humans, disillusionment of people's illusion and motivating the wandering believers because of material world.

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The Place of Child Victimization in Iran Penal Law and International Documents based on the Applications of Physical Persecution in the Family

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Abstract: Among the victims, minors, as the future of human race, due to being more sensitive require more support which is given through a segregating policy represented in domestic laws as special crimes in minors' rights and liberties or aggravation of punishment against them. A comparative study of international documents and domestic regulations demonstrates various gaps and inadequacies in domestic laws in such a way that current legal system cannot prevent minor persecution and victimization properly. Therefore, domestic laws should be modified in line with international enactment; to prevent crimes and collaborate with other countries, specific conventions of the crimes should be enacted and the considerations of the given crime in domestic laws should be taken into account. The present study examines the place of minor victimization in Iran penal laws and compares it with Convention of Minors' rights and other international documents at hand based on the evidences of physical persecution in the family and familial violence against minors and comparability of Iran laws with international standards. The research was done through referring library references and consulting documents available on domestic and international laws which were derived and elucidated via comparative research plan.
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Key Words: Victimization, Criminal law, international laws, minors' rights, physical victimization of minors.

Introduction

Theoretical foundations of minors' victimization should include special conditions like being under age, dependence on parents, need for love and care, family brutality, poverty, and hanging about with bad friends. Child's growing up within 36 months will include the most important part of development during which the child will acquire linguistic ability, thinking, and sensory-motor movements; also, the foundation of adulthood is structured in the given age. Therefore, parents play an important role in forming behaviour and personality of their children. Despite developments of human society in the area of individual and social rights in the modern times, minors' victimization phenomenon has variously increased. Although, several documents had already considered minors' rights and the necessity of special attention to them, International society still is in severe need of an international binding document in the late twentieth century. Subsequently, General Assembly of the United Nations enacted the convention of minor rights to improve children's situation in all countries in 1989. However, minors in Iran laws still have got an unstable condition and despite lots of changes, the convention of minor rights is not applied proper enough. This happens in the situation that all international documents of minor rights stress the necessity of paying particular attention to the matter.

Minor victimization in Iran penal law and international documents

Considering the characteristics of child victimization and perpetrators' morale and incentive in each country, the phenomenon has got various applications. Minor victimization includes any action or inaction by parents or other responsible people that hurts or threatens under-18-year-old minors' and teenagers' physical and mental health or their welfare or well-being (Jahed, 1391). Physical victimizations consists of crimes including minor's soul and body, which is sometimes so intense that concerns occurrence of death as the most crime. Of the physical victimization, the following ones are among ones are among the most noticeable ones: beating with hand, bludgeoning, singeing, burning by spoon, breaking bones, hurting, doing internal injuries like internal bleeding, pulling ear and hair, slapping, pinching, shoving, squeezing, thrashing, lashing, burning with cigarette, biting, putting chilli pepper in child's mouth, hitting head to wall, bruising child's body, and any other ways of physical damage.

Article one: "All the people who are under the age of 18 will enjoy the legal supports provided in the law". Following article 1 of the convention of minor's rights (1989) that considers the criterion of recognizing minors as being under 18 years old, the legislator has limited penal support to those who are under the age of 18 and has regulated that everybody

from birth to 18 will be supported by the law. Inattention to judicial and legal criteria of distinguishing minors from those who are not (that is judicially 9 lunar years for females and 15 for males) and replacing solar year instead of lunar one for determining age year has been one of the new innovations of the legislator for harmonizing with international standards of human rights. Two common instances of the application of child physical victimization, including murder and physical punishment in Iran penal laws and international documents are cited here.

Child murder

The law supporting minors and teenagers was enacted in 9 articles in 1391 and a crime called minor victimization with imprisonment or pecuniary penalty was added to the body of regulations. Iran criminal law does not include any special law regarding minor victimization but the one supporting minors and teenagers enacted in 1381/9/25; the applications of the given law have not been recognized and even when the victimized is an infant, lower penal support has been considered. But, the convention of minors' rights to which Iran joined emphasizes the necessity of crime recognition of minor victimizations.

Foreign law considers relaxation of penalties for child murder by mother, while domestic law considers the relaxation for a murder by the father. The foreign statute law lays down that child murder by mother is normally similar to any other murder and will be sentenced to the same punishment; but, whenever the mother commits the crime in a special situation, she will enjoy relaxation of penalty. The situation happens when the mother gives birth to an illegitimate child and commits murder for hiding her unlawful action or when a mother due to childbirth is not in good spirits and does not do of her volition (Zera'at, 1381). Iran law (Islamic punishment law) does not regulate any special law for murdering child by a mother; therefore, the penalty inflicted will be retaliation. Not retaliating father for child murder in Iran is an obvious representation of legal brutality against minors. Islamic punishment law article 20 states that "father or paternal ancestor who kills his child will not be retaliated and must pay the blood-price"; while, according to the convention, minors should be protected against any physical violence and the child's natural right for living has been emphasized (article 19), let alone murder which is the extreme brutality against minors or any other human being.

Child's and teenager's supporting law article 2 and 3 forbids physical damages and any torture and physical hurt and imprisonment or pecuniary penalty will be inflicted on the perpetrator. But, unfortunately, article 220 of Islamic punishment law has been misused by some fathers. Honour killings, murder after sexual rape of child and other types of murder that is committed by fathers under any excuse signifies promotion of violence at the heart of the given article and requires legislators' attention and modification in favour of minors.

Physical punishment of minors

Neither criminal law nor civil law specifies the amount of punishment of minors by their parents. Under special conditions civil law part 1 of article 59 and article 1179 prescribes customary amount of punishing minors by parents, legal guardians and protectors of infants in order to train them. According to the given articles, punishing infants by parents is considered a crime, in case it is administered based on custom; but, the problem is how much punishment should be considered normal! Moreover, parents' and legal guardians' misunderstanding of the meaning of "customary amount" can be highly problematic for both preventing the crime and suing and punishing wrongdoers. It is probable that following their parents, fathers and mothers really believe what they do for punishing their children is exactly based on custom and part of their right for teaching them. On the one hand, sentencing the parents would be difficult because punishing a person who believes in the rectitude of his/her action while it is provoked by social custom would not be based on the principles of punishment; on the other hand, from the point of view of general prevention, changing this way of thinking and teaching appropriate and lawful methods of punishment would be too difficult and even impossible (Jahed, 1391).

The second article of children's and teenagers' supporting law enacted in 1381 forbids any kind of annoying and harming minors and teenagers that injure them physically, mentally and morally or threatens their physical or mental health. However, on the hand, in article 7 excludes training measures mentioned in article 59 of Islamic Punitive Law enacted in 1370/9/7 and article 1179 of civil law enacted in 1314/1/19. Nevertheless, article 37 of the convention of minors' rights requires the members not to torture or humiliate any child and article 19 entirely forbids physical brutality against children. Therefore, by excluding training measures of parents from the law supporting minors and teenagers (in 1381), the Iranian legislator has provided misusing grounds of children.

Despite forbidding several forms of child victimization, the second article of supporting law due to lack of predicting punishment for the given victimizations is subject to strong criticism and

hesitation. Essentially, what has the legislator's purpose been by enacting this article? However, the same phrase along with the punishments has been repeated in article 4. On the whole, even if the second article were not mentioned in the given law, there would not be any gap in the nature and aim of the law (Jahed, 1391).

Article 5: "Infant victimization is of general crimes and does not require complaint of a private plaintiff."

As the complainant or victimized is an underage infant or teenager who is impotent and usually under the dominance and adoption of the perpetrator, by predicting the given article, the legislator has taken a positive step toward protecting children and teenagers. Therefore, anyone can inform attorney general of witnessing child victimization so that the attorney as the sakeber will be required to make a legal claim against the wrongdoer.

As a result of the given claim, even if the private plaintiff (victimized mature infant or teenager) gives up his claim, it will not have any influence on proceeding with hearing and inflicting punishment unless settlement is considered among penalty relaxation cases.

Article 6: "All people, institutes and organizations that are in a way engaged in taking care and safeguarding infants should immediately inform righteous legal authorities of witnessing infant victimization to sue the perpetrator. Disobeying the given obligation will lead to 6 month imprisonment of 5 million IR Rial pecuniary punishment".

Contrary to common people who are not responsible for reporting infant victimization cases, everyone including any organization which is responsible for supporting children, e.g. childcare facilities, is required to report infant victimization cases to legal authorities. Forbearance of the given measures will result in imprisonment or pecuniary penalties as it was mentioned in article 6.

Of course, it was more suitable, if legislator had extended the obligation to children's parents and other organizations that have got supervisory duties regarding protecting children's rights and not merely institutes and organizations which keep and safeguard infants.

Conclusion

At the present time, attention to infants' rights is of the important areas of legal system that amounts to cultural, social, political, economical and international dimensions. Universal Declaration of Human Rights and international convention of children's rights are based on general law of human beings and specially children that is represented in the forms of educational, cultural, social and economical rights which should be found in the infrastructure of a society and its available processes. Reducing "children's rights" and increasing penal applications results in ignoring the underlying factors and requirements. The slogans of Islamic Republic of Iran that presents itself in the second principle of constitution as a system founded on munificence, human dignity and freedom and his duty to God by disavowing any tyranny, suffering, dominance and subordination and considering respect for legitimate freedoms as one of the indispensible principles does not seem to be appropriate. Moreover, international documents that have not been appended form a body of international binding texts and codes that commits Iran government to being responsive. Regarding the substantial area of penal law, Iranian legislator is so distracted that sometimes protect the victimized while in other cases limits the scope of support. This distraction is often resulted from legislator being variously impressed by jurisprudence, custom, and international codes in such a way that referring to some of these sources in compiling a law would prevent applying supportive dimensions of other sources. For example, in special situations, gender is a discriminating factor for enjoying segregating support. In case, the amount of blood money is higher than third part of the total fine, females' blood prices would be half of males' and this happens in the situation that the damage inflicted is equal, but the females will enjoy lower redress than males. Incorrect legislations, inattention to children's requirements, unsuitability of crimes against infants and their punishments, inappropriate administration of life development programs and etc still has put children in a widespread victimization and therefore, doing "justice" has been perverted.

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Prevalence of Disabilities among preschool children in one selected village of Beni- suif Governorate

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Abstract : In Egypt, "a disabled person" means a person who need rehabilitation service to meet the basic needs in society because impairment such as movement-related function, sensory function and mental function brings physical, social, economical and psychological disability. More than 1.5 million Egyptians are living with physical and mental disabilities. **Objectives:** The present paper aiming to study the prevalence of disabilities and the most common types of disabilities among preschool children in one selected village of Beni- suif Governorate . In addition to, develop and Implement educational program regarding disabilities among preschool children to the mother. **Results:** The study found that 35.7 % of the preschool children in the selected village have different types of disability. also, revealed a highly significant relation between the mothers knowledge, level of education and types of disability .Moreover, found that a highly significant relation between socioeconomic level and the children health status **Conclusion:** The present study concluded that the family needs to improve their knowledge and attitude regarding disability and rehabilitation to handicap children. **Recommendations:** emphasis on the implementation of educational programe and early detection and intervention, and rehabilitation. Nursing management should assess all children for signs of developmental delays, Support the family at the time of initial diagnosis, Facilitate the child's self-care abilities and Provide child and family teaching.

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Keywords: Impairment, Disability, Handicap, Early intervention, Nursing management

1. Introduction

In Egypt, "a disabled person" means a person who need rehabilitation service to meet the basic needs in society because impairment such as movement-related function, sensory function and mental function brings physical, social, economical and psychological disability. According to the Central Authority for Public Mobilization and Statistics, there are approximately two million persons with disabilities in Egypt, which represents about 3.5% of the total population. Unfortunately, no comprehensive data on disabilities is currently available *(Arab Republic of Egypt, 2002)*

The World Health Organization (WHO) has defined these concepts Impairment (first stage) as : It is any loss or abnormality of the psychological, physiological or anatomical structure or function. Impairment may be a missing or defective body part. Disability (second stage): It is any restriction or lack (resulting from impairment) of ability to perform an activity in the manner or within the range considered normal for a human being. Handicap (third or final stage): A disability becomes a handicap when it interferes with one's ability to do what is expected at a particular time in one's life. Some handicapping conditions can be congenital and show at time of birth or progress in the first year of life. Others might be acquired during childhood. Thus, causes can be due to, Familial or genetic many find it hard to access the emotional, medical and financial support that they require. It is estimated that only 2% of disabled people in Egypt access any services at all. In addition, many disabled children are stigmatised and excluded from society, although some progress has been made to encourage integration. Helping children cope with their disability early on can have a huge impact on their lives. The government of Egypt places a high priority on disability, with governmental and non-governmental organizations working together to solve disability issues. However, current services cover only about 10% of the total number of persons with disabilities sectors, prenatal factors and Social reasons *(Arab Republic of Egypt, 2002)*.

On the other hand, Avoidable disability is a major socio-economic and public health problem in the developing countries. According to the National Sample Survey Organization (NSSO) Survey-20021, the prevalence of disability in India has been estimated as 1.8%. About 10.63 % of the disabled persons suffered from more than one type of disabilities and 8.4 and 6.1% of the total households in rural and urban India respectively have at least one disabled person. The prevalence of disability has been reported to be higher (1.85%) in rural compared to urban population (1.5%) according to the NSSO Survey. The census 20012 has estimated prevalence rate of disability in

India as 2.2% of the total population *(Arab Republic of Egypt, 2002)*.

Handicapped children's action group is a registered charity, working to provide specialist equipment for children with disabilities, learning difficulties and other special needs. The children, from all areas of the UK are unable to obtain this equipment from the NHS and because of the cost it is usually unaffordable by the families. Equipment for children with disabilities, learning difficulties and other special needs. The children, from all areas of the UK are unable to obtain this equipment from the NHS and because of the cost it is usually unaffordable by the families *(World Bank. World Development Indicators, 2001)*.

The government of Egypt places a high priority on disability, with governmental and non-governmental organizations working together to solve disability issues. However, current services cover only about 10% of the total number of persons with disabilities. The Ministry of Education provides special education services for children with disabilities. It introduced education services for the visually, hearing and mentally impaired through 165 specialized schools and 204 schools, with at least one or more special classrooms for children with disabilities. *(World Bank. World Development Indicators, 2001)*.

Nowadays, Physical handicapping becomes one of the priorities of all governments due to its hazardous effect on physical, mental and social health. The year 1981 was considered the international year of disabled persons. A child is considered to be handicapped if he cannot cope with things other children of his age can do, if he is hindered in achieving of his full physical, mental and social potentialities *(Abdullah et al., 2009)*.

Children who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, other health impaired, deaf-blind, multi handicapped, or as having specific learning disabilities, who because of those impairments need special education and related services. *(Social Research Center, American University in Cairo. 2001)*.

Major causes of impairment and disability in Egypt

In Egypt, there are two major causes of impairments - economic and social. As a developing country Egypt suffers from widespread poverty. This is associated with unsanitary living conditions, lack of access to safe drinking water, and inadequate means of garbage disposal. All these factors are the cause of communicable diseases leading to various impairments *(Qandil et al., 1994)*. The causes of disability are multiple. Disability can occur at birth, from genetic disorders, but many forms of disability are preventable, and may occur because of lack of preventive health care services (i.e. polio, malnutrition, micronutrient deficiencies) or on account of social situations (armed conflict, war, landmines, poverty). It must not be overlooked that violence is often a cause of childhood disability. (Anne *et al.,* 2008).

Prevention

Children with disability are in all societies of the world. More than 80% live in developing countries and have no access to appropriate services (Anne *et al.,* 2008). Early intervention can be considered as preventive measures. The levels include health promotion, specific protection, early detection and intervention, disability limitation, and rehabilitation. Nursing management should be assess all children for signs of developmental delays, Support the family at the time of initial diagnosis, Facilitate the child's self-care abilities and Provide child and family teaching. (ICMR Bulletin, 2007 nd Stephen et al., 2012).

In another hand , Many physical, mental and sensory impairments can be prevented. Even if the impairments have occurred, their undesirable physical, psychological and social consequences can be minimized. A disability prevention programe needs several measures to make it effective, viz. improvements in the educational, economic and social status of the population, introduction of early detection and intervention programmes, improvement to health service delivery particularly primary health care systems that reach all segments of the population expansion of programmes of immunization, modification of lifestyles; control of environmental hazards, conduct of education and information campaigns related to disability prevention and rehabilitation for the public and professionals; and fostering of better informed and strengthened families and communities. Avoidable disability causes economic waste. Developmental programmes that result in better primary health care, nutrition, education and housing increase the likelihood of improved disability prevention and rehabilitation. The provisions of health care and related services for all people are important to eliminate or minimize the disabling consequence of impairment (*ICMR Bulletin, 2007 and Leidy, 2012*

Study design:

The design for this study was (a cross-sectional household survey) used to conduct this study, aiming to study the prevalence of disabilities and the most common types of disabilities among preschool children in one selected village of Beni- suif Governorate (Shraf Basha Village). In addition to, evaluate the impact of an implemented health educational program to improve the knowledge and attitude of mothers

regarding disabilities among preschool children to the mother following criteria:

- Preschool children.
- All family agree to participate in this study

Tool of data collection:

A questionnaire sheet was designed by the researcher, based on literature review,. Data were collected through using one tools which includes 3 main parts as follows

Part I: Was includes questions regarding a sociodemographic characteristics of children and family such as age, income, mother education, housing condition ……etc

Part II: Was includes questions regarding medical history of children such as diseases, when and how discovered ,level of education and achievement.

Part III: Was includes questions regarding child caregiver data such as level of education ,age, job …….etc.

Part V: Was includes mother's knowledge regarding handicap and effect of disability on child's daily life practice

2. Methods of data collection:

This research was covered in four phases:-

1-validity & Reliability of tool:-. Tool was developed based on the identified needs and demands of preschool children and their family. Validity by expertise from Pediatric nursing & Pediatric medicine professor , Family and Community nursing professor in the field.

2- Ethical considerations:

Approval was taken from Undersecretary of the Ministry of Health structures in Bani Sueif and rural health unit director before starting the research and data were collected after explain the aim of the study to family's participated in the study .

3- Pilot study: - assess mother abilities to participate in filling questionnaire, and any modifications were done it is approximately 10% of study sample.

4- Data collection: data were collected from home to home through survey study from February 2012 until March 2012 for two days weekly mainly Monday, Tuesday, each week according to time available to family and researcher. Each family takes time approximately between 30-45 minutes to filling a questionnaire, also researcher of study help illiterate's mother in filling their questionnaire

Statistical analysis:

Data were analyzed using statistical package for social sciences (SPSS). The P-value < 0.05 was used as the cut off value for statistical significance and the following statistical measures were used.

Graphic presentation:

Graphs were done for data visualization and using Microsoft Excel.

3. Results

Tables (1) describe the health status of preschool children in the study sample. The table reveals that about (35.7%) of children in the study sample were unhealthy (handicapped).in the same table can be observed that the handicapped children from male with a statistically significant relation were founded between child's sex and health status Ps (< 0.05***).

Table (2) shows the association between socioeconomic level and health status. In this table 100.0% of low socioeconomic were handicapped children while only (20.0%) from Very high level with highly a statistically significant relation were founded between socioeconomic level and health status of the study sample Ps (< 0.05***).

Figure 1 demonstrates association between type of child delivery and health status .more than half (51.1%) of children were delivered normally have handicapped and children were delivered by forceps (100.0%) handicapped. Also, in the same table there are highly a statistically significant relation were founded between type of child delivery and health status Ps (< 0.05***).

Table (3) Illustrates association between mother's educational level and their knowledge regarding handicapped. In this table the Illiterate mothers don't know the meaning of handicapped. In the on the opposite side the all University women have good knowledge regarding handicapped Also, observed that a statistically significant differences between the studied mother's knowledge in all areas related to handicapped before health education program implementation (P< 0.005).

Table (4) presented the types of handicapped in children of the study sample. In this table physical disability is the most common type (26.3%), followed by mental disability (10.1%), while visual and hearing disability (14%).

Table (5) described the intervention study sample total knowledge score related to handicapped. In this table can be seeing that 63.1 % of the mother have sufficient answer regarding physical handicapped while only 23.0 %

Table (6) shows the level of intervention group's knowledge regarding handicapped after the implementation of the program. The improvement in total knowledge score related to handicapped can be observed in the end of the same table to 93.2 % in posttest regarding physical handicapped.

Figure 2 describe the relation between Family leisure time spent in and effect of disability on child's daily life practice. In this table can observed that handicapped have great effect (53.7%) on family relationship with other friends and 68.0% at home while 100 % great effect At gardens.

Table (1) : Relation between child's sex and health status

Sex	Health status				Total	
	Healthy		Handicapped			
Male	455	60.2%	301	39.8%	756	100.0%
Female	188	77.0%	56	23.0%	244	100.0%
Total	643	64.3%	357	35.7%	1000	100.0%

X^2=22.854 *P*= 0.000 *P*< 0.05***

Table (2) : Association between Socioeconomic level and health status

	Health status No. (1000)					
Socioeconomic level	**Healthy**		**Handicapped**		**Total**	
Low	0	0%	168	100.0%	168	100.0%
Intermediate	139	96.5%	5	3.5%	144	100.0%
High	171	62.9%	101	37.1%	272	100.0%
Very high	333	80.0%	83	20.0%	416	100.0%
Total	643	64.3%	357	35.7%	1000	100.0%

X^2=4.129 *P*= 0.000 *P*< 0.05**

Table (3): Association between mother educational level and knowing handicapped before implementing the educational program

Mother's educational level	Knowing handicapped No. (1000)				Total	
	Satisfactory		Unsatisfactory			
	No	Percent	No	Percent	No	Percent
Illiterate	0	.0%	34	100.0%	34	100.0%
Read & write	72	87.8%	10	12.2%	82	100.0%
Primary	163	100.0%	0	.0%	163	100.0%
Secondary	515	78.7%	139	21.3%	654	100.0%
University	67	100.0%	0	.0%	67	100.0%
Total	592	59.2%	4o8	40.8%	1000	100.0%

X^2=4.950 *P*= 0.000 *P*< 0.05***

Table (4): Types of handicapped among children in the study sample

Types of handicapped	The answer No. (1000)				Total
	Yes		No		
Physical disability	263	26.3%	737	37.7%	100%
Mental disability	101	10.1%	899	89.9%	100%
visual disability	140	14.0%	860	86.o%	100%
hearing disability	140	14.0%	860	86.o%	100%

Table (5): the level of Mother's knowledge regarding handicapped before the implementation of the program

Items	Level of knowledge				Total
	Satisfactory		Unsatisfactory		
Hearing disability	626	62.6%	374	37.4%	100%
Mental disability	626	62.6 %	374	37.4%	100%
Visual disability	230	23.0 %	770	77.0 %	100%
Physical disability	631	63.1 %	369	36.9 %	100%

Table (6): the level of intervention group's knowledge regarding handicapped after the implementation of the program

Items	Level of knowledge No. (103)				Total
	sufficient answer		Insufficient answer		
Hearing disability	77	74.8%	26	25.2 %	100%
Mental disability	62	60.2	41	% 39.8	100%
Visual disability	54	52.4 %	49	47.6 %	100%
Physical disability	96	% 93.2	7	6.8 %	100%

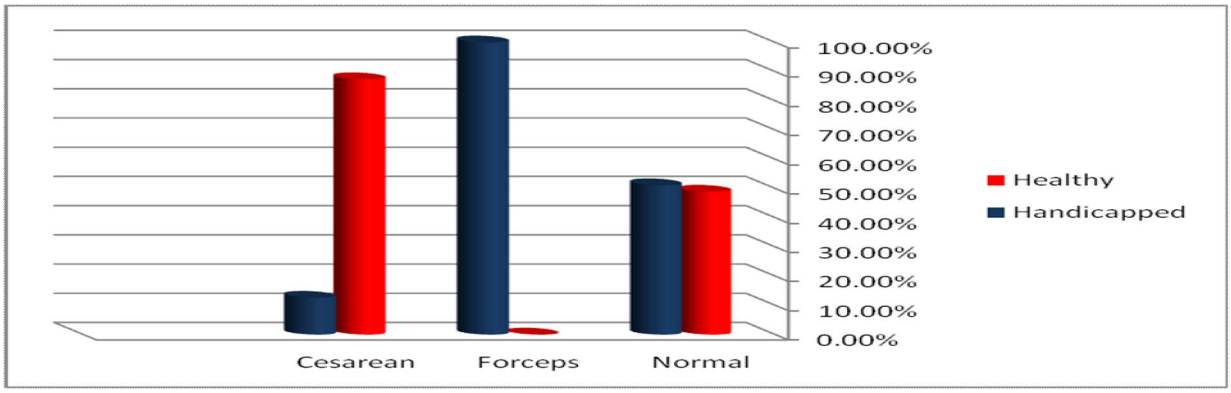

Figure (1) Relation between type of child delivery and health status.

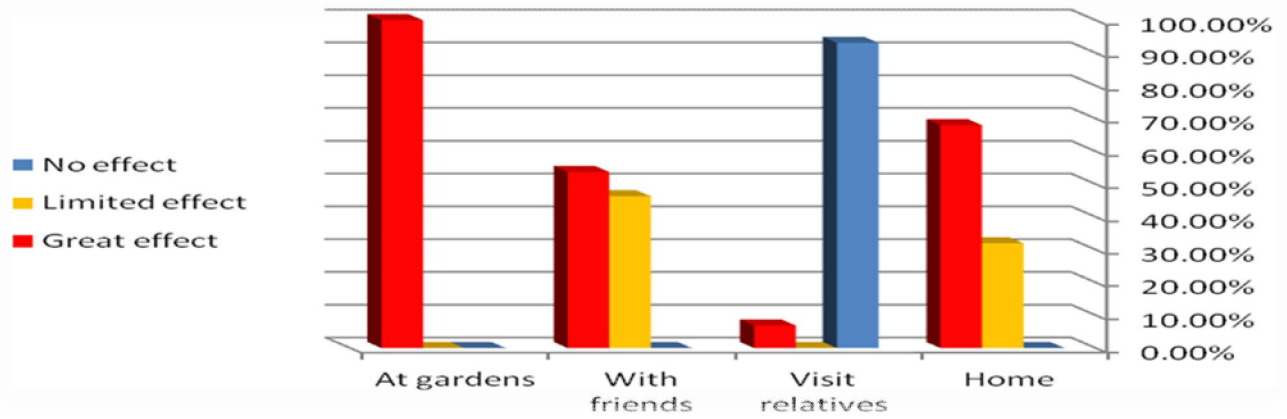

Figure (2) : relation between Family leisure time spent in and effect of disability on child's daily life practice

4.Discussion

WHO and the World Bank estimate that more than a billion people live with some form of disability, which equates to approximately 15% of the world's population. Among these, between 110 million (2.2%) and 190 million (3.8%) adults have very significant difficulties in functioning There are currently no reliable and representative estimates based on actual measurement of the number of children with disabilities Existing prevalence estimates of childhood disability vary considerably because of differences in definitions and the wide range of methodologies and measurement instruments adopted. The limitations of census and general household surveys to capture childhood disability, the absence of registries in most low- and middle-income countries and poor access to culturally appropriate clinical and diagnostic services contribute to lower estimates. As a result many

children with disabilities may neither be identified nor receive needed services *(WHO, 2012*).Regarding the health status of the preschool children in our study sample, 35.7% were handicapped and 100.0% of low socioeconomic were handicapped children while only (20.0%) from Very high level with highly a statistically significant relation were founded between socioeconomic level and health status of the study sample The probable reason for the high prevalence of disability in lower socio-economic group as due to illiteracy and ignorance coupled with meagre income which had prevented them to seek proper advise at the appropriate time in order to prevent permanent disability *(Mathur,1995)*

In addition, recent World Health Organization estimates indicate that at least 642 million individuals in the world are affected by some degree of hearing loss. Of this sizable population, 278 million have hearing loss that is defined as disabling. 80% of those with a disabling hearing loss come from low and middle income countries. Low-income communities have the least access to infant and child health services that could otherwise prevent many types of hearing loss. Of the many millions of individuals with a hearing disability in developing countries who would benefit from the use of hearing aids, only about 1 in 40 have the opportunity to use one. Especially for children, not having access to a hearing aid will have a profound negative impact on their expected quality of life *(Stephen et al., 2012).*

Approximately 48.9 million individuals with a disability live in the United States. Of these, approximately 2.9 million are children. This figure translates into nearly one in five Americans having a disability or 19.4% of the total population of the United States *(United States Census Bureau, 2005)*. It cannot be disputed that individuals with a disability make up a significant portion of the United States population. Given that, it is important to understand attitudes of non-disabled individuals toward their peers with a disability. This understanding becomes increasingly more important for researchers and practitioners in early childhood, given the current model of inclusive public education and the integration of children with a disability into classrooms with typically developing children. In our research project 35.7% of the study sample handicapped children. On the other hand ,one person in 20 has a disability. More than three out of four of these live in a developing county. An integrated approach is required, linking prevention and rehabilitation with empowerment strategies and changes in attitudes *(Anonymous, 2002)*

Results of this study showed that the mothers have unsatisfactory knowledge regarding handicapped, also there are statistically significant differences between the studied mother's knowledge in all areas related to handicapped before health education program implementation .Several studies have revealed that the mothers' education has a positive impact on their knowledge and how she deals with child health care issues. Child care is mostly the responsibility of mothers. Therefore, the mother's knowledge about child care influences the nature and quality of care that is given to the child. Our experience in pediatric practice has revealed significant gaps pertaining to child health issues in the mothers' knowledge. There seems to have been very little improvement in the knowledge of mothers on common child health matters over the year's inspite of the many years of girl's education in the country *(Ibrahim, 2012).*

According to *WHO, (2012*), some children will be born with a disabling health condition or impairment, while others may experience disability as a result of illness, injury or poor nutrition Children with disabilities include those with health conditions such as cerebral palsy, spina bifida, muscular dystrophy, traumatic spinal cord injury, Down syndrome, and children with hearing, visual, physical, communication and intellectual impairments. A number of children have a single impairment while others may experience multiple impairments. For example a child with cerebral palsy may have mobility, communication and intellectual impairments. The complex interaction between a health condition or impairment and environmental and personal factors means that each child's experience of disability is different. In our study the most handicapped children were delivered by forceps and from low socioeconomic status.

Moreover, children's development is influenced by a wide range of biological and environmental factors, some of which protect and enhance their development while others compromise their developmental outcomes .Children who experience disability early in life can be disproportionately exposed to risk factors such as poverty; stigma and discrimination; poor caregiver interaction; institutionalization; violence, abuse and neglect; and limited access to programmes and services, all of which can have a significant effect on their survival and development. Also, Children with disabilities who receive good care and developmental opportunities during early childhood are more likely to become healthy and productive adults. This can potentially reduce the future costs of education, medical care and other social spending *WHO. (2012).* Through our study observed that the improvement in total knowledge of the mothers score related to handicapped after implementation of health education program.

Conclusion

This study revealed that, the majority of the studied sample had unsatisfactory scores of knowledge regarding handicap before implementation the educational program. Also, more than thirty five children in the study sample were handicapped. So, the family needs to improve their knowledge and attitude regarding disability and rehabilitation to handicap children.

Recommendations

The parents will need to take on board a lot of new information in addition to having to cope with the emotional difficulties of adapting to the news. They will also suddenly have to face making important decisions during the different stages of their child's illness. The results indicate that parent-orientated Child Find awareness campaigns must focus on: (1) increasing awareness of the role parents can play in early identification and reduce dependency on physicians, (2) heightening awareness of the importance of early intervention, (3) providing a mechanism to enable parents to detect developmental delays, (4) information parents of services available to handicapped children and their families, and (5) informing parents of handicapped children's educational rights.(6) elevate caregiver awareness regarding child handicapped (7) Increasing disability rehabilitation center to educate family and caregiver to help the handicapped children how to cope with their statues and prevent any complications. Health (8) The public should be made aware of the fact that everyone may carry and inherited disease so as to prevent prejudice and misinformation (9) The effectiveness of the services offered through premarital and reproductive health units(10) Encourage the prevention of handicapped through (Encourage early and regular prenatal care, Provide support for high risk infants, administer immunizations, especially rubella immunization, Encourage genetic counseling when needed and Teach injury prevention – both intentional and unintentional).

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Fuzzy AG-Subgroups

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Abstract. An AG-group is a generalization of an abelian group. A groupoid $(G, \cdot)$ is called an AG-group, if it satisfies the identity $(ab)c = (cb)a$, called the left invertive law, contains a unique left identity and inverse of its every element. We extend the concept of AG-group to fuzzy AG-group. We define and investigate some structural properties of fuzzy AG-subgroup.

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1. Introduction

A fuzzy subset μ of a set X is a function from X to the unit closed interval [0, 1]. The concept of fuzzy subset of a set was initiated by Lofti A. Zadeh [1] in 1965. Zadeh's ideas developed new directions for researchers worldwide. The concept of fuzzy subset of a set has a lot of applications in various fields like computer engineering, AI, control engineering, operation research, management sciences and many more [7]. Lots of researches in this field show its importance and applications in set theory, algebra, real analysis, measure theory and topological spaces [2]. Rapid theoretical development's and practical applications based on the concept of a fuzzy subset in various fields are in progress.

In 1971, Azriel Rosenfeld introduced the notion of a fuzzy subgroup [4]. Recently the structure of AG-groupoid (a groupoid satisfying the left invertive law: $(ab)c = (cb)a$ is fuzzified [10]. An AG-groupoid is a generalization of a commutative semigroup. It is also easy to verify that an AG-groupoid always satisfies the medial law: $(ab)(cd) = (ac)(bd)$. Many features of AG-groupoids can be studied in [6], newly discovered classes of AG-groupoids and their enumeration has been done in [11], Quasi-cancellativity of AG-groupoids can be seen in [12] and construction of some algebraic structures from AG-groupoids and vice versa can be found in [13]. In the present paper we are fuzzifying the structure of AG-group initiated by [10]. An AG-group is related to an AG-groupoid as a group to a semigroup. An AG-group is one of the most interesting non-associative structures. There is no commutativity and associativity in AG-group in general, but an AG-group becomes an abelian group if any one of these holds in it. AG-groups are not power associative otherwise it becomes an abelian group. For these and further studies on AG-groups we refer the reader to [5, 6].

2. Preliminaries

In this section we list some basic definitions that will frequently be used in the subsequent sections of this paper.

