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Water Quality and Phytoplankton Density in Alinsaog River, Zambales, Central Luzon, Philippines: Implications on Its Land Use

***Sazon, Rowena R. [1,2] and Migo, Veronica P.[3]**

[1] School of Environmental Science and Management, University of the Philippines at Los Baños, College, Laguna 4031, Philippines.
[2] Department of Biology, College of Arts and Sciences, Ramon Magsaysay Technological University, Iba, Zambales 2201, Philippines.
[3] College of Engineering and Agro-Industrial Technology, University of the Philippines at Los Baños, College, Laguna 4031, Philippines.

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ABSTRACT

The study aimed to assess the water quality and phytoplankton density of Alinsaog River in Zambales, Central Luzon, Philippines. Water quality on the four designated stations along the stretch of the river was evaluated based on physicochemical parameters such as temperature, pH, dissolved oxygen (DO), electrical conductivity (EC), salinity, total dissolved solids (TDS), Secchi disk visibility, nitrate-nitrogen, phosphate, and chemical oxygen demand (COD); hydrologic properties like stream flow; and biological characteristics like phytoplankton density. The results were compared with the water quality standards for freshwater using the Department of Environment and Natural Resources Administrative Order 34, series 1990. The results showed that TDS and COD, and the DO concentration during the dry season exceeded the standard limit for Class C water. A high density of non-toxic red tide organism *Peridinium* sp. of up to 111,982 cells/L was recorded two months after storm-induced flooding caused by typhoon *Koppu*. This result was concurrent with increased level of nitrate and phosphate in the upstream and downstream stations. There was a negative correlation between dinoflagellates density and EC, TDS and salinity and between total phytoplankton density and EC. The results suggest that the water quality of Alinsaog River failed to meet the local regulatory standards in terms of DO, COD and TDS. Some land-based activities were found to influence the health status of the river. These findings can be used as a basis for the formulation of river management plan including the policies and strategies for its protection and rehabilitation.
KEYWORDS: *Peridinium* sp., typhoon *Koppu*, chemical oxygen demand, stream flow

INTRODUCTION

Streams, rivers, lakes and ponds comprise the freshwater biomes that can provide economically valuable goods (fishes and other aquatic resources) and services such as navigation, recreation, water purification, and flood control. They also serve as a natural medium for the growth and survival of a variety of life forms, which continuously interact with each other and the environment in freshwater ecosystems [1]. In some locations, however, these ecosystems are being degraded at an alarming rate.

The degradation of freshwater ecosystems is usually associated with a decrease in water quality and quantity. This can be brought about by natural and anthropogenic factors. Natural processes such as weathering of bedrock minerals, leaching of organic matter and nutrients from the soil, and biological processes such microbial decomposition, can alter the chemical composition of water. Furthermore, as the freshwater ecosystems are tightly linked with the water catchment or watershed in which they are located, their condition is easily influenced by land-based activities. These include runoff from agriculture, aquaculture, mining, quarrying, and direct discharge of industrial or domestic wastewater. Runoff transports different substances such as fertilizers, grease, sediment, [1] pesticides, and others to ecosystems downstream of the discharge. Once these pollutants gain entry into the river system, they alter the physical, chemical and biological properties of water, properties that serve as indicators of its quality and ability to support life. Given that some aquatic ecosystems are sensitive to small changes in the properties of water, such changes lead to the degradation of ecosystem services and loss of biological diversity [2]. Furthermore, resultant poor water quality can lower the economic value of the freshwater resources that support the livelihood of the people including the irrigation water that is being used for agricultural activities [3]. The effect of declining water quality in freshwater biomes is now becoming a global concern. It is compounded by the continually

***Corresponding Author:** Sazon, Rowena R., Department of Biology, College of Arts and Sciences, Ramon Magsaysay Technological University, Iba, Zambales 2201, Philippines.
+6329466660776; rsazon@yahoo.com/rsazon1@up.edu.ph

growing human population, the corresponding increase in water consumption, the increase of industrial and agricultural activities, and the alterations in the hydrologic cycle brought about by the changing climate [4].

Measurement of water chemistry and physical parameters from samples of a freshwater biome can indicate its water quality and can provide a clear picture of the degree and extent of water pollution, where it exists. These parameters are compared with established water quality standards that identify unacceptable levels of substances that are toxic to aquatic organisms or to humans, based on scientific studies [4]. Likewise, the composition and diversity of biological communities reflect the quality of the aquatic environment. Various aquatic organisms, known as the "engineers of aquatic ecosystem," can serve as good water quality indicators due to their sensitivity to physical and chemical changes occurring in their environment [2]. Hence, these biological indicators, which include the phytoplankton, are extremely useful in evaluating the impacts of anthropogenic stress on aquatic habitats [5].

The Philippines, being an archipelago, is endowed with significant surface freshwater resources. It has 412 principal river basins in 119 proclaimed watersheds [6]. The country's vast river systems and coastal waters provide income sources to a large percentage its population. However, the fisheries productivity of water bodies in some parts of the country has declined in recent years as a result of deteriorating water quality due, in part, to watershed deforestation and increasing soil erosion [7]. In Central Luzon, the rivers and coastal waters of Sta. Cruz, Zambales are experiencing heavy siltation due to increased runoff from the mountain ridges and slopes and soil erosion from the adjoining farmlands. Aside from agriculture, mining is considered a profitable industry in the municipality since it started in 2007. After several years of mining operation, however, some environmental issues arose stemming from mine sites, access roads, and other deforestation activities; these issues include, *inter alia,* increased turbidity and changes in color of the water bodies, especially during the rainy season. To address these issues, the quality of marine water was assessed by the Bureau of Fisheries and Aquatic Resources in 2013. No study yet has been conducted on the freshwater environment, where silt deposition is already evident.