A fuzzy subset of X is a function from X into the unit closed interval [0, 1]. The set of all fuzzy subsets of X is called the fuzzy power set of X and is denoted by $\mathrm{FP}(X)$. Let $\mu \in \mathrm{FP}(X)$. Then the set $\{\mu(x) : x \in X\}$ is called the image of μ and is denoted by $\mu(X)$ or $\mathrm{Im}(X)$. The set $\{x : x \in X, \mu(x) > 0\}$, is called support of μ and is denoted by μ^*. In particular, μ is called a finite fuzzy subset if μ^* is a finite set, and an infinite fuzzy subset otherwise. Let $\mu, \nu \in \mathrm{FP}(X)$. If $\mu(x) \le \nu(x)$ for all $x \in X$, then μ is said to be contained in ν (or ν contains μ), and we write $\mu \subseteq \nu$ (or $\nu \supseteq \mu$). If $\mu \subseteq \nu$ and $\mu \neq \nu$, then μ is said to be properly contained in ν (or ν properly contains μ) and we write $\mu \subset \nu$ (or $\nu \supset \mu$). Let

$\mu,\nu \in \mathrm{FP}(X)$. Define $\mu \cup \nu$ and $\mu \cap \nu \in \mathrm{FP}(X)$ as follows: $\forall x \in X$,

$$(\mu \cup \nu)(x) = \mu(x) \vee \nu(x)$$
$$(\mu \cap \nu)(x) = \mu(x) \wedge \nu(x).$$

In this case $\mu \cup \nu$ and $\mu \cap \nu$ are called the union and the intersection of μ and ν respectively.

Lemma 1. [5, Lemma 1] Let G be an AG-group. Let $a,b,c,d \in G$ and e is the left identity in G. Then the following conditions hold in G:

(i) $(ab)(cd) = (db)(ca)$, paramedial law;

(ii) $a \cdot bc = b \cdot ac$;

(iii) $(ab)^{-1} = a^{-1}b^{-1}$;

(iv) $(ab)(cd) = (dc)(ba)$.

Remark 2. We will not reproduce a proof in the paper if it is similar to that of groups.

3. Fuzzy AG-subgroups

In the rest of this paper G will denote an AG-group unless otherwise stated and e will denote the left identity of G.

Definition 3. Let $\mu \in \mathrm{FP}(G)$, then μ is called a fuzzy AG-subgroup of G if for all $x, y \in G$;

(i) $\mu(xy) \geq \mu(x) \wedge \mu(y)$;

(ii) $\mu(x^{-1}) \geq \mu(x)$.

We will denote the set of all fuzzy AG-subgroups of G by $\mathrm{F}(G)$. μ satisfies conditions (i) and (ii) of Definition 3, if and only if

$$\mu(xy^{-1}) \geq \mu(x) \wedge \mu(y)\ ;\ \forall x, y \in G.$$

Definition 4. If $\mu \in \mathrm{F}(G)$, then

$$\mu_* = \{x : x \in G, \mu(x) = \mu(e)\}, \text{ and}$$
$$\mu^* = \{x : x \in G, \mu(x) > 0\}$$

μ^* is called the support of G.

Proposition 5. If $\mu \in \mathrm{F}(G)$. Then μ_* is an AG-subgroup of G.

Proposition 6. If $\mu \in \mathrm{F}(G)$. Then μ^* is an AG-subgroup of G.

Definition 7. Let $\mu \in \mathrm{F}(G)$. For $\alpha \in [0,1]$, define μ_α as follows:

$$\mu_\alpha = \{x : x \in G, \mu(x) \geq \alpha\}$$

μ_α is called the α-cut, (or α-level set) of μ.

Definition 8. The binary operation "o" and unary operation "$^{-1}$" on $\mathrm{FP}(G)$ is defined as follows: for all $\mu,\nu \in \mathrm{FP}(G)$ and for all $x \in G$,

$$(\mu \mathrm{o} \nu)(x) = \vee\{\mu(y) \wedge \nu(z) : y, z \in G, yz = x\}$$

and

$$(\mu^{-1})(x) = \mu(x^{-1}).$$

We call $\mu \mathrm{o} \nu$ the product of μ and ν, and μ^{-1} the inverse of μ.

Lemma 9. [4, Lemma 1.2.5] Let $\mu \in \mathrm{F}(G)$. Then for all $x \in G$,

(i) $\mu(e) \geq \mu(x)$;

(ii) $\mu(x) = \mu(x^{-1})$.

Theorem 10. Let $\mu \in \mathrm{FP}(G)$. Then $\mu \in \mathrm{F}(G)$ if and only if μ satisfies the following conditions:

(i) $\mu \mathrm{o} \mu \subseteq \mu$;

(ii) $\mu^{-1} \subseteq \mu$ (or $\mu^{-1} \supseteq \mu$, or $\mu^{-1} = \mu$).

The following theorem holds for groups on the condition of commutativity, and also holds for AG-groups without commutativity.

Theorem 11. Let $\mu,\nu \in \mathrm{F}(G)$. Then $\mu \mathrm{o} \nu \in \mathrm{F}(G)$.

Proof. By [10, Proposition 1], $\mathrm{FP}(G)$ is an AG-groupoid. Now using Lemma 1-(iii) we have

$$(\mu \mathrm{o} \nu)^{-1} = \mu^{-1} \mathrm{o} \nu^{-1}$$
$$= \mu \mathrm{o} \nu \qquad \text{(by Theorem 10)}$$

also we have,

$$(\mu \mathrm{o} \nu) \mathrm{o} (\mu \mathrm{o} \nu) = (\mu \mathrm{o} \mu)(\nu \mathrm{o} \nu) \qquad \text{(by medial law)}$$
$$\subseteq \mu \mathrm{o} \nu \qquad \text{(by Theorem 10)}$$

Hence both the conditions of Theorem 10, are satisfied. Therefore, $\mu \mathrm{o} \nu \in \mathrm{F}(G)$. ■

Next we give an alternative proof of the same fact. Let $\mu,\nu \in \mathrm{F}(G)$. Then we have for all $x \in G$,

$$((\mu \mathrm{o} \nu) \mathrm{o} (\mu \mathrm{o} \nu))(x) = \vee\{(\mu \mathrm{o} \nu)(y) \wedge (\mu \mathrm{o} \nu)(z) : y, z \in G, x = yz\}$$
$$= \vee\{(\vee\{\mu(y_1) \wedge \nu(y_2) : y_1, y_2 \in G, y = y_1 y_2\})$$
$$\wedge (\vee\{\mu(z_1) \wedge \nu(z_2) : z_1, z_2 \in G, z = z_1 z_2\})\}$$
$$= \vee\{(\vee\{\mu(y_1) \wedge \mu(z_1) : y_1, z_1 \in G\})$$
$$\wedge (\vee\{\nu(y_2) \wedge \nu(z_2) : y_2, z_2 \in G : x = (y_1 y_2)(z_1 z_2)\}$$

$= \vee\{(\vee\{\mu(y_1) \wedge \mu(z_1) : y_1, z_1 \in G\}) \wedge$
$(\vee\{\nu(y_2) \wedge \nu(z_2) : y_2, z_2 \in G : x = (y_1z_1)(y_2z_2)\}$
(by medial law)
$\subseteq \vee\{(\mu(x) \wedge \nu(x) : x = (y_1z_1)(y_2z_2)\}$
$= (\mu o \nu)(x)$
$\Rightarrow ((\mu o \nu) o (\mu o \nu))(x) \subseteq (\mu o \nu)(x)$
Also we have
$(\mu o \nu)^{-1}(x) = \mu o \nu(x^{-1})$ (by Definition 8)
$= \vee\{\mu(y^{-1}) \wedge \nu(z^{-1}) : y, z \in G, x = yz \Rightarrow x^{-1} = (yz)^{-1} = y^{-1}z^{-1}\}$
(by Definition 8)
$= \vee\{\mu(y) \wedge \nu(z) : y, z \in G, x = yz\}$ $(\mu, \nu \in \mathrm{F}(G))$
$= (\mu o \nu)(x)$ (by Definition 8)
$\Rightarrow (\mu o \nu)^{-1}(x) = (\mu o \nu)(x) \ \forall x \in G$
$\Rightarrow (\mu o \nu)^{-1} = (\mu o \nu)$
Hence both the conditions of Theorem 10, are satisfied. Therefore, $\mu o \nu \in \mathrm{F}(G)$. ■

Theorem 12. Let $\mu \in \mathrm{FP}(G)$. Then the following assertions are equivalent; for all $x, y \in G$,

(i) $\mu(xy) = \mu(yx)$;
(ii) $\mu(ye) = \mu(y)$;
(iii) $\mu(ye) \geq \mu(y)$;
(iv) $\mu(ye) \leq \mu(y)$.

Proof. (i) ⇒ (ii) : Let $y \in G$. Then

$\mu(ye) = \mu(y \cdot x^{-1}x)$
$= \mu(x^{-1} \cdot yx)$ (by Lemma 1-(ii))
$= \mu(yx \cdot x^{-1})$ (since $\mu(xy) = \mu(yx)$)
$= \mu(x^{-1}x \cdot y)$ (by left invertive law)
$= \mu(ey)$
$= \mu(y)$.

(ii) ⇒ (iii) : Obvious.
(iii) ⇒ (iv) : Let $y \in G$. Then

$\mu(ye) \leq \mu(ye \cdot e)$
$= \mu(ee \cdot y)$ (by left invertive law)
$= \mu(ey)$
$= \mu(y)$.

(iv) ⇒ (i) : Let $x, y \in G$. Then

$\mu(xy) = \mu(ex \cdot y)$
$= \mu(yx \cdot e)$ (by left invertive law)
$\leq \mu(yx)$
$= \mu(ey \cdot x)$
$= \mu(xy \cdot e)$ (by left invertive law)
$\leq \mu(xy)$.

Thus $\mu(xy) \leq \mu(yx) \leq \mu(xy)$. Hence $\mu(xy) = \mu(yx)$. ■

Corollary 13. Let $\mu \in \mathrm{F}(G)$. Then the following assertions holds; for all $x, y \in G$,

(i) $\mu(xy) = \mu(yx)$;
(ii) $\mu(ye) = \mu(y)$;
(iii) $\mu(ye) \geq \mu(y)$;
(iv) $\mu(ye) \leq \mu(y)$.

Proof. Since μ is an AG-subgroup. So μ always satisfies Condition (iii) of Theorem 12. As indeed,

$\mu(ye) \geq \mu(y) \wedge \mu(e)$
$= \mu(y) \ \forall \ y \in G.$

Hence by Theorem 12, all the conditions holds always. ■

Theorem 14. $(\mu o \nu)(x) = (\nu o \mu)(xe) \ \forall \mu, \nu \in \mathrm{FP}(G)$ and $x \in G$.

Proof. Let $x \in G$. Then we have

$(\mu o \nu)(x) = \vee_{y \in G}\{\mu(xy) \wedge \nu(y^{-1})\}$ (by Definition 8)
$= \vee_{y \in G}\{\nu(y^{-1}) \wedge \mu(xy)\}$
$= (\nu o \mu)(y^{-1} \cdot xy)$ (by Definition 8)
$= (\nu o \mu)(x \cdot y^{-1}y)$ (by Lemma 1-(ii))
$= (\nu o \mu)(xe)$. ■

Corollary 15. $(G, \cdot)$ is commutative ⇔ $(\mathrm{FP}(G), o)$ is commutative.

Remark 16. We note that if μ is a fuzzy AG-subgroup of an AG-group G and if $x, y \in G$ with $\mu(x) \neq \mu(y)$, then $\mu(xy) = \mu(x) \wedge \mu(y)$.

Suppose $\mu(x) > \mu(y)$. Then

$\mu(y) = \mu(ey)$
$= \mu(x^{-1}x \cdot y)$
$= \mu(yx \cdot x^{-1})$ (by left invertive law)
$\geq \mu(yx) \wedge \mu(x^{-1})$
$= \mu(xy) \wedge \mu(x)$ (by Lemma 9, and Cor. 13).

Thus $\mu(y) \geq \mu(xy) \wedge \mu(x)$ and since $\mu(x) \geq \mu(y)$, it follows that

$\mu(y) \geq \mu(xy)$
$\geq \mu(x) \wedge \mu(y)$
$= \mu(y)$.

Thus $\mu(xy) = \mu(x) \wedge \mu(y)$. A similar argument can be

used for the case $\mu(y) > \mu(x)$.

Lemma 17. Let μ be a fuzzy AG-subgroup of G. Let $x \in G$ then $\mu(xy) = \mu(y)\ \forall y \in G$ if and only if $\mu(x) = \mu(e)$.

Proof. Suppose that $\mu(xy) = \mu(y)\ \forall y \in G$, then by letting $y = e$, we get that

$$\mu(xe) = \mu(e)$$
$$\Rightarrow \mu(x) = \mu(e) \quad \text{(by Corollary 13)}$$

Conversely, assume that $\mu(x) = \mu(e)$. Then by Lemma 9,

$$\mu(x) = \mu(e) \geq \mu(y)\ \forall y \in G$$
$$\Rightarrow \mu(x) \geq \mu(y)\ \forall y \in G, \text{ and so,}$$
$$\mu(xy) \geq \mu(x) \wedge \mu(y) = \mu(y). \text{ Also,}$$
$$\mu(y) = \mu(ey)$$
$$= \mu(x^{-1}x \cdot y)$$
$$= \mu(yx \cdot x^{-1}) \quad \text{(by left invertive law)}$$
$$\geq \mu(yx) \wedge \mu(x^{-1})$$
$$= \mu(xy) \wedge \mu(x) \quad \text{(by Lemma 9, and Cor. 13)}$$
$$= \mu(xy)$$

Thus $\mu(xy) \geq \mu(y) \geq \mu(xy)$.

Hence $\mu(xy) = \mu(y)\ \forall y \in G$. ■

Definition 18. If $\mu, \nu \in \mathrm{F}(G)$ and there exists $u \in G$ such that $\mu(x) = \nu(ux \cdot u^{-1})\ \forall x \in G$, then μ and ν are called conjugate fuzzy AG-subgroups (with respect to u) and we write, $\mu = \nu^u$, where $\nu^u(x) = \nu(ux \cdot x^{-1})$ for all $x \in G$.

Definition 19. Let $\mu \in \mathrm{F}(G)$. Then μ is called a normal fuzzy AG-subgroup of G if,

$$\mu(xy \cdot x^{-1}) = \mu(y)\ \forall x, y \in G.$$

We will denote the set of all normal fuzzy AG-subgroups of G by $\mathrm{NF}(G)$.

Theorem 20. Let $\mu \in \mathrm{F}(G)$. Then the following assertions are equivalent; for all $x, y \in G$,

(i) $\mu(xy \cdot x^{-1}) = \mu(y)$;

(ii) $\mu(xy \cdot x^{-1}) \geq \mu(y)$;

(iii) $\mu(xy \cdot x^{-1}) \leq \mu(y)$.

Proof. (i) ⇒ (ii): Obvious.

(ii)⇒ (iii):

$$\mu(xy \cdot x^{-1}) \leq \mu((x^{-1}(xy \cdot x^{-1})) \cdot (x^{-1})^{-1})$$
$$= \mu((x^{-1}(xy \cdot x^{-1})) \cdot x)$$
$$= \mu((x(xy \cdot x^{-1})) \cdot x^{-1}) \quad \text{(by left invert. law)}$$
$$= \mu((xy)(xx^{-1})) \cdot x^{-1}) \quad \text{(by Lemma 1)}$$
$$= \mu((xy \cdot e) \cdot x^{-1})$$
$$= \mu((ey \cdot x) \cdot x^{-1}) \quad \text{(by left invertive law)}$$
$$= \mu(yx \cdot x^{-1})$$
$$= \mu(x^{-1}x \cdot y) \quad \text{(by left invertive law)}$$
$$= \mu(ey)$$
$$= \mu(y)$$
$$\Rightarrow \mu(xy \cdot x^{-1}) \leq \mu(y)\ \forall x, y \in G$$

(iii) ⇒ (i):

$$\mu(xy \cdot x^{-1}) \geq \mu((x^{-1}(xy \cdot x^{-1})) \cdot (x^{-1})^{-1})$$
$$= \mu(y), \text{ (as in the proof (ii) } \Rightarrow \text{ (iii))}$$
$$\Rightarrow \mu(xy \cdot x^{-1}) \geq \mu(y)\ \forall x, y \in G$$

Hence $\mu(xy \cdot x^{-1}) = \mu(y)$. ■

Lemma 21. Let $\mu \in \mathrm{FP}(G)$. Then μ is a fuzzy AG-subgroup of G if and only if μ_a is an AG-subgroup of G, $\forall a \in \mu(G) \cup \{b \in [0,1] : b \leq \mu(e)\}$.

Theorem 22. Let $\mu \in \mathrm{FP}(G)$. Then $\mu \in \mathrm{NF}(G)$ if and only if μ_a is a normal AG-subgroup of G $\forall a \in \mu(G) \cup \{b \in [0,1] : b \leq \mu(e)\}$.

Proof. Suppose that $\mu \in \mathrm{NF}(G)$. Let $a \in \mu(G) \cup \{b \in [0,1] : b \leq \mu(e)\}$. Since $\mu \in \mathrm{F}(G)$, μ_a is an AG -subgroup of G. If $x \in G$ and $y \in \mu_a$, it follows from Theorem 20, that

$$\mu(xy \cdot x^{-1}) = \mu(y) \geq a \Rightarrow \mu(xy \cdot x^{-1}) \geq a,$$

thus $xy \cdot x^{-1} \in \mu_a$. Hence μ_a is a normal AG-subgroup of G.

Conversely, assume that μ_a is a normal AG-subgroup of G $\forall a \in \mu(G) \cup \{b \in [0,1] : b \leq \mu(e)\}$. By Lemma 21, we have $\mu \in \mathrm{FP}(G)$. Let $x, y \in G$ and $a = \mu(y)$. Then $y \in \mu_a$ and so $xy \cdot x^{-1} \in \mu_a$.

Hence $\mu(xy \cdot x^{-1}) \geq a = \mu(y)$. That is, μ satisfies Condition (ii) of Theorem 20. Consequently, it follows from Theorem 20, that $\mu \in \mathrm{NF}(G)$. ■

Theorem 23. Let $\mu \in \mathrm{NF}(G)$. Then μ_* and μ^* are normal AG-subgroups of G.

Proof. Since $\mu \in \mathrm{F}(G)$, it follows from Propositions 5 and 6, that μ_* and μ^* are AG-subgroups of G. Let $x \in G$ and $y \in \mu_*$. Since μ satisfies Condition (i) of Theorem 20, we have $\mu(xy \cdot x^{-1}) = \mu(y) = \mu(e)$ and thus $xy \cdot x^{-1} \in \mu_*$. Hence μ_* is a normal AG-subgroups of G. Now let $x \in G$ and $y \in \mu^*$. Since μ satisfies Condition (i) of Theorem 20, it follows that $\mu(xy \cdot x^{-1}) = \mu(y) > 0 \Rightarrow \mu(xy \cdot x^{-1}) > 0$, thus $xy \cdot x^{-1} \in \mu^*$. Hence μ^* is normal AG-subgroups of G. ■

Theorem 24. Suppose $\mu \in \mathrm{FP}(G)$. Let $N(\mu) = \{x : x \in G, \mu(xy) = \mu(yx)\ \forall y \in G\}$. Then $N(\mu)$ is either empty or an AG-subgroup of G if the restriction of μ to $N(\mu)$, $\mu\big|_{N(\mu)}$ is a normal fuzzy AG-subgroup of $N(\mu)$.

Proof. Here we discuss two cases.

Case: 1. If also $\mu \in \mathrm{F}(G)$, then by Corollary 13, $N(\mu) = G$ and the theorem holds trivially.

Case: 2 Suppose $\mu \notin \mathrm{F}(G)$. Clearly $N(\mu)$ is nonempty, because $\mu(ey) = \mu(e)$ and $\mu(ye) = \mu(y) \Rightarrow \mu(ey) = \mu(ye)\ \forall y \in G$ $\Rightarrow e \in N(\mu)$. Let $x, y \in N(\mu)$. For any $z \in G$, we see that

$$\begin{aligned}\mu(xy^{-1} \cdot z) &= \mu(zy^{-1} \cdot x) && \text{(by left invert. law)}\\ &= \mu(x \cdot zy^{-1}) && \text{(by Theorem 12)}\\ &= \mu(z \cdot xy^{-1}) && \text{(by Lemma 1-(ii))}\end{aligned}$$

Thus $xy^{-1} \in N(\mu)$. Hence $N(\mu)$ is an AG-subgroup of G. Now by [4, Comment 1.2.4] if $\mu \in \mathrm{F}(G)$ and H is a subgroup of G, then $\mu\big|_H \in \mathrm{F}(H)$, consequently $\mu\big|_{N(\mu)} \in \mathrm{F}(N(\mu))$. ■

The fuzzy AG-subgroup $N(\mu)$ of G defined in Theorem 24, is called the normalizer of μ in G.

Definition 25. For $x, y \in G$. Then the commutator $[x, y]$ of AG-group G is defined as

$$[x, y] = (xy)(y^{-1}x^{-1}).$$

Theorem 26. Let μ be a fuzzy AG-subgroup of G. Then $\mu \in \mathrm{NF}(G)$ if and only if

$$\mu([x, y]) \geq \mu(x)\ \ \forall x, y \in G.$$

Proof. Suppose μ is a normal fuzzy AG-subgroup of G. Let $x, y \in G$, then

$$\begin{aligned}\mu([x, y]) &= \mu((xy)(y^{-1}x^{-1}))\\ &= \mu((y^{-1}x^{-1})(xy)) && \text{(by Corollary 13)}\\ &= \mu((yx)(x^{-1}y^{-1})) && \text{(by Lemma 1-(iv))}\\ &= \mu(x^{-1} \cdot ((yx)y^{-1})) && \text{(by Lemma 1-(ii))}\\ &\geq \mu(x^{-1}) \wedge \mu(yx \cdot y^{-1})\\ &\geq \mu(x) \wedge \mu(x) && \text{(by Lemma 9, and } \mu \in \mathrm{NF}(G)\text{)}\\ &= \mu(x).\end{aligned}$$

Hence $\mu([x, y]) \geq \mu(x)\ \ \forall x, y \in G$.

Conversely, assume that μ satisfies the given inequality. Then for all $x, y \in G$, we have

$$\begin{aligned}\mu(xz \cdot x^{-1}) &= \mu(e(xz \cdot x^{-1}))\\ &= \mu((zz^{-1})(xz \cdot x^{-1}))\\ &= \mu(((xz \cdot x^{-1})z^{-1})z) && \text{(by left invert. law)}\\ &= \mu(((z^{-1}x^{-1})(xz))z) && \text{(by left invert. law)}\\ &= \mu((xz)(x^{-1}z^{-1})z) && \text{(by Lemma 1-(iv))}\\ &= \mu([z, x]z)\\ &\geq \mu([z, x]) \wedge \mu(z)\\ &\geq \mu(z) \wedge \mu(z) = \mu(z).\end{aligned}$$

Thus $\mu(xz \cdot x^{-1}) \geq \mu(z)\ \forall x \in G$. Then by Theorem 20, we have $\mu(xz \cdot x^{-1}) = \mu(z)\ \forall x \in G$. Hence μ is normal fuzzy AG-subgroup of G. ■

Proposition 27. Let μ be a fuzzy AG-subgroup of G. Then $\mu([x, y]) = \mu(e)\ \ \forall x, y \in G$ if and only if μ is normal fuzzy AG-subgroup of G.

Proof. Suppose $\mu \in \mathrm{NF}(G)$. Then we have

$$\begin{aligned}&\mu(yx \cdot y^{-1}) = \mu(x)\ \forall x, y \in G\\ &\Leftrightarrow \mu(e(yx \cdot y^{-1})) = \mu(x)\\ &\Leftrightarrow \mu((xx^{-1})(yx \cdot y^{-1})) = \mu(x)\\ &\Leftrightarrow \mu(((yx \cdot y^{-1})x^{-1})x) = \mu(x) && \text{(by left invertive law)}\\ &\Leftrightarrow \mu(((x^{-1}y^{-1})(yx))x) = \mu(x) && \text{(by left invertive law)}\\ &\Leftrightarrow \mu(((xy)(y^{-1}x^{-1}))x) = \mu(x) && \text{(by Lemma 1-(iv))}\\ &\Leftrightarrow \mu([x, y] \cdot x) = \mu(x)\\ &\Leftrightarrow \mu([x, y]) = \mu(e)\text{; by lemma 17.}\end{aligned}$$ ■

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Kidney Injury Molecule -1 (KIM-1): an early novel biomarker for Acute Kidney Injury (AKI) in critically – ill patients

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Abstract Background: Acute Kidney Injury (AKI) is a major cause of morbidity and mortality especially in critically-ill patients. The lack of early biomarkers for AKI in humans has interfered with potentially effective therapies in a timely manner. Kidney Injury Molecule-1 (KIM-1) is a type I cell membrane glycoprotein, which is associated with proximal tubule cell injury/dedifferentiation. Presence of KIM-1 in the urine is highly specific for kidney injury as indicated by absence of its expression in the normal kidney; its marked upregulation with proximal tubular cell injury and/or differentiation. **Objective*:*** To investigate the role of KIM-1 as an early marker for AKI in critically-ill patients. **Methods*:*** The study was carried out on 20 critically-ill patients who were at risk for developing AKI. Other 20 healthy subjects were included as control. The Sequential Organ Failure Assessment (SOFA) score was chosen to select critically-ill patients. All candidates were subjected to thorough history taking, complete clinical examination including assessment of Glasgow coma scale & urine output as well as laboratory investigations including urinary KIM-1 (by ELISA), blood urea, serum creatinine, arterial blood gases, platelet count and serum bilirubin. **Results:** The results of our study have shown that there were no significant statistical differences between patient and control group as regards gender (12 females and 8 males for both groups) and age (51.90 $\pm$ 16.32 years for patient group and 51.60 $\pm$ 13.67 years for the control group) with *p*.value of 0.950 and 0.988 respectively. Our study has shown that KIM-1 becomes significantly elevated before a rise of serum creatinine (*p*.value 0.001) by a mean of 27.60 $\pm$15.62 hours. Urinary KIM-1 was shown to have excellent sensitivity & specificity, 90.9 % and 95.24 % respectively. Also it showed a positive predictive value of 95.24 %, and a negative predictive value of 90.9 %. Our results have also shown that urinary KIM-1 was significantly elevated on admission (7.88$\pm$1.72 ng/mL) as compared with elevation of serum creatinine (0.895$\pm$0.173 mg/dL & *p*.< 0.001), blood urea (37.4$\pm$14.53 mg/dL & *p*.< 0.001) and reduction in estimated glomerular filtration rate (eGFR) (85.2$\pm$21.02 mL/minute/1.73 m^2 & p.< 0.001). There was a significant rise of serum creatinine in patient group as compared with control group from the 2nd day (1.425$\pm$0.505 mg/dL & p. < 0.001). However this was insignificant at admission (*p*.value 0.854). Same results apply to blood urea (57.93$\pm$23.1 mg/dL & p.< 0.001 on 2nd day and 0.052 at admission). On the other hand, significant reduction in eGFR occurred only on the 3rd day (27$\pm$13.97 mL/minute/1.73 m^2 & p.< 0.001); however this reduction was insignificant early in the course of illness with p.value of 0.527 & 0.008 at admission and after 24 hours respectively. In comparison, urinary KIM-1 was significantly elevated before a rise in blood urea & serum creatinine and before a reduction in eGFR at admission (*p*< 0.001) and continued to rise significantly over the next two days. **Conclusion:** The data presented suggest that urinary KIM-1 is a reliable early marker for AKI with excellent sensitivity and specificity, especially in critically-ill patients, therefore allowing early diagnosis & institution of appropriate therapy.

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Keywords: acute kidney injury (AKI), kidney injury molecule-1 (KIM-1), critically-ill patients, early biomarker.

1. Introduction

Acute Kidney Injury (AKI) is a major cause of morbidity and mortality especially in critically-ill patients. The lack of early biomarkers for AKI in humans has interfered with potentially effective therapies in a timely manner (1).

AKI is generally defined as an abrupt and sustained decrease in kidney function'. Until recently there has not been a consensus on what markers best reflect kidney function, and what values of those markers discriminate normal from abnormal kidney function (2).

The Acute Dialysis Quality Initiative (ADQI) formulated the Risk, Injury, Failure, Loss, and End-stage Kidney (RIFLE) classification. RIFLE defines three grades of increasing severity of AKI - risk (class R), injury (class I) and failure (class F) - and two outcome classes (loss and end-stage kidney disease) based on changes in either serum creatinine or urine output from the baseline condition (3).

However creatinine measurements can be affected by the clinical scenario, by the presence of chromogenic substances, including bilirubin, and by the laboratory assay utilized. There is an increasing evidence from published studies that creatinine concentration is not a decisive marker in diagnosing AKI (4). This is because of the following: ***1)*** Elevated serum creatinine concentrations are not specific for AKI and require differentiation from other prerenal or extrarenal causes of azotemia. ***2)*** Serum creatinine concentrations are not specific for renal tubular lesions, but seem to reflect the loss of glomerular filtration function, accompanying the development of AKI. ***3)*** Increases in serum creatinine are detected later than the actual GFR changes as creatinine accumulates over time. ***4)*** Serum creatinine is a poor marker of kidney dysfunction as changes in its concentrations are neither sensitive nor specific in response to slight GFR alterations and become apparent only when the kidneys have lost 50% of their functional capacity. ***5)*** Pre-existing baseline results may not always be available, and similar baseline values do not always reflect similar renal function (5, 6)

Kidney injury molecule-1 (KIM-1) is a type 1 membrane protein that is not expressed in normal kidney but is markedly upregulated in the injured proximal tubular epithelial cells of the human and rodent kidney in ischemic and toxic AKI (7). KIM-1 is also expressed in other conditions where proximal tubules are dedifferentiated e.g. renal cell carcinoma (8).

There were a number of characteristics of KIM-1 that led us to believe that the protein might be an ideal biomarker of kidney injury: the absence of KIM-1 expression in the normal kidney; its marked upregulation and insertion into the apical membrane of the proximal tubule; its persistence in the epithelial cell until the cell has completely recovered; the rapid and robust cleavage of the ectodomain and the ex vivo room temperature stability of the ectodomain (9). Presence of KIM-1 in the urine is highly specific for kidney injury. No other organs have been shown to express KIM-1 to a degree that would influence kidney excretion (10).

The Sequential Organ Failure Assessment (SOFA) score is a six-organ dysfunction/failure score measuring multiple organ failure daily. It was used to predict prognosis & mortality in critically ill patients (11-13).

This work was designed in an attempt to elucidate the role of KIM-1 as a marker for early detection of AKI in critically-ill patients.

2. Subjects and Methods:

Design and study population*:* 20 critically-ill patients admitted at Tanta University Hospitals were eligible for this study. We included 20 clinically-healthy subjects, of matched age & gender, as control group for comparison.

The study was reviewed and approved by the ethical committee at Faculty of Medicine, Tanta University, and written informed consent was obtained from all participants.

Variables: Data obtained include variables from the following domains: demographic, clinic, and specific organ involvement variables; SOFA score was also recorded.

Simultaneous to the clinical evaluation we obtained of each patient, 4 mL of aseptically-collected urine. After collection, samples were centrifuged, and an aliquot was immediately stored at −20^{o}C until KIM-1 measurement.

KIM-1 levels were measured by enzyme-linked immunosorbent assay (ELISA) (14) The detection range was 0.78 -50 ng/mL. The standard curve concentrations used for the ELISA's were 50 ng/mL, 25 ng/mL, 12.5 ng/mL, 6.25 ng/mL, 3.12 ng/mL, 1.56 ng/mL, 0.78 ng/mL.

Calculation of estimated Glomerular Filtration Rate (eGFR) (15)***:*** The Modification of Diet in Renal Disease (MDRD) Study equation was used ***for*** estimating glomerular filtration rate (GFR) from serum creatinine. ***eGFR*** *(mL/min/1.73 m2) = 186 x (Scr)-1.154 x (Age)-0.203 x (0.742 if female) x (1.212 if African-American) (conventional units).*

Statistical analyses: Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation and chi-square test by SPSS V.16. Probability values of less than 0.05 were considered of statistical significance (16).

3.Results:

The study was performed on 20 patients (12 females & 8 males) with mean age of 51.90 ± 16.32 and 20 clinically-healthy subjects as control (12 females & 8 males) with mean age of 51.60 ± 13.67. There was no significant statistical difference as regards age & gender between patient and control groups, with p.value of 0.950 and 0.988 respectively (Table 1). Clinical data of the patient group as regards age, gender, SOFA score &diagnosis are illustrated in (Table 2).

Results of our study have shown that urinary KIM-1 becomes elevated before rise in serum creatinine by a mean of 27.60 ±15.62 hours. Our study has also shown that KIM-1 becomes significantly elevated before a rise of serum creatinine (*p*.value 0.001) (Table 3).

Urinary KIM-1 has excellent sensitivity & specificity. The marker has a sensitivity of 90.9 %, a specificity of 95.24 %, a positive predictive value of

95.24 %, and a negative predictive value of 90.9 % (Table 4).

Our results have also shown that there is a significant rise of serum creatinine in patient group as compared with control group from the 2nd day (*p*.value 0.001). However this was insignificant at admission (*p*.value 0.854) (Table 5). Same results apply to blood urea with *p*.values of 0.001 on 2nd day and 0.052 at admission (Table 6). On the other hand, significant reduction in eGFR occurred only on the 3rd day (*p*.< 0.001); however this reduction was insignificant early in the course of illness with *p*.< 0.527 & 0.008 at admission and after 24 hours respectively (Table 7). Urinary KIM-1, however, was significantly elevated since admission and continued over the next two days (*p*.value 0.001) (Table 8).

It was noted that time elapsed between rise in KIM-1 and rise in serum creatinine was non-significantly related to age and gender (*p*.values 0.147 and 0.051 respectively) (Tables 9 & 10). Urinary KIM-1 was significantly elevated before a rise in blood urea & serum creatinine and before a reduction in eGFR at admission (*p*.value 0.001) (Table 11).

Table 1: Demographic data of patient and control groups.

	Control	Patient	*p*. value
Age (years)	51.60+13.67	51.90+16.32	0.950
Gender	8 males & 12 females	8 males 12 females	0.988

Probability values of less than 0.05 were considered of statistical significance.
Probability values of less than 0.001 were considered highly significant.

Table 2: Clinical Data of the Patient Group.