To understand the complex relationships within freshwater biomes necessitates the need for the assessment of the ecological status of the affected surface waters such as Alinsaog River. It drains its water to the West Philippine Sea, which harbors diverse species of fishes, seaweeds, corals and other marine resources. It serves as the source of irrigation water for farmlands and as fishing ground for the locals as well. The results of such an assessment can provide scientific information and insights to the policy makers in the formulation of river rehabilitation measures and regulatory policies pertaining to land use optimization and water resource management. Furthermore, the information generated can be utilized as basis for future studies related to remediation and removal of pollutants in water.

This study was conducted to assess the water quality of the Alinsaog River in terms of its physicochemical and hydrologic characteristics; to evaluate its phytoplankton community composition and density during the wet and the dry seasons; and to determine the correlation of water quality parameters with phytoplankton density.

MATERIALS AND METHODS

The Study Area and Sampling Stations

Sta. Cruz, the northernmost municipality in the province of Zambales, is situated at $15^0$46'1" north latitude and 119^0 54' 32" east longitude (Figure 1). Farming, fishing, and mining serve as its major industries. One of its two watersheds, the Nayom Watershed, drains its water into a series of springs, creeks, and other tributaries cascading down the mountainside, including the four rivers that support the major irrigation systems in the area. The Alinsaog River that is draining its water into the West Philippine Sea was selected as the study area due to its high laterite deposits in the sediments and along the stream banks. The sampling stations were designated as: S1 (upstream), S2 (midstream), S3 (downstream), and S4 (pond-like). S1 is vegetated with shrubs and trees while S2 has patches of mangrove species such as *Sonneratia alba*, *Avicennia* sp., *Rhizophora* species and *Nypa fruticans*. The downstream station (S3) is bordered with commercial establishments and residential houses of the fisherfolks. The pond (S4) is vegetated with mangroves *Sonneratia alba* and *Avicennia* sp. This station is receiving water from S3 during high tide.

Water Sampling and Analysis

In-situ measurement of water quality parameters was done at mid-depth in the months of October (2014), April, June, August, September and December (2015) to represent the wet and dry seasons. Zambales is characterized by Type 1 Climate with two pronounced seasons: dry season from November to April and wet season from May to October. The physicochemical properties of water were measured using portable devices: multiparameter water quality meter (HANNAH® HI9828/4/-2, Hannah Instruments) for temperature and dissolved oxygen (DO); hand-held conductivity meter (SARTORIUS PT20) for salinity, electrical conductivity (EC) and total dissolved solids (TDS); WTW pH meter for pH; and the water transparency using Secchi disk.

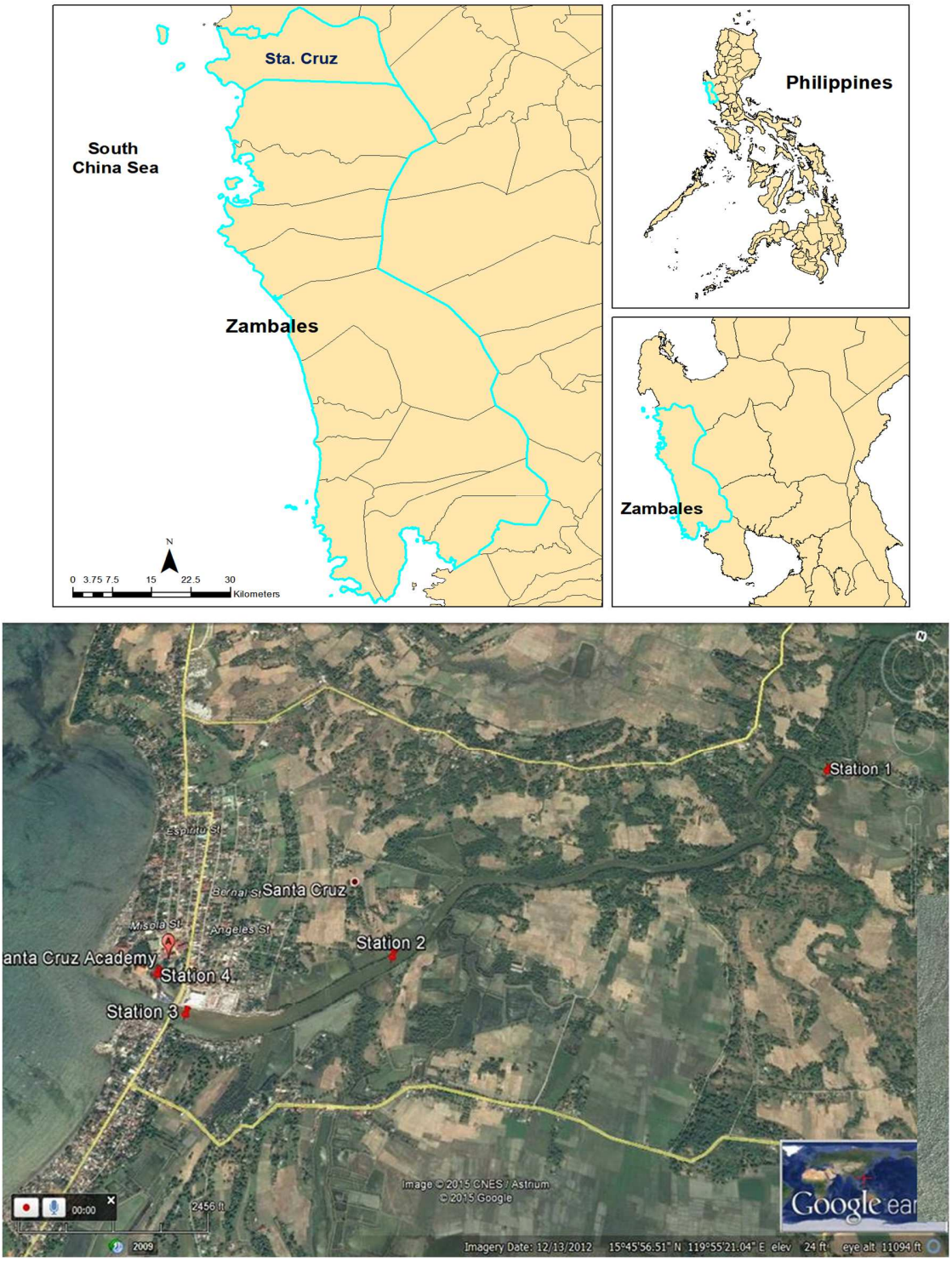

Figure 1. Map showing the location of Sta. Cruz and the sampling stations in Alinsaog River, Sta. Cruz, Zambales, Philippines

GPS coordinates (Station 1: 15.77727 N, 119.93640 E, Station 2: 15.76382 N, 119.91927 E, Station 3: 15.75941 N, 119.91185 E, Station 4: 15.76065 N, 119.90997 E).

The water sampling for analyses of chemical oxygen demand (COD), nitrate-nitrogen (NO_3^- - N) and phosphate (PO_4^3) was likewise carried out at mid-depth using a fabricated water sampler. The sampler was designed following the weighted bottle catcher of the Department of Environment and Natural Resources-Environmental Management Bureau Water Quality Monitoring Manual [8]. The improvised sampler had no weighted sinker because it is already made up of metal. A removable polyethylene plastic bottle was used instead of glass bottle. This sampler was designed in such a way that once it is lowered to the desired depth, the lid would open filling it up with water and would close by pulling the string before lifting it to the surface. The stirring up of the bottom sediments was avoided during sampling in order to maintain the integrity of the water samples. The composite samples from the left, middle and right sections of each station were transferred to pre-washed glass bottles, and placed in an ice box during their transport. The COD was analyzed by open reflux method and NO_3^- - N and PO_4^3 by colorimetric method at the National Institutes of Molecular Biology and Biotechnology (BIOTECH) Central Analytical Service Laboratory (CASL), University of the Philippines Los Baños (UPLB).

Stream Flow Measurement

The stream flow or river discharge was measured using the float method [8] during the months of August and December to represent the wet and dry season, respectively. Two transect lines representing the upstream and the downstream sections of each station were laid perpendicular to the river banks. The average depth and width of each transect at four interval points were used to calculate the cross-sectional area of a 6 m-long stretch of river. The time it took for the floating material to travel between the transects was determined, and the stream flow was calculated using the formula: Flow = ALC/T, where A is the average cross-sectional area of stream, L is the length of the stream reach measured (6 m), C is the coefficient of correction factor (0.8 for rough, rocky bottom; 0.9 for smooth sandy, muddy and smooth bedrock), and T is the time (s) for traveling through L.

Phytoplankton Sampling and Identification

The Bucket method was followed in the sampling of phytoplankton [1] but only 60 L was collected at each station using a graduated pail. The sample was filtered through a plankton net (25 µm mesh size), transferred to a polyethylene bottle, and added with 1.0 ml of 4% formalin as preservative. In the laboratory, the samples were allowed to settle for 24-48 hours, filtered using 26µm sieve and the residuum was diluted with 50 ml of water filtrate. One (1) ml of thoroughly mixed aliquot was dispensed on a Sedgwick-Rafter counting chamber (20 mm x 50 mm). The phytoplankton was identified to the lowest possible taxon. The number of plankton in three (1 ml) replicate subsamples was counted (cells/ml) and the density was extrapolated into number of cells/L by multiplying the number of plankton with 50 ml and dividing it with the total volume of the water samples (60 L).

Data Analysis

The data were evaluated using the Department of Environmental and Natural Resources Administrative Order (DAO) No. 34, series of 1990 and DAO 1990-35 (Revised Effluent Regulation of 1990). The seasonal variations in water quality parameters were tested by One -way Analysis of Variance (ANOVA) and the differences among the means by Duncan's Multiple Range Test (DMRT). The linear association between the water quality variables and phytoplankton density was determined by Pearson Correlation Coefficients using the SAS software.

RESULTS AND DISCUSSION

Physicochemical Characteristics

Water in the four sampling stations along the stretch of Alinsaog River in Sta. Cruz, Zambales was characterized during the wet and dry seasons using various physicochemical parameters which include temperature, dissolved oxygen, pH, salinity, total dissolved solids, electrical conductivity, Secchi disk visibility, nitrate-nitrogen, phosphate, and chemical oxygen demand.

Temperature, dissolved oxygen and pH. The water temperature, ranging from 28.27 – 35.31 ^{0}C (Table 1), had the highest value in August though this was considered as part of the rainy period. The study area is characterized by Type 1 climate, having two pronounced seasons; the dry which starts from November to April and the wet season on the rest of the months. The delayed onset of the rainy season could explain the recorded warm temperature in August. In general, the temperature was high during the dry season and before the onset of rainy season (April, June). Water temperature can directly regulate the concentration of dissolved oxygen in water, the metabolic rate and the other life processes of aquatic organisms [9].

The amount of oxygen dissolved in water is commonly used as an indicator of water quality since it is required in the metabolism of aerobic organisms. High oxygen concentration indicates good water quality [2]. The mean level of dissolved oxygen (DO), ranging from 3.73 – 8.77 mg/L, was higher during the rainy months. This showed that the solubility of oxygen in water increased at lower temperature. Most of the stations during the dry season (October, December) had a DO below the standard limit for Class C water (5 mg/L). Aside from temperature, other factors could influence the amount of oxygen in water such as pollution, and water movement. The demand for oxygen escalates in polluted water because microorganisms used up the oxygen for the decomposition of organic pollutants leading to oxygen depletion. DO should be at least 5 mg/L for the water body to sustain aquatic [10]. Organic pollution in the stream may have originated from wastewater from the commercial establishments, domestic sewage from the migrant settlers along the river banks, and agricultural runoff. The upstream and middle stations (S1, S2) are situated closed to the farmlands which are flooded during heavy rainfall events due to river overflow.