No.	Age	Gender	Diagnosis	SOFA Score	Department
1	47	Female	Haemorrhagic stroke.	19	Neuropsychiatry.
2	50	Male	Mesenteric vascular occlusion with resection anastomosis.	16	Anaesthetic ICU
3	27	Female	HELLP Syndrome.	14	Anaesthetic ICU
4	25	Female	SIRS complicating IUFD	12	Anaesthetic ICU
5	63	Female	Haemorrhagic stroke.	14	Neuropsychiatry.
6	30	Female	Fever & disturbed conscious level for investigation, encephalitis?	12	Neuropsychiatry.
7	45	Female	Ischaemic stroke.	14	Neuropsychiatry.
8	70	Male	Hepatic Encephalopathy, Cardiac cirrhosis of liver, Prosthetic mitral valve, Heart failure.	15	Cardiology
9	65	Female	Massive anterior myocardial infarction.	12	Cardiology
10	50	Male	Large subdural haematoma.	12	Neuropsychiatry.
11	44	Male	Brain tumour with haemorrhage.	12	Neuropsychiatry.
12	50	Female	Perforated duodenal ulcer complicated by peritonitis.	12	Anaesthetic ICU
13	24	Male	SIRS complicating infective endocarditis.	15	Cardiology
14	47	Female	Ischaemic stroke.	12	Neuropsychiatry.
15	70	Male	Haemorrhagic stroke.	12	Neuropsychiatry.
16	50	Female	Ischaemic stroke.	12	Neuropsychiatry.
17	20	Female	HELLP Syndrome.	12	Anaesthetic ICU
18	25	Male	Contrast-induced nephropathy.	12	Internal medicine ICU
19	45	Female	Haemorrhagic stroke.	12	Neuropsychiatry.
20	60	Male	Haemorrhagic stroke.	13	Neuropsychiatry.

HELLP: Haemolytic anaemia, Elevated Liver enzymes, Low Platelet count; NO: Number; ICU: Intensive Care Unit; SIRS: Systemic Inflammatory Response Syndrome; IUFD: Intra Uterine Foetal Death.

Table 3: Mean time elapsed between positive KIM-1 and rise of serum creatinine.

Time elapsed (In hours)	**Control**	**Patients**
Mean ±SD	0	27.60 ± 15.62
t. test	**7.901**	
***p*. value**	**0.001***	

Table 4: Number of true & false positive and true & false negative subjects (as regards KIM-1)**.**

	Positive	**Negative**
True	19	18
False	1	2

Table 5: Comparison of serum creatinine between patient and control groups at admission, at 24 & 48 hours intervals.

		Mean ± SD	**t. test**	***p*. value**
Serum creatinine (1st day) (mg/dl)	Control	0.905±190	**0.174**	**0.854**
	Patients	0.895±0.173		
Serum creatinine (2nd day) (mg/dl)	Control	0.980±0.164	**3.325**	**0.001***
	Patients	1.425±0.505		
Serum creatinine (3rd day) (mg/dl)	Control	0.935±0.173	**6.856**	**0.001***
	Patients	2.905±1.375		

Notes: - Blood urea & serum creatinine were measured in mg/dL.
- KIM-1 was measured in ng/mL.
-eGFR was measured in mL/minute/1.73 m^2

Table 6: Comparison of blood urea between patient and control groups at admission, at 24 & 48 hours intervals.

		Mean ± SD	**t. test**	***p*. value**
Blood urea 1st day (mg/dL)	Control	19.65±12.06	**1.235**	**0.052**
	Patients	37.40±14.53		
Blood urea 2nd day (mg/dL)	Control	16.05±10.30	**7.325**	**0.001***
	Patients	57.93±23.1		
Blood urea 3rd day (mg/dL)	Control	15.35±9.82	**10.925**	**0.001***
	Patients	111.80±41.86		

Table 7: Comparison of eGFR between patient and control groups at admission, at 24 & 48 hours intervals.

		Mean ± SD	**t. test**	***p*. value**
eGFR 1st day (mL/minute/1.73 m^2)	Control	81.25±13.49	**0.707**	**0.527**
	Patients	85.20±21.02		
eGFR 2nd day (mL/minute/1.73 m^2)	Control	74.05±10.40	**3.529**	**0.008**
	Patients	54.60±20.21		
eGFR 3rd day (mL/minute/1.73 m^2)	Control	77.75±11.23	**12.207**	**0.001***
	Patients	27±13.97		

Table 8: Comparison urinary KIM-1 between patient and control groups at admission, at 24 & 48 hours intervals.

		Mean ± SD	t. test	*p*. value
KIM-1 1st day (ng/mL)	Control	0.782±0.335	**4.880**	**0.001***
	Patients	7.88±1.72		
KIM-1 2nd day (ng/mL)	Control	0.902±0.370	**5.628**	**0.001***
	Patients	14.49±2.53		
KIM-1 3rd day (ng/mL)	Control	0.820±0.318	**4.058**	**0.001***
	Patients	25.315±5.29		

Table 9: Comparison of time interval between positive KIM-1 and rise in serum creatinine between male and female in patient group.

Time elapsed (In hours)	**Male (n=16)**	**Female (n=24)**
Mean ±SD	13.50 ± 4.88	14 ± 3.43
t. test	**0.658**	
***p*. value**	**0.147**	

Table 10: Time interval between positive KIM-1 and rise in serum creatinine in relation to age in patient group.

	Age	**Time elapsed**
Mean ±SD	43.25 ± 5.325	13.80 ± 3.21
t. test	**1.658**	
***p*. value**	**0.051**	

Table 11: Comparison of urinary KIM-1, serum creatinine, blood urea, and eGFR at admission.

	Mean ± SD	**t. test**	***p*. value**
KIM-1 1st day (ng/ml)	**7.88±1.72**	-	-
Serum creatinine 1st day (mg/dL)	0.895±0.173	**4.475**	**0.001***
Blood urea 1st day (mg/dL)	37.4±14.53	**9.528**	**0.001***
eGFR 1st day (mL/minute/1.73 m^2)	85.2±21.02	**29.321**	**0.001***

4.Discussion:

The absence of sensitive and specific biomarkers for the early detection of AKI has impaired progress in the diagnosis and treatment of patients with AKI. Traditional blood (creatinine & blood urea) and urinary markers of kidney injury (urinary casts, fractional excretion of Na^+) are insensitive for the early diagnosis of AKI (17).

Many urinary proteins have been evaluated as noninvasive indicators of renal injury. Examples include α and π glutathione-S-transferases (α and π GST) (18), neutrophil gelatinase-associated lipocalin (NGAL) (19), cysteine rich protein 61 (CYR61) (20), interleukin-18 (IL-18) (21), clusterin (22), F-actin (23), N-acetyl-β-D-glucosaminidase (NAG) (24).

However, problems with reliable use of these proteins to identify and monitor kidney injury include instability in the urine, modification due to physicochemical properties of the urine, delayed appearance, inconsistency of upregulation with different models of nephrotoxicity, absence of sustained elevation throughout the time course of renal injury to monitor progression and regression of injury and lack of a high throughput detection method (25).

Human kidney injury molecule-1 (KIM-1) is a type 1 transmembrane protein that is not detectable in normal kidney tissue or urine, but is expressed at very high levels in dedifferentiated proximal tubule epithelial cells in human and rodent kidneys after ischemic or toxic injury and in renal cell carcinoma (26-29). High urinary KIM-1

expression was also associated with adverse clinical outcomes in patients with AKI (30).

Urinary KIM-1 was evaluated as a marker for AKI in several studies (25, 27). In our study, we proved that urinary KIM-1 levels serve as a non-invasive, rapid, sensitive, reproducible, and potentially high throughput method to detect early kidney injury in critically-ill patients.

Yuzhao Zhou, *et al.* have concluded that KIM-1 may serve as a useful general biomarker for renal proximal tubule injury in preclinical and clinical studies of drug safety evaluation, chemical-related renal injury, and the monitoring of renal disease states (31).

The FDA and EMEA have included KIM-1 in the small list of kidney injury biomarkers that they will now consider in the evaluation of kidney damage as part of their respective drug review processes of new drugs (32).

KIM-1 has many potential uses other than a urinary biomarker for AKI. **Van Timmeren, *et al.*** evaluated its utility in renal transplant recipients. The occurrence of graft loss increased with increasing tertiles of KIM-1 excretion. KIM-1 levels predicted graft loss independent of creatinine clearance, proteinuria and donor age (33). **Ichimura, *et al.*** have provided a compelling case that activated renal proximal tubular epithelial cells also phagocytose apoptotic cells utilizing KIM-1 as a critical receptor. Ichimura study opens new avenues for research that might provide the foundations for novel treatments to protect the kidney from acute injury or to promote its repair (34).

We need to investigate whether increased KIM-1 expression enhances renal protection from nephrotoxic insult. Future studies should focus on other aspects of this biomarker as a predictor for graft loss in renal transplant patients. Also we should study whether modification of urinary levels of this biomarker would have any therapeutic benefit.

Limitations of the study include the limited number of patients. Other biomarkers for AKI had to be included for comparison. Whether a combination of biomarkers would give better sensitivity & specificity for early diagnosis of AKI should be the matter of future studies.

5. Conclusion:

From the present study, we conclude that urinary KIM-1 is a reliable early marker for AKI with excellent sensitivity and specificity, especially in critically-ill patients, as compared to traditional markers namely blood urea & serum creatinine, therefore allowing early diagnosis & institution of appropriate therapy.

Urinary KIM-1 should be included as a screening test to depict AKI in those at high risk including critically-ill patients.

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11/11/2012

SVC Application for Stability Improvement of Multi Machine Power System

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Abstract: This paper presents the application of Static Var Compensator (SVC) to stability improvement in a multi-machine electric power system installed with SVC. A adaptive supplementary stabilizer based on SVC is designed. To show effectiveness of SVC in damping oscillations, different disturbances are applied and simulated. The adaptive stabilizer is compared with a conventional stabilizer. Several nonlinear time-domain simulation tests visibly show the ability of SVC in damping oscillations.
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Keywords: Static Var Compensator, Low Frequency Oscillations, Multi Machine Electric Power System, Adaptive Control.

1. Introduction

The ability of synchronous machines of an interconnected power system to remain synchronism after being subjected to a small disturbance is known as small signal stability that is subclass of phase angle related instability problem. It depends on the ability to maintain equilibrium between electromagnetic and mechanical torques of each synchronous machine connected to power system. The change in electromagnetic torque of synchronous machine following a perturbation or disturbance can be resolved into two components: (i) a synchronizing torque component in phase with rotor angle deviation and (ii) a damping torque component in phase with speed deviation. Lack of sufficient synchronizing torque results in non-oscillatory instability; where lack of damping torque results in low frequency oscillations.

Low frequency oscillations are generator rotor angle oscillations having a frequency between 0.1 -2.0 Hz and are classified based on the source of the oscillation. The root cause of electrical power oscillations are the unbalance between power demand and available power at a period of time. In the earliest era of power system development, the power oscillations are almost non observable because generators are closely connected to loads, but nowadays, large demand of power to the farthest end of the system that forces to transmit huge power through a long transmission line, which results an increasing power oscillations.

The phenomenon involves mechanical oscillation of the rotor phase angle with respective to a rotating frame. Increasing and decreasing phase angle with a low frequency will be reflected in power transferred from a synchronous machine as phase angle is strong coupled to power transferred. The LFO can be classified as local and inter-area mode.

Local modes are associated with the swinging of units at a generating station with respect to the rest of the power system. Oscillations occurred only to the small part of the power system. Typically, the frequency range is 1-2 Hz.

Inter-area modes are associated with swinging of many machines in one part of the system against machines in other parts. It generally occurs in weak interconnected power systems through long tie lines. Typically frequency range is 0.1-1 Hz.

With regard to the proposed LFO, many methods have been investigated to damp out such oscillations in power systems. Recently, with development of flexible AC transmission system (FACTS) devices, these devices have been widely used to damp out the oscillations [1-5].With the practical applications of converter-based FACTS controllers such as the static synchronous compensator (STATCOM), static synchronous series compensator (SSSC) and unified power- flow controller (UPFC), modeling and analysis of these FACTS controllers in power-system operation and control is of great interest. Power-flow calculations are fundamental to the operation, planning and control of power systems. In recent years, significant work has been done in the modeling of the FACTS controllers in power flow and optimal-power-flow studies [6-11].

The ultimate objective of applying reactive shunt compensation such as SVC in a transmission system is to increase the transmittable power. This may be required to improve the steady-state transmission characteristics as well as the stability of the system. Var compensation is thus used for voltage regulation at the midpoint (or some intermediate) to

segment the transmission line and at the end of the (radial) line to prevent voltage instability, as well as for dynamic voltage control to increase transient stability and damp power oscillations.

The objective of this paper is to investigate the ability of SVC for dynamic stability improvement via damping low frequency oscillations. A multi machine power system installed with a SVC is considered as case study. The advantages of the proposed methods are their feasibility and simplicity. Different load conditions are considered to show effectiveness of SVC. Simulation results show the validity of SVC in stability improvement at large electric power systems.

2. System under study

Figure 1 shows a multi machine power system installed with SVC. Detail of the system data are given in [12]. In this paper, turbine-governor system is also modeled to eliminate steady state error of responses.

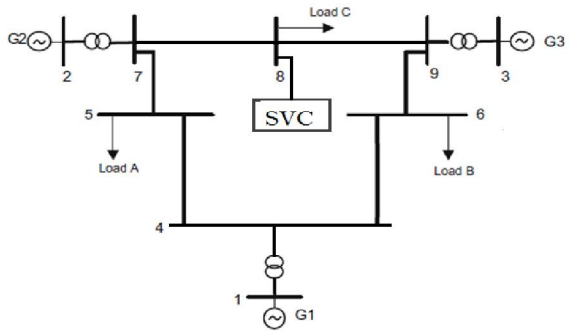

Figure 1. Multi-machine electric power system installed with SVC

2.1. SVC model

The SVC is implemented as a time constant regulator to voltage support as depicted in Figure 2. In this model, a total reactance b_{SVC} is assumed and the following differential equation holds [13]:

$$\dot{b}_{SVC}=\left(K_r\left(V_{ref}-V\right)-b_{SVC}\right)/T_r \qquad (1)$$

The model is completed by the algebraic equation expressing the reactive power injected at the SVC node [13]:

$$Q=-b_{SVC}V^2 \qquad (2)$$

The regulator has an anti-windup limiter, thus the reactance b_{SVC} is locked if one of its limits is reached and the first derivative is set to zero [13].

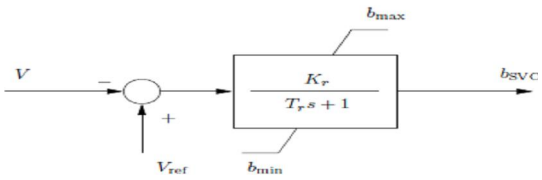

Figure 2. SVC model as a time constant regulator

2.2. Dynamic model of the system with SVC

The nonlinear dynamic model of the system installed with SVC is given as (3). The dynamic model of the system is completely presented in [12] and also dynamic model of the system installed with SVC is presented in [13]. By controlling b_{SVC}, the output reactive power of the shunt compensator is controlled.

$$\begin{cases}\dot{\omega}=\left(P_m-P_e-D\omega\right)/M\\ \dot{\delta}=\omega_0\left(\omega-1\right)\\ \dot{E}'_q=\left(-E_q+E_{fd}\right)/T'_{do}\\ \dot{E}_{fd}=\left(-E_{fd}+K_a\left(V_{ref}-V_t\right)\right)/T_a\\ \dot{V}_{dc}=\dfrac{3m_E}{4C_{dc}}\left(\sin\left(\delta_E\right)I_{Ed}+\cos\left(\delta_E\right)I_{Eq}\right)\end{cases} \qquad (3)$$

3. Model Reference Adaptive System

The general idea behind Model Reference Adaptive Control (MRAC) or Model Reference Adaptive System (MRAS) is to create a closed loop controller with parameters that can be updated to change the response of the system. The output of the system is compared to a desired response from a reference model. The control parameters are update based on this error. The goal is for the parameters to converge to ideal values that cause the plant response to match the response of the reference model. Figure 3 shows the general diagram of MRAS [14].

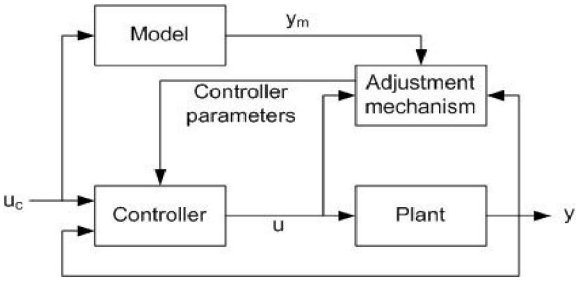

Figure 3. General diagram of MRAS

The idea behind MRAS is to create a closed loop controller with parameters that can be updated to change the response of the system to match a

desired model. There are many different methods for designing such a controller. This tutorial will cover design using the MIT rule in continuous time. When designing an MRAS using the MIT rule, the designer chooses: the reference model, the controller structure and the tuning gains for the adjustment mechanism. MRAS begins by defining the tracking error, *e*. This is simply the difference between the plant output and the reference model output [14]:

$$e = y_{plant} - y_{model} \quad (4)$$

From this error a cost function of *theta* (*J(Θ)*) can be formed. *J* is given as a function of theta, with theta being the parameter that will be adapted inside the controller. The choice of this cost function will later determine how the parameters are updated. Below, a typical cost function is displayed.

$$J(\theta) = \frac{1}{2}e^2(\theta) \quad (5)$$

To find out how to update the parameter *theta*, an equation needs to be formed for the change in *theta*. If the goal is to minimize this cost related to the error, it is sensible to move in the direction of the negative gradient of *J*. This change in *J* is assumed to be proportional to the change in *theta*. Thus, the derivative of *theta* is equal to the negative change in *J*. The result for the cost function chosen above is:

$$\frac{d\theta}{dt} = -\gamma\frac{\delta J}{\delta\theta} = -\gamma e\frac{\delta e}{\delta\theta} \quad (6)$$

This relationship between the change in theta and the cost function is known as the MIT rule. The MIT rule is central to adaptive nature of the controller. Note the term pointed out in the equation above labeled "sensitivity derivative". This term is the partial derivative of the error with respect to *theta*. This determines how the parameter *theta* will be updated. A controller may contain several different parameters that require updating. Some may be acting n the input. Others may be acting on the output. The sensitivity derivative would need to be calculated for each of these parameters. The choice above leads to all of the sensitivity derivatives being multiplied by the error. Another example is shown below to contrast the effect of the choice of cost function:

$$J(\theta) = |e(\theta)|$$

$$\frac{d\theta}{dt} = -\gamma\frac{\delta e}{\delta\theta_c}\text{sign}(e)$$

where (7)

$$\text{sign}(e) = \begin{cases} 1, & e > 0 \\ 0 & e = 0 \\ -1 & e < 0 \end{cases}$$

To see how the MIT rule can be used to form an adaptive controller, consider a system with an adaptive feed word gain. The block diagram is given as Figure 4. The plant model can be given as (8).

$$\frac{Y(s)}{U(s)} = kG(s) \quad (8)$$

The constant *k* for this plant is unknown. However, a reference model can be formed with a desired value of *k*, and through adaptation of a feed forward gain, the response of the plant can be made to match this model. The reference model is therefore chosen as the plant multiplied by a desired constant k_o:

$$\frac{Y(s)}{U_c(s)} = k_o G(s) \quad (9)$$

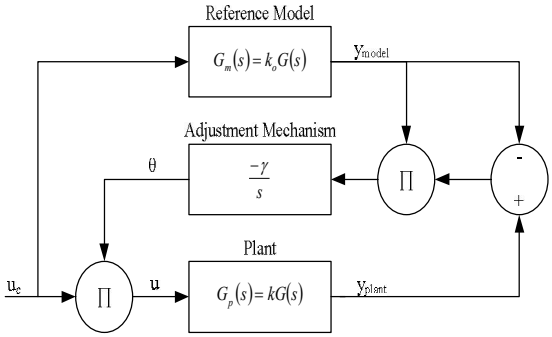

Figure 4. Adaptive feed forward gain

The same cost function as above is chosen and the derivative is shown:

$$J(\theta) = \frac{1}{2}e^2(\theta) \rightarrow \frac{d\theta}{dt} = -\gamma e\frac{\delta e}{\delta\theta} \quad (10)$$

The error is then restated in terms of the transfer functions multiplied by their inputs.

$$e = y - y_m = kGU - G_m U_c = kG\theta G_c - k_o G U_c \quad (11)$$

As can be seen, this expression for the error contains the parameter *theta* which is to be updated. To determine the update rule, the sensitivity derivative is calculated and restated in terms of the model output:

$$\frac{\delta e}{\delta\theta} = kGU_c = \frac{k}{k_o}y_m \quad (12)$$

Finally, the MIT rule is applied to give an expression for updating *theta*. The constants *k* and *ko* are combined into *gamma*.

$$\frac{d\theta}{dt} = \gamma'\frac{k}{k_o}y_m e = -\gamma y_m e \quad (13)$$

The block diagram for this system is the same as the diagram given in Figure 4. To tune this system, the values of *ko* and *gamma* can be varied [14].

4. Stabilizer design

4.1. Adaptive stabilizer

To get a suitable performance and tracking characteristics, a reference model should be adopted for MRAS system. In this paper, since the SVC supplementary stabilizer is a regulatory controller, thus, the reference model should have a regulatory nature. In this regard, the reference model is defined as below;

$$y = \frac{0.02s(s + 1.1)}{s^2 + 3s + 2}u \qquad (14)$$

4.2. Conventional stabilizer

In order to comparison, a conventional stabilizer is designed based on SVC. The transfer function model of a conventional stabilizer is as (15). This model contains two lead–lag compensators with time constants, T_1–T_4 and an additional gain K_{DC}. The parameters of the proposed stabilizer are tuned by using GA. The detailed procedure of stabilizer design by using optimization methods can be found in [15]. The proposed stabilizer is obtained as Table 1.

$$U_{out} = K_{DC}\frac{ST_W}{1+ST_W}\frac{1+ST_1}{1+ST_2}\frac{1+ST_3}{1+ST_4}\Delta\omega \qquad (15)$$

Table 1. Optimal parameters of conventional stabilizer

Parameter	K_{DC}	T_1	T_2	T_3	T_4
Optimal value	9.71	0.23	0.05	0.64	0.1

5. Results and discursions

In this section, the designed adaptive stabilizers are simulated on the test system. A scenario of fault is considered as 6 cycle three phase short circuit in bus 9. The simulation results are presented in Figs. 5-7. Each figure contains two plots: adaptive stabilizer (solid line) and conventional stabilizer (dashed line). It is clearly seen that the adaptive stabilizer is very stronger than conventional stabilizer and can successfully damp out the oscillations.

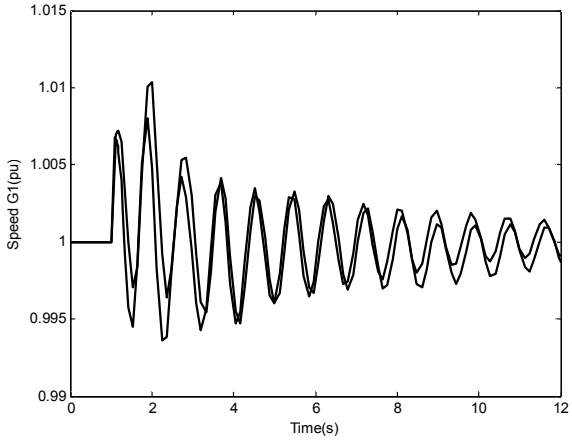

Figure 5. Speed G_1 following fault (solid: adaptive; dashed: conventional)

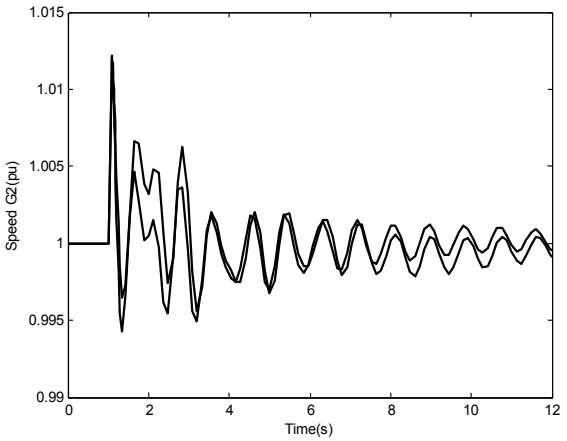

Figure 6. Speed G_2 following fault (solid: adaptive; dashed: conventional)

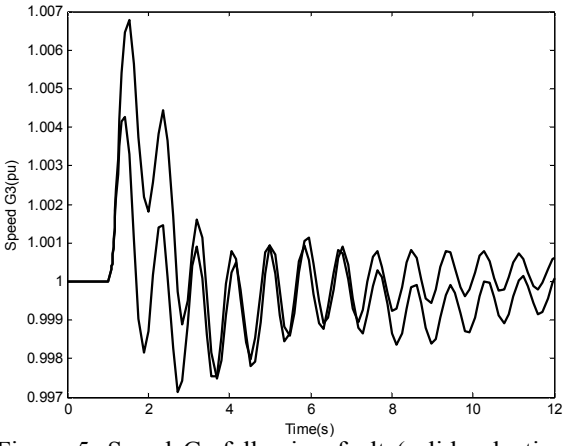

Figure 5. Speed G_3 following fault (solid: adaptive; dashed: conventional)

6. Conclusions

An adaptive supplementary stabilizer was carried out based on SVC. The proposed stabilizer was compared with conventional stabilizer. Simulation result on a multi machine electric power

system demonstrated the ability of SVC in damping low frequency oscillations. the adaptive controller showed a robust and stronger performance than conventional stabilizer.

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Subsistence Farming and Food Security in Cameroon: A Macroeconomic Approach

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Abstract: According to the Food and Agriculture Organization (FAO), the development of subsistence agriculture is the best way to assure food security in developing countries. The objective of this study fits into this logic in that it analyzes the impact of subsistence farming to food security in Cameroon. Data from the FAO and the World Bank over the period 1961-2007 were used to formulate a cointegration model between food availability and subsistence framing index based on the ARDL (Autoregressive Distributed Lag) procedure. Firstly, the analysis shows that the long-run elasticity of subsistence farming index is 0.38, higher than in short-run (0.27). This result confirms the positive impact of subsistence farming on food security in short-run and long-run. Secondly, the trend is significant and positive, meaning that structural variables such as market functioning, the development of road and market infrastructures etc., positively impact on food security in Cameroon. However, population growth reduces food availability, a factor that could obscure the positive impact of subsistence farming. Therefore it would be necessary to consider a scenario in which the subsistence farming growth rate is higher than the population growth rate.
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Keywords: Food Security, subsistence farming, ARDL model, Cameroon.

1. Introduction

Food security is a major and growing challenge in developing countries mostly in sub-Saharan Africa. Even if it is clear that agricultural development remains a strategic option for achieving food security in sub-Saharan Africa, it should be noted that agricultural policies were hitherto focused on cash crops. Subsistence farming then has been under estimated. In the case of Cameroon, for example, agricultural subsidies and aid were focused on export crops such as cocoa, coffee and cotton. However, subsistence farming is likely to affect quickly and significantly the household nutrition. Literature review demonstrated that several studies on African economics are also in line with this vision.

The role of subsistence food production in improving food security was highlighted by Aliber and Hart (2009) and Baipheti and Jacobs (2009) in a case study of South Africa. Thus, it is necessary to support subsistence production to curb food insecurity in both rural and urban areas. This requires an increase in supply and a decrease in dependence on the market. In fact, subsistence farming products can directly be consumed by households. In the under-industrialized economies, subsistence food production can be transformed locally contrary to the export crops which require further processing. Therefore, increasing food production will reduce importation and improve the trade balance even more than the net importing countries mostly import subsistence farming products. Besides, reduce food imports also reduces the risk of international food prices volatility transmission to the domestic economy.

According to the third Cameroonian household survey (ECAM III), majority of farming households engaged in subsistence farming which is the main source of household income (INS[1], 2008). Then, when the output prices are stable, ceteris paribus, any increase in subsistence farming production will raise farm income (Kidane & al., 2006). However, these incomes provide access to other food which they cannot grow cheaply (vegetable oils, milk ...). Thus, farm household food security increase when their subsistence farming production is growing to help to provide other kind food that they do not cultivate themselves. Therefore, subsistence agriculture can play an important role in reducing household vulnerability to food insecurity by improving welfare and reducing the effect of inflation (Baipheti & Jacobs, 2009).

The aim of this study is to analyze the impact of subsistence farming production on food security in Cameroon. It has both a positive and methodological interest. On the positive side, few

[1] National Institute of Statistics

scientific studies have addressed the impact of the subsistence farming sector in food security in sub Saharan Africa. Concerning the methodological level, the use of new techniques of cointegration can be interesting. Theoretical clarification of ideas being indissolubly linked to the analysis of facts; we choose a theoretical and empirical approach in order to achieve our goals. Thus, theoretical bases justifying the role of agricultural production for food security are presented before assessing the effect of subsistence farming production on food availability in Cameroon.

2. Methodology

Data sources

The data used is derived from FAO (Food and Agriculture Organization) and The World Bank. The variables are derived from the economic literature on the determinants of food security. All data series are annual and cover the period of 1961-2007.

Theoretical framework

The agricultural production as a determinant of food security finds its anchor in the theory of self-reliant development focused on protectionism, particularly in the "Boserupian" and "Malthusian" theories.

Boserupian theory and food security

According to the "Boserupian" theory, the national economy itself generates the food availabilities necessary to ensure national food security. In fact, the high density of the population is helpful for intensification of the agricultural production and improvement of the food resources. The growing urban markets translate into effective demand which impact producers create conditions for intensification of production systems. According to authors, the increase in production occurs through adaptation techniques; subject letting the markets reveal the real prices which express the relative scarcity of the factors of production and the products.

Malthusian theory and food security

According to the "Malthusian" theory, growth of food products is less rapid than the population growth, and then population pressure leads to increasing food dependency and leads to a regulation of the population either by famines, or migrations and wars.

The increase in the rural population led to increased pressure on resources particularly a land. This pressure involves a fall of the fertility of land which leads to a reduction in crop yields and thus a decrease in agricultural production available in long run causing famines somehow restore the balance between population and the capacities to produce of considered spaces.

In the modern version of "neo-Malthusian" thesis famine is replaced by migration when there is desequilibrium between the capacity to produce of a city and the needs for the population. In the Malthusian approach therefore, the growth rate of the food products must be necessary greater than the population growth rate to ensure the national food security.

ARDL Model

This study aims to analyze the impact of subsistence farming production on food availability using ARDL (Autoregressive distributed lag) model due to Pesaran, Shin and Smith (2001).

The equation for long-run equilibrium of the model is as follows:

$$fs_t = \pi_0 + \pi_1 ipv_t + \pi_2 pib_t + \pi_3 pop_t + \pi_4 T + \varepsilon_t \quad (1)$$

π_i : Long-run elasticities.

The variables are essentially taken from the literature and they are presented in the following table:

Table 1: Description of variables use in the ARDL model

Variables	Comments
Food availability (fs)	The food availability measure the average calorific contribution per capita during one year
Index of subsistence farming production (ipv)	The index of subsistence farming production is calculated using the value of subsistence farming production given by World Bank
per capita gross domestic product (GDP)	GDP is used here as an approximation of national income
growth rate of population (pop)	The growth rate of population captures the effect of population growth on food security
Trend (T)	The trend captured the effect of other variables which are not including in the model specification (the development of road and market infrastructures, the governance…

Reduced form of ARDL model

For the empirical analysis of a long-run relationship and dynamic interactions between the variables, we use the ARDL cointegration procedure according to to Pesaran, Shin and Smith (2001). We could adopt a standard approach by implementing the

usual tests of unit roots and cointegration (Dickey-Fuller, Phillips-Perron, ...). However, it is recognized that the standard unit root tests to determine the order of integration in time series suffer from many disadvantages. The main disadvantage of these tests is their low power (Schwert, 1989, Cochrane, 1991; Blough, 1992). Our study uses new econometric techniques able to estimate both the short-run and long-run dynamics.

The procedure called "bounds test" is adopted for three main reasons:

- Firstly, it is a simple procedure. In contrast to other techniques of multivariate cointegration (Johansen, Juselius), it allows the estimation of the cointegrating relationship by using the ordinary least squares (OLS) method.
- Secondly, it does not require a prior unit root test on variables in contrast to other techniques such as Johansen. While other methods of cointegration analysis require that all regressors are of the same order of integration, the ARDL approach offers the possibility of using mixed regressors. This new test procedure is valid whatever the distribution of variables are I (1)[2], I (0)[3] or a combination of 2. It also allows capturing both the short-run and long-run dynamics in cointegration analysis.
- Thirdly, this approach is statistically more appropriate to analyze the cointegration relationships in small samples, whereas the Johansen cointegration method requires large samples to be valid.

The "bounds test" procedure arises as follows:

Given the error correction model below:

$$\Delta fs_t = \beta_0 + \sum_{j=1}^{q_1} \beta_{1j}\Delta fs_{t-j} + \sum_{j=0}^{q_2} \beta_{2j}\Delta ipv_{t-j} + \sum_{j=0}^{q_3} \beta_{3j}\Delta pib_{t-j} + \sum_{j=0}^{q_4} \beta_{4j}\Delta pop_{t-j} + \delta_1 fs_{t-1} + \delta_2 ipv_{t-1} + \delta_3 pib_{t-1} + \delta_4 pop_{t-1} + \alpha T + \varepsilon_t \quad (2)$$

δ_i : Long-run multipliers.

β_{ij} : Short-run dynamics.

The "bounds test" procedure

The first step of the ARDL approach is to estimate equation (2) by OLS to test the existence of a long-run relationship between the variables.

$$\begin{cases} H0 : \delta_i = 0 \\ H1 : \delta_i \neq 0 \end{cases}$$

The test procedure is to calculate F-statistics under the null hypothesis of no cointegration and compare them with the critical values tabulated by the authors. Two critical values were calculated by the authors, corresponding to the "terminal" zones of acceptance and rejection of the test. The lower bound assumes that all the regressors are I (0), whereas the upper limit them as I (1). If the value of F-statistics is outside the interval, the hypothesis of a relationship level (in case I (0)) or cointegrating relationship (in case I (1)) between the variables cannot be rejected. Then the estimation can be performed regardless the order of integration of the series. On the other hand if the test statistics fall inside the interval, the test is undetermined.

In order to extend the cointegration test of the coefficient of error correction term due to Banerjee Doladi and Mestre (1998), the authors have developed a second version of the test based on the t of student of the error correction term in the equation (2). The procedure is identical to the F-test. This test is useful when the F-test is undetermined. It is presented as follows:

$$\begin{cases} H0 : \delta_1 = 0 \\ H1 : \delta_1 \neq 0 \end{cases}$$

In the second step, when the cointegration between the variables is, the model is specified as follows:

$$fs_t = \pi_0 + \sum_{j=1}^{p_1} \pi_{1j} fs_{t-j} + \sum_{j=0}^{p_2} \pi_{2j} ipv_{t-j} + \sum_{j=0}^{p_3} \pi_{3j} pib_{t-j} + \sum_{j=0}^{p_4} \pi_{4j} pop_{t-j} + \alpha T + \varepsilon_t \quad (3)$$

The optimal lag of each variable is determined using the Akaike information criterion.

In the third step, the short-run dynamics is obtained by estimating an error correction model associated with long-run model. The specification is as follows:

$$\Delta fs_t = \mu + \sum_{j=1}^{q_1} \beta_{1j}\Delta fs_{t-j} + \sum_{j=0}^{q_2} \beta_{2j}\Delta ipv_{t-j} + \sum_{j=0}^{q_3} \beta_{3j}\Delta pib_{t-j} + \sum_{j=0}^{q_4} \beta_{4j}\Delta pop_{t-j} + \alpha T + \gamma ecm_{t-1} + \varepsilon_t \quad (4)$$

Where

β_{ij} : Coefficients associated with the short-run dynamics

γ : Speed adjustment to long-run equilibrium

ecm : Error correction term

3. Results and discussion

Firstly we present the results of cointegration test and secondly result of short-and long-run of impact of subsistence farming production on food availability.

The "bounds test" Results

Applied to Equation 2, the test procedures provide:

$$\Delta fs_t = \beta_0 + \beta_1\Delta fs_{t-1} + \beta_2\Delta ipv_t + \sum_{j=0}^{1} \beta_{3j}\Delta pib_{t-j} + \sum_{j=0}^{3} \beta_{4j}\Delta pop_{t-j} + \delta_1 fs_{t-1} + \delta_2 ipv_{t-1} + \delta_3 pib_{t-1} + \delta_4 pop_{t-1} + \alpha T + \varepsilon_t \quad (5)$$

For the F-test:

$$\begin{cases} H\ 0 : \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0 \\ H\ 1 : \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0 \end{cases}$$

For the t-test: $\begin{cases} H\ 0 : \delta_1 = 0 \\ H\ 1 : \delta_1 \neq 0 \end{cases}$

The values of F (.) and t (.) test statistics are given in the following table:

[2] Order of integration is one. The first difference of this time series should be stationary.

[3] Stationary times series.

Table 2: Test-statistics

	Value of test-statistics	critical values at 5%	
		I(0)	I(1)
$F(fs_t / ipv_t, pib_t, pop_t, T)$	5.98	4.01	5.07
$t(fs_t / ipv_t, pib_t, pop_t, T)$	-4.66	-3.41	-4.16

The value of the two tests (Fisher and Student) are outside the interval (more than critical value in absolute), therefore the assumption of cointegration can be accepted (table 2). The equation can be estimated assuming that all the series are I (1) without testing them individually.

Impact of subsistence farming production on food availability

According to Pesaran, Shin and Smith (2001), the equation is estimated with the appropriate number of lags. Using the Akaike criterion, an ARDL (1, 1, 1, 0) model has been chosen:

$$\log fs_t = \pi_0 + \pi_1 \log fs_{t-1} + \pi_2 \log ipv_t + \pi_3 \log ipv_{t-1} + \pi_4 \log pib_t + \pi_5 \log pib_{t-1} + \pi_6 \log pop_t + \pi_7 T + \varepsilon_t \quad (6)$$

In this equation inclusions of various lag variables describe the process dynamics of the variables before equilibrium. Thus, it corresponds to a short-run representation of ARDL model. The estimation results are given in Table 3.

Table 3: Short-run elasticity

Variable	Coefficient	t-Statistic	Prob.
$\log fs_{t-1}$	0.433340	3.502824	0.0012
$\log ipv_t$	0.339321	4.783837***	0.0000
$\log ipv_{t-1}$	-0.091801	-1.086699**	0.2840
$\log pop_t$	-1.259807	-3.639982***	0.0008
$\log pib_t$	0.052445	1.090663	0.2823
$\log pib_{t-1}$	-0.051238	-1.010568	0.3186
T	0.029235	3.039759***	0.0043
π_0	26.28213	4.058901***	0.0002
Adjusted R-squared	0.893232		
Durbin-Watson stat	2.327644		
F-statistic	54.78191		
Prob(F-statistic)	0.00000		

*, **, *** denote statistical significance at the usual confidence levels.

In general, the short-run elasticities are consistent with those expected. Any increase in 1% of the index of subsistence farming production leads to increased food availability from 0.33%. This result confirms the positive impact of subsistence farming production on food security, although this effect is limited (the elasticity remains lower than 1). This can also be explained by the insufficiency of support for subsistence farming production and the

population growth (elasticity is greater than 1 in absolute value). Consequently, boosting subsistence farming production by massive funding of crops such as rice, wheat or maize (which are main cereals imported and consumed in Cameroon) and tubers, is necessary.

In the short run, GDP has no effect on food availability. This can be explained by a poor redistribution of the growth effect between different sectors of the economy. In fact, the growth does not improve food security if it is directed towards the productive sectors. Kidane and al. (2006) have also shown that the growth has effect on poverty only if it is directed towards city where the poor live and the goods they consume. Similarly, it will have effect on food security only if it is directly towards food security and to the most consumed food.

In addition, the results suggest that the trend is significant. This could mean that structural variables such as the development of road and markets infrastructure, and other uncontrollable factors positively affect food security in Cameroon. Therefore it is important to improve the quality of institution and governance. Better alimentary governance is needed to support the consolidation of food security in Cameroon.

The long-run impacts concern the value of variables in equilibrium. Thus, the long-run elasticity is derived as follow:

$$\log fs_t = \pi_0^* + \pi_1^* \log ipv_t + \pi_2^* \log pib_t + \pi_3^* \log pop_t + \pi_4^* T + \varepsilon_t \qquad (7)$$

$$where \quad \pi_0^* = \frac{\pi_0}{1-\pi_1} \quad \pi_1^* = \frac{\pi_2}{1-\pi_1} \quad \pi_2^* = \frac{\pi_3}{1-\pi_1} \quad \pi_3^* = \frac{\pi_4+\pi_5}{1-\pi_1} \quad \pi_4^* = \frac{\pi_6}{1-\pi_1}$$

The elasticity of food availability related to subsistence farming production index is:

$$\theta = \pi_1^* = \frac{\pi_2}{1-\pi_1}$$

Table 4: Long-run elasticities

Variable	Coefficient	t-statistics
log ipv	0.387645	5.5115900***
log pop	-2.183850	-7.733133***
log pib	0.023913	1.366760
T	0.051258	5.720542***

*, **, *** denote statistical significance at the usual confidence levels.

The hypothesis of cointegration is accepted; then an error correction model can be specified.

Table 5: Error correction model

Variable	Coefficient	t-Statistic	Prob.
$ecm(-1)$	-0.598938	-4.753210	0.0000
$\Delta \log ipv_t$	0.343986	6.139329	0.00
$\Delta \log pib_t$	0.071873	1.696759	0.0971
$\Delta \log pop_t$	-0.267243	-2.517625	0.0157

$$ecm = \log fs - 0.38 \log ipv_t + 2.18 \log pop_t - 0.02 \log pib_t - 0.05T$$

The error correction term is negative and significant, indicating those food availability and subsistence farming production indexes are cointegrated. Shocks that affect food availability are absorbed at a rate of 59.89%.

The long-run elasticity of subsistence farming production index (0.38) is higher than in short-run (0.33) (Table 4). This result confirms the positive impact of subsistence farming production on food security in the long-run. However, the population growth reduces the food availabilities what could obscure the positive impact of the subsistence farming production. Therefore it would be necessary to consider a scenario in which the subsistence farming production growth is always higher than the population growth.

Due to the fact that resources are scarce and limited; a special emphasis should be placed on the

efficiency in the use of agricultural input. Then the marginal productivity of labor must be greater than the marginal consumption in order to transform the population growth as engine of the agricultural intensification according to the Boserupian approach. Moreover improvement in market functioning in rural and urban area can help agricultural production in exceed to reach to the markets in deficit. This would allow an increase in farm household income and also the stability of food prices. Indeed, in Cameroon in as much as rural infrastructure and rural institution are missing, crops are generally wasted. Therefore, development of infrastructure such as road and markets must be part of sustainable agricultural policies in order to improve the effect of agricultural production on food security.

Overall, the results confirm the positive impact of food production on food availability either in the short-run or in the long-run. Thus food security is improved. However, increasing the subsistence farming production could not be the only one solution to achieving food security, if it is not accompanied by a better markets functioning, development of road infrastructure, and good governance in order to improve the purchasing power of households who are net buyers of food.

4. Conclusion

The objective of this paper was to show the impact of subsistence farming production on food security in Cameroon. The theoretical literature suggests that in general food production must improve food security. Although the controversies opinions, in many cases subsistence farming production positively affect food security in macro level.

These general results are confirmed in the specific case of Cameroon and conform to those Baipheti and Jacobs (2009) and Aliber and Hart (2009). Indeed, we show that the elasticity of food availability compared to the subsistence farming production index is 0.27 and 0.38 in the short-run and long-run respectively. This confirms the positive impact of subsistence farming production on food security in the short-run and long-run. Therefore it seems to be necessary to finance subsistence farming production. However to be efficient these measures must be accompanied by other structural measures such as development of market and rural infrastructure, the quality of food governance

In addition, ppopulation growth negatively affects food security in Cameroon. Then the subsistence farming production growth must be greater than the population growth to avoid the Malthusian scenario. In a context of climate change, the focus should be on efficiency use of agricultural inputs to improve farm income.

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Efficiency of Groundnuts/Maize Intercropped Farms in Zoetele, South Cameroon: A Data Envelopement Approach

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Abstract: This article aims at evaluating and analysing the production efficiency of farms (FF) in the locality of Zoetele, South Cameroon. From a sample of 62 FF, we first estimate a model of Data Envelopment Analysis with constant and variable returns to scale, then a censored TOBIT model enabling therefore to identify factors of efficiency. Two main outcomes result from this study. First of all, we can see that on average, the level of technical efficiency of FFs is 44.60% when returns to scale are constant, and 67.80% when return to scale are variable. This shows off possibilities of efficiency substantial gains. Secondly, the farm size and the production destination impact negatively on the technical efficiency. Finally, the adherence to a peasant organisation and age improve it. From those results, we estimate that if one wants to improve the efficiency of the FFs, it would be interesting that the FFs organise themselves into associations in order to benefit from experience sharing, and government and nongovernmental organisations (NGO).

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Introduction

In Cameroon, agricultural sector accounted for 75% of the primary sector and employ around 60% of the labor in 2009. The agricultural sector also generates foreign exchange accounting for 55% of the total of exports (MINADER, 2005). The sector indisputably occupies a strategic place in the national economy in terms of wealth creation, foreign exchange earnings, employment generation, social stability, food security, food self-sufficiency and poverty alleviation, especially amont those living in rural area. According to the Millennium Development Goals (MGDs), the government has set up programmes to increase producers' incomes by about 4.5% per annum in to ensure poverty reduction by half in 2015, households' food security (MINADER, 2005) The improvement of family farms (FF) efficiency may help in the fulfillment of these goals. Indeed, the agricultural production growth rate is influenced by three main factors: the volume and type of resources mobilised in production, the technology status, and the efficiency with which those resources are used. The aforementioned efficiency of resources helps identify possibilities of production growth without supplementary financial resources and it is also a source to productivity growth (Datt & Ravallion, 1998; Nkamleu, 2004).

Koopmans (1951) and Debreu (1951) were the first to work on the concept of efficiency. Koopmans set up a measure of the concept of efficiency and Debreu tested it empirically. Debreu (1951) set up the coefficient of the use of resources, which gives a numerical evaluation of the loss associated to non-optimal situation. However, Farrell (1957) is the first to clearly define the concept of economic efficiency and to distinguish the concept of technical efficiency from the concept of allocative efficiency. He did also show an approach for the estimation of efficiency frontiers, starting from the idea that available information on a given activity should enable an estimation of the "best practice envelope" for that activity.

The notion of efficiency therefore represents three main components which are: technical efficiency [1], allocative efficiency [2] and economic efficiency[3] (Bravo-Ureta & Pinheiro, 1997).

[1] According to Farrell (1957), the technical efficiency measures the manner according to which a firm (here an FF) chooses the quantities of inputs that fall into the process of production given the proportions of utilisation of factors. Hence, the farm is technically efficient if for a given level of factors and products used, it is possible to increase the quantity of a product without increasing the quantity of one or more factors, or without reducing the quantity of another product.

Considering the criteria of the origin of the family income and whether labour force is assigned to the farm or not, Oliveira (1997) distinguishes three categories of family farms: those with a productive function, those which serve as labour reserve and those which rely mainly on social transfers for a living (monetary resources other than incomes from the farm or external activities of the family members). However, it is indispensable to precise like Gastellu (1980) that "the African family farm is different from the European family farm". The author substitutes the term "community" which he finds more convenient than "unity", because it depicts more the privileged exchanges that unite individuals of a same group. That is also the definition kept by Kleene (2007) for whom the African family farm is a family team of workers cultivating together, at least a main field to which are linked or not, one or more secondary fields of variable importance depending on the case and having their own decision centres.

Numerous works on the efficiency of farms, both in developing and developed countries, show that farmers are not often able to use their technical potentialities and/or allocate inefficiently their productive resources (Bravo-Ureta & Evenson, 1994; Nkamleu, 2004; Nyemeck & al., 2004, 2008; Latruffe, 2005; Nuama, 2006; Fontan, 2008). So far, few studies have been based on Cameroon. Hence, this study analyses the technical efficiency of FFs in the locality of Zoetele in South-Cameroon, using the method of Data Envelopment Analysis (DEA) and then identifies factors that explain observed inefficiencies using the model of the censored TOBIT.

Such an analysis is very rich because it can contribute to enlighten the government in targeting, and on the potential effects of different programmes set up in the agricultural sector. Following this introduction, this article presents the methodology and the analysis tools. Then the results are presented on the distribution of indices of technical efficiency, and factors that explain inefficiencies. The paper comes up with some conclusions and policy recommendations

2. Materials and Methods

Sample and data

Data were collected during an investigation made while the programme for the Improvement of Agro Pastoral Family Farms Competitiveness (IAPFFC)[4] was running in April and May 2010. Data collected related to FFs cultivating groundnuts and maize. That was due to its importance in the region. In fact, it is one of the farming systems that is mostly practiced in the study area. Among the issues that were investigated during the survey are:

The farming system practiced in relation to the inputs and outputs quantities; structural characteristics of the FF households and Accessibility of the villages during the rainy season. In the survey, 62 FFs were sampled by simple random sampling of three villages from the locality of Zoetele. The respondents were drawn from Ntsimi (19), Otetek (21) and Ebamina (22).

The Data Envelopment Analysis (DEA) method

Data analysis was carried out with the DEA method Blancard and Boussemart (2006) asserted that this approach is particularly adapted to the modelling of a multi input-multi output primal technology, without going through the dual cost function, presupposing the absence of technical inefficiency. It is about a method taking into consideration only hypothesis of free disposition of inputs and outputs, and of convexity for the whole production. It does not set any functional form of production and cost functions as imperative.

The DEA method enables us to identify an efficient set that can serve as reference for efficient farms. Efficient farms have inputs and outputs similar to those of inefficient farms. Hence, they can serve as reference. The purpose of DEA is to construct a non-parametric envelopment frontier over the data points such that all observed points lie on or below the production frontier (Coelli, 1996). Efficient farms are located on the production frontier which indicates the maximum production which can be made using different combinations of factors for a given technology. In literature, the most used two variants of the DEA method are: the Constant Return to Scale (Charnes et al., 1978) model which supposes constant returns to scale (CRS model) and the BCC (Banker et al. 1984) model which supposes variables returns to scale (VRS model).

Following Coelli (1996), suppose there is a set of information on K inputs and M outputs for each

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[2] It is the optimal combination, or in the best proportion of resources given their relative prices (Amara and Romain, 2000). A farm is therefore declared allocatively efficient if at a given level of production, the cost of factors is minimum.

[3] The economic efficiency, generally known under the name of "total efficiency" is jointly determined by technical efficiency and allocative efficiency. It is the product of those two types of efficiency. An agricultural farm is then said to be economically efficient if it is at the same time technically efficient and allocates efficiently its productive resources.

[4] In french : « programme d'Amélioration de la Compétitivité des Exploitations Familiales Agropastorales (ACEFA) ».

N farms. Information from the i-th farm is represented by column vectors x_i and y_i respectively. Matrixes of inputs X with dimension KxN, and of outputs Y with dimension MxN regroup information related to all the farms. The ratio approach is an intuitive way to introduce the DEA method. For a given farm, the ratio measures the technical efficiency, and a set of constraints is placed for the ratio of each farm to be always less than or equal to 1. The mathematical program used for the CCR ratio is:

$$\max_{u,v}(u'y_i / v'x_i),$$
$$s/c \quad u'y_j / v'x_j \le 1 \quad j = 1,2,\ldots,N \qquad (1)$$
$$u, v \ge 0.$$

Where u is a vector of dimension Mx1, and v is a vector of dimension Kx1, representing respectively the weights of the outputs and the inputs determined by solution of the problem: that is to say, by the data of all the farms used as reference set. Since that type of ratio allows an infinite number of solutions, Charnes and Cooper (1962) developed a fractioned linear program. The latter selects a representative solution in each equivalence class and the dual linear program which is associated is:

$$\min_{\theta,\lambda} \theta$$
$$s/c - y_i + Y\lambda \ge 0$$
$$\theta x_i - X\lambda \ge 0$$
$$\lambda \ge 0$$

(2)Where θ is a scalar that gives the measure of the technical efficiency of the considered farm, λ is a vector (N, 1) of constants called multipliers. They indicate the way that farms combine together to create the frontier to which the i-th farm will be compared, according to Farrell definition (1957). The problem is solved N times, one time for each farm in the sample, and generates N optimal values of θ and λ.

In the DEA program (2), the performance of a producer is evaluated in terms of the producer capacity to reduce his vector of factors up to the level of the best practice that has been observed.

However, the hypothesis of constant returns is really adapted only if the enterprise operates at an optimal scale (Ambapour, 2001). That is not always the case (imperfect competition, financial constraints...). This remark led Banker et al. (1984), to propose a model that enables to determine if the production is happening in an area of increasing returns, constant returns or decreasing returns.

Hence, the CCR model can be modified then considering the hypothesis of variable returns to scale. We just have to add a constraint $N1'\lambda = 1$ to the previous programme. We have:

$$\min_{\theta,\lambda} \theta$$
$$s/c \quad -y_i + Y\lambda \ge 0$$
$$\theta x_i - X\lambda \ge 0 \qquad (3)$$
$$N1'\lambda = 1$$
$$\lambda \ge 0$$

Where $N1$ is a dimension vector Nx1 made of 1s.

The difference between the technical efficiency index obtained with the DEA model type CRS, and the one from the same farm obtained with the DEA model type VRS constitutes a good measure of scale efficiency for the considered farm.

Furthermore, this model enables the decomposition of the technical efficiency into total technical efficiency and pure technical efficiency. The hypothesis of constant returns to scale leads to the determination of the total efficiency; whereas the hypothesis of variable returns to scale leads the determination of pure efficiency.

The used DEA model integrates three inputs and two outputs.

The inputs: inputs were categorized into three namely: Farm size (hectare), Labour (man/day)[5] and Capital (XAF)[6]. The choice of those variables is justified by the fact that they are commonly used for the estimation of agricultural production frontiers in developing countries (Kalirajan 1981, 1984; Kalirajan and Shand 1986; Bravo-Ureta and Evenson 1994).

The outputs: outputs were categorized into two: output A (kilogram)[7] and output B (kilogram)[8]. Moreover, basing ourselves principally on two arguments taken from the literature, we keep an input orientation of the DEA model. According to Coelli (1996), the chosen orientation is function of inputs and outputs quantities that farmers are able to control. In fact, farmers are best able to control inputs: labour (work), farm size (land) and capital (cost of assets

[5] It will be evaluated in terms of work volume, and expressed in man/day. The volume is obtained by proceeding to an aggregation of the work of every person, weighed by coefficients given by the Food and Agriculture Organisation (adult man=1, adult women=0.75, children younger than 14 and old men=0.5).

[6] It is the sum of both the invariable and the variable capital. The invariable capital in this study concerns the total value of the assets used (depreciation of the assets), while the variable capital refers to the cost of consumed inputs (seeds).

[7] Amount of groundnuts produced by farmers in the 2009/2010 farming season.

[8] Amount of maize produced by farmers in the 2009/2010 farming season.

used and cost of seeds); than the outputs that are from the agricultural production. Finally, the choice of one specific orientation or another has only a slight influence on the obtained scores, and consequently on the ranking of the production units.

The Tobit model

The TOBIT model belongs to the family of models with limited dependent variable. They are models in which the dependent variable is continuous, but only observable on a certain interval. Hence, these are models that are found halfway between qualitative variable models and the linear regression model where endogenous variable is continuous and observable. However, these models are also called censored regression models[9] or truncated regression models[10].

A censored TOBIT model helps explain the inefficiencies. Indeed, the choice of that model is justified by the fact that the dependent variables that will be the inefficiency indexes (1-efficiency), are continuous and include values in the range [0 1[.

The model can be represented like this:

$$\begin{cases} Y_i = X_i\beta + u_i \\ avec \begin{cases} \mathrm{Y_i} = \mathrm{Y_i^*}\ si\ \mathrm{Y_i^*} \succ 0 \\ \mathrm{Y_i} = 0 \text{ if not} \end{cases} \end{cases}$$

(4)

In relationship (4);

- X_i is a vector of explanatory variables,
- β is a vector representing parameters to estimate,
- Y_i is a latent variable that can be considered as the threshold from which X_i affect the efficiency of a FF.

The "inefficiency" dependent variable in the frame of this study continues to be limited to zero. Considering that perturbations u_i are identically distributed following a normal distribution $N\left(0,\ \sigma_u^2\right)$, the estimation of the above censored TOBIT model is done through the maximisation of the probability logarithm which is:

$$\log L = \sum_{i=1}^{n} \log\left[1 - \Phi\, X_i\beta/\delta\right] + \sum_{i=1}^{n} \log\left(\frac{1}{\sqrt{2\pi\delta}}\right) - \frac{\sum_{i=1}^{n}\left(Y_i X_i\beta\right)^2}{2\delta^2}$$

(5)

Where **n** represents the number of observations, and **δ** the standard deviation.

The complete empirical form of the TOBIT model that we are going to estimate is the following:

$$Y_i = \beta_0 + \beta_1 AGE + \beta_2 EDUCATION + \beta_3 TRAINING + \beta_4 SIZE + \beta_5 PO + \beta_6 DESTPROD$$

Therefore, variables that are likely to explain inefficiency (and to affect the efficiency) of the FFs of the sample are presented in the following table:

Table 1: Variables used in the study of the determinants of efficiency

Variable	*Definition*	*Measure*
AGE	Age of the farmer	Continuous variable
EDUCATION	Level of education of the farmer	Binary variable (1 = Primary and 0= secondary)
TRAINING	Training in agriculture	Binary variable (1 = Yes and 0= No)
SIZE	Farm size	Continuous variable
PO	Adherence to a peasant organisation	Binary variable (1 = Yes and 0 = No)
DESTPROD	Destination of production	Binary variable (1 = Auto consumption and 0 = Sale + Auto consumption)

In this section, the results obtained from data analysis are presented and discussed as outlined below. Three sections are used in the presentation as follows: firstly, the characteristics of the FFs, secondly, the levels of efficiency estimates; finally, the determinants of efficiency of the FFs.

Socio-economic Characteristics of Farmers

From table 2, on average, the sampled family farms produce 172.34 Kg of groundnuts. However, we notice a huge disparity among FFs. This can be linked to the variability of endowment of FFs in with resources. We also notice huge disparities in the production of maize of FFs. Added to the variability of endowment of FFs with resources, the use of improved seeds by a specific FF can explain that disparity.

The inputs of land, labour and capital have respectively average values of 0.72 ha, 115.60 m/d and XAF 36057.24. The average family farm leader is about 46 years old. For the farming system studied, half of the FFs were producing only for family consumption.

Concerning the level of education, majority of the FFs heads have been to the primary school. Less than half of FFs heads belonged to peasant organisations (PO) (37.10%). FFs heads that had some form of trainings in agriculture represent around the quarter of the sample(25.80%).

[9] A regression model is said to be censored when one has at least observations of explanatory variables on the whole sample.

[10] On the other hand, a regression model is said to be truncated when all the observations of explanatory variables and of the dependent variable, showing out of a certain interval are totally lost.

Table 2: Summary statistics of farmers' characteristics

Variable	*mean*
Amount of groundnuts (kg)	172.34
Amount of maize (kg)	81.02
Labor (man/day)	115.60
Size (ha)	0.72
Capital (xaf)	36057.24
Age (years)	46
Education (Binary variable)	0.45
Training (Binary variable)	0.26
OP (Binary variable)	0.37
DESTPROD (Binary variable)	0.55

Technical Efficiency Analysis

The average level of technical efficiency obtained for the farmers is 0.446. In other words, an efficient use of all the inputs would lead on average to a reduction of inefficiency by 55.4%, while maintaining a constant production volume. This result shows a relatively low level of average efficiency of FFs practicing a system of farming based on groundnuts a

Considering variable returns on scale, it comes out that the average level of pure technical efficiency of the FFs of the sample is 0.678. This means that on average, they can reduce by 32.2% the use of the factors of production while maintaining the same level of production.

Hence, the maximum values of technical efficiency obtained (higher than 0.8) shows that some of the farmers are very effective and close to the production frontier. These FFs which have a high level of efficiency can serve as reference to improve globally the efficiency of the studied area.

The DEA method enables also to detect among the factors of production that are used, those in particular that are used in excess. The "inputs slack" tally to the additional excess of the use of each factor, in percentage of their used level (table 3). This percentage represents, in addition to the potential reduction depicted by the level of technical efficiency (proportional reduction applying to all the factors), the potential supplementary reduction of considered factor of production (meaning proportional).

For the whole sample, land is on average the most used factor in excess. The additional excess of land is 10.9%. Therefore, the FFs could reduce their use of land by 55.5% on average, which means 44.6% (proportional reduction depicted by the technical efficiency) plus 10.9% (non proportional reduction depicted by the additional excess, applying only on the land factor), whilst producing at the same level. This result reflects the overuse of land previously mentioned, and may be justified by the abundance of the resource.

Concerning labour, the FFs could on average reduce their use of this factor by 50.05%; whereas an average reduction of capital of 53.83% would be possible with the same level of production.

The FFs of the Nsimi and Ebamina villages show a noticeable overuse of capital and labour factors, compared to those of Otetek village. Nevertheless labour is the less used compared to the others (on average 5.45% against 10.9% and 7.23%).

Table 3: Additional excess of factors (total technical efficiency), percentage of the level of factor used

	Total sample	*Ebamina*	*Nsimi*	*Otetek*
Size (%)	10,90	13,05	10,10	9,38
Labour (%)	5,45	5,27	6,47	4,71
Capital	7,23	7,35	8,79	5,67

Determinants of Technical Efficiency

The results of the econometric estimation (table 4) show that we can distinguish two categories of variables: insignificant variables (level of education and training in agriculture) and significant variables (age, farm size, peasant organisation, destination of production).

Talking about education, the main reason that explains the obtained result is the fact that formal education in Cameroon does not integrate knowledge on agricultural practices and techniques hence, the human capital produced by school is slightly useful to agriculture. The result is shared by Gurgand (1993; 1997), in the case of the Ivorian agriculture. He observed that education does not impact positively on the technical efficiency of agricultural production. On the other hand, data collected in Africa are often less reliable than those from Asia for instance. Despite that, the widely accepted hypothesis is that there is a qualification effect in agriculture that cannot be rightfully generalised in sub-Saharan Africa. However, the positive sign of the parameters explaining inefficiency means that those parameters

have a negative effect on efficiency. The coefficient of the level on education being positive, we can conclude that cultivation leaders with a primary school education are less efficient than the ones with a secondary and higher school education.

Training in agriculture does not contribute significantly ($p>0.10$) to the explanation of technical efficiency in the total sample. Indeed, this counter intuitive result can be explained with various reasons. The nature of trainings in agriculture and their length enable us to understand the situation. Also, the low representation in the sample of the FFs leaders who have been through an agricultural training (less than 25%) may explain this result. Added to that, trainings in agriculture in the southern part of Cameroon are generally organised in the form of seminars to farmers. The seminars are based principally on income generating farming systems (cocoa, coffee, palm oil...) On the same hand, these seminars are sometimes too theoretical and are not accompanied by practical examples due to financial and time constraints. Nevertheless, the minus sign of the coefficient associated with the training variable means that training in agriculture has a positive impact on efficiency, but insignificantly.

Variables that explain significantly the technical efficiency of FFs in the sample are: the age of the FF heads, the farm size, the membership to a peasant organisation and the destination of the production.

The minus sign of the coefficient affected to the cultivator age translates the fact that the variable impacts positively on the technical efficiency of the family farms of the sample. Here, the oldest cultivation leaders are more efficient than the young people. This result is explained by the experience of the oldest people. Indeed, the average experience of the sample in the practice of agriculture is 20 years. The culture system based on groundnut and maize of the locality of Zoetele in South Cameroon is therefore practiced for some cultivators, during the whole of their life. The result is in contradiction with Coelli and Fleming (2004) remark for whom; younger cultivators are more efficient than older cultivators. According to the authors, younger people are more disposed to accept new technologies and vulgarisation. Besides, an analysis of marginal effects shows that all things being equal, a variation of the age by a year would cause a variation of the probability to be inefficient by 0.54%.

Results also suggest in disagreement with intuition that, the smallest cultivations are the most efficient all things being equal. Indeed, in the sample, we demonstrated by analysing the scale efficiency the existence of a huge waste due to the excessive use of land. This means that cultivators are not able to use efficiently their resources when the farm size is big. This can be explained by the gender of the FFs leaders who are in majority females and consequently do not have the labour force necessary for an efficient production. The quasi-elasticity obtained indicates that a variation of a unit of the farm size would cause a variation of the probability to be inefficient by 13.02%. The negative relationship between the size of the cultivation and technical efficiency was also depicted by Chirwa (1998) in the case of Malawi. Other studies on the contrary show the positive influence of the size of the cultivation of technical efficiency (Thiam and al., 2001; Nyemeck and al., 2004; Latruffe, 2005).

The membership to a peasant organisation affects positively the technical efficiency. In Cameroon, since the crisis on the 80s the government encourages cultivators to put themselves together. It is in fact the only way for cultivators to benefit from control, subventions and counsels of the government (ACEFA programme which is replacing progressively the National Programme for Agriculture Vulgarisation and Research "NPAVR"), and from Non Governmental Organisations (NGO). This notice confirms the results of the literature according to which, social capital: membership to a peasant organisation being a component, has a positive impact on technical efficiency (Nuama, 2006; Audibert, 1997). Indeed, the communal organisation enables the resolution of problems such as labour force and access to credit which are factors that improve the technical efficiency of cultivators (Helfand and Levine, 2004). Technical efficiency gains linked to membership to a peasant organisation are 11.44%.

It also comes out from the analysis of the determinants of technical efficiency that, the FFs whose production destination is auto consumption are less efficient than those, which in addition to auto consumption sell their production. The sale constraint obliges cultivators to be more efficient and to better manage their resources. As a matter of fact, efficiency gains of FFs whose production destination is auto consumption and sale are 21.23%.

Coming to the end of the investigations, it comes out that there are possibilities of substantial efficiency because the FFs can on average reduce the use of the factors of production by 55.4% when returns on scale are constant and by 32.2% when returns on scale are variables, while keeping the same level of production, all things being equal. This result confirms the idea according to which the agricultural sector both in developed countries and in those who are not, suffers from inefficiency (Bravo-Ureta and Evenson, 1994; Nyemeck and al., 2004, 2008; Latruffe, 2005; Fontan, 2008).

Table 4: factors explaining the nefficiencies of the FF

Variables	Coefficients	P>|t|	dy/dx
Age	-.00539273**	0.013	-.0053927
Education	.01629497	0.758	.016295
Training	-.03812419	0.543	-.0381242
Size	.13019005**	0.031	.13019
OP	-.11444569**	0.047	-.1144457
DESTPRO	.21229597 ***	0.000	.212296
Constant	.6320591 ***	0.000	
Sigma	.20117245***		
Number of obs = 62			3 left-censored observations
LR Chi2(6) = 26.79			59 uncensored observations
Prob > chi2 = 0.0002			0 right-censored observations

Notes:
*, **, *** denote statistical significance at the usual confidence levels.
Dependent variable: Level of inefficiency of FFs

Conclusion and Recommendations

The analysis of efficiency determinants suggests that the factors level of education and training in agriculture do no contribute significantly to the explanation of technical efficiency. However, whereas age and membership to a peasant organisation improve technical efficiency, the farm size and auto consumption as destination of production affect it negatively.

Based on those results, our study puts the accent on suggestions at two levels: at the level of the government and at the level of FFs.

To the government: we suggest on a hand the promotion of the creation of agricultural peasant schools that would enable the improvement of the managerial talents of cultivators, and hence make them more efficient in the use of available resources. On the other hand, we suggest to all corporate interveners of the agricultural sector to organise training seminars that could take into consideration systems of culture in association, more precisely food-producing cultures. Besides, it would be interesting that those seminars be more practical and spread over a long period in order to give to cultivators the opportunity to better understand the teachings that are given.

To the family farms: we suggest that they should regroup themselves for them to benefit from the sharing of experience on a side, and from government and nongovernmental organisations (NGO) subventions on the other side. That is why we think that it would be interesting to pursue this study by focusing specifically on the relationship between efficiency and social capital based on agricultural cultivations in developing countries in general, and in Cameroon in particular.