Among the sampling sites, S4 had the lowest DO. It can be due to the high amount of autochthonous organic materials (OM) or instream primary production in the area, particularly the litterfall from the mangrove trees in the riverbanks. Furthermore, low DO can be explained by the limited water movement in the pond (S4), as indicated by its low flow (Table 3). The slower the water movement at the water-air interface, the lower the level of dissolved oxygen. The configuration of S4, having a narrow water inlet and outlet, did not allow the materials that enter to flow out of the station. Consequently, the oxygen in the area might have been used up by the decomposing organisms.

Table 1. Seasonal changes in water quality parameters at different sampling stations in Alinsaog River, Sta. Cruz, Zambales

Parameters	Stations	Sampling Period						Class C limit	Class D limit
		Oct. 2014	Apr. 2105 (D)	June 2015	Aug. 2015 (W)	Sept. 2015 (W)	Dec. 2015 (D)		
Temperature (^{0}C)	S1	29.47 C	33.16 B	33.36 A	31.26 C	26.86 D	29.67 B	3 ^{0}C rise [b]	3 ^{0}C rise [b]
	S2	32.61 B	32.14 C	33.20 A	32.34BC	29.03 C	29.73 B		
	S3	30.39 C	30.61 D	32.58 A	32.68 B	30.35 B	30.37 A		
	S4	34.61 A	35.30 A	31.79 A	35.31 A	34.82 A	28.27 C		
pH	S1	n.d.	7.84 C	7.84 A	7.84 B	7.92 A	7.34 B	6.5 – 8.5 [b]	6.5 – 9.0 [b]
	S2	n.d.	7.90 B	7.91 A	8.20 A	7.56 A	7.88 A		
	S3	n.d.	7.99 A	7.77 A	8.13 A	7.86 A	7.93 A		
	S4	n.d.	7.89 B	8.04 A	8.13 A	8.15 A	7.52AB		
Dissolved oxygen (mg/L)	S1	5.08 A	n.d.	6.04 A	5.09 B	6.28 B	3.73 B	5.0 [b]	3.0 [b]
	S2	4.94 A	n.d.	6.15 A	5.82 AB	5.40 C	4.20 B		
	S3	3.50 B	n.d.	6.17 A	7.00 A	5.21 C	6.56 A		
	S4	4.83 A	n.d.	5.03 B	7.53 A	8.77 A	3.97 B		
Salinity (ppt)	S1	0.97 C	2.00 A	2.33 A	1.80 AB	0.10 C	1.17 B		
	S2	2.63 B	1.67 B	1.73 B	1.47 B	1.10 B	1.37 B		
	S3	2.63 B	1.23 C	1.70 B	1.73 AB	1.97 A	1.37 B		
	S4	3.10 A	1.27 C	1.17 C	2.20 A	2.70 A	2.3 A		
Electrical conductivity (mS/cm) = ds/m	S1	3.81 C	4.48 A	3.53 A	3.53 AB	0.26 C	2.25 B		
	S2	3.26 B	3.35 AB	2.88 B	2.88 B	2.24 BC	2.68 B		
	S3	2.56 B	3.28 C	3.38 B	3.38 AB	3.79 AB	2.16 B		
	S4	3.00 A	2.65 BC	4.21 B	4.21 A	5.04 A	4.63 A		
Total dissolved solids (mg/L)	S1	968 C	1897 A	2230 A	1717 AB	131 C	1110 B	1,000 [b]	1,500 [c]
	S2	2453 B	1603 B	1673 B	1440 B	1095BC	1277B		
	S3	2473 B	1215 C	1643 B	1683AB	1887AB	1343 B		
	S4	2890 A	1247 C	1172 C	2080 A	2547 A	2160 A		
Secchi disk visibility (cm)	S1	57.0	123.0	129.0	103.7	27.7	136.7		
	S2	61.7	102.7	99.0	153.7	27.2	117.5		
	S3	71.0	140.3	80.3	150.7	30.8	121.2		
	S4	n.d.	39.7	64.0	39.0	41.3	46.5		

[a] Means having the same letter within the same column are not significantly different from each other
[b] DAO 34, s. 1990 (for freshwater)
[c] DAO 35, s. 1990 (for inland water)
- standard of these substances are not considered necessary for the present time, considering the stage of the country's development and the capabilities of the Department of Environment and Natural Resources (DENR), equipment and resources (DAO 34)
n.d. - no data

The pH values (7.34 – 8.20), on the other hand, were all within the permissible limit (6.5 – 8.5) suggesting that the water pH was favorable for aquatic life. The pH range is said to be typical for most drainage basins worldwide [11]. The river studied by [12] also shifted towards the alkaline side of neutrality and this was attributed to the geological characteristics of the area which is primarily composed of limestone.

Salinity, electrical conductivity, total dissolved solids and water transparency. Water salinity is a measure of the concentration of salts dissolved in water. Table 1 shows that the lowest salinity was 0.10 ppt at the upstream (S1) and 3.10 ppt at S4. According to [13], freshwater has a salinity of less than 0.5 ppt while brackish water ranges from 0.5-35 ppt. The river under study could then be classified as brackish. This could explain why several species of mangroves are thriving very well on the riparian zone of the river. Salinity was generally high on S3 and S4 due to their proximity to the river mouth.

When these salts in water dissolve, they form both negative and positive ions, the mobility of which allows current to flow between two electrodes placed in the water (i.e. with a conductivity meter); thus salinity is considered to be a strong contributor to EC. When the salt concentration in water is high, EC correspondingly rises [14]. The EC varied over sampling periods and had no distinct trends over time though the lowest value (0.26 mS/cm) was observed at the upstream in September, parallel with that of salinity. The local regulatory agencies had no standard limit yet for EC. The lowest value was considered normal for freshwater. In the mangrove ecosystem on the southwest coast of India, the minimum EC of 0.26 mS/cm was observed in July but its maximum EC reached only 29.8mS. This variation was due to the influx of freshwater and mixes up with ebb and flow [15]. It was likewise reported by [16] that water evaporation during warm months and tidal changes are possible causes of fluctuations in EC.

Since the river water is primarily used for irrigation of the adjacent farmlands, it is important to consider the influence of this parameter to crop productivity. According to [17], high EC of stream water makes it unfit for irrigation. The guidelines for salinity hazard of irrigation water based on EC [18] showed that the EC values of Alinsaog River had limitations with regards to its use. It reported that EC of 1.51-3.00 dS/m and more than or equal to 300 dS/m had moderate to severe limitation as irrigation water. The EC unit of milliSiemens/cm (Table 1) is equivalent with that of deciSiemens/meter. When this type of water is used for irrigation, it requires a good drainage. It was explained by [18] that at high EC of water, the usable plant water in the soil solution decreased due to the reduced ability of the plants to compete with ions in the soil solution leading to physiological drought. This would eventually affect plant germination and crop yield.

Furthermore, the total dissolved solids (TDS), with the exception of September sampling at the upstream (131 mg/L), exceeded the limit for Class C water (1000 mg/L). The elevated levels of solids in water could be a result of siltation due to various land uses upstream. As the river flows, it carries the sediments from the river bed and eroding river banks. In areas with mining activities, [19] reported that the TDS was usually high due to the dissolution of minerals from the rocks. This condition could lead to a decline in fishery resources [20] because these solids could reduce light penetration in the water column thereby lowering the photosynthetic activity of the phytoplankton, the primary producers in freshwater habitats. The photic zone or the layer of water that can be reached by sunlight is reduced when the water is turbid. Among the stations, S4 had the highest TDS which can be due to its enclosed feature and low stream flow. As a result, the particulate matters that flowed in the pond during high tide simply settled along the banks.

TDS can be associated with water transparency or secchi disk visibility which is a measure of the depth at which sulight can penetrate water. The month of September had the lowest Secchi reading (27.7 and 27.2 cm at S1 and S2, respectively) which can be due to excessive turbidity of water brought about by rainfall. There was a downpour of rain the day before the sampling such that the water appeared murky during the measurement. The rain increased the volume of water in the stream, hence increasing the water flow. This led to the resuspension of settled sediments and erosion of the river banks [21] with heavy silt deposits. The recorded low water transparency can also be due to runoff. Excessive precipitation caused the flow of water over the land surface where it picked up silt, clay and other small particles, and deposited them in the river [16]. The transparency values of less than 30 cm, according to [22], indicate excessive turbidity, which when further lowered could lead to a reduction in concentration of oxygen dissolved in water. The report added that if the sources of turbidity are the suspended solids, it could lower the productivity of the water body.

The measured water transparency at S4 (39.0 - 46.5 cm), on the other hand, mostly corresponded with the site depth. The Bureau of Fisheries and Aquatic Resources (2013) reported that the safe optimum level for transparency was 30-45 cm. At this condition, light can penetrate the entire water column. When the water is clear, the photic zone or the layer of water that can be reached by sunlight is deeper, hence an increased photosynthetic activity [16] of the plankton. This transparency range could indicate good condition of the pond if the turbidity is

due to the presence of phytoplankton [22]. Other stations at different sampling periods had a secchi reading of >60 cm, which could indicate inadequate primary productivity.

Analysis of variance (ANOVA) at 5% level of significance revealed that, in general, the measured parameters differed significantly across the stations except for temperature and pH in June and pH in September sampling period. Table 1 presents which among the stations exhibited significant variations at each sampling period.

Other water quality parameter that was observed visually was the color. During sampling, the water appeared brownish and clear but a slight stirring of the sediments immediately turned the water reddish. This has already reduced the aesthetic value of the rivers in the area which have undeniably high potential for tourism activities like swimming and boating.

Chemical oxygen demand, nitrate and phosphates. Table 2 presents the measured COD, nitrate-N and phosphates at different sampling periods. Chemical oxygen demand principally measures the amount of oxygen that is required for the oxidation of organic matter (OM) into carbon dioxide and water under strong oxidizing agents and acidic conditions [23], although it also oxidizes non-organic matter constituents such as ammonia and nitrates. The COD levels, ranging from 110-210 mg/L, exceeded the standards for Class C water. The high amount of COD was a result of the existing land uses in the area. The presence of commercial establishments and communities that directly discharged their sewage and solid wastes contributed to the high COD in the downstream station (S3). The riparian vegetation likewise provides a large input of organic matter via leaf litter and its decomposition in other stations. High COD levels indicate organic pollution. In an environment with high OM, oxygen depletion might become a problem since microorganisms utilize oxygen for the decomposition process. The results show that the high COD at S1 and S2 in August and December paralleled to low DO concentration. Lowering of DO to 3 mg/L might lead to hypoxia, a condition that could trigger the release of pollutants in the sediments [24]. High COD could also indicate high ammonia, high nitrates, or a toxic condition and the presence of biologically resistant organic substances that cannot be acted upon by bacteria [25]. Moreover, the blue green algae *Oscillatoria* sp. was found to be present at S2 and S4, the stations that are vegetated with mangroves. It was reported as early as 1999 that *Oscillatoria* sp. could indicate organic pollution [26]. The litter fall of mangroves contributed to the enrichment of organic matter (OM) in the area in the form of detritus and living organisms [27].

The measured NO_3^- - N, ranged from 0.023 ± 0.011 to 0.616 ± 0.007 mg/L. The concentration was lower during the rainy months due to the dilution effect of rainfall. The limit for Class A to C water is 10 mg/L while the measured nitrate-N was even less than 1 mg/L indicating that the water has limited nutrient hence, the river can be considered as oligotrophic. The nitrate measured was typical for freshwater, according to [28].