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The Role of Balanced Scorecard Implementation on Financial Performance Transparency

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Abstract: If you ask most people how they measure the performance of companies, with a meaningful smile will tell you it is very clear "When you make more money". Somehow it is true: profitability, gross sales revenue, investment return and others are fundamental". End line is a type of results that companies should reach it to survive. Unfortunately, if senior management only focuses on the financial health of the organization, unfavorable outcome occurs. One of these ways of financial measuring are delayed indices. This means that how more or less numbers depend on different events that may have occurred months or years. This is the question that is proposed in this study whether the balanced scorecard implementation effect on financial performance transparency. In this study 24 companies are considered. Data collection was done through the distribution of questionnaires among 192 people of senior, middle and financial managers of food industry companies, which have been accepted in Tehran Stock Exchange. By presence and continuous following, only 120 questionnaires were collected. Operational variables in this study include: perspective, company values, transparency of financial performance in implementation of company's performance evaluation with the balanced scorecard. Their testing was done with statistical techniques. Findings indicated that implementation of balanced scorecard in spite of the organization's prospective can have an influence on both company value and the transparency of financial performance.
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1. Introduction

Strategic cost management approach with the aim of creating value is a new approach to the new business that by application of multiple, new and comprehensive techniques provide the presence of economic establishments in competitive area and also provide their continuous improvement condition. Performance management and making strategic decisions with the aim of survival, continuity of operations and continuous improvement are important issue in management of strategic cost. Performance management is considered as managerial duties that gives concrete concept to management and business. The globalization of business activity has increased its importance.

To assess how to do the work, an indicator and method is essential to make measuring concept concrete and practical. In management literature, different indicators are presented to measure performance management from different perspectives.

Perspective determines the purposes and assessment objectives. Performance evaluation from a comprehensive perspective means comprehensive look at all aspects that in fact make clear the functional symptoms of establishment management which is very important. In indicators of comprehensive performance measurement, the financial and non-financial aspects are considered. Balanced scorecards approach resulting in financial or economic outcome or any output are considered as a comprehensive indicator of the performance measurement.

1.1. Research Background in Iran

Regarding the research done in this area in Iran, Vahidiye Torachi (2010) in a research entitled "Performance management of welfare bank branches based on BSC model in Khorasan Razavi", found that although the sub-hypotheses including financial perspective, internal process, growth and learning were rejected (lower than average), the welfare bank performance in customer perspective is highly desirable. Therefore, this perspective (client) could affect the other three perspectives. Finally, in overall assessment, welfare bank performance of Khorasan Razavi was above average

In another study, Kothari (2010), during a study titled "Performance Evaluation of Safety Health and environmental management system by the help of balanced scorecard approach", found that a performance evaluation of health, safety and environmental system based on the BSC model was done in five areas of the same weight (in terms of functional capacity) of National Iranian oil Products Distribution and Superior area is selected by using Analytical Hierarchy Process (AHP)and based on predetermined indicators on the bases of balanced scorecard.

Then, Karim Khani (2010) studied the performance evaluation of Social Security Branches in Tehran by using Fuzzy data envelopment analysis models and Balanced Scorecard. He concluded that based on this model, after determining and calculating the dimensions of the Balanced Scorecard in four aspect of customer, internal processes, growth, learning and financial were measured and ranked by Fuzzy data envelopment analysis. Finally, efficient and inefficient branches were identified. By using this method, strengths and weaknesses of inefficient branches are identified and provide opportunity for an appropriate improvement.

In another study, Mortazaie (2009) conducted a research about considering the role of balanced scorecard in evaluating and ranking automaker companies of Saipa group" and found that by taking advantage of the Balanced Scorecard concepts and quantitative multiple attribute decision making methods, we can provide a framework for evaluating and ranking automaker Saipa Group companies and can assist a group of senior managers in achieving to understanding and appropriate visual of performance and automaker companies position in holding level.

In addition, in another study, Askarzadeh (2010), studied the rating of banks branches by Balanced Scorecard (BSC)approach and Fuzzy Multiple Attribute Decision Making (MADM) methods (Case Study: Tehran, Sepah Bank branch, Zone 3) and found that the important aspects of the evaluation criteria and passages to improve the performance of banks in order to achieve the desired level.

Accordingly, Nasershahrasbi (2009), in a research entitled "Providing a method to assess the organization's architecture performance by using the balanced scorecard approach" found that totally 25 goals has been extracted and formulated as a general purposes of the Balanced Scorecard of organization's architecture. Finally, administrative measures were determined in achieving to the desired goals by making use of organization managers' opinions and consultant team.

Also, Zolghadr (2009), did a study about " Evaluation of mechanization of customs' processes by using of the Balanced Scorecard Customs of Tehran " After describing various aspects of Balanced Scorecard including financial, customer and market, internal processes and learning and growth, the operating system of Asikoda custom showed the effect of applying this system in mentioned funds.

In next study, in 2009, Khazaeiye Asl, carried out a study entitled "Evaluating the effect of application of Office Automation on performance of city of Zahedan university of Medical Sciences based on Balanced Scorecard model. Based on the data collection from the analysis of questionnaires and available documents and evidence in studied organization, he came to the conclusion that application of office automation leads to performance improvement of university of Medical Sciences in Zahedan city.

Then, Alahyari Abhari (2007) followed a research about " Considering the application of balanced scorecard techniques in performance measuring of accepted companies in Tehran Stock Exchange ". Results showed that the most important financial criteria of companies include the net income, operational benefit and total revenue. In addition, 6/92 percent of companies do not use this technique, however, non-financial criteria can also be used for performance evaluation such as customer satisfaction.

Finally, Kamaliye Shahri in 2005, carried out a research entitled "feasibility of balanced scorecards implementation in active companies at home appliance industry accepted in Tehran Stock Exchange". This finding suggests that there are the possibility of implementing balanced scorecard in active companies at home appliance industry accepted in Tehran Stock Exchange and also indicators making in four perspectives. Furthermore, the customer was presented as the most interesting aspect of this study.

1.2. Research Background outside of Iran

Regarding some researches done outside of Iran, Balanced Scorecard approach was introduced by Robert Kaplan and David Norton that are prominent management consultants and both are from the Boston area. In 1990, Kaplan and Norton studied twelve companies in order to found new methods for performance evaluation. This study was motivated by the increasing belief that the financial measures of performance are not effective enough for modern business enterprises. The studied companies were convinced with Kaplan and Norton that reliance on financial measures has affected their ability in value creation. The survey team examined a variety of possible alternative but they were agreed on the idea of the balanced scorecard. It is characterized by performance measures which covered all the organizations. Kaplan and Norton called this new method the *balanced scorecard approach.*

In addition, in 1992, the first paper published at Harvard by Kaplan and Norton who were benefited from several criteria that were organized in four ways to improve the performance.

Four years later, in 1996, Kaplan and Norton were published their first book. The first section

describes the Balanced Scorecard as a performance measurement system. In second part of the book, the way that managers of organizations use Balanced Scorecard for strategic performance management system is presented.

Then, companies' performance was taken under consideration, these companies at short time- Two or three years after performing the Balanced Scorecard project and organizational change had achieved an appropriate performance. Balanced Scorecard has helped them so much in coordinating of organizational resources, etc. Experiences of organizations' activities were published in second book of Kaplan and Norton.

The second article of Kaplan and Norton in 1993, at Harvard Business describes how the criteria should focus on what is more important to the organization that is the organization's strategy. This article mentioned that each stage must be started with agreements of managers about their objectives in four aspects of balanced scorecard and managers by outlining objectives in four aspects by drawing arrows connect objectives to each other.So, the management strategy was described among four aspects of balanced scorecard.

The theory of stochastic relations among the objectives of the balanced scorecard and measures leads to the creation of strategic map that was presented in H.B.R article and in several books by Kaplan and Norton in 2000, 2001 and 2004.

Then, Neon (2003) in a research entitled " The stages of Balanced Scorecard for governmental and non-governmental organizations" concluded that Balanced Scorecard leads to mission conversion, values and perspective and strategy are operational in standard size which can be used to measure success in achieving to general objectives.

Kaplan and Norton 2007, in their book, which has been translated in Iran considered this issue that the strategy plans are used for describing and visualizing strategy. Moreover, several new topics were introduced such as a pattern that describes the basis of way of creating value in aspect of internal processes and growth and learning.

Furthermore, a case study in 2009 which was done in one of institutions of higher education in Turkey indicated that the Balanced Scorecard system which was designed for private organizations is frequently used for governmental organizations and nonprofit is also applied. Preliminary evaluation of the performance management system was provided in Sakarya University that showed more attention since 2003 to quality management, strategic planning studies. At the end of the project polls forms were distributed in which students and staff expressed satisfaction. By Balanced Scorecard System of Sakarya University (SABSC), organizational strategies were expended to all parts and by verification mechanisms which was implemented from top managers to employee. Creating unfair situations were prevented. One of the most important feedbacks of implementation of Balanced Scorecard refers to creation of Sakarya University's strategic plan. The relationship between top managers and employees was low that enabled them to achieve this strategic plan.

Finally, Robert Kaplan in 2010 in a research entitled mental infrastructure of balanced scorecard concluded that leadership is introduced as the most important variable in describing the success or failure. To express this important hypothesis, leadership must be necessary and also be effective for being successful. Leadership is essential because without it the balanced scorecard is a business reporting system which is obtained by implementation of balanced scorecard in a system for effective strategy to implementation which is not specified.

2. Review of Literature

2.1. Balanced Scorecard

Balanced evaluation method in 1990 was introduced by Robert S. Kaplan, Professor of Harvard University and David P. Norton, the prominent management consultants and both are from the Boston area [1].

This innovative system was introduced as a comprehensive framework for performance evaluation and promotion strategy and improvement of communication which will create balance between short-term and long-term goals, financial and non-financial measures, domestic and foreign operations, internal and external stakeholders, irritants and strategic barriers and shows where the root of the problem is because it represents the relationship between goals and activities that are associated with progression and consider this problem from four-side perspectives including financial, customer, internal processes and learning and growth of human resources [5].

Background infrastructural of this balanced scorecard is that no single criterion can reflect a transparent reflection of an organization's performance. Therefore, strategic objectives of organization are translated into a set of performance indicators [8]

Instead of cross-sectional and short looks on firm performance, we should have a comprehensive look and with equal emphasis on results measuring (financial measurements and delayed indicators), the measurements that show the current state of the company (current indicators) and the measurements

that tell us what we do in the future (strategic indicators) [5].

Many companies are using operating profit as an internal financial criterion and accounting while companies complete this criterion with external financial data (stock price), external non-financial information (customer satisfaction) and domestic nonfinancial information (time of delivery). Companies expressed these financial and nonfinancial criteria by a report with the name of criterion of comprehensive measure of performance. In these reports, the followings are observed: [8]

- Profitability criteria: operating profit and revenue growth
- Customer satisfaction criterion: market share, responsiveness to customers, timely operation
- Innovation criteria: the number of patents, number of new products

Comprehensive indicators to measure performance are known as balanced scorecard which consists of a list of numbers that shows key part of the organization's success. Sectors such as finances, people, enforcement, suppliers, customers and support systems. These numbers must evaluate not only the important results but also we should consider the influential factors or result in outcome factors.

Balanced Scorecard represents interpretation of organization's strategy and shows where the root of the problems is because it represents the relationship between goals and activities that are associated with progression and lead to understanding of this thread that where the organization is going and show to all personnel how to play their role in this pathway [8].

Kaplan says "The Balanced Scorecard is looking to give power and authority to all levels of the labor force by training them about the company's strategy and taking small steps to achieve big goals "The Balanced Scorecard philosophy work is people who supervise on what you have measured. This is mostly because of your accuracy or due to finance. When we look at the actual practice of most organizations rather than their claims, they focus on quantitative financial measure. But, it does not help them to improve their results because if you tell your employees, what they should do to increase shareholder value?

Regarding what determines the value of the stock, high loyalty of customer, high quality and low price of products and so on, you can plan for managers and staff. Therefore, in these cases, Balanced Scorecard by focusing on the organization has magical properties by which the leadership team makes decision for key items leading to successfulness. This is nothing more than a series of numbers namely it is the implementation of Balanced Scorecard whose key is human resources. In other words, we can say that expensive software cannot lead to absolute profitability.

Stephen Letzain believes that the Balanced Scorecard should not be seen as a panacea but it should focus on performance as a dynamic, continuous and integrated process, and should operate as a complementary tool and provide information for present and future pathway that is actually the backbone of the organization's strategy.

2.2. Balanced scorecard perspectives

Four perspectives of financial, customer, internal processes, learning and growth were proposed in general model presented by Kaplan and Norton for evaluating the performance of organizations. Today, it has been proven that the number of this perspective can be different according to the contents and notable areas of organizations in connection with the strategy.

2.3. Performance evaluation and measurement of variables

2.3.1. Measurement and its objectives

A quantitative measurement of the observations of some characteristics is a production process or a project. There are four reasons for measurement including the followings:

- *Characterize*: To obtain an understanding of the processes, products, resources, and environment.
- *Evaluate*: It is conducted to compare the current situation with what has been planned.
- *Predict*: Prediction leads organization to plan.
- *Improve*: Often quantitative information is gathered to help identify barriers, root causes, inefficiencies and other opportunities to improve product and process performance as well as helping to efforts for improvement of measures, scheduling and tracking helps. (Vahidi Torch, 2010, p.59)

2.3.2. The concept of measurement and evaluation of organization's performance

Late 1980s, numerous articles about inefficient methods for assessing the performance of companies were published in management journals of Europe and US. Traditional systems of performance evaluation mainly relied on financial measures and financial affair of companies were responsible for this assessment. In economic era financial measures were good indicators for measuring success of companies, because competitive advantage of that era was mainly based on reduction of whole cost caused

from thrift in scale and dense production. The most complex economic relations and business issues at the threshold of the 21st century, the companies' reliance on financial measures to evaluate performance and demonstrate their strengths and weaknesses were pale and the failure of mere financial measures was more than ever before detected (Kaplan & Norton, 2004).

A performance measurement is one of the topics which are both new and old. Each company in the world typically measures its performance. But what is considered as a new topic is that what should be measured. In this case many managers have been found that their performance measurement systems do not function properly (Iran Zade and Bargi, 2009).

Performance appraisal is a process that to evaluate progress toward achieving determined targets including information about product conversion efficiency, services provided, customer satisfaction rate, achievements, effectiveness of activities along with their specific objectives. Although solutions can be offered to design a performance measurement system, organizations must act according to their specific conditions. In other words, performance measuring system cannot be injected into the organization from the outside; rather it should be designed, developed and improved in organization. (ibid, 2009, p.7).

Nili states that performance measurement is a process of making numerical the efficiency and effectiveness of the activity which leads to performance. In past it has focused on financial performance measures such as sales volume, profit, liability and investment return. These financial measures cannot be matched in complete form with competent and required skills of companies for today's business environment. It is not enough just to know the net profit rate but it is essential that the driving forces behind the success or failure are described. (Vahiditorchi, 2010, p.65).

Performance measures play a crucial role in the formulation of organization's strategies, evaluating of findings and reward of organizational members.

When the financial and non-financial measures in a model participate next to each other, administrators can apply function in several areas simultaneously in order to make strategic decisions effectively.

2.4. Traditional and modern performance appraisal systems

As you know, the traditional performance appraisal systems were mainly based on financial measures that had efficiency in the era of the industrial economic. But in the era of knowledge-based economy, value creation activities of organization do not just depend on tangible assets because performance measurement tools have defects with financial criteria. (Kaplan and Norton, 2004, p.12)

Generally, there is great emphasis on the individual as the subject of evaluating in traditional systems while in modern systems this emphasis is on the processes (Vahiditorchi, 2010).

But the new measurement systems have been created with the aim of implementation strategies. Implementation of strategy refers to making appropriate decisions with respect to link of strategy and organizational structure, development of funds, operational strategy, motivational systems and performance monitoring and effectiveness of the strategy. In adjustment of these types of systems, an excellent manager selects a set of criteria that offer the best performance of the strategy. These criteria can be seen as the critical factors in company's present and future success. If these factors improve, the company has implemented its strategy. What is important for implementers of organization not only is tracking financial measures that depicts the results of past performance but also nonfinancial criteria leading indicators of future performance (Ebne Alrasol, 2005).

Table 1. The difference between traditional and modern systems of performance evaluation

Modern assessment system	Traditional evaluation system
Emphasis on evaluation of processes	Emphasis on performance evaluation
Emphasis on evaluation of organization's different dimensions	Emphasis on the evaluation of rganization's financial dimension
Indicators of retrospective and prospective	Indicators retrospective
Emphasis on improving	Emphasis on monitoring
Creating a reliable and cooperative environment	Creating a reliable environment
Create and promote spirit of creativity and innovation	Low spirit of creativity and innovation
Establishing the cause and effect relationship and finding root of problems	Devote attention to the problem
Process-oriented	Result-oriented
- Emphasis on understanding the goals and strategies before performance evaluation	Exclusive emphasis on performance evaluation
Continuous evaluation	Discrete evaluation

If an evaluation of strategy performs in effective manner, organization can make use of the internal strengths and benefit from external opportunities, identify threats and defend themselves against them and ultimately reduce their force before internal weaknesses (Divandari, et al, 2005).

Performance evaluation criteria are considered as management control systems, because economic programs and key decisions need to

evaluate the performance of organizations. A timely evaluation can lead to an optimized resource allocation. Different countries have different patterns of evaluation.

3. Methodology

3.1. Participants

192 managers of different companies participated in this study including 120 senior managers (director board members), 48 middle managers (product and supplies managers) and 24 financial managers who were working in food companies and these companies were the accepted companies in the Stock Exchange.

3.2. Design of study

The design of this study is based on survey and field study , and in terms of practical targets and performance of research place in framework of inductive- deductive reasoning. This means that theoretical foundations and research background through library, websites, articles, in deductive form and gathering information to confirm or refute the hypothesis is based on deductive form.

3.3. Data Collection

Data collection is done through secondary information in form of a five-item Likert questionnaire.

3.4. Measuring instruments

Since the five-item Likert questionnaire responses are qualitative (too high - too low), they converted to quantitative data (1-5) in order to test the hypothesis.

3.5.Hypotheses

In line with the research questions, the researcher formulated the following hypotheses:

H1: Implementing the Balanced Scorecard is an effective perspective.

H2: The ability to implement the balanced scorecard affects the value of the company.

H3: The ability to implement the balanced scorecard on clarity of financial performance is impressive.

3.6. Variables for each hypothesis

Perspective: The organization's perspective makes visualized future image that make clear the direction of organization and help managers to understand why and how it should be support [12].

Value of the company: The value is a kind of variables, which has wide connotations. This is due to the breadth of disciplines and specialties. In general, the value is the specific connotations human ascribes to some actions, states and phenomena. But the value of the company or financial value in fact is asset prices that are determined in different ways such as nominal value, historical value (cost price), the conventional value, the value of trading (market) and intrinsic value (current) [8]

Value of the company = Stock market price × Number of shared stock

Financial Performance: Financial performance of each organization is evaluated with respect to costs and revenues. Profitability is a function of costs and revenues. Financial performance emphasizes the size of the accounting and financial and indeed these sizes are considered for the outcomes of performance management [1].

Balanced Scorecard: The Balanced Scorecard is a framework not only measures past performance with the help of financial criteria. But, at present one can measure factors that are the determiner of the future performance. It should be noted that the objectives and assessment criteria in this technique is extremely influenced by organization's perspective and strategy [13].

4. Results and Discussion

4.1. Descriptive statistics

Statistically, the research hypothesis can be demonstrated as follows:

$$\begin{cases} H0: \mu \leq 3 \\ H1: \mu > 3 \end{cases}$$

Regarding the judgment of results of data analysis, if the amount of calculated mean in each hypothesis is 3 or less than 3, H1 is rejected and null hypothesis is accepted. In other words, research hypothesis is not confirmed. If the calculated mean value is greater than 3, the null hypothesis is rejected and H1 is accepted. In other words, hypothesis is confirmed.

4.2. Research hypotheses testing

After data were analyzed, the following information were obtained in order to reject or confirm the hypotheses.

Table 2. Descriptive statistics of the impact of the implementation of a balanced scorecard with a perspective

N	Mean	Median	Mode	SD	Variance	Max	Min
120	4.13	4	4	0.579	0.333	3	5

As it is clear from Table 2, the average of implementation of the Balanced Scorecard rate with a perspective is equal to 4.13 ± 0.579, which is greater than 3. Therefore, it can be concluded that the first hypothesis is accepted.

Table 3. Descriptive statistics of the ability of balanced scorecard implementation impact on the company's value

N	Mean	Median	Mode	SD	Variance	Max	Min
120	3.72	4	4	1.02	1.047	1	5

According to table 3, the average of implementation of the Balanced Scorecard rate on

company's value is equal to 3.72 ± 1.023, which is greater than 3. Therefore, second hypothesis is accepted.

Table 4. Descriptive indicators of the ability of balanced scorecard implementation impact on the transparency of financial performance

N	Mean	Median	Mode	SD	Variance	Max	Min
120	3.93	4	3.7	0.6	0.36	2.29	4.86

As it is clear from table 4, the mean of the ability of balanced scorecard implementation impact on the transparency of financial performance of companies is equal to 3.93 ± 0.607, which is greater than the number 3, leading to this conclusion that the third hypothesis is accepted.

5. Conclusion

Organizational development depends on creating competitive advantage through effectiveness (short-term) and applying successful strategies (long-term).Despite the importance of strategies organizations attempting to apply them, results show that very few organizations are able to implement the strategies. Indeed, control systems are not able to do their job properly, because these systems are often based on mere financial control. While the financial controls control results of past performance and cannot afford to evaluate comprehensively the organization's ability to implement strategy. On the other hand, if the organizations are interested in implementing the strategies successfully, they need to mobilize all its assets including both tangible and non-tangible, whereas traditional financial controls are not able to do that. Performance measurement system, with the balanced scorecard approach will be able to overcome barriers of implementation applying strategies. Indeed, as it was observed in research, by implementing this model in the companies, it can be better to reach the desired perspective of company. As a result, the company's long-term goals are achievable and financial control and company value will increase as well. In addition, the ability of companies increases for the implementation of strategies to achieve the desired perspective of company. In fact, implementation of balanced scorecard influence on the transparency of companies' financial performance.

5.1. Recommendations and suggestion for further research

The following recommendations will be suggested for the companies:

- It is necessary for food industrial managers to act for the preparation of perspective and strategic management in order to survive in the market.
- It is recommended for the General Assembly of food industry to take action toward the performance evaluation of their managers by making use of the balanced scorecard.
- It is essential for actual and potential investors to look at company's perspective before buying stocks and take some action to evaluate the performance of its managers in a framework.

Regarding the suggestion for further research, the followings can be mentioned:

- Performance evaluation of other companies with the Balanced Scorecard
- The study of the reasons why companies do not use perspective for their survival
- The evaluation study of companies' performance towards the perspective with different models

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Theater Therapy and its Integration with Improvisation

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Abstract: Role playing has been a common treatment since immemorial and theater therapy was founded by Jacob Levi Morand in the 1920's. Theater therapy runs in the open and flexible environment which the authorities observe and investigate better solutions on their issues and Treatments of predominant personality characteristics, interpersonal communication, contradictions and inner conflict as well as psychological and sensational disorders by special procedures. The main factors of this method includes: 1- first person (protagonist) which is the main axis exhibiting his/her psychological problems with the help of others called "helper" 2- "Helper" which exhibits different aspects and dimensions of the first person 3- Director (therapist) who guides participants in drama therapy towards greater awareness and insight. 4- Stage, scene of theater is circular. This method is not restricted to the patients but it is applied to delinquents, criminals, education, industry problems and so on. In theater therapy, the individuals are assisted to play and review the issue instead of talking about that. On the scene of psycho-dramatic disorder, self-centeredness is discovered and the individual hears himself through his own language and since there is no punishment, the person starts the creativity which le ads to the appearance of inner personality conflicts and contradictions. Finally, when it reaches to the level of creativity and spontaneity (improvisation), it would be easy for patient to show emotion.

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Key words: protagonist, helper, psycho-drama, catharsis, impromptu, director, speech therapy

1. Introduction

Playing a role as theater has been existed since ancient times and after the creation of civilization and urbanism. At first, the theater was used as a means to perform certain traditional ceremonies. About four thousand years BC, the Egyptians took advantage of theater and tragic theater flourished in ancient Greece. Ancient myths like Oedipus myth came on the scene. Dancing, and singing are regarded as a human need for symbolic expression and then are gradually replaced in certain cases such as training and education and psycho-therapy.

Theater therapy was founded by Jacob Levi Moreno. He was a psychologist who was born in Romania and was living in Vienna and finally in the year 1925 went to America to continue his career. He was one of the followers of Freud and conducted a tireless and hard effort in separation principles of theater therapy from principles of psychoanalysis.

In today's theater therapy, the essence of group therapy, Gestalt therapy, analysis method of behavioral therapy relationship and some other methods of psychotherapy are used.

To define theater therapy, it can be said that following a group therapy and outstanding characteristics of personality, interpersonal relations, conflicts and psycho contradictions as well as mental and emotional disorders can be observed and evaluated.

In 1919, Cori March used group therapy method to psychiatric patients. In the 1920s, Jacob Levy Moreno employed group therapy for non-admitted (outpatients) neurotic psychiatric patients.

Samual Slavason whose main profession was mechanical engineering founded "The American association of psychological group therapy" in 1948.

From the 4th decade of twentieth century on wards, groups therapy became one of the methods of psycho-therapy drawing the attention of psychologists and psychiatrists.

The early man accustomed to show the form of his excitements and psychological sufferings by body movement, anger and happiness since the pre-historical times. In the most primitive, in which social and religion customs were more performed collectively, love and episodic stories were done by imitating the gestures and movements by which they reduced stress and excitement. After the foundation of medical science, many psychic and physical patients were treated with the aid of (psycho-dramatic) shocks.

Aristotle invented the word Catharsis; he used this term for expression and decreasing the

exhilaration effects of Greek dramas of Hercules torch and Achilles on the spectators. Aristotle believed that drama by means of artistic theaters has a tranquilizing effect on the lost affection and selfishness and spectators will heal.

Since the psychodrama theaters of Vienna in 1919, the concept of Catharsis has changed. Instead of influencing audience, it tended towards actors (spontaneously) and when Moreno registered the spontaneous theater in 1923, he defined Catharsis as follows. It has a curing and healing effect not on the audience but on the actors and executors by which at the same time he creates it and frees himself from it.

In theater therapy, we can simultaneously think that behavior and excitement together recognize inter-connections and the contradiction. In brief, in this kind of treatment thought, feelings and behavior, every three come to awareness and in the process art creation is in integration, adjustment and conformity between these three elements. The means of therapy and drama therapy consists of music pantomime, improvisation, doll and etc. The best possibility of treatment is artistic dramatic therapy that has plenty of dramatic possibilities. In safe conditions of theater therapy, individuals are invited impromptu because it is in this safe circumstance which spontaneity and creativity would arise.

1.2. The purpose of theater therapy and its implicational methods

Theater therapy was founded in the 20th century by Dr Levi Jacob Moreno. Theater therapy is a kind of scientific search for truth through a theatrical manner.

In theater therapy, the person is assisted to act out and review a given subject instead of talking about it. In practice, the interaction is implemented between individuals, engaging with the problem, and engaging of body and mind simultaneously. Further, the most anger mode of behavior or the more visible fears leads to awareness of hidden and collapsed excitements.

Practical approaches are effective not only for prescribing patients who possess limited capacity of mental activity but for those who have badly experiences and deny a making logic mechanism. It can be used in any area that requires disclosure of the psychological dimensions of the issue.

Education, psycho therapy, industry and industrial communications, experimental learning and in the field of mental, hygiene has a wider range of applications such as health care mental hospitals, clinics and counseling centers in spurious treatment of drug addicts in rehabilitation centers.

2. Theater therapy for adolescent and the young

It is effective for emotional treatment and conflicts of children, adolescent and young people. These methods can be changed occasionally and performed at home, clinics, child counseling, treatment centers, orphanages, speech clinics, nursery schools, recreation centers, summer camps, family classes and sports field. Theater therapy can be applied also in professional training such as social work education, teachers, nurses, missionaries, police, medical students and other groups.

2.1. Psychodrama principles

Self motivation and creativity is one of the fundamental features of psychodrama, acceptance of desiring roles and flowing ultimately free speech. Free creation and self motivation enables a person to decipher the role uncovers. The magic of improvisation is an opportunity to be a gift to the creative consciousness and actor to create new reality in the heart of their living reality and for this creativity there is a need to practical freedom which so far he has not experienced it. The reaction of human creative consciousness is a response to external adversity which is manifested through improvisational acts. Moments of self motivation and improvising in psychological shows are considered as a kind of reflection of personality and reflection of mental organization to the closed framework of life. Even in cultural norms, we cannot easily talk about sheer imitation. Self motivation is the basic need of life. Clients (Protagonist) talk about itself in creative scene and illustrate the deepest inner needs.

Psychodrama is a harbinger of flexibility. In this method, the living space is an expanded and desiring space. Barriers and prohibitions of this treatment are very little. In the space of psychodrama, the person can do everything and give them concrete realization without any fear of his/her behavior consequence. As Psychodrama is a kind of living exercise that the person is not punished because of his/her mistakes. Helper selves are some aspects of person's self and different dimension of his/her characteristics. These helpers' selves play as group members in the stage against protagonist (first person). Psychodrama is a response to repeated mental illness and his/her robotic style life.

In Psychodrama, what is replaced by stories and authors scenarios is the life story of the person which has been recreated at once and is performed immediately. Here protagonist stands in the center of play and is the hero of his / her real life events. If occasionally he goes out of his role because of technical requirements and plays the opposite role

his/her aim again is to correct his/her attitudes. The psychodrama can have the following functions:

- Through psychodrama, one can upgrade what it is to what it can be and achieve the improvement of mind, emotions and suppressed affections and gain a translucent look of self.
- Through psychodrama one can search for the person's past, present and future and opens closed doors of mind and find the enclosed inner way of characteristic which is the main role.
- Sometimes it can be reached on this importance by exploring dreams and fantasies and sometimes these unknown parts of character can be realized with dramatic plays.
- Playing different roles teach an individual how to take the accustomed and unpleasant behaviors and adapt with the new behavior.
- The role is part of life, so it should be analyzed all stages of human life from birth to death to create it in a true and correct manner.

In theater therapy definition, Moreno starts his career with the slogan "I want to be myself". In his point of view, the most important psychological and educational achievements of the drama therapy is to teach spontaneity (elasticity movement) and creativity. In his opinion, creativity and spontaneity are the fundamental of human personality and in principle the human being is based on creativity. However, creativity involves errors and essentially without the possibility of mistake and spontaneous movement no one would learn something.

2.3. Theater therapy and its elements

Theater therapy is carried out with two elements of action and active observation. Action means mental visualization via dramatic movements which is done by special techniques (Doubling, the mirror, movement, hot chair, dark room, empty chair, fairy dream and projection). Active observation means to be aware exactly of what we experience in any moment of time. In the theater, the time is always present tense even if some parts of past and future is traced by the authorities.

Moreno believes the person is forced to act and observe in the moment. He has to react against what is going and forces the others into act. Therefore, the person is the creator and the creature at the same time.

Human in the scene of theater therapy is creating and projecting his inner world and outer world constantly, and the world is made of these two worlds.

Theater therapy is a way of intersecting two worlds of out and inside and a different way to reach creativity where communication is established between the conscious and unconscious parts of mind and human emotional process is formed.

Spontaneity has a great importance in theater therapy. The people do not enjoy any text on the stage. They attend on the scene to find a worthy response to the situation. Regarding the most important feature of theater therapy, we can mention the followings:

- Cause to creativity and spontaneity.
- The inner images are to be objective.
- Since there is no discipline in theater therapy and everything is possible, things experience that has never been experienced in real life.
- Theater therapy is the language of emotion, affection, act and observation.
- Theater therapy is a confliction of central character with the understanding of space and situations. And, with this act, the right hemisphere of the brain is stimulated and it stimulation leads to increase of spatial awareness, memory and affection. As Moreno says, theater therapy is an aesthetic description of freedom, because in the stage one can become everything he wants. Since showing them, one can review his / her problems via dialogue.
- In the scene of psychodrama, the self-centered disease is discovered where the person hears his description via his own language. If he/she is not able to describe him/her a helper goes to assist.
- The role enjoys such a place in the theory of psychodrama which Moreno considers it prior to himself. The role is not a product of self, but the creator of it. Role was existed before the advent of self. Young children are not capable of self – perception in the first period of their lives, but at that same period play their role. In short, the role before the formation of ego and before self starts its action. So at first role is born and then the role consciousness, that is self or ego.

One of the main elements of psychodrama is "Director", that is an individual who is expert in psychotherapy. Since he accepted the psychodrama as a guide of therapeutic activity, he gained the scientific and practical skills and is familiar with the art of theater and role playing. The most important role of director is to prepare the way for spontaneity. If a director consider the group dynamics, he can understand which one of team members is ready to display a section of his/her life in front of the group.

The first person (protagonist) is selected by the director or group or volunteer. The director encourages the persons to express their issues and perform them at the scene. And this performance has a natural and spontaneous form.

The director has a variety of actions, display production, therapists, analyzing the game and group leadership is considered as one of his most important actions. One of the important duties of a director (the therapist) in psychodrama is production. Finally, the director role in production includes:

- No danger scene (a free risk environment for first person)
- Stage resolution (mise en scène without any annoying and untargeted associations)
- Presence at the scene (in order to support the first person to be present at the scene)
- Use of space (any space in which the first person to be able to play among the other actors)
- Use of the platform (use of a platform is necessary)
- The audience and the stage (stage observation by the audience and a sense continuity)
- Changing the scene (If there is any need to change the scene, the scene changes)
- Light (light is an important role, has many symbols)
- Equipment (some does not believe in equipment and thinks that creativity and spontaneity of the actors should utilize as much as possible)

2- Protagonist (first person): someone who has mental, social and personality problems and is introduced to the group to improve and achieve the changes and psychological desired changes. Protagonist is the hero of the story and is the main aim of treatment (he is the patient or client). Feeling of safety and trust that is the basis of psychotherapist is at its peak in psychodrama.

3. How to select the first person?

The first person is chosen by the director, by the group, introduction by others and based on readiness. The first person explores and exhibits his own inner world in the stage. He is the main element of psychodrama.

The very important technique melting the closed spontaneity and frozen creativity of first person is the "*role inversion"*. This technique is capable of improving the behavioral treasury of first person and causing the variation in his/her behavior.

The second technique is "*poly protagonist"* in one stage, in which the simultaneous presence of several references in the stage of psychodrama requires high experienced director, intellectual defense to lead them on the stage and practical skills that should be scientific and practical expertise. When the clients problems are more similar to each other and there are other variables (such as age, gender, culture, education, etc.) one can use this method.