The phosphate level, on the other hand, ranged from non-detectable to 0.002 mg/L in the first two sampling periods. Though there were potential non-point sources of phosphates in the river water such as natural rock weathering, erosion and agricultural runoff, phosphate enrichment was not observed. Most of the phosphates probably bound to the river sediments. The sediment has both the capacity to retain and release phosphorous depending on the existing environmental condition. It was reported that the deposition of inorganic P from the overlying water to the sediments exceeded the rate at which it is released by desorption or diffusion [29]. The phosphate level in the upstream (0.31 mg/L) and in the pond (0.267 mg/L) in December was beyond the permissible limit. This could be a result of river bank erosion and runoff from the adjacent rice farms during the typhoon-induced flood (*Koppu*) in October. During the storm, the fields that were routinely fertilized by nitrogen and phosphorous were inundated by floods, causing it to overflow. Since P tends to be associated with the particulate and organic matter in the soil, it was carried in the runoff causing the enrichment of phosphates.

Table 2. Seasonal variations in chemical oxygen demand, nitrate-N and phosphate in Alinsaog River

Station	COD (mg/L)		Nitrate-N (mg/L)			Phosphate (mg/L)		
	1-Aug-15	19-Dec-15	26-Oct-14	1-Aug-15	19-Dec-15	26-Oct-14	1-Aug-15	19-Dec-15
1	139 ± 8	204.31 ± 13.12	0.172 ± 0.005	0.116 ± 0.00	0.616 ± 0.007	nd	0.002 ± 0.001	0.310 ± 0.000
2	210 ± 0	175.26 ± 6.56	0.128 ± 0.032	0.051 ± 0.001	0.464 ± 0.004	nd	0.003 ± 0.002	0.003 ± 0.001
3	110 ± 2	152.76 ± 0.94	0.117 ± 0.004	0.065 ± 0.004	0.191 ± 0.016	nd	0.009 ± 0.002	0.005 ± 0.001
4	125 ± 7	137.77 ± 6.56	0.023 ± 0.011	0.064 ± 0.006	0.204 ± 0.020	nd	0.012 ± 0.002	0.267 ± 0.001
Class C	100 [b]		10 [a]			0.2 [a]		
Class D	200 [b]		-- [a]			0.4 [a]		

[a] DAO 34, s. 1990 (for freshwater); [b] DAO 35, s. 1990 (for inland water); nd – non detectable

Hydrologic Characteristics

The stream flow is the volume of water that moves over time in a water course [8]. This affects the transport of sediments and consequently influences the quality of surface water. Table 3 shows that stream flow varied between seasons and among stations. The flow was higher during the wet season because high amount of precipitation brought large volume of water causing an increase in the width and cross sectional area of the stream. A study of [30] also reported high stream flow during the period of increased precipitation.

The stream flow was increasing from the upstream going to the downstream (S1 to S3). The highest flow was measured in the downstream (S3), which was 22.17m^3/s and 20.48m^3/s during the wet and dry seasons, respectively. Though stream flow is not technically classified as a measure of water quality, monitoring of this parameter needs to be done because it can affect both the chemical and biological components of a freshwater system [2]. Water movement can influence the transport of sediments [31]. At high flow, more stress is exerted on the river bed and this contributed to elevated levels of TDS and low water transparency during the rainy months (Table 1). The lowest flow was measured in S4. Due to its limited water flow, sediments together with other particulate matters that are bound to it, just settled at the bottom and might be resuspended only if the flow is increased by strong tidal fluctuations or increased precipitation.

Table 3. The stream flow (m^3/s) of the sampling stations in Alinsaog River on the wet and dry season

	Wet Season (August)				Dry Season (December)			
	S1	**S2**	**S3**	**S4**	**S1**	**S2**	**S3**	**S4**
Ave. width (m)	31	56.8	105	24	26	52	105	42.4
Ave. depth (m)	2.09	1.85	1.10	0.61	1.35	1.10	1.15	0.34
Ave. cross sectional area (m^2)	64.96	105.08	115.64	14.67	34.97	57.2	120.75	14.26
Stream flow (m^3/s)	11.82	18.69	22.17	0.47	4.52	4.86	20.48	0.46

Phytoplankton Composition and Density

Investigation of the state of the biological communities thriving in the freshwater habitat likewise reflects the quality of its water. In this study, the phytoplankton composition and density was assessed in relation to physicochemical properties of water. Five major taxonomic groups of phytoplankton were identified, namely; Bacillariophyta (diatoms), Chlorophyta (green algae), Cyanophyta (blue green algae), Dinophyta (dinoflagelates) and Protista. The diatoms had the most number of taxa (22) which is due to their preference to alkaline conditions [32]. The stream under study had a neutral to slightly basic pH. The diatoms possess inorganic cell wall that is comprised of hydrated silica [33]. The solubility of silica that is required for the synthesis of diatoms cell wall increased at higher pH [34].This could probably explained the abundance of diatoms relative to other taxa in the study area.

The study sites had more taxa and higher phytoplankton density during the dry season (Table 4a, Table 4c). The high plankton productivity was a consequence of high temperature and increased light penetration in the water column during the dry months. The fewer taxa and lower density per taxon during the period of high precipitation, on the other hand, could be due to high water velocity [35] and dilution effect of the rain. This was also the same explanation offered by [36] in their study on variability of plankton community in India. Another study stated that rainy season, cloudy weather, low transparency and flood can contribute to lower phytoplankton density [37]. The short residence time of water at enhanced river flow could limit phytoplankton growth [38].

Pyrodinium sp. was detected on August 2015 (Table 4b) but at a low density (0.83 cells/L). Some species of *Pyrodinium* are known to be causative agent of red tide. The cases of PSP (paralytic shellfish poisoning) in the coastal waters of Zambales occurred from April to August in 1988 [39] and the bloom of dinoflagellates was found to be due to *Pyrodinium bahamense* var. *compressum* [40]. This finding suggests the need for periodic monitoring of red-tide causing organisms since there were recurrent occurrences of red tide toxins in Zambales and Bataan coastal waters in the past.

A very high density of dinoflagellates *Peridinium* sp. (74 – 111,982 cells/L) was detected in December. This can be linked with the sudden upsurge in phosphate levels of Stations 1 and 4 (0.31 mg/L and 0.267 mg/L, respectively) after the typhoon-induced flooding in October. An increase in nitrate-N concentration, another limiting factor for the growth of dinoflagellates, was also observed. The flood could transfer these dissolved and particulate matters from the land to the river [41]. The upstream and middle stations (S1, S2) are adjacent to the rice fields where nitrogen and phosphorous-based fertilizers are intensively applied every cropping season. Two more factors could probably cause the bloom of *Peridinium* sp.; seeding due to temperature – induced germination and trace metal stress [42]. The warm temperature in December, reaching up to 30.37^{0}C, and the high water transparency (117.5 - 136.7 cm) triggered the germination of cysts in the sediments. When low concentration of metal is present in water, the plankton could accumulate them several fold higher than their levels in water. This might reduce the grazing pressure of the

zooplankton hence increasing the density of phytoplankton in water. In a separate study of [43], the levels Fe, Cr, Ni and Mn in the river sediments exceeded the standard limit, however, detection of trace elements in water and plankton was not covered by the study. A study of [44] also reported the dominance of these dinoflagellates in a mangrove habitat in Oman. This was due to their ability to survive various environmental conditions such as high salinity and temperature enabling them to outcompete the other plankton species including diatoms.

The massive growth of *Peridinium* sp., though considered as a non-toxic red tide organism, could kill fishes and invertebrates by depleting the oxygen in water [42]. This species, based on available data, had no record yet in the area.

Table 4a. Phytoplankton density in the four sampling stations during the dry season (October 2014).

Phytoplankton Group	Density (cells/L)				
	S1	S2	S3	S4	Total
Bacillariophyta	7.92	13.33	6.81	4.31	32.36
Chlorophyta	3.61	437.92	6.39	4.58	452.50
Cyanophyta	0.14	0.83	0.00	3.47	4.44
Grand Total	15.42	452.08	13.19	12.36	946.25

Table 4b. Phytoplankton density in the four sampling stations during the wet season (August 1, 2015)

Phytoplankton Group	Density (cells/L)				
	S1	S2	S3	S4	Total
Bacillariophyta	0.00	1.67	2.22	37.08	40.97
Chlorophyta	3.47	0.00	1.39	0.83	5.69
Cyanophyta	0.00	0.00	0.00	0.28	0.28
Dinophyta	0.00	0.83	0.00	0.00	0.83
Grand Total	3.47	2.50	3.61	38.19	47.78

Table 4c. Phytoplankton density in the four sampling stations during the dry season (December 19, 2015)

Phytoplankton Group	Density (cells/L)				
	S1	S2	S3	S4	Total
Bacillariophyta	5.00	0.83	8.75	6.67	21.25
Chlorophyta	0.28	0.00	0.00	0.00	0.28
Dinophyta	111,981.81	104,393.89	87,255.97	66.25	303,697.92
Protista	0.00	0.00	0.00	1.25	1.25
Grand Total	111,987.08	104,394.72	87,264.72	74.17	303,720.69

Correlation of Phytoplankton and Water Quality Parameters

Table 5 shows the positive correlation between the density of Cyanophyta and the three related parameters: salinity (P>0.0283), EC (P>0.0371) and TDS (P>0.0295). The high TDS in water became favorable for the growth of blue green algae because the dissolved solids in water contained the minerals that served as nutrient source for the Cyanophyta [45]. However, this was only up to a certain limit because osmotic stress could negatively affect the aquatic organisms.

Table 5. Pearson correlation coefficients (r) between the phytoplankton group density and the physicochemical properties of water

Density of Phytoplankton Group	Physicochemical Parameters					
	Temperature	pH	DO	Salinity	EC	TDS
Bacillariophyta	0.50067	0.23899	0.49432	0.23112	0.21571	0.23237
Chlorophyta	0.18105	0.14963	-0.06471	0.35384	0.31879	0.34657
Cyanophyta	0.50035	---	-0.10139	0.62944*	0.60505*	0.62569 *
Dinophyta	-0.41768	-0.47394	-0.22184	-0.53510	-0.60047*	-0.55592
Protista	-0.45676	-0.46501	-0.29410	0.19034	0.25441	0.18649
Total density	-0.41730	-0.47391	-0.22204	-0.53437	-0.59988 *	-0.55522

* Correlation is significant at the 0.05 level (2-tailed)

The density of Dinophyta (*Pyrodinium* sp., *Peridinium* sp.) and the total density of phytoplankton, on the other hand, were negatively correlated with EC (P> 0.0390). This implies that the density of the phytoplankton is reduced with increasing electrical conductivity. It was also reported by [46] that EC, together with water temperature,

were the most common factors negatively controlling phytoplankton density. The high EC suggested the presence of high concentration of salts dissolved in water including silt and clay particles and other particulate matters that could reduce light penetration in water [21] and consequently impaired the photosynthetic activity of plankton.

CONCLUSIONS

The study showed the influence of land uses on the stream water properties and the interconnection between the physicochemical and biological components of the aquatic system. Furthermore, the impacts of land-based activities on water quality was found to be intensified by natural calamities such as typhoon that transported huge amount of silt from the eroded river banks and overflow of the adjacent farms and from the mountain slopes where mineral extraction is being carried out.

The water quality could provide information on the current condition of the river ecosystem under study. This showed the need for periodic monitoring and assessment of the stream characteristics specifically those that pose impacts to the phytoplankton and higher organisms in the food chain.