The third technique is "*Blocking the first person in the scene*". In the procedure of psychodrama, it is possible for the first person to lie in the interruption and blockage situation of energy where there is no passages to continue the play.

Some ways that director deal with the problems of interruption and blockage situation of energy in the session of psychodrama include the use of a partner, playing the reversed role, the use of the coming technique, other team members, and stop the play.

The fourth technique "psychodrama and telling the story of the soul, or storytelling", is used when the concept is retelling his life. Through this way, one can improve their relationship with one's soul. On one hand, with the deepest parts of his/her mental and on the other hand, it connects to the highest and most idealistic inner desires.

Building a new concept in recent years which have been increasingly considered by philosophers and psychologists can be considered as another technique. Psychodrama is one way to aware of this creative process.

One way to understand the creative nature of mind is family therapy. In fact, each member regarding to the set of his/her mental attitudes (especially emotional) considers parts of event and rebuilds it in a completely unconsciousness manner. In psychodrama sessions, we realize the astonishing power of creative retelling process or reconstruction. But, the human needs moments of new evolution in the set of his personality. This evolution is called "*intuition*".

The evolution means the entrance of soul to the realm of psychology. Some therapists are going to use the term soul in the process of psychodrama effect. This method of treatment deepens the realms of meaning and imagination. Deepening is the person's continuity with the soul.

Spirit is a simple semantic meaning and therefore communication with the spirit means entrance in fluid and unconscious inner world which has a global nature. In the stressful world of individual and social life, the spirit lose parts of his existence. But. It is always searching for his missing part. Need to hear and be heard indicate the spirit effort to recover its wholeness. In the story retelling

in the scene, the spirit tries to rescue the unwanted break and gather it's lost.

Ego- the human self has the role of mediator between the soul and the world. My world, self and soul are in the continuum its starting point is the outside world and visible realistic in the material and human world. The midpoint of the continuum is the human who is able to bind the spirit world among the best and most ideal conditions. The spirit is not able to manifest itself while the spirit is crystallized and proves its existence.

The stage psychodrama is the binding of spirit separations, the strengthening of the place of relationship among three elements, world, ego-self and the soul. Retelling the story of life is the outline of soul ulcers and its treatment. Psychological effects of this retelling are also critical.

Retelling is not just an alert, but can take picture the human in his/her dream. Storytelling in a dream can be noted in a few points:

- The unconscious nature: therapists ask the clients to rebuild the scene as it was in the dream world. Validity and therapeutic value is performed based on the dream events, as the source of story is the unconscious system and creativity of personality. Between the human behaviors, no behavior but dream enjoys arousal feature, so it is noteworthy. Therefore, the purest psychodrama sessions are hidden behind the dreams, since the most unconscious life stories appear in dreams which is full of emotion, passion and happiness.
- The symbolic nature: dreams are full of different symbols: personal symbols, cultural symbols, ethnic, and international symbols. What are depicted in dreams are the symbolic retelling and life story and its objective are visualized and repeated.
- Refining value of dream: retelling the life story and illustrating and visualizing life events in dream has a great action therapy.
- Moreno, in comparison draws a parallel between the theoretical basics of psychodrama, psychoanalyzing of stage and playing parts of clients' life in the scene and dreaming. He believes that Freud interprets and analyzes clients' dreams, while the therapist of psychodrama encourages the clients to dream again.
- Helper egos: in order to bring objectivity to the subjective world of the first person (protagonist) it is required in addition to the first person, other people come on stage and play the role of influential people in the life of first person.
- Helper ego and theoretical position: if we consider the presence of helper me as an expansion of client personality and objectivity of inner world, then what is outer and objective, has a root in the theory of subject relations.

Otokrenberg (1967) explain how every interaction with the outside world (e.g. Feeding the baby by the mother) leads to a symptom of memory that stays in the mind and includes internalizing those aspects of self in connection with some aspects of others. This phenomenon is related to the memory of emotion.

In the psychoanalyzing these aspects come into inner issues in the mind.

Helper ego: group members are involved in life group by undertaking different roles such as the role of advocate, and helper and helper ego as necessary.

Director's role is clear in some treatment sessions, but some sessions may consider as the mother or the father, a phenomenon that Psychoanalyzing refers to it as transformation.

There are two roles for helper ego: the first is related to the discovery of the inside in which one of the unique techniques of psychodrama is to discover the inner world of group members. Guiding of client or first person can be regarded as the second role in which helper me in their relationship with the first person facilitates his/her cognitive development and leads him/her to the higher level of knowledge about themselves and communication with others and the world.

When helper ego could consider creatively and accurately some of unknown aspects of the first person and guide him to study the aspects that are usually very high therapeutic value, has accomplished his main task.

1- Acting role: the helper ego's role as an analyst or counselor and therapist has a profound impact on the quality of the display.
2- Scene: the scene where psychodrama is that clients and helper egos have been on it and play the role. This scene is often circular and group members and the audience sit around it and the scene has profound philosophical and psychological explanations.

In the superior scene, psychodrama leaves good effects on psychiatric patients (schizophrenic). Since the patients suffer from auditory hallucinations and can't deal with the problem, the director based on the principle of superior reality gives character to their mind voice and then a conversation occurs between the patients.

Regarding the superior time, the time has three dimensions including past, present and future

and that each of these dimensions is the source of suffering and stresses. It is worth mentioning that the coordination of these dimensions is to influence the clients.

Further, appealing to the approach of superior time in the stage of psychodrama is based on the conflicts removing. As alive and dead come together on the scene, imagination and reality forget their permanent conflict. Therefore, the superior reality is created and the past and the future are intertwined and ultimately the superior time is created.

Moreno confirms the dynamics of the present and call it here and now. It cannot be denied that a number of psychological disorders result from patients' anxiety about the future phenomenon.

The most important techniques used in psychodrama are accurate and effective ones and are designed for situations that allow the client's compromise with the future.

The evolved concept of superior time in psychodrama and dreams is to strengthen the life force and keep up with the being soul. The unconscious state which creates the sleep mode is the magnanimous source of the rebirth of the vital forces. During sleep, human is doing procreation and creativity.

As Blanter believes (1996), one of the most important assistance of psychodrama is that it supports the developing flow towards the technical integration in psychotherapy. Though it is possible to apply psychodrama efficiently to various types of individual therapy, its strongest state is when the group reception is used.

Therapists face to this challenge that what would be a useful tool in a given situation. Blanter (1996) believes that psychodrama is not a panacea and should be judged properly and be applied in balance with other group skills of therapy. Although arousal is one of the fundamental concepts of psychodrama, it can be exploited. It is necessary for a group leader that his/her resilience, creativity and encouragement for using new techniques be accompanied with their caution, respect to members and attention to welfare.

Further, those who use psychodrama should be careful to observe people who has exhibitive behaviors or people with severe disorders. It is also important that leaders have experience and knowledge of dealing with psychopathology.

The play has a positive effect on individual's creativity or the patient which is a factor to discharge the inside of a person. But, when the therapist faces with people, who have trouble in communicating, here it is essential to find new strategies to overcome the patient's problem. Further, those who lack confidence or have no motivation to communicate must be encouraged to communicate and motivate in order to create creativity and foster analysis and verbal and physical performances (To accomplish).

4. Speech therapy

When the speech therapy is done, the person expresses his sentiments and opinions by talking or expression and the person is encouraged to stimulate his subconscious mind and to express his thoughts and feeling.

Those having problems are not aware of the nature of their issue end even it is possible for those who are aware of their problem not to be able to complete discharge and to relax themselves. (Such as loss of a dearest one).

Expressing manner of each person depends on his/her thoughts and feelings. In fact, the expression is a bridge between feelings and thoughts. Now the time of expressing is important and is done consciously or unconsciously. Whenever a person feels the need to communicate with others tries to express hidden feelings through non-verbal expression. This act is done consciously and people tend to express their daily life through the day and night dreams, fantasies, and desires that may be unconsciously and while the life is going they are able to express their description. Further, people are always playing different roles. However, what is important is that in all of these roles, there are the existence character of the individual with that playing role.

One of the duties of psychodrama is to help the patient in order to discharge him/her and to establish the necessary condition for a peaceful coexistence between him/her and the virtual person.

Dreams are also effective in changing mind. The dream is a living sample of subconscious mind which plays an important role to fulfill wishes and strengthen the emotional relationship. When it interprets a correct image of patient, it plays an important role in his/her treatment, so in receiving its important points, it should be done with sufficient accuracy and insight.

The therapist as a leader and guide enters the person into the world of imagination and after pouring out all his inside world returns him/her to the real world and at this time treatment begins. When the patient says, no one understands me, I feel being or not being of me is not important for anyone, I do not have independence, and I am damaged emotionally and so on.

In some cultures, the loneliness and strangeness emotion of this people push them to the sport and art, so perhaps in this way, they can show off and they intend to remind the society of them to be gain importance and value.

To assess the health condition of the client, some insight into the skills is needed to see the unconscious factors in the person's attitude clearly. These methods can be said complementary to the verbal analysis during the analytical psychotherapy (called psychoanalytic) in relation to emotional problems. Since each client has its own unique issues and capabilities and so has an independent solution, the person should express his/her emotions, failures and inner conflicts with improvisation and creativity in a space which produces inner peace for him/her.

Therapist and the director can consider an occasion and position without conditional dialogue and with the improvisation of the first person (client) and indirect relationship on stage in a manner that the client does not feel director controlling and be able to express and discharge his emotions and create new insight. And, while the client doesn't reach to the level of creativity and spontaneity (improvisation), showing emotions is not easy. Furthermore, everyday imaginations of the client has a self-consciously and self –made dimensions and gives him the power to watch him in distance. This imaginations are part of the human aspects includes the surplus fact.

When the client stands in the scene and communicates with the accessories, touches them, plays with them, takes hold with craving, tears, keeps the exclusion, he/she discharges all of his/her feeling towards those symbolic tools. He expresses all of his feelings and hatreds.

Finally, the space construction can face the persons with their behavioral mistakes (client) in an environment free of risk, which is draining emotions and encouraging to the consistent behavior. Then, the desired result will be achieved.

5. Conclusion

Theater has been used since ancient times to perform certain rituals and traditions. Dance, verbal and non-verbal movements have been as different symbols and it changed to an art over time. In the 20s was found by Jacob Levy Moreno as an effective art in treatment and discharge of individual and group emotions.

This art is used in training, education, mental health professions, treatment of children and adolescents with emotional and physical problems, in some professions such as teachers, nurses, missionaries, etc and in the industry through the role performance and management skills, and also group therapy and family therapy.

In the theater therapy, outstanding characteristics of personality, interpersonal relations, conflicts and psycho contradictions as well as mental and emotional disorders can be observed and evaluated

Because of the performance of mental illnesses arising from the emotional disorders and accumulation of stresses and negative and positive emotions on the stage, they can justify the clients and cause to discharge all of the mental and emotional aspects of an individual.

The best possibility in the treatment of the client about his character issues is through psychodrama which has plenty of facilities. In the safe situation of theater therapy, the individuals are invited to be improvised, because it is only safe condition which leads to spontaneity, creativity and advent of feelings, emotions and discharge of them. This situation is a position to consider and solve the problems with reduction of action and emotional distance. In this way, they can make flourish their destructive reactions. One of the most important tools of these changes is the roles replacements in improvisation.

When tragic and painful situations that occurred in earlier times are repeated, their pressure would be reduced and each time of reconstruction by the client has a less pressure on him. In addition, at this time, he achieves his repressed emotions and feeling and gains a transparent view of his own life and finds his balance and gravity point through the theater therapy since nobody will punish him because of his mistakes on the stage.

In the scene of improvisation, the person is constantly creating and projecting his inner world to the outer world and his world is made of the intersection of these two worlds. Therefore, improvisation is the intersection of two inner and outer worlds and is a different method to reach to the creativity of the client. Since the time is not a single dimension reality, in theater therapy which is not focused on the past, the person can trace the different parts of life in the past, present and future.

Thus, in the theater therapy, treatment is reflected as a kind of client-centered treat. As Carl Rodgers, the father of counseling believes, the counselor should be beside the client to help him from mistakes and it is the client who conducts the counseling sessions.

The treatment method of theater therapy is like this. Treatment of the therapist is like assistance and the client come on the stage without prior dialogue in an improvisation manner. The therapist is

allowed to use only theater therapy methods in order to clarify and explore client's problems. The improvisation of feelings and emotions should remain in the client-centered manner. The director (therapist) allow the client (patient) to participate with his own steps and without any violence in the theatre therapy process to use his spontaneity and creativity to discharge emotions and feelings and the therapist determine indirectly the direction of patient's role.

Finally, with the use of symbolic objects of the stage, the director can define the correct direction of exploration and self-connection for the client in order to disclose the blind spots of problems and unsatisfied needs on the stage.

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The study of relationship between earning management through real activities and cash flow operation in companies accepted in Tehran Stock Exchange

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Abstract: The main goal of this research is to study whether is there any relationship between the criteria of earning management through real activities (non-ordinary cash flow, non-ordinary production and non-ordinary arbitrary costs) and cash flow operation? Statistical population of the present research is all companies accepted in Tehran Stock Exchange which 103 companies were selected by randomized sampling method. Regarding to that the collected data for hypotheses were of combined data kind; panel analysis method and the integrated least squares regression were used to test the hypotheses and to estimate the coefficients. Research results indicate that at confidence level of 95 percent, there is a relationship between the criteria of earning management through real activities and cash flow operation and this relationship is of the inverted kind.

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Keywords: Earning management through real activities, non-ordinary cash flow, non-ordinary production, non-ordinary arbitrary costs, and cash flow operation.

1. Introduction

Through selection of special accounting policies, change in accounting estimations and management of the assumed items, the managers balance the reporting profits.

One of the fundamental goals to formulate accounting standards is that the consumers can make relatively relevant and correct decisions by relying on financial statements. Therefore, the accounting profession needs that method of reporting in which the benefits of all customers would desirably be observed. On the other hand, to achieve special goals which satisfy logically the benefits of a special numbers, the managers report the profit in such a way that is contrary to the goal satisfying general benefits of the customers. The auditors are responsible to confirm the desirability of financial statements within the framework of accounting standards while accounting standards give authority to the managers to select the accounting method in some cases. In fact, the problem is resulted from this issue that earning management causes sometimes the financial statements to be confusing, while in terms of placing within the framework of accounting standards, financial statements have no difficulty and the auditors cannot criticize financial statements in this respect. Therefore, regarding to that profit is one of the most important factors in decision–makings; users' awareness of being reliable the profit can assist them to make better decisions. (stolowy and Bereton, 2004).

Manipulation in cash flow operation by manager is not easily possible unless he delays or proceeds consciously and intentionally cash flow related to incomes or costs. In this research, it is assumed that earning management rate depends on operational activities. On the other hand, when operational activities are weak (based on cash flow operation), companies intend to follow earning profit strategies.

Regarding to benefits opposition between the managers and investors; sometimes, the profit is managed by the managers and therefore, the reported profit is different from real earning. In this case, users of financial statements should have more precision in their decision-makings and they should perform more cautious.

Since the distance between earning management and the reported deceptions is not very high, and since the main task for the auditors is not to discover the deception, the results of this research remind the risk of fraud presence in companies which have performed earning management both to the customers and the auditors (Mashayekhi and Safari, 2006). One of the goals of financial statements is to reflect the results of management supervision or their calculation in respect of resources which are available for them. The users of financial statements to make economic decisions intend often to evaluate

the task of management accounting or supervision. The above-mentioned economic decisions include cases such as sale or maintenance of investment in business unit and re-selection or replacement of managers. The users of financial statements examine and evaluate the task for management supervision regarding to financial statements. Profit and loss statement is one of the financial statements which enjoy a high significance in evaluation of the task for management supervision. Profit and loss statement reflects the performance of business unit and involves the efficiency resulted from the resources under controlling of business unit's management.

Since preparation of financial statements is assumed by business unit's management, it is possible to perform earning management due to different reasons (Pour Heydari and Aflatouni, 2006). On the other hand, by considering the assumption of benefits opposition between managers and owners, the managers of economic agencies enjoy the required motivation to manipulate the profit by the goal of maximizing their wealth. Regarding to the authority which they have especially in implementation of the lagged items, the managers seek to be informed about the method of affecting these factors on their wealth until by implementing them parallel with their benefits, they would maximize their wealth as much as possible. Of course, sometimes, the benefits of managers will be guaranteed when the benefits of stock holders shall be guaranteed. As a result, the managers have strong motivation to maximize shareholders' wealth, because they regard their benefits owed to increase in stock holders' welfare. Therefore, the managers embark to perform earning management and to increase stockholders' wealth; not because of this that stockholders' asset shall be maximized, but because they intend to guarantee their own benefits. Especially, when this event occurs those managers' salaries and benefits are a function of increase in stockholders' asset. In this case, the managers will embark to perform earning management by more motivation. On the other hand, the owners of business units may be the incentives of managers in order to exert earning management in order to exert earning management in direction of their interests (Bahar Moghaddam, 2006).

According to definition of Noronha et.al. earning management is a chain of objective manipulations in the process of external financial reporting, from legal activities to fraudly violation of the accepted accounting principles in order to mislead some stockholders about the performance of business unit (Noronha, Zeng and Vinten, 2008).

A review on the performed studies in respect of earning management indicates that the managers can manage the current term profit in two methods. In first method, the managers manipulate the profit through arbitrary undertaking items. In this method, the accounting procedures are based on the accepted accounting Principles but the effort is made until real economic performance shall be shown ambiguous. (Gunny, 2005)

This method of earning management is generally performed at the end of fiscal year and after accomplishment of most of real transactions. In this method, the price of undertaking items influenced but it has no direct effect on cash flows. (Roychowdhury, 2006)

On the other hand, sometimes, the managers manipulate the profit by real activities. Especially, the time and rate of real activities such as production, sale, investment and financial supply activities can be changed to achieve the desired profit goal. For example, the reported profit can temporarily be increased through excess production, elimination of arbitrary costs or delaying them and also decrease in prices at the end of year in order to transfer the sale of future fiscal year to the current year. Generally, this manipulation of real activities indicates to earning management through real activities. In general, the decisions of earning management through real activities are made by managers before earning management through undertaking items (which occurs generally at the end of fiscal year).

When the managers use both earning management methods as a substitution for each other, the application of each of these, methods depends on their relative cost in views of managers (Zhang, 2007).

Various studies have discussed the manipulation of managers in reporting process not only in estimations and selection of accounting methods but in operational decisions. Manipulation of real activities through excess production was studied by Thomas and zhang (2002).

The results of their research show that the managers have produced more than the required value for sale and normal level of the inventory which this results in decrease in the finished price for the sold item and consequently, increase in profit (Thomas and Zhang, 2002).

Also, there is various evidence which real activities' management emphasizes on decrease in the costs of research and development in order to decrease the costs. According to the results of performed researches in respect of earning management, most managers intend to use the manipulation of real activities for earning management even though this damages to future value of company (Graham et al. 2005).

Also, Yu showed that companies with strong motivations manipulate real activities more than other companies for earning management (Yu, 2008). Now, this question is posed whether when operational activities are weak (based on cash flow operation), the managers use manipulation of real activities by goal of increase in profit? In response to this question that why instead of using earning management through undertaking items, the managers intend to use earning management through real activities, various reasons are presented. First, managers in earning management through undertaking items may have a limited flexibility (on the other hand, in reporting the arbitrary undertaking items, company's ability may be limited). For example, company operations and manipulation of undertakings during last years, can create a limitation for the undertaking items management (Barton & Simko, 2002). Generally, it can be said that if a company has used earning management through the undertaking items more than other industrial companies in the past, it will enjoy lower flexibility to exert earning management through the undertaking items during future years. Therefore, it has more inclination towards earning management through real activities. Second, selection of adventurous accounting methods for undertaking items, especially in studies of stock exchange, guarantees a high risk. Third, essentially, earning management through the guaranteed items should be performed at the end of fiscal year, while the auditors don't permit some accounting operations at that time period. On the other hand, operational decisions are under control of managers; but the selection of accounting methods will be addressed by the auditor (Gunny, 2005).

In this research, the following hypotheses are reviewed:

Primary hypothesis:

There is a relationship between earning management through real activities and cash flow operation.

Secondary hypotheses:

First hypothesis: There is a relationship between non-ordinary cash flow and cash flow operation.

Second hypotheses: There is a relationship between non-ordinary production and cash flow operation.

Third hypotheses: There is a relationship between non-ordinary arbitrary costs and cash flow operation.

2. Material and Methods

This research is placed within the domain of verification researches of accounting. Regarding to that historical data has been used in hypotheses testing; it is classified into pseudo-experimental research group.

Also, since the goal of performing this research is to study the relationship between earning management through real activities and cash flow operation; regarding to the nature and method which are used in this research, it is regarded as a kind of descriptive-correlational research .

In addition, in terms of statistical analysis, this research will use the integrated regression. Meanwhile, data analysis and testings are performed by aid of Excel, Eviews and SPSS softwares. All companies accepted in Teheran's stock exchange during the years 2004-2009, constitute statistical population of this research. By consideration of several criteria and using of census method, the companies accepted in Tehran's stock exchange were studied and a sample including 103 companies was obtained. The required data for this research was collected by compact disc of stock reporting, novel achievement (Rahavard-e-Novin) software as well as the reports published by organization of exchange and securities. Then, Excel page was used and the required variables were calculated. Due to being data as integrated, panel analysis and pooled least squares (PLS) regression through SPSS software was used for hypothesis testing and coefficients estimation. For analysis of regression coefficients, t-student test was implemented and for total regression, F-test was applied. It should be mentioned that the following tests were performed before regression analysis:

1- Normality of dependent variables (using of kolmogorov-Smirnov Test).
2- Homo scedensity of variances for different levels of independent variable (using of Scatter plot diagrams).
3- Lack of self-correlation between model remainings (using of Durbin-Watson Test).
4- Appropriateness of linear pattern and lack of irrelevant points.

2-1- Internal and external validity of Research

Internal validity of research is related to study this question whether independent variables have really changed the dependent variable or not?

The following cases may have negative effect on internal validity of research:

1- Historical events simultaneous with the study time, structural changes in Iran's economy including fluctuation in oil price, change in exchange rate, prices liberation policy, business ages (stagnation and prosperity), change in state supports of industries and change in conditions of bank loans are some factors which cause to mistake research results. Although one method for omission of these factors is to separate the studied age; for example, into two periods of prosperity and stagnation and then to perform statistical tests, but

modeling the effect of these factors is out of limitations of the present research.

2- Inflation has influenced on the numbers of companies' profits. Although the effect of inflation on the profits of all sampled companies as well as during the studied years has not been the same, but the process of variables' growth due to inflation can mistake the research result.

3- Difference in the characteristics of the sampled companies such as the structure of ownership, kind of product, size and degree of competition.

External validity means the capability of generalization or indicator-being of research findings. The characteristic of companies which are selected as sample, determines the value of generalization of research findings. First, the samples are selected from companies accepted in Tehran Stock Exchange (TSE). Second, the selection is based on the existence of data for the studied period. Third, the sampled companies in terms of size, ownership, product and competition are necessarily neither the indicator of the all companies in Tehran exchange, nor the indicator of all active economic units in the country. Therefore, acceleration of findings should be performed by caution.

2-2- Descriptive Statistics

In the following table, the values of central and distribution parameters for research variables are calculated.

Table 1. Descriptive statistics

Parameter statistical variable	Number of observations	Mean	Standard Deviation	Distribution	Skewness
1. CFO_{it} / A_{it-1}	618	0.27	0.21	0.78	0.43
2.$PROD_{it}$/ A_{it-1}	618	0.49	0.34	1.67	1.08
3.$DISEXP_{it}$/A_{it-1}	618	0.15	0.42	2.96	1.53
4. Beta	618	0.40	0.24	0.87	0.86
5. Size	618	0.32	0.18	1.53	0.64
6. BM	618	4.06	0.26	1.07	0.96

2-3- The quality of validity testing of research models

The hypotheses of this research are modeled within the framework of specified regressional relationships and therefore, it is necessary before testing these regressional relationships and the analysis of their results, fundamental assumptions of these relationships should be studied.

Therefore, in this section, the following four essential issues in respect of regressional relationships of research will be studied which are as follows:

2-3-1- Normality of research data.

2-3-2- Appropriateness of linear pattern and lack of irrelevant points.

2-3-3- Lack of self – correlation.

2-3-4- Homo scedensity of variances.

2-3-1- Normality testing of research data:

One of the most important pre-assumptions of regressional models is to have normal distribution for model remainings. If model remainings are abnormal, the validity of some tests will be under question which are used for the factors. Therefore, the distribution of remaining in processing each regressional model should be controlled. In estimation models, it is assumed that the remainings and following it, dependent variable, are randomized variables. Therefore, dependent variable distribution follows the remainings' distribution. In this research, the examination of data normality will be performed by kolmogorov-Smirnov testing. In is obvious that based on the results of this test, if significance level is above 0.05, the normality of data distribution is confirmed. Therefore, to examine the normality of dependent variable using of Kolmogorov-Smironov test, the following statistical hypotheses should be tested:

H_0: Asymp. Sig (2-tailed) ≥ 0.05 rejection of research claim
H_1: Asymp. Sig (2-tailed) <0.05 research claim

H_0: Dependent variable doesn't follow normal distribution.
H_1 : Dependent variable follows normal distribution.

2-3-2- Test of appropriateness of linear pattern and lack of irrelevant points

In order for test of appropriateness of linear pattern and lack of irrelevant points, the distribution scattering charts are used. Regarding to that these diagrams don't represent a specified pattern (for example; crescent- shaped, diameter-shaped and …), the appropriateness of linear pattern and lack of irrelevant points is confirmed.

2-3-3- Testing of data non-self-correlation

The issue of self-correlation between the remainings is one of the other cases to violate classic assumptions of linear models. It means that to estimate the parameters of linear models, it is assumed that the remainings are not dependent to each other. Durbin-Watson parameter tests this issue whether the remainings are dependent to each other or not. Experimentally, it was determined that whenever the value of this parameter approaches to 2 (from left to night), there is not the problem of remainings' self- correlation. In this research, in some cases where there was the problem of remainings' self-correlation, auto-regression model was used to solve this problem.

2-3-4- Testing of homoscedensity of variances

The last fundamental point which was tested in this research in respect of regression relationships, is the issue of homoscedensuty of variances in the remainings' diagrams against R^2 values. If this diagram depicts a special pattern, one of the fundamental assumptions of regression will be under question and it cannot be claimed that data distribution is randomized. Therefore, regarding to that the drawn diagrams don't show a special pattern, the homoscedensity of variances can be hopeful. Generally the results obtained from tests indicate that the realization of all validity pre-assumptions of regression model is usable.

2-4- Significance testing of research models

To calculate non-ordinary cash flow, non-ordinary production and non-ordinary arbitrary costs, the following regression relationships are used:

$CFO_{it}/A_{it-1} = \alpha_0 + \alpha_1 (1/A_{it-1}) + \alpha_2 (S_{it}/A_{it-1}) + \alpha_3 (\Delta S_{it}/A_{it-1}) + \varepsilon_{it}$

$PROD_{it}/A_{it-1} = \alpha_0 + \alpha_1 (1/A_{it-1}) + \alpha_2 (S_{it}/A_{it-1}) + \alpha_3 (\Delta S_{it}/A_{it-1}) + \alpha_4 \alpha_3 (\Delta S_{it-1}/A_{it-1}) + \delta_{it}$

$DISEXP_{it}/A_{it-1} = \alpha_0 + \alpha_1 (1/A_{it-1}) + \alpha_2 (S_{it-1}/A_{it-1}) + \lambda_{it}$

Therefore, we observe that the above-mentioned regression relationships have a significant role in the results of main regression relationships of the research and the presence of a meaningful relationship between them, will have a high effect on the validity of research.

Therefore; here, it is necessary to test the significance of these models. For this same reason, testing of the following statistical hypotheses is recommended in this section:

H_0 : $\alpha_0 = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$, there is no meaningful

H_1: Taking all coefficients of the model together, is not zero, there is a meaningful model.

In this section, to test the significance of each model completely, F-test will be used and if the significance level of F is less than $\alpha = 0.05$, the above- mentioned zero hypothesis (H_0) will be rejected at confidence level of 95 percent and its opposite hypothesis which confirms the significance of model, will be accepted. Since for the models of the present research, level of significance is less than $\alpha = 0.05$; therefore, the significance of model will be confirmed.

3. Results

H_1: There is a relationship between non-ordinary cash flow and cash flow operation.In table 2, F-statistics represents general significance of R^2 regression model at confidence level of 95 percent.

Regarding to R^2 of the processed model, it can be claimed that about 22 percent of changes in cash flow operation (as dependent variable) is explained by non-ordinary cash flow as one of the criteria of earning management through real activities. According to the prediction, the coefficient and t-statistics of non-ordinary cash flow variables announces about the existence of a negative and meaningful relationship between non-ordinary cash flow and cash flow operation at confidence level of 95 percent. Therefore, it can be acknowledged that first secondary hypothesis of this research including the existence of a relationship between non-ordinary cash flow and cash flow operation, is confirmed at significance level of 5 percent.

Table 2 Test results for first secondary hypothesis

Dependent variable: CFO
Method: Pooled least squares
Sample: 2004-2009
Included observations:6
Cross-sections included: 103
Total pool (unbalanced) observations:618
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	-statistic	Prob.
C	0.412365	0.085123	4.84434	0.0016
Beta	- 0.029845	0.009542	-3.127751	0.0284
Size	0.018451	0.011325	1.629227	0.0046
BM	- 0.010243	0.003125	-3.27776	0.0307
ABCFO	- 0.061325	0.031548	-1.94386	0.0000
R-squared	0.23548	Mean dependent var		0.31254
Adjusted R- squared	0.22845	S.D. dependent var		0.11356
S.E. of regression	0.18452	Akaike info criterion		-0.73454
Sum squared resid	14.54821	Schwarz criterion		-0.48412
Log likelihood	212.548	F-statistic		1.84214
Durbin-Watson stat	1.98451	Prob (F-statistic)		0.0000

3-4-2- Testing of second secondary hypothesis:

H_0 = There is no relationship between non-ordinary production and cash flow operation.

H_1 = There is a relationship between non-ordinary production and cash flow operation.

In table3, F-statistics represents general significance of R^2 regression model at confidence level of 95 percent. Regarding to R^2 of the processed model, it can be claimed that about 19 percent of changes in cash flow operation (as dependent variable) is explained by non-ordinary production as one of the criteria of earning management through real activities.

According to prediction, the coefficient and t-statistic of non-ordinary production variable announces about the existence of a negative and meaningful relationship between non-ordinary production and cash flow operation at confidence level of 95 percent. Therefore, it can be acknowledged that second secondary hypothesis of

this research including the existence of a relationship between non-ordinary production and cash flow operation, is confirmed at significance level of 5 percent.

Table 3. Testing results for second secondary hypothesis

Dependent variable: CFO
Method: Pooled least squares
Sample: 2004-2009
Included observations:6
Cross-sections included: 103
Total pool (unbalanced) observations:618
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	0.356214	0.11254	3.165221	0.0027
Beta	-0.112654	0.02462	-4.575710	0.0421
Size	0.198451	0.12354	1.606370	0.1063
BM	-0.095321	0.03215	-2.964883	0.0267
ABCFO	-0.102354	0.02421	-4.227757	0.0001
R-squared	0.20187	Mean dependent var		0.23542
Adjusted R-squared	0.19562	S.D. dependent var		0.43154
S.E. of regession	0.35621	Akaike info criterion		-0.38542
Sum squared resid	9.8451	Schwarz criterion		-0.26845
Log likelihood	231.542	F-statistic		0.94512
Durbin-Watson stat	1.89652	Prob (F-statistic)		0.00017

Table 4 Testing results for third secondary hypothesis

Dependent variable: CFO
Method: Pooled least squares
Sample: 2004-2009
Included observations:6
Cross-sections included: 103
Total pool (unbalanced) observations:618
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	0.38649	0.21548	1.79362	0.0084
Beta	0.14652	0.06541	2.24002	0.0157
Size	0.07481	0.04512	1.65802	0.001
BM	0.08645	0.10364	0.83413	0.0846
DISEXP	-0.01036	0.00845	-1.22603	0.0028
R-squared	0.23354	Mean dependent var		0.203481
Adjusted R-squared	0.23154	S.D. dependent var		0.175432
S.E. of regession	0.19845	Akaike info criterion		-0.86214
Sum squared resid	17.3268	Schwarz criterion		-0.73481
Log likelihood	242.845	F-statistic		2.76248
Durbin-Watson stat	1.98452	Prob (F-statistic)		0.00000

3-4-3- Testing of third secondary hypothesis:

H_0: There is no relationship between non-ordinary arbitrary costs and cash flow operation.
H_1: There is a relationship between non-ordinary arbitrary costs and cash flow operation.

In table 4, F-statistic represents general significance of R^2 (R-squared) regression model at confidence level of 95 percent. Regarding to R^2 of the processed model, it can be claimed that about 23 percent of changes in cash flow operation (as dependent variable) is explained by non-ordinary arbitrary costs as one of the criteria for earning management through real activities. According to prediction, the coefficient and t-statistic of non-ordinary arbitrary costs variable announces about the existence of a negative and meaningful relationship between non-ordinary arbitrary costs and cash flow operation at confidence Level of 95 percent.

Therefore, it can be acknowledged that third secondary hypothesis of this research including the existence of a relationship between non-ordinary arbitrary costs and cash flow operation, is confirmed at significance level of 5 percent.

3-4-4- Testing of primary hypothesis:

H_0: There is no relationship between earning management through real activities and cash flow operation.
H_1: There is a relationship between earning management through real activities and cash flow operation.

The results of pervious researches show that manipulation in cash flow operation is not easily possible by management, unless he/she delays or proceeds cash flow related to incomes or costs consciously and intentionally.

In this research, it was expressed that the rate of earning management depends on operational activities. On the other hand, when operational activities are weak (based on cash flow operational), the companies intend to follow profit increasing strategies and in this way, they will use manipulation in real activities. In the present research, since the existence of a relationship between the criteria of earning management through real activities (non-ordinary cash flow with the adjusted- R^2 coefficient of about 22 percent, non-ordinary production with the adjusted- R^2 coefficient of about 19 percent and non-ordinary arbitrary costs with the adjusted- R^2 coefficient of about 23 percent) and cash flow operation was confirmed at significance level of 5 percent and negative coefficient of non-ordinary cash flow, non-ordinary production and non-ordinary arbitrary costs in the models indicate to the inverted relationship; therefore, it can be said that primary hypothesis of research including the existence of a relationship between earning management through real activities and cash flow operation is also confirmed at significance level of 5 percent and the above-mentioned relationship is of the reversed inverted kind of relationship.

Conclusion and Recommendation

Regarding to the performed testings, final conclusion of this research represents that there is a relationship between the criteria of earning management through real activities (non-ordinary

cash flow, non-ordinary production and non-ordinary arbitrary costs) and cash flow operation and this relationship is of the reversed kind. On the other hand, when operational activities are weak (based on cash flow operation), the managers will use manipulation in real activities by a goal of profit increasing.

The applied recommendations:

1- Analysis of the collected data shows that managers of economic agencies embark to manipulate the profit in a wide spectrum. This should be addressed by individuals interested in investment in economic agencies and during the study of essential financial statements, particularly profit and loss statement, the problem of possibility exerting earning management (undertaking and real) by the managers should be considered.

2- It is appropriate the auditing organization and other legislation and supervision foundations and accounting and auditing associations shall more address the issue of profit manipulation in compiling accounting standards and financial rules and by presentation of necessary guidance (for restriction of managers in exerting earning management), users of financial data should assist increasingly in order to make optimal and conscious decisions.

3- By consideration of the hypothesis of effective investment market, the organization of securities exchange can besides the appropriate supervision and enough control on the method of financial reporting of the accepted companies, by presentation of desired guidelines and the efficient management, conduct gradually the investment market from weak state towards semi-strong market and finally the strong market which its result will be the substitution of social welfare instead of personal welfare in the investment market.

4- One of the required practices in the current conditions of the country is to establish the authorities and institutions where evaluate the economic agencies and classify them in terms of risk and efficiency. One of the unique advantages of companies' classification is the significant improvement in the method of financial reporting of business units. In addition, the realization of this issue causes managers' errors shall not be ignored by users of financial statements.

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Effect of the Expousre to Low Dose of Ionizing radiation on KAU Hospital Medical Stuff by Using Early Response of Biological Dosimetry

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Abstract: Cytogenetic and Comet analysis were performed in forty volunteer students and hospital workers who were chronically exposed to Low ionizing radiation from king Abdulaziz University Hospital (KAUH), Radiology Department and Faculty of Applied Medical Sciences, were enrolled and divided into three groups. Peripheral blood samples were collected by venipuncture in heparinized and EDTA tubes (BD vacationer, Becton Dickinson, NJ, USA) on 6 different times during a period of 3 months. Accumulated absorbed doses calculated for the radiation workers ranged from 9.5 to 209.4 mSv. The mean of chromosomal aberration (CA) frequencies demonstrated statistically significant differences between the mean frequencies of CA between staff, intern students and second year students. Dicentric chromosome was only found in one technician from workers group while the other two groups have shown no dicentric chromosomes at all. Mean values (± standard deviation of the mean) of comet tail moment were 7.44±2.35 for the staff worker group and 3.51±2.1 for the intern students group and 3.01±1.33 for second year students (control group). Difference between mean tail moments were statistically significant when comparison between the worker stuff group and second year student group (P<0.01, ANOVA) and also significant between staff group and intern students (p<0.01, ANOVA) while there is no significance between intern and second year student groups (p>0.05, ANOVA). The range of tail moment in exposed worker stuff was 5.21- 12.53 and for the intern students was 2.99-5.31 and for the control second year student was 2.00-4.37. These results also indicate that occupation and occupation periods significantly contributed to the level of primary DNA damage as recorded by mean of alkaline comet assay and the relevance of conducting cytogenetic analysis in parallel to physical dosimetry in routine clinical setting

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Key words: Radiation, Fluorescence in Situ Hyperdization (FISH), Single Cell Gel Electrophoresis Technique (Comet); Lymphocytes; Chromosomes; Thermo Luminescent Dosimeter (TLD), ionizing radiation, biological dosimetry

1. Introduction

Application of ionizing radiation in many different fields is continuously increasing, including the use for medical purposes. Many assays use molecular endpoints that measure DNA breakage, changes in the regulation of some sentinel genes or the presence of protein biomarkers that may be detected within cells or in blood plasma/serum. This is an area of rapidly emerging technologies with a number of assays at differing stages in development and verification. The range of biological dosimetry options now available have led to proposals for a multi-parametric approach to investigating an overexposed person [1] and having a variety of assays available may be particularly useful if a laboratory has to deal with an event involving many casualties.

Genomic abnormal changes can be analyzed by using cytogenetic parameters such as chromosomal aberrations (CA), sister chromatid exchanges (SCE), and micronuclei (MN), which are considered to be the biomarkers of carcinogenic effects [2]. Chromosomal aberrations have been correlated with genetic changes that can trigger the development of cancer. Therefore, a biological dosimeter based on CA frequencies makes possible to estimate the cancer risk [3], and this method has been applied to monitor hospital workers in order to estimate the absorbed radiation doses during the period of employment in the hospital [4-7]. It has been shown that workers engaged in operational radiology [8] and Nuclear Medicine [9] is chronically exposed to low-level ionizing radiation.

The lymphocytes are the major and most important cells that are used as the bio indicators for the effect of ionizing radiation. Two main types of lymphocytes can be distinguished, i.e. T and B cells. Both types originate from immunologically incompetent stem cells in the yolk sac and

eventually settle in the bone marrow. These undifferentiated stem cells migrate into the thymus and other primary lymphoid organs, multiply there, undergoing somatic mutations and give rise to a pool of long lived lymphocytes that circulate. On the basis of their surface markers, T and B cells comprise a mixture of naïve and memory cells with differing life spans and differing roles in the immunological processes [10]. It is the T cells, mostly of the CD4+ and CD8+ subtypes, which are stimulated *in vitro* by phyto-haemagglutinin (PHA) and are used for biological dosimetry.

Chromosomal aberrations have been widely accepted for many years as a biological marker of exposure for ionizing radiation. Also the risk of cancer increase by increasing of chromosomal aberration. The past two decade have seen significant improvement in the ability to identify and quantify chromosomal damage. One of the most effective methods is fluorescence in situ hyperdization (FISH) with whole chromosome paints. FISH painting can identify translocation (with one centromere, dicentric or acentric fragment). The ability to identify translocation with light accuracy and efficiency is significant because translocation have substantially greater persistence through cell division than dicentrics [11].The using of chromosomal painting to detect the translocation has significant advantage when it is compared by any other techniques. The use of translocation for bio-dosimetery has increased recently and some of commercial probes are become available. There are some observations prove that translocations may be the most relevant cytogenetic and point for assessing cancer risks.

Prior development of single cell gel electrophoresis methods in 1980, measurement of the effect of radiation on the DNA strand breaks in the individual cell was limited to conventional methods such as classical karyotyping and also micronuclei test. Development of comet assay which relies on single-cell gel electrophoresis that depends on migration of DNA fragments has shown a rapid and sensitive method of quantifying the level of DNA damage either in single or double strand breaks from single cells through movement of damaged DNA (tail fraction) away from the distinct head fraction representing the intact DNA. The distance between the means of head and tail defines the tail moment parameter during analysis which represents the percentage of fluorescently labeled damaged DNA by the increase in the tail moment. The degree of DNA migrated from the head is proportional to the amount of damaged DNA per cell [12]. Applying such methodology in clinical practice will eliminate the need to use radio labeled cells and Furthermore, methods to detect the migration of DNA from single cell permitted the direction of initial radiation induced DNA in single cells. Therefore, using comet assay has eliminated the use of radio labeled cells and this gives a new opportunity for analysis of radiation induced DNA damage at any tissue provided a single cell suspension.

In this study assessment of lymphocytes by using fluorescence in situ hybridization (FISH) and single cell gel electrophoresis technique (Comet) for detection of single DNA strand breaks mediated by quantifying the DNA damage in tail moment was carried out as a mode of comparing between the two methods interims of sensitivity, cost and duration of analysis which enables further selection of the best suited technology as an indicator of DNA damage among exposed hospital workers to radiation. The results of this study may provide further insights towards the possible implementation of such method in routine clinical setting. Also, it will enable further establishment of biological dosimetry data base at KAUH radiology department by evaluating radiation risks to various groups of exposed personnel, and conveying recommend criteria for development and construction for a Saudi Standard Bio-dosimetry Laboratory.

2. Material and Methods

Subjects

The sampled groups consisted of forty volunteer students and hospital workers from king Abdulaziz University Hospital (KAUH), Radiology department and Faculty of Applied Medical Sciences were enrolled and divided into three groups. The first group (A) included 15 staff from X-rays, radiotherapy and nuclear medicine departments who had been occupationally exposed to low-level ionizing radiation during their work for a period of time ranging from 10 to 32 years (20 ± 5). The second group (B) covered 15 students who were spending the whole year in the radiology department (intern students) at KAUH. The third group (C) was consisted of 10 second year students who were taking a practical experience of working with X ray machine for only few months (control).

The study was performed in accordance with high standards of ethics (approved by ethical committee at faculty of Applied Medical Sciences). Informed consent was obtained from all participants prior to the start of the study. All participants were also informed about the aim and the experimental details of the study and they were free to withdraw from the study at any time. All of them were healthy and did not complain of any health issues. However, no adverse effects occurred, and the data of all participants were available for analysis. All exposed

subjects completed a standardized questionnaire that covers personal data, working activities, type and duration of occupational exposure to X ray radiation at the time of the study, and information on exposure to possible confounding factors (smoking habits, intake of medications ,contraception, viral diseases, recent vaccinations, presence of known inherited genetic disorders, chronic disease, family history of cancer, sunlight exposure, and radio diagnostic examinations) was recorded followed by blood samples collection from all participants.

Sample collection and preparation

The requirements of samples collection and preparation for comet and FISH assays were fulfilled such as avoidance of hemolyzed samples, the use of sodium heparin as an anticoagulant of choice for FISH studies and collected samples were maintained at room temperature during processing.

Sample processing and investigation

The following tests were performed in each sample form each subject: Complete blood count (CBC), Comet, Karyotyping and FISH techniques for the following chromosomes 1, 4, and 18 using whole chromosome painting (WPC) technique. Peripheral blood samples were collected by venipuncture in EDTA and Heparinized tubes (BD vacationer, Becton Dickinson, NJ, USA) on 6 different times during a period of 3 months. Blood samples from the exposed subjects were always collected in the morning hours, between 9 am and 10 am of the last day of working week. Blood samples from the age- and sex matched control group were taken at the same time during the study (a balanced collection design was used). Samples from both exposed and non-exposed individuals were handled in the same manner. After collection, all blood samples were randomly coded, refrigerated at 4 ^{0}C, transported to the laboratory and processed immediately (usually within 2 hours after blood sampling).

Alkaline Comet Assay

Comet assay was carried out under alkaline conditions [5, 14]. 1% of normal melting point (NMP) agarose (Sigma) was added to fully frosted slides. Following solidification, all slides were scraped off the gel followed by coating the slides with 0.6% NMP agarose. Then a second layer containing the whole blood sample (2 mls) mixed with 0.5% low melting point (LMP) agarose (Sigma) was placed on the slides. Following this, slides were covered with 0.5% LMP agarose after 10 minutes of solidification on ice. Afterwards the slides were immersed for 1 hour in ice-cold freshly prepared lysis solution (2.5MNaCl, 100mM Na_2EDTA, 10mM Tris–HCl, 1% Na-sarcosinate (Sigma), pH 10) with 1% Triton X-100 (Sigma) and 10% of dimethyl sulfoxide (Kemika) to lyse cells and allow DNA unfolding. Then random placing of slides side by side was taken place in the horizontal electrophoresis tank, facing the anode. The unit was filled with freshly prepared electrophoresis buffer (300mM NaOH, 1mM Na2EDTA, pH 13.0) and the slides were set in this alkaline buffer for 20 minutes to allow DNA unwinding and expression of alkali-labile sites. Denaturation and electrophoresis were performed at 4 ^{0}C under dim light. Electrophoresis was carried out for the next 20 minutes at 25V (300 mA). After that, the slides were washed gently three times for 5 minutes with a neutralizing buffer (0.4M Tris–HCl, pH 7.5) to remove excess alkali and detergents. Each slide was stained with ethidium bromide (20 mg/ml) and covered with a cover slip. Slides were stored at 4 ^{0}C in humidified sealed containers until analysis. To prevent additional DNA damage, handling of blood samples and all steps included in the preparation of slides for the comet analysis were conducted under yellow light or in the dark. Moreover, two parallel replicate slides were prepared per sample in order to avoid possible position effect during electrophoresis. Each replicate slide was processed in a different electrophoretic run.

Comet Capture and Analysis

Each slide was examined at 250-fold magnification with a fluorescence microscope (Zeiss, Germany), equipped with an excitation filter of 515–560 nm and a barrier filter of 590 nm. One hundred comets per subject were scored (50 from each of two replicate slides). Comets Random capturing of the comets was carried out at a constant depth of the gel, avoiding the edges of the gel, occasional dead cells and superimposed comets. The microscope was connected to a black and white camera and to a computer-based image analysis system (Comet Assay II, Perceptive Instruments Ltd., UK). This system acquires images, computes the integrated intensity profiles for each cell, estimates the comet cell components, and then evaluates the range of derived parameters. To avoid potential observer variability, one well-trained personnel performed all scorings of the comets. Tail length (μm) was calculated from the centre of the head and served as measure of DNA damage.

FISH Protocol

Analysis of chromosomes aberration was performed according to current IPCH and IAEA guidelines [14,15]. Whole blood cultures were established by adding 0.5 ml heparinized whole blood into 5ml of RPMI 1640 medium (Chromosome kit P, Euroclone) containing 10% foetal bovine serum, phyto-haemagglutinin, heparin,

glutamine, growth factors, and gentamycin. Duplicate cultures per subject were set up and incubated at 37 ^{0}C for 48 hours. Metaphase arrest of dividing cells was done using colchicine (0.004%) for 2 hours prior to the harvest. Cultures were centrifuged at 1000 rpm for 10 minutes, the supernatant was carefully removed, and the cells were re-suspended in a hypotonic solution (0.075MKCl) at 37 ^{0}C. After centrifugation for 5 minutes at 1000 rpm, the cells were fixed with a freshly prepared fixative of ice-cold methanol/glacial acetic acid (3:1, v/v). Fixation and centrifugation were repeated several times until the supernatants were clear. Cells were pelleted and re-suspended in a minimal amount of fresh fixative to obtain a homogeneous suspension. The cell suspension was dropped onto microscope slides and left to air-dry. Whole chromosome labeled probes for chromosomes 1, 4 and 18 were added to the slides for specific hybridization process (Metasystm Probe, Germany). 10 µl of probe mixture was applied to the slide and covered with a cover slip 22x22 mm^2 and sealed with rubber cement. The slides were heated at hot plate at 75^{0}C for 2 minutes to allow co-denaturation process of template DNA with labeled probes of single stranded DNA. Following this, the slides were incubated in humidifier chamber overnight at 37 ^{0}C for probes hybridization with targeted region of chromosomes indicated by emission of fluorescence. Post-hybridization washing step was applied to the slides by firstly removing the cover slips and all traces of glue carefully followed by washing the slide with 0.4x of SCC (pH 7.0) at 72^{0}C for 2 minutes. The slides were then drained and washed in 2x SSC, 0.05% Tween-20 (pH 7.0) at room temperature for 30 seconds. Following this, the slides were rinsed briefly in distilled water to avoid crystal formation and subjected to air drying. All slides were counter stained with DAPI/anti-fade of 10 µl and covered by 24x32 mm^2 cover slip for 10 minutes to allow the anti-fade to penetrate chromosomes followed by analysis using fluorescent microscope. Metaphase analysis was conducted by a well trained and experienced cytogeneticist. Two hundred metaphase cells per subjects (100 metaphases from each parallel culture) were counted and analyzed for chromosomal aberrations (CA). Structural CAs were classified based on the number of sister chromatids and breakage events involved. Total numbers and types of aberrations, as well as the percentage of aberrant cells per subject were evaluated.

Statistical Analysis

Statistical analyses were carried out using microstat software (StatSoft, Tulsa, USA). Each subject was characterized for the extent of DNA damage by considering the mean (±standard deviation of the mean), median, range and dispersion coefficient (H) for the comet tail moment. It was calculated as the ratio of the sample variance to the sample mean in order to determine the effect of exposure on the distribution of comet tail moment within each subject [14]. Multiple comparisons between groups were done by means of multifactor ANOVA on transformed data in order to normalize distribution and to equalize the variances. Post analysis of differences was done by Scheffe´ test. The level of statistical significance was set at $p \geq 0.05$. The correlations between confounding factors and the studied parameters were also determined using Pearson's correlation matrices

3. Results

Alkaline Comet Assay

Characteristics of the study subjects (gender, occupation, and mean frequency of the comet) and groups mean values are reported in Table (1). Also, the comparison of the groups mean values was carried out between the exposed radiology department staff, intern students and second year students (control group). Mean values (± standard deviation of the mean) of comet tail moment were 7.44±2.35 for the staff worker group and 3.51±2.1 for the intern students group and 3.01±1.33 for second year students (control group). The difference in mean tail moments were statistically significant between the staff group and second year students group (P<0.01, ANOVA) and also significant between staff group and intern students (P<0.01, ANOVA) while there is no significant difference between intern and second year student groups (P>0.05, ANOVA). The range of tail moment was 5.21- 12.53 in exposed worker staff and 2.99-5.31 for the intern students and 2.00-4.37. for the control second year students.

To determine the effect of X ray radiation on the distribution of the tail moment within each tested individual the dispersion coefficient (H) for the row data was also calculated. H was defined as the ratio of sample variance to the sample mean. The mean value of (H) was 4.7 in the staff, 0.71 in the intern students and 0.21 in the second year control students. This indicates that the increase in DNA damage was due to the increase in the percentage of damaged cells with a high extent of damage. According to the study results, the distribution of tail moment among the staffs was highly adverse with shift towards higher values. On the other hand, the distribution of tail moment among intern and second year students were

homogenous with majority of tail moments showing base line DNA damage level.

These results also indicate that occupation and occupation periods significantly contributed to the level of primary DNA damage as recorded by the mean of alkaline comet assay. However, there was a significant difference in the level of DNA damage represented by tail moment between the three groups as shown in table 1. The DNA damage decreased gradually among

The three groups depending on the level of exposure hospital where radiology staff showed higher level of DNA damage as compared to other two groups. On the other hand, the level of DNA damage between intern and second year students showed no significant difference. Furthermore, the gender in this study showed no effect on the DNA damage when exposed to x ray radiation as there was no significant difference between male and female subjects (P>0.05 ANOVA).

The distribution of tail moment (tail length µm x amount of DNA in the tail) measured in peripheral blood leukocytes of exposed staff, intern radiology students and second year students with regards to their occupations is illustrated in Figure 1.

Chromosomal Aberration (CA)

The mean frequencies of CA is summarized in Table (2) as recorded for radiology staff, intern and second year students from the faculty of applied medical science.

Table 1: Demonstrates the characteristics of the study population including the median, minimum and maximum of DNA breakage using the comet techniques.

			Comet Tail Moment				
Subject	Gender	# of Subject	Mean Frequency (M±SD)	Median	Min	Max	H
Radiology staffs group (A	Male	10	7.11 ± 1.73	6.71	4.66	14.50	6.33
	Female	5	7.45 ± 2.61	6.8	6.17	11.27	3.07
	(Total) Mean	15	7.44 ± 2.35	6.72	5.21	12.53	4.7
Group (B	Male	8	3.50 ± 2.6	2.90	3.11	5.5	1.25
	Female	7	3.41 ± 2.0	3.84	1.73	4.75	0.17
	(Total) Mean	15	3.51 ± 2.1	3.25	2.99	5.13	0.71
Group (C)	Male	5	3.26 ± 0.90	3.05	1.69	4.11	0.22
	Female	5	2.75 ± 1.51	2.75	2.17	5.21	0.20
	(Total) Mean	10	3.01 ± 1.33	2.96	2.0	4.37	0.21

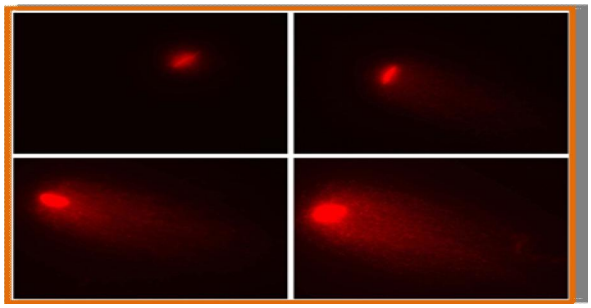

Figure 1: Demonstration of the comet assay results showing the normal control at the upper and the lower right sides. The left side image represents the DNA damage for exposed radiology staff.

Table 2: Demonstrates the results of the three tested groups exploring the mean of chromosomal aberrations and its percentage among males and females (Mean±SD).

Subject	Gender	Mean Frequency	Chromatids	Chromosome	Acentric	Dicentric	% of aberration
Radiology staffs group (A)	Male	3.35 ± 0.69	2.24 ± 0.43	0.28 ± 0.10	0.85 ± 0.18	0.005	1.50
	Female	2.90 ± 0.29	2.1 ± 0.27	0.22 ± 0.02	0.60 ± 0.12		1.42
	Mean	3.14 ± 0.45	2.17 ± 0.35	0.25 ± 0.05	0.75 ± 0.15	0.005	1.45
Group (B)	Male	1.43 ± 0.10	0.75 ± 0.11	0.08 ± 0.02	0.57 ± 0.12		0.44
	Female	1.18 ± 0.07	0.91 ± 0.10	0.03 ± 0.01	0.34 ± 0.09		0.29
	Mean	1.25 ± 015	0.83 ± 0.10	0.05 ± 0.02	0.42 ± 0.08		0.35
Group (C)	Male	1.36 ± 0.05	0.75 ± 0.77	0.08 ± 0.02	0.53 ± 0.05		0.33
	Female	0.95 ± 0.03	0.75 ± 0.02	0.03 ± 0.02	0.19 ± 0.08		0.41
	Mean	1.10 ± 0.42	0.75 ± 0.05	0.05 ± 0.02	0.32 ± 0.06		0.35.

There was a significant differences between the mean frequencies of CA between staff (3.41± 0.45 CA per 200 cells), intern students (1.25± 0.15) CA per 200 cells) and second year students (1.10 ± 0.42) (P<0.001, ANOVA). The percentage of aberrant cells was also significantly higher in the staff (1.45±0.08) as compared to the other two groups where the percentage was (0.35±0.04). Among the exposed group, a remarkable inter individual variation in aberration types were observed. The control and intern students on the other hand, have a more homogenous distribution of CA in their peripheral blood. The mean frequencies of chromatids breakage was 2.17±0.35 per 200 cells among staff, while the mean frequencies was 0.83 ±0.10 and 0.75± 0.05 per 200 cells among the intern and second year students respectively. The mean frequencies of chromosome breaks were 0.25±0.05 per 200 cells in radiology staff and 0.05 ±0.02 in both intern and second year students. The mean yield of acentric fragments was 0.75±0.15 in the exposed workers and 0.42±0.08 in the intern student subjects and 0.32± 0.0.06 in the control group of second year students. Dicentric chromosome with two centromeres representing an abnormal structural change was only found in one technician from staff group while the other two groups have shown no dicentric chromosomes at all.

The results also implied that the observed chromosomal aberrations have no significant interaction between the aberration type, gender, and age. Also, it has been noticed that there is no significant difference between the two students groups and some of the results showed similar finding in both groups. Ring chromosome was only observed in one case involving chromosome one from the hospital worker while other chromosomes (4 and 18) showed no changes in all studied subjects following FISH technique using whole chromosome painting method as shown in Figure 2 (B).

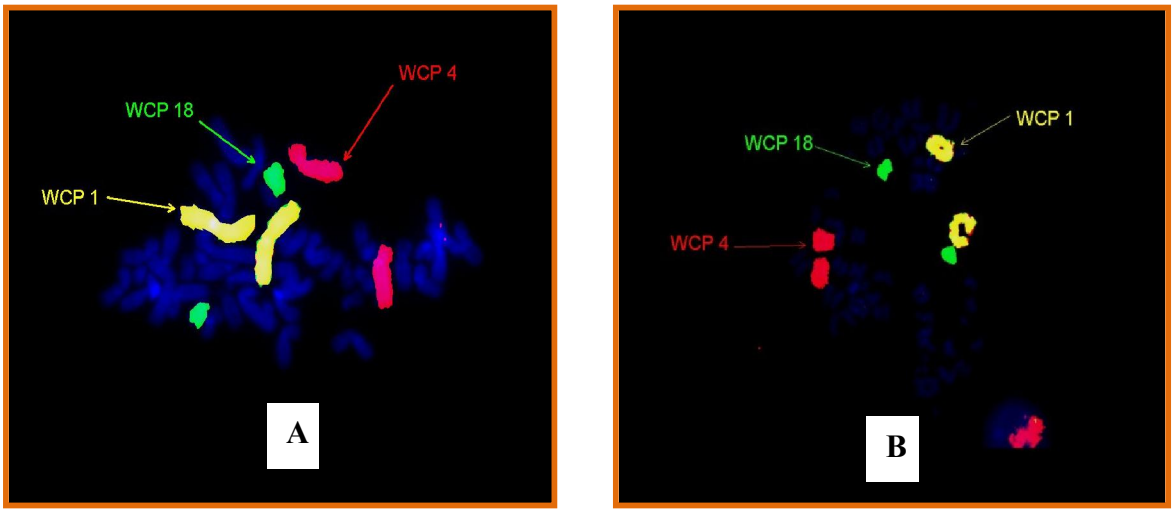

Figure 2: Whole chromosomal painting results of metaphase stage using FISH technique. Image (A) represents different fluorescents of specific chromosomes showing red, green and yellow signals (paints) in chromosomes 4, 18 and 1 respectively of normal control sample. Image (B) represents the chromosome structural change reflected by the ring chromosome on one copy as indicated by yellow arrow in image B.

4. Discussion

In this study, two different methods were used to evaluate the effect of ionizing radiation (x ray) on the students from faculty of applied medical sciences, radiology department and the technician workers at KAU hospital with different periods of exposure to the radiation. The comet and FISH assays were applied to detect unrepaired and erroneously repaired chromosomal aberrations from metaphase stage of dividing cells. Despite of some limitations with respect to FISH technique such as time of analysis, possible failure of culture, efficiency of hybridization and the resolution of chromosomal painting, the results showed possible acquired chromosomal changes resulting from chronic low dose exposure of X ray. Most common aberrations observed for all individuals were gaps, breaks, minutes, and fragments, but the frequencies of chromatid-type aberrations were higher in most of the exposed individuals, compared to the respective matched control values. Achromatic lesions or gaps were also considered to calculate the CA frequencies, since they represent discontinuity regions in the chromosomal arm [16], and they have been found to be greatly induced by ionizing radiation [17]. Most radiation-exposed individuals

presented higher CA frequencies than their matched controls, with the mean values of 3.14 and 1.10 aberrations per 200 cells for the exposed and the control groups respectively. Although the difference between those values was shown to be significant ($P < 0.01$ ANOVA), the individual CA frequencies were not correlated to the absorbed doses. Most cells showed only one aberration, and the absence of centric rings and dicentric chromosomes (which are mostly induced by high radiation doses). In fact, at this level of exposure, a very high number of scored metaphases are required in order to detect the presence of dicentric chromosomes. In the present work, the exposed group presented higher absorbed doses, which were within the range of 9.5 to 209 Gray.4

However, fluorescence detection of DNA has been used in this study that has removed the necessity of applying radiolabel substance in dividing cell as a mean of DNA damage measurement [18-21]. The alkaline comet assay has been used as bio monitoring method in multiple studies *in vitro* and *in vivo* of different cell lines as well as to the exposed population to different sources of radiation. Furthermore, occupationally exposed radiation workers, for example, exposure to radon, as well as children of Chernobyl revealed a positive correlation between DNA damage and exposure level [22]. The results of this study may imply the presence of DNA damage primarily in peripheral blood lymphocytes of hospital exposed workers in addition to the increase of chromosomal aberration frequency. Moreover, the two techniques that have been applied in this study appear to be very sensitive methods of DNA damage detection and increases therefore the need to apply such techniques in routine clinical setting as an assessment of possible biological effect particularity in chronically exposed high risk group taking into account the cost, the time of analysis, the flexibility and possible challenges of data interpretation.

It has been estimated that each dividing mammalian cell is subjected to different forms of DNA damages per day including base alterations and strand breakage during DNA replication process of mitotic cells [23-24]. However, unlike single strand breaks and base damages that can be repaired by corresponding repair mechanisms by most cells, DNA double-strand breaks and other complex DNA lesions are relatively rare and much more difficult to repair [25]. Un-rejoined double-strand breaks are likely to be lethal, and mis-rejoined double-strand breaks can cause chromosome aberrations and cell death [25-27]. In the 1980s, interest moved from detection of single strand breaks to the development of methods that could detect the DNA lesion associated with lethality and chromosome damage by ionizing radiation.

Although it is fortunate that double-strand breaks are produced relatively infrequently, this poses problems for their detection. Twenty to forty times fewer of double-strand breaks as compared to single-strand breaks are produced per Gy [28]. The comet assay allows detecting un-repaired initial lesions in cells. Many of these primary abrasions are successfully repaired within few minutes (4–15 minutes) [29, 30] to couple of hours (2–3 hours) [31] after exposure. Therefore, the levels of primary DNA damage in study subjects in the present study could be associated to an enhanced intracellular oxidative stress following exposure to ionizing radiation. This could give an increased steady-state DNA damage, high enough to be detected by the sensitive comet assay. If base damages are located closely together (10 bp apart) on opposite DNA strands, simultaneous excision of such modified bases can lead to the formation of DSB (double strand break), which is the supposed initial lesion in the formation of CA. Chromosome and chromatid breaks arise when DSB have been un-repaired or repaired incompletely. Double fragments can also result from repair of DSB, giving rise to polycentric chromosomes or centric ring chromosomes [32] that may be visualized on metaphase preparations. In the student group population, a high intra-individual homogeneity of DNA damage was recorded and dispersion coefficients were similar and low. However, in spite of very rigorous procedures (exactly the same conditions for all steps of the procedures and a very good reproducibility of the employed assays), the inter-individual variability of data obtained in the exposed population was considerable. Variability is a typical feature of biological systems, extensively reported by various authors when using the comet assay [20, 33-36]. It should also be pointed out that results obtained in the present comet assay study reflect DNA damage in all types of leukocytes, while the results of the CA test reflect only the response of mitogen-stimulated lymphocytes. Because peripheral blood leukocytes are a heterogeneous mixture of cells as regarding to their life-span and sensitivity, some differences may be due to the different cell populations being compared. Despite the risk of reduced sensitivity, most investigators prefer the use of whole leukocyte fractions or whole blood when studying induced or basal levels of DNA damage in the comet assay. During the process of separating the various cell types from each other it is always

possible to damage the cells, this in many cases will be hard to control [34].

Currently, the recommended radio dosage limit is 50 mSv [37]. However, with current regulation in place, it is occasional that a radiation worker exceeds this dose limit. It should be emphasized that doses recorded among the exposed subjects in this study were also below this dose. In spite of the relatively low doses that were received, the exposed worker population had significantly increased levels of primary DNA damage compared to control student populations. Other authors also discussed the difficulty of establishing relationships between radiation dose and their effect for low doses limits [38, 19]. This observation could be, at least in some cases, related to the ‘‘adaptive response’’. Chronic low-level radiation from various isotopes is known to induce the adaptive response, i.e., exposed cells become less sensitive to the chromosome breaking effects of subsequently delivered challenging X-ray doses. The magnitude of adaptive response varies among blood samples from different donors; this was observed in resting human leukocytes [22, 39]. It is possible that a similar phenomenon was also pronounced in occupationally exposed subjects.

Conclusion and Recommendations

In conclusion, this study implies the possibility of genomic structural changes of exposed workers to ionizing radiation of low doses. Therefore, carefully applying the radiation protection precautions will minimize greatly, the potential adverse effects. Furthermore, the significance of utilizing radiation dose monitoring devices is apparent which in turn provide useful information on the actual risk of radiation exposed individuals. With aspect to methods of measuring radiation effect on biological parameter, the alkaline comet assay and FISH test are both sensitive techniques that can be utilized in combination with dosimeter monitoring devices as a clinical routing surveillance of exposed workers. Also, it should be emphasized on the usefulness of comet assay in increasing awareness towards the behavior of individual cells exposed to ionized radiation as the results of his technique were consistent to those obtained by FISH assay. Also it should be focused on the simplicity and low cost of the comet assay technique when compared to the other cytogenetic techniques. So the study strongly recommends using the comet assay as a primary method for detection the effect of ionizing radiation on individual cells and also for detection of the intra-individual variation in respond to the X ray radiation. However, conducting further studies is recommended in order to aid in further exploration of the benefits of routine dose measurement combined with assessment of biological parameter as mode of decreasing the risk of biological damage.

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New exact solutions of Boiti-Leon-Manna-Pempinelli equation using extended F-expansion method

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Abstract: Using a computerized symbolic computation technique, we study the Boiti-Leon-Manna-Pempinelli equation using extended F-expansion method. It is shown that soliton solutions and triangular periodic solutions can be established as the limits of Jacobi doubly periodic wave solutions.
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Keywords: Extended F-expansion (EFE) method; Nonlinear partial differential equations; Nonlinear physical phenomena; Boiti-Leon-Manna-Pempinelli equation.

1. Introduction

The nonlinear wave phenomena can be observed in various scientific fields, such as plasma physics, optical fibers, fluid dynamics, chemical physics, etc. Mathematical modelling of physical phenomena often leads to nonlinear partial differential equations NLPDEs. The exact solutions of these NLPDEs plays an important role in the understanding of nonlinear phenomena. In the past decades, many methods were developed for finding exact solutions of NLPDEs as the inverse scattering method [1, 2], Hirota's bilinear method [3], Bäcklund transformations [4], similarity transformation method [5], homogeneous balance method [6], tanh function methods [7, 8], Jacobi and Weierstrass elliptic function method [9]-[11], Exp-Function method [12], $\frac{G'}{G}$-expansion method [13, 14], F-expansion method [15]-[17], etc.