LIMITATIONS AND FUTURE RESEARCH

The conducted study was limited to the evaluation of river water quality in terms of physicochemical and biological properties; thus it is suggested that further studies be done on the levels of toxic elements in water in order to determine the suitability of the river as source of irrigation water and to ensure public health. Investigation on the seasonal occurrence of red tide organisms in Zambales surface and marine waters is likewise recommended.

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REFERENCES

1. Ramachandra, T. V. and M. Solanki, 2007. Ecological Assessment of Lentic Water Bodies of Bangalore, January 2007. Environmental Information System [ENVIS] Centre for Ecological Sciences, Indian Institute of Science, India. ENVIS Technical Report: 25.
2. Carr, G.M. and Neary, J.P., 2008. Water quality for ecosystem and human health (2nd ed.). United Nations Environment Programme, Global Environment Monitoring System/Water Programme, p. 22, 31.
3. Palaniappan, M., P.H. Gleick, L. Allen, M.J. Cohen, J. Christian-Smith and C. Smith, 2010. Clearing the Waters: Focus on Water Quality Solutions, March 2010. United Nations Environment Programme, Nairobi, Kenya.
4. United Nations Department of Economic and Social Affairs, 2014. Water quality. International Decade for Action 'Water for Life' 2005-2015. UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC).
5. Michels, A., 1998. Use of Diatoms (Bacillariophyceae) for Water Quality Assessment in Two Tropical Streams in Costa Rica. Rev. Biol. Trop., 46 (6), 143-152.
6. World Bank, 2007. Philippines environment monitor, 2006. World Bank, Washington, DC. Report number 40856.
7. Guerrero, R.D. III, 1997. Philippine Freshwater Resources: Strategies for Sustainable Development. Philippine Council for Aquatic and Marine Research and Development, Los Banos, Laguna. Scientific Paper: Philippine Freshwater.
8. Department of Environment and Natural Resources-Environmental Management Bureau (DENR-EMB), 2008. Water Quality Monitoring Manual. EMB-DENR, Quezon City, pp: 49; 54; 113-119.
9. Baron, J.S., LeRoy, Poff, P.N., Angermeier, P.L., Dahm, C.N., Gleick, P.H., Hairston, N.G., Jr., Jackson, R.B., Johnston, C.A., Richter, B.D. and A. D. Steinman, 2003. Sustaining Healthy Freshwater Ecosystems. Ecological Society of America, Issues in Ecology Series 10.
10. Department of Environment and Natural Resources- Environmental Management Bureau. (2005). National Water Quality Status Report. DENR-EMB. Diliman, Quezon City.
11. United Nations Environment Programme Global Environment Monitoring System/Water Programme, 2008. Water Quality Outlook, ISBN 95039-11-4. UNEP GEMS/Water Programme.

12. Abdulwahid, S.J., 2013. Water Quality Index of Delizhiyan Springs and Shawrawa River within Soran District, Erbil, Kurdistan Region of Iraq. J. Appl. Environ. Biol. Sci., 3(1):40-48.
13. Freshwater. In New World Encyclopedia (2013). Retrieved September 10, 2014 from http://www.newworldencyclopedia.org/entry/Freshwater
14. Ohrel, R.L. Jr. and K. M. Register, 2006. Volunteer Estuary Monitoring: A Methods Manual, Second Edition, March 2006. Document prepared under cooperative agreement of U.S. EPA and The Ocean Conservancy. EPA-842-B-06-003.
15. Kumara, V. and V. Kumar, 2011. Evaluation of Water Quality of Mangrove Ecosystems of Kundapura, Udupi district. Journal of Ecobiotechnology, 3 (12): 23-29.
16. Fondriest Environmental, Inc., 2014. Conductivity, salinity and total dissolved solids. Fundamentals of Environmental Measurements.
17. Machiraju, P.V.S., Namratha, V. and Ch Veerababu, 2013. Physicochemical and Biochemical Characterization of Surface Waters in Mangrove areas of Godavari Region for Assessing their Interaction with Ground waters. Asian J. Research Chem., 6(3).
18. Bauder, T.A., Waskom, R.M., Sutherland, P.L. and J. G. Davis, 2011. Irrigation Water Quality Criteria. Fact Sheet No. 0.506. Colorado State University, U.S. Department of Agriculture.
19. Baker, J.A., Elphick, J. R., McPherson, C. A. and P. M. Chapman, 2015. Effect of Total Dissolved Solids on Fertilization and Development of Two Salmonid Species. Bulletin of Environmental Contamination and Toxicology, 95 (4): 488-493.
20. Bilotta, G.S. and R. E. Brazier, 2008. Understanding the Influence of Suspended Solids on Water Quality and Aquatic Biota. Water Res., 42 (12): 2849-2861.
21. US Environmental Protection Agency, 2012. Water: Monitoring and Assessment. Office of Water, U.S. Environmental Protection Agency, Washington, D. C.
22. Boyd, C. E., 2004. Secchi Disk Visibility: Correct Measurement, Interpretation. Global Aquaculture Advocate, 7(1):66-67.
23. Verstraete, W., 2009. Biotechnological Processes in Environmental Sanitation Course Book. [Available to enrolled students of Ghent University]. Belgium: Universitiet Ghent.
24. Ecological Society of America, 1999. The Role of Atmospheric Deposition in the Gulf of Mexico Hypoxic Zone. ESA Workshop Report 1999.
25. D.A. Chin, 2006. Water quality engineering in natural systems. John Wiley & Sons, p: 37.
26. Adakole, J.A. and A.D. Oladimeji, 1999. The Effects of Pollution on Phytoplankton in a Stretch of River Kubanni, Zaria, Nigeria. In the 13th Annual Conference of the Fisheries Society of Nigeria (FISON), 3-8 November 1996, New Bussa, Nigeria, pp. 151-158.
27. Khalid, A., Adnan, A., Claereboudt, M. R., Piontkovski, S. and S.M.N. Amin, 