Although Porubov et al. [18]-[20] have obtained some exact periodic solutions to some nonlinear wave equations, they use the Weierstrass elliptic function and involve complicated deducing. A Jacobi elliptic function (JEF) expansion method, which is straightforward and effective, was proposed for constructing periodic wave solutions for some nonlinear evolution equations. The essential idea of this method is similar to the tanh method by replacing the tanh function with some JEFs such as sn, cn and dn. For example, the Jacobi periodic solution in terms of sn may be obtained by applying the sn-function expansion. Many similarly repetitious calculations have to be done to search for the Jacobi doubly periodic wave solutions in terms of cn and dn [21]. Recently F-expansion method [22]- [28] was proposed to obtain periodic wave solutions of NLEEs, which can be thought of as a concentration of JEF expansion since F here stands for everyone of JEFs.

Gilson et al. [29] derived (2+1)-dimensional Boiti-Leon-Manna-Pempinelli (BLMP) equation while they study (2 + 1)-dimensional generalization of the AKNS shallow-water wave equation through the bilinear approach.

$$u_{yt} + u_{xxxy} - 3u_{xx}u_y - 3u_x u_{xy} = 0, \qquad (1)$$

The (2+1)-dimensional BLMP equation has been studied in many papers such as, in [30] Bäcklund transformation of potential BLMP system with aid of symbolic computation, given solution of the potential BLMP system with three arbitrary functions. The bilinear form for the BLMP equation is obtained using the binary Bell polynomials in [31]. New solutions include rational function solutions, double-twisty function solutions, Jacobi oval function solutions and triangular cycle solutions of BLMP equation are obtained in [32]. Using exponential function, some new exact solutions of BLMP equation are obtained[33].Using the binary Bell polynomials, the bilinear form for the BLMP equation is obtained in [34]. In this paper, we apply the extended F-expansion (EFE) method with symbolic computation to Eq. (1) for constructing their interesting Jacobi doubly periodic wave solutions. It is shown that soliton solutions and triangular periodic solutions can be established as the limits of Jacobi doubly periodic wave solutions. In addition the algorithm that we use here also a computerized method, in which generating an algebraic system.

2. Materials and Methods (Extended F-expansion method)

In this section, we introduce a simple description of the EFE method, for a given partial

differential equation

$$G(u,u_x,u_y,u_z,u_t,u_{xy},\ldots)=0. \quad (2)$$

We like to know whether travelling waves (or stationary waves) are solutions of Eq. (2). The first step is to unite the independent variables x, y, z and t into one particular variable through the new variable

$$\zeta=\alpha x+\beta y+\gamma z+\nu t, \quad u(x,y,t)=U(\zeta),$$

where ν is wave speed. Thus Eq. (2) can be reduced to an ordinary differential equation(ODE)

$$G(U,U',U'',U''',\ldots)=0. \quad (3)$$

Our main goal is to derive exact or at least approximate solutions, if possible, for this ODE. For this purpose, we shall consider U as the expansion in the form,

$$u(x,y,z,t)=U(\zeta)=\sum_{i=0}^{N}a_iF^i+\sum_{i=1}^{N}a_{-i}F^{-i}, \quad (4)$$

where

$$F'=\sqrt{A+BF^2+CF^4}, \quad (5)$$

the highest degree of $\frac{d^pU}{d\zeta^p}$ is taken as

$$O\left(\frac{d^pU}{d\zeta^p}\right)=N+p, \qquad p=1,2,3,\cdots, \quad (6)$$

$$O\left(U^q\frac{d^pU}{d\zeta^p}\right)=(q+1)N+p, \quad q=0,1,2,\cdots,p=1,2,3,\cdots. \quad (7)$$

Where A, B and C are constants, and N in Eq. (3) is a positive integer that can be determined by balancing the nonlinear term(s) and the highest order derivatives. Normally N is a positive integer, so that an analytic solution in closed form may be obtained. Substituting Eqs. (2)- (5) into Eq. (3) and comparing the coefficients of each power of $F(\zeta)$ in both sides lead to get an over-determined system of nonlinear algebraic equations with respect to ν, a_0, a_1, $\cdots$. Solving the over-determined system of nonlinear algebraic equations by use of Mathematica. The relations between values of A, B, C and corresponding JEF solution $F(\zeta)$ of Eq. (4) are given in table 1. Substitute the values of A, B, C and the corresponding JEF solution $F(\zeta)$ chosen from table 1 into the general form of solution, then an ideal periodic wave solution expressed by JEF can be obtained.

Table 1: Relation between values of (A,B,C) and corresponding F

A	B	C	$F(\zeta)$
1	$-1-m^2$	m^2	$\mathrm{sn}(\zeta)$ or $\mathrm{cd}(\zeta)=\frac{cn(\zeta)}{dn(\zeta)}$
$1-m^2$	$2m^2-1$	$-m^2$	$\mathrm{cn}(\zeta)$
m^2-1	$2-m^2$	-1	$\mathrm{dn}(\zeta)$
m^2	$-1-m^2$	1	$\mathrm{ns}(\zeta)\frac{1}{sn(\zeta)}$ or $\mathrm{dc}(\zeta)=\frac{dn(\zeta)}{cn(\zeta)}$
$-m^2$	$2m^2-1$	$1-m^2$	$\mathrm{nc}(\zeta)=\frac{1}{cn(\zeta)}$
-1	$2-m^2$	m^2-1	$\mathrm{nd}(\zeta)=\frac{1}{dn(\zeta)}$
1	$2-m^2$	$1-m^2$	$\mathrm{sc}(\zeta)=\frac{sn(\zeta)}{cn(\zeta)}$
1	$2m^2-1$	$-m^2(-1-m^2)$	$\mathrm{sd}(\zeta)=\frac{sn(\zeta)}{dn(\zeta)}$
$1-m^2$	$2-m^2$	1	$\mathrm{cs}(\zeta)=\frac{cn(\zeta)}{sn(\zeta)}$
$-m^2\times(1-m^2)$	$2m^2-1$	1	$\mathrm{ds}(\zeta)=\frac{dn(\zeta)}{sn(\zeta)}$
$\frac{1}{4}$	$\frac{1-2m^2}{2}$	$\frac{1}{4}$	$\mathrm{ns}(\zeta)+\mathrm{cs}(\zeta)$
$\frac{1-m^2}{4}$	$\frac{1+m^2}{2}$	$\frac{1-m^2}{2}$	$\mathrm{nc}(\zeta)+\mathrm{sc}(\zeta)$
$\frac{1}{4}$	$\frac{m^2-2}{2}$	$\frac{m^2}{4}$	$\mathrm{ns}(\zeta)+\mathrm{ds}(\zeta)$
$\frac{m^2}{4}$	$\frac{m^2-2}{2}$	$\frac{m^2}{4}$	$\mathrm{sn}(\zeta)+ics(\zeta)$

Where $\mathrm{sn}(\zeta)$, $\mathrm{cn}(\zeta)$ and $\mathrm{dn}(\zeta)$ are the JE sine function, JE cosine function and the JEF of the third kind, respectively. Also

$$cn^2(\zeta)=1-sn^2(\zeta), \quad dn^2(\zeta)=1-m^2sn^2(\zeta), \quad (8)$$

with the modulus m $(0<m<1)$.

When $m \to 1$, the Jacobi functions degenerate to the hyperbolic functions, i.e.,

$sn\zeta \to tanh\zeta,\quad cn\zeta \to sech\zeta,\quad dn\zeta \to sech\zeta,$

when $m \to 0$, the Jacobi functions degenerate to the triangular functions, i.e.,

$sn\zeta \to sin\zeta,\quad cn\zeta \to cos\zeta$ and $dn \to 1$.

3. Results

3.1. Boiti-Leon-Manna-Pempinelli equation

In this section, we will apply extended method to study the (2+1)-dimensional BLMP equation (1)

$$u_{yt} + u_{xxxy} - 3u_{xx}u_y - 3u_x u_{xy} = 0. \quad (9)$$

If we use $\zeta = \alpha x + \beta y + \nu t$, $u(x,y,t) = U(\zeta)$ carries PDE (9) into the ODE

$$\beta\nu U'' + \beta\alpha^3 U^{(4)} - 6\beta\alpha^2 U' U'' = 0, \quad (10)$$

where by integrating once we obtain, upon setting the constant of integration to zero,

$$\beta\nu U' + \beta\alpha^3 U^{(3)} - 3\beta\alpha^2 (U')^2 = 0, \quad (11)$$

Setting $u' = v$, Eq. (11) becomes

$$\beta\nu V + \beta\alpha^3 V'' - 3\beta\alpha^2 V^2 = 0. \quad (12)$$

Balancing the term V'' with the term V^2 we obtain $N = 2$ then

$$V(\zeta) = a_0 + a_1 F + a_{-1} F^{-1} + a_2 F^2 + a_{-2} F^{-2}, \quad (13)$$
$$F' = \sqrt{A + BF^2 + CF^4}.$$

Substituting Eq. (13) into Eq. (12) and comparing the coefficients of each power of F in both sides lead to get an over-determined system of nonlinear algebraic equations with respect to ν, a_i, $i = 1, -1, -2, 2$. Solving the over-determined system of nonlinear algebraic equations by use of Mathematica, we obtain three groups of constants:

1. $$a_{-1} = a_{-1} = 0,\ a_0 = -\frac{2\alpha(B + \sqrt{B^2\alpha^2 + 12AC})}{3},\ a_2 = 2C\alpha,\ a_{-2} = 2A\alpha,$$
and $\nu = \pm 4\alpha^3\sqrt{B^2 + 12AC}$, (14)

2. $$a_{-1} = a_{-1} = a_2 = 0,\ a_0 = -\frac{2\alpha(B + \sqrt{B^2\alpha^2 - 3AC})}{3},\ a_{-2} = 2A\alpha,$$
and $\nu = \pm 4\alpha^3\sqrt{B^2 - 3AC}$, (15)

3. $$a_{-1} = a_{-1} = a_{-2} = 0,\ a_0 = -\frac{2\alpha(B + \sqrt{B^2\alpha^2 - 3AC})}{3},\ a_2 = 2C\alpha,$$
and $\nu = \pm 4\alpha^3\sqrt{B^2 - 3AC}$. (16)

Letting $\varphi = 0.5Am[(\alpha x + \beta y + \nu t)|m]$, $R = E[Am[(\alpha x + \beta y + \nu t)|m]|m]$, recalling $\zeta = \alpha x + \beta y + \nu t$, and using Eqs.(14)-(16), we can obtain the electrostatic potentials of Eq. (9) as follows:

$$u_1 = \frac{2}{3}[((2 + (3-m)m)\alpha + \sqrt{(1 + 14m^2 + m^4)\alpha^2})(\zeta) - \frac{3\alpha cn(\zeta)dn(\zeta)}{sn(\zeta)} - \frac{3(1+m)\alpha R dn(\zeta)}{\sqrt{1 - msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{(12m^2 + (1+m^2)^2)}, \quad (17)$$

$$u_2 = \frac{1}{3cn(\zeta)\sqrt{1 - m + mcn^2(\zeta)}\sqrt{1 - msn^2(\zeta)}} \times[(6m^2\alpha cn^2(\zeta)dn(\zeta)sn(\zeta) + 6\alpha dn^3(\zeta)sn(\zeta) - 2cn(\zeta)\sqrt{1 - m + mcn^2(\zeta)} \times(\zeta(\alpha + m^2\alpha - \sqrt{(1 + 14m^2 + m^4)\alpha^2})\sqrt{1 - msn^2(\zeta)} - 3(1+m)\alpha(\zeta - R)dn(\zeta)))],$$
$$\nu = \pm 4\alpha^3\sqrt{(12m^2 + (1+m^2)^2)}, \quad (18)$$

$$u_3 = -\frac{2}{3\sqrt{1 - msn^2(\zeta)}}[\zeta((1 + (-3+m)m\alpha - \sqrt{(1 - 16m^2 + 16m^4)\alpha^2})\sqrt{1 - msn^2(\zeta)} + 3\alpha dn(\zeta)((-1 + m^2)(\zeta) + (1 + 2m)R - (1+m)\sqrt{1 - m + mcn^2(\zeta)}sc(\zeta))],$$
$$\nu = \pm 4\alpha^3\sqrt{(12m^2 + (-1 - m^2)^2)} \quad (19)$$

$$u_4 = \frac{1}{3\sqrt{1 - m + mcn^2(\zeta)}\sqrt{1 - msn^2(\zeta)}} \times[6\alpha dn(\zeta)(m(1+m)cn(\zeta)sn(\zeta) - (2+m)R\sqrt{1 - m + mcn^2(\zeta)}) + 2\alpha(\zeta)\sqrt{1 - m + mcn^2(\zeta)}\sqrt{1 - msn^2(\zeta)} \times((2 - m^2) + \sqrt{16 - 16m^2 + m^4})],$$
$$\nu = \pm 4\alpha^3\sqrt{12m^2 + (-1 - m^2)^2} \quad (20)$$

$$u_5 = \frac{1}{3\sqrt{1-msn^2(\zeta)}}[-6\alpha dn(\zeta)((2+m)R + dn(\zeta)(cs(\zeta)-(1+m)sc(\zeta))) + 2((\zeta)((2-m^2)\alpha + \alpha\sqrt{16-16m^2+m^4})\sqrt{1-msn^2(\zeta)})],$$
$$\nu = \pm 4\alpha^3\sqrt{12(1-m^2)+(2-m^2)^2} \quad (21)$$

$$u_6 = \frac{1}{(m-1)\sqrt{1-msn^2(\zeta)}}[6m^2\alpha(\zeta) - \frac{3\alpha dn(\zeta)}{\sqrt{1-msn^2(\zeta)}}((m-1)(\zeta)+R+\frac{cn(\zeta)dn(\zeta)}{sn(\zeta)}) - 3m(1+m^2)\alpha dn(\zeta)((m-1)(\zeta) + R - \frac{mcn(\zeta)sn(\zeta)}{\sqrt{1-m+mcn^2(\zeta)}})],$$
$$\nu = \pm 4\alpha^2\sqrt{12m^2(1+m^2)+(-1+2m^2)^2} \quad (22)$$

$$u_7 = \frac{1}{dn(\zeta)sn(\zeta)\sqrt{1-msn^2(\zeta)}}[0.5m\alpha Rsn^3(\zeta) + 0.5\alpha cn(\zeta)dn^2(\zeta)\sqrt{1-1msn^2(\zeta)} + sn(\zeta)(-0.5\alpha R+(\zeta)(0.833333\alpha - 0.66667m^2\alpha + 0.66667\sqrt{(1-m^2+m^4)\alpha^2}) \times dn(\zeta)\sqrt{1-msn^2(\zeta)} + \alpha dn^2(\zeta)(0.5\zeta - 1.5R + \sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}(-0.353553cs(\zeta) - 0.707107ns(\zeta) + 0.707107tan(\varphi))))],$$
$$\nu = \pm 4\alpha^3\sqrt{0.75+(0.5-m^2)^2} \quad (23)$$

$$u_8 = \frac{2}{3}[(0.5+0.5m^2)(\zeta)\alpha + (\zeta)\alpha\sqrt{1.75(1+m^4)-2.5m^2} + ((2.12132034355964 3(-1+m^2)\alpha dn(\zeta)nc(\zeta)) \times \frac{\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}}{(m-1)\sqrt{1-msn^2(\zeta)}} + \frac{(1.5(0.5-0.5m^2)\alpha dn(\zeta)2R}{(m-1)\sqrt{1-msn^2(\zeta)}} - \frac{1.41421356237 31sc(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}}{(m-1)\sqrt{1-msn^2(\zeta)}} + \frac{3(0.5-0.5m^2)\alpha}{m-1}(-\frac{dn(\zeta)sn(\zeta)}{cn(\zeta)} + m(\zeta) - \zeta + \frac{mR(-1+1/m+cn^2(\zeta))}{dn(\zeta)\sqrt{1-msn^2(\zeta)}}) + \frac{1}{((m-1)\sqrt{1-msn^2(\zeta)}(cos(\varphi)+sin(\varphi)))} \times (0.707106781186547 5(0.75(1-m^2)\alpha dn(\zeta) \times (2\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)} \times (cos(\varphi)-sin(\varphi)) + 1.41421356237 31(m-1)(\zeta) \times (cos(\varphi)+sin(\varphi)) + 2.82842712474619 03R \times (cos(\varphi)+sin(\varphi))))],$$
$$\nu = \pm 4\alpha^3\sqrt{12(0.5-0.5m^2)(0.25-0.25m^2)+(0.5+0.5m^2)^2}, \quad (24)$$

$$u_9 = \frac{2}{3}[(0.5+0.5m^2)(\zeta)\alpha + (\zeta)\sqrt{(1.75-2.5m^2+1.75m^4)\alpha^2} + \frac{\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}}{(m-1)\sqrt{1-msn^2(\zeta)}} \times (-2.12132+2.12132m^2)\alpha dn(\zeta)nc(\zeta) + \frac{1.5(0.5-0.5m^2)\alpha dn(\zeta)2R}{(m-1)\sqrt{1-msn^2(\zeta)}} - \frac{1.41421sc(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)})}{(m-1)\sqrt{1-msn^2(\zeta)}} + \frac{3\alpha(0.5-0.5m^2)}{m-1}(-\frac{dn(\zeta)sn(\zeta)}{cn(\zeta)} + (m-1)(\zeta) + \frac{mR(1-m+mcn^2(\zeta))}{dn(\zeta)\sqrt{1-msn^2(\zeta)}})) + \frac{0.707107(0.75-0.75m^2)\alpha dn(\zeta)}{(m-1)\sqrt{1-msn^2(\zeta)}(cos(\varphi)+sin(\varphi))} \times (2\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)} \times (cos(\varphi)-sin(\varphi)) + 1.41421(m-1)(\varphi)(cos(\varphi)+sin(\varphi)) + 2.82843R(\cos(\varphi)+sin(\varphi)))],$$
$$\nu = \pm 4\alpha^3\sqrt{(0.75m^2+(-1+0.5m^2)^2} \quad (25)$$

$$u_{10} = \frac{2}{3}[(2-m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha + \frac{3(1+m)\alpha dn(\zeta)(R-dn(\zeta)sc(\zeta))}{\sqrt{1-msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{3(m^2-1)+(2-m^2)^2}, \quad (26)$$

$$u_{11} = \frac{2}{3}[(3m-1-m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3m\alpha R\sqrt{1-msn^2(\zeta)}}{dn(\zeta)}],$$
$$\nu = \pm 4\alpha^3\sqrt{-3m^2+(-1-m^2)^2}, \quad (27)$$

$$u_{12} = \frac{2}{3}[(3m-1-m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3\alpha cn(\zeta)dn(\zeta)}{sn(\zeta)} - \frac{3\alpha R\sqrt{1-msn^2(\zeta)}}{dn(\zeta)}],$$
$$\nu = \pm 4\alpha^3\sqrt{-3m^2+(-1-m^2)^2}, \quad (28)$$

$$u_{13} = \frac{2}{3}[(\sqrt{1-m^2+m^4}-(1+m^2))(\zeta)\alpha - \frac{3\alpha dn(\zeta)}{\sqrt{1-msn^2(\zeta)}}\times((\zeta)-R + \frac{sc(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}}{\sqrt{2}})],$$
$$\nu = \pm 4\alpha^3\sqrt{-3m^2+(-1-m^2)^2}, \quad (29)$$

$$u_{14} = \frac{2}{3}[(-(1+m^2)+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3m(\zeta)\alpha dn(\zeta)}{\sqrt{1-msn^2(\zeta)}} - \frac{3m\alpha R dn(\zeta)}{\sqrt{1-msn^2(\zeta)}} + \frac{3\sqrt{2}m^2\alpha cn(\zeta)dn(\zeta)sn(\zeta)}{\sqrt{1-msn[x,m]^2}\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{-3m^2+(-1-m^2)^2}, \quad (30)$$

$$u_{15} = \frac{2}{3}[(3m-3m^2-1+2m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3m\alpha R(1-m+mcn^2(\zeta)}{dn(\zeta)\sqrt{1-msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{3m^2(1-m^2)+(-1+2m^2)^2}, \quad (31)$$

$$u_{16} = \frac{2}{3}[((2-m^2)+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3m\alpha R dn(\zeta)}{\sqrt{1-msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{(2-m^2)^2+3(-1+m^2)}, \quad (32)$$

$$u_{17} = \frac{2}{3}[(2-m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha + \frac{3(1+m)\alpha cn(\zeta)sn(\zeta)}{dn(\zeta)} + \frac{3(1+m)\alpha dn(\zeta)R}{\sqrt{1-msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{(2-m^2)^2+3(-1+m^2)}, \quad (33)$$

$$u_{18} = \frac{2}{3}[(2-m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha + \frac{2(1+m)\alpha dn(\zeta)sn(\zeta)}{cn(\zeta)} + \frac{2(1+m)\alpha dn(\zeta)R}{\sqrt{1-msn^2(\zeta)}}],$$
$$\nu = \pm 4\alpha^3\sqrt{3m^2(1-m^2)+(1-2m^2)^2}, \quad (34)$$

$$u_{19} = \frac{2}{3}[(2m^2-1+\sqrt{1-7m^2+m^4})(\zeta)\alpha - \frac{3m(1+m^2)\alpha dn(\zeta)}{(m-1)\sqrt{2(1-msn^2(\zeta))}}(\sqrt{2}(m-1)(\zeta) + \sqrt{2}R - \frac{cn(\zeta)sn(\zeta)}{\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}})],$$
$$\nu = \pm 4\alpha^3\sqrt{(1-2m^2)^2-3m^2(1+m^2)}, \quad (35)$$

$$u_{20} = \frac{2}{3}[(2-m^2+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3\alpha dn(\zeta)}{2\sqrt{2(1-msn^2(\zeta))}}(2R + \sqrt{2}cs(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)})],$$
$$\nu = \pm 4\alpha^3\sqrt{3(m^2-1)+(2-m^2)^2}, \quad (36)$$

$$u_{21} = \frac{2}{3}[(2m^2-1+\sqrt{1-m^2+m^4})(\zeta)\alpha - \frac{3\alpha dn(\zeta)}{2\sqrt{1-msn^2(\zeta)}}(2(m-1)(\zeta)+2R + \sqrt{2}cs(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)})],$$
$$\nu = \pm 4\alpha^3\sqrt{3m^2(1-m^2)+(-1+2m^2)^2}, \quad (37)$$

$$u_{22} = \frac{2}{3}[(0.83333-0.66667(m^2-\sqrt{0.0625-1.m^2+m^4}))(\zeta)\alpha - \frac{0.5\alpha cn(\zeta)dn(\zeta)}{sn(\zeta)} - \frac{0.5\alpha R\sqrt{1-msn^2(\zeta)}}{dn(\zeta)} - \frac{1}{\sqrt{1-msn^2(\zeta)}} \times(0.707107dn(\zeta)ns(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)} - 0.25\alpha dn(\zeta)(2R + 1.41421cs(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)})],$$
$$\nu = \pm 4\alpha^3\sqrt{(0.5-m^2)^2-0.1875}, \quad (38)$$

$$u_{23} = \frac{2}{3}[(2-m^2+\sqrt{1.25m^2-0.125-0.125m^4})(\zeta)\alpha - \frac{1}{(m-1)\sqrt{1-msn^2(\zeta)}} \times((2-2m^2)\alpha dn(\zeta)nc(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)} + 1.5(0.5-0.5m^2)\alpha dn(\zeta)(2R - 1.41421sc(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}) + 3(0.5-0.5m^2)\alpha(\frac{R(1-m+mcn^2(\zeta))}{dn(\zeta)} - \frac{dn(\zeta)sn(\zeta)\sqrt{1-msn^2(\zeta)}}{cn(\zeta)}))],$$
$$\nu = \pm 4\alpha^3\sqrt{3(0.5m^2-0.5)(0.25-0.25m^2)+(0.5+0.5m^2)^2}, \quad (39)$$

$$u_{24} = \frac{2}{3}[(0.833333m^2 - 0.666667(1-\sqrt{1-1.1875m^2+0.25m^4}))(\zeta)\alpha - \frac{0.25(m^2)\alpha dn(\zeta)}{\sqrt{1-msn^2(\zeta)}}(2(m-1)(\zeta)+2R + 1.41421cs(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}) - m^2\alpha cs(\zeta) - \frac{0.5m^2\alpha cn((\zeta)dn(\zeta)}{sn(\zeta)} - \frac{0.5m^2\alpha R\sqrt{1-msn^2(\zeta)}}{dn(\zeta)})],$$

$$v = \pm 4\alpha^3\sqrt{(1-0.5m^2)^2-0.1875m^2}, \quad (40)$$

$$u_{25} = \frac{2}{3}[(0.333333m^2+0.5m-0.666667(1-\sqrt{1-m^2+0.0625m^4}))(\zeta)\alpha - \frac{dn(\zeta)}{\sqrt{1-msn^2(\zeta)}}(i\,m^{\frac{3}{2}}\arctan(\frac{1.41421\sqrt{m}sn(\zeta)}{\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}} - \frac{0.5m^2\alpha R(1-sn^2(\zeta))}{dn^2(\zeta)}) + 0.35m^2cs(\zeta)\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)}+\frac{m^2}{2}R)],$$

$$v = \pm 4\alpha^3\sqrt{(1-0.5m^2)^2-0.1875m^4}, \quad (41)$$

$$u_{26} = \frac{2}{3}[(0.5m^2+0.5+\sqrt{1.25m^2-0.125(1+m^4)})(\zeta)\alpha - \frac{0.707107(0.75-0.75m^2)\alpha dn(\zeta)}{(m-1)\sqrt{1-msn^2(\zeta)}(cos(\varphi)+sin(\varphi))} \times(1.41421(m-1)(\zeta)(cos(\varphi)+sin(\varphi)) + 2.82843R(cos(\varphi)+sin(\varphi)) + 2\sqrt{2-m+mcn^2(\zeta)-msn^2(\zeta)} \times(cos(\varphi)-sin(\varphi)))],$$

$$v = \pm 4\alpha^3\sqrt{3(0.5m^2-0.5)(0.25-0.25m^2)+(0.5+0.5m^2)^2}, \quad (42)$$

$$u_{27} = \frac{2}{3}[(0.33333(m^2+2)+\sqrt{1-1.1875m^2+0.25m^4})(\zeta)\alpha - \frac{\alpha dn(\zeta)}{m^2\sqrt{1-msn^2(\zeta)}}((\zeta)-0.5m(\zeta) - R - 0.707107\sqrt{2-m+mcos(4\varphi)}cs(\zeta) + \frac{cs(\zeta)\sqrt{1-msn^2(\zeta)}}{dn(\zeta)})],$$

$$v = \pm 4\alpha^3\sqrt{(1-0.5m^2)^2-0.1875m^2}, \quad (43)$$

3.2. Soliton Solutions

Some solitary wave solutions can be obtained, if the modulus m approaches to 1 in Eqs. (17)-(43), letting $\chi = \alpha x + \beta y$, we obtain

$$u_{28} = \frac{2\alpha}{3}(8(\chi \pm 16\alpha^3 t) - 3\coth(\chi \pm 16\alpha^3 t) - 3\tanh(\chi \pm 16\alpha^3 t)), \quad (44)$$

$$u_{29} = \frac{2\alpha}{3}(2(\chi \pm 16\alpha^3 t) - 3\tanh(\chi \pm 4\alpha^3 t)), \quad (45)$$

$$u_{30} = \frac{2\alpha}{3}(2(\chi \pm 16\alpha^3 t) - 3\coth(\chi \pm 4\alpha^3 t)), \quad (46)$$

$$u_{31} = \frac{2\alpha}{3}(3(\chi \pm 20\alpha^3 t) - 3\coth(\chi \pm 20\alpha^3 t) + \frac{3}{2}\sinh(2(\chi \pm 20\alpha^3 t))), \quad (47)$$

$$u_{32} = \frac{4\alpha}{3}(\chi \pm 4\alpha^3 t) - \alpha\coth(0.5(\chi \pm 4\alpha^3 t)) - \alpha\tanh(0.5(\chi \pm 4\alpha^3 t)), \quad (48)$$

$$u_{33} = \frac{10\alpha}{3}(\chi \pm \alpha^3 t) + \alpha sech(0.5(\chi \pm \alpha^3 t)) \times(5.55112\times 10^{-17}\cosh(0.5(\chi \pm \alpha^3 t)) - \sinh(0.5(\chi \pm \alpha^3 t))), \quad (49)$$

$$u_{34} = \frac{2\alpha}{3}(-2+i\sqrt{5})(\chi \pm i\sqrt{5}\alpha^3 t) + \frac{3}{2}\sinh(2(\chi \pm i\sqrt{5}\alpha^3 t))), \quad (50)$$

$$u_{35} = \frac{4\alpha}{3}(\alpha x + \beta y \pm 4\alpha^3 t) + \alpha\cosh(2(\chi \pm 4\alpha^3 t)) + \alpha\sinh(2(\chi \pm 4\alpha^3 t)), \quad (51)$$

$$u_{36} = \frac{10\alpha}{3}(\chi \pm \alpha^3 t) + 2.i\,\alpha\arctan(\tanh(0.5(\chi \pm \alpha^3 t))) + 0.25\alpha\coth(0.5(\chi \pm \alpha^3 t)) + 0.25\alpha\tanh(0.5(\chi \pm \alpha^3 t)) - 0.5\alpha\tanh(\chi \pm \alpha^3 t), \quad (52)$$

3.3. Triangular Periodic Solutions

Some trigonometric function solutions can be obtained, if the modulus m approaches to zero in Eqs. (17)-(43)

$$u_{37} = -2\alpha\cot(\chi \pm 4\alpha^3 t), \quad (53)$$

$$u_{38} = 2\alpha\tan(\chi \pm 4\alpha^3 t), \quad (54)$$

$$u_{39} = 2\alpha\tan(\chi \pm 4\alpha^3 t) - 2\alpha\cot(\chi \pm 4\alpha^3 t), \quad (55)$$

$$u_{40} = \alpha\tan(0.5(\chi \pm 4\alpha^3 t)) - \alpha\cot(0.5(\chi \pm 4\alpha^3 t)), \quad (56)$$

$$u_{41} = 0.784783\alpha(\chi \pm 5.3\alpha^3 t) + \frac{4\alpha\sin(0.5(\chi \pm 5.3\alpha^3 t))}{\cos(0.5(\chi \pm 5.3\alpha^3 t)) - \sin(0.5(\chi \pm 5.3\alpha^3 t))} + \frac{2\alpha\sin(0.5(\chi \pm 5.3\alpha^3 t))}{\cos(0.5(\chi \pm 5.3\alpha^3 t)) + \sin(0.5(\chi \pm 5.3\alpha^3 t))}, \quad (57)$$

$$u_{42} = 0.0625(\chi \pm 4\alpha^3 t)\alpha - 0.03125\alpha \sin(2(\chi \pm 4\alpha^3 t)), \quad (58)$$

$$u_{43} = (-0.666667 + 0.235702i)\alpha(\chi \pm 1.414212i\alpha^3 t) + \frac{4\alpha \sin(0.5(\chi \pm 1.414212i\alpha^3 t))}{\cos(0.5(\chi \pm 1.414212i\alpha^3 t)) - \sin(0.5(\chi \pm 1.414212i\alpha^3 t))}, \quad (59)$$

The modulus of solitary wave solutions u_1 and u_2 are displayed in figures 1 and 2 respectively, with values of parameters listed in their captions.

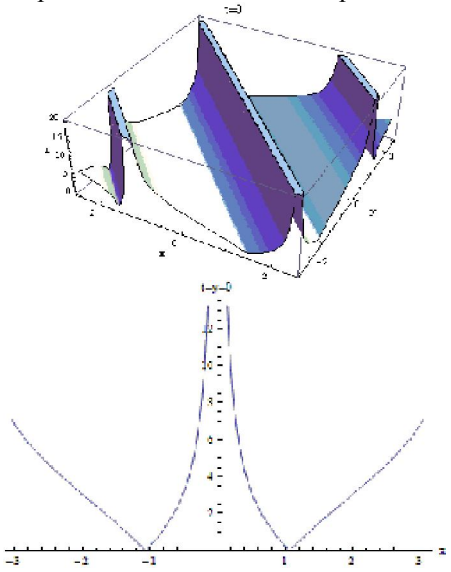

Fig. 1 The modulus of solitary wave solution u_1 (Eq. 17) where $\alpha = \beta = 1$, $m = 0.5$ and $t = 0$.

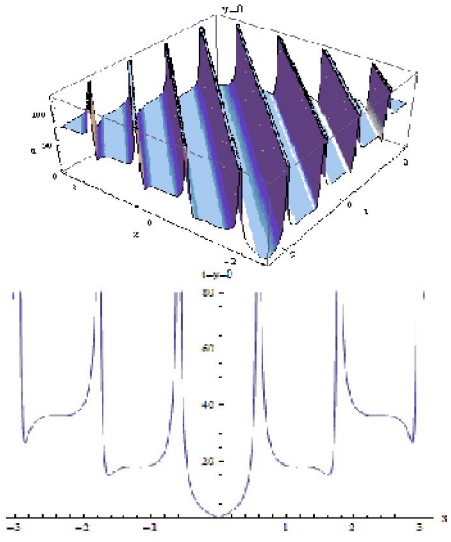

Fig. 2 The modulus of solitary wave solution u_2 (Eq. 18) where $\alpha = \beta = \pi$, $m = 0.5$ and $t = 0$.

4. Discussion

The investigation of exact solutions is the key of understanding the nonlinear physical phenomena. It is known that many physical phenomena are often described by NLPDEs. Many methods for obtaining exact travelling solitary wave solutions to NLPDEs have been proposed. By introducing appropriate transformations and using extended F-expansion method, we have been able to obtain in a unified way with the aid of symbolic computation system-mathematica, a series of solutions including single and the combined Jacobi elliptic function. Moreover, it is shown that soliton solutions and triangular periodic solutions can be established as the limits of Jacobi doubly periodic wave solutions. For $m \to 1$, the above solutions are obtained using the hyperbolic and extended hyperbolic functions method. Where $m \to 0$, these solutions are equivalent to these obtained using the triangular and etended triangular functions method.

5. Conclusion

By introducing appropriate transformations and using extended F-expansion method, we have been able to obtain in a unified way with the aid of symbolic computation system-mathematica, a series of solutions including single and the combined Jacobi elliptic function. Also, extended F-expansion method is shown that soliton solutions and triangular periodic solutions can be established as the limits of Jacobi doubly periodic wave solutions. When $m \to 1$, the Jacobi functions degenerate to the hyperbolic functions and given the solutions by the extended hyperbolic functions methods. When $m \to 0$, the Jacobi functions degenerate to the triangular functions and given the solutions by extended triangular functions methods.

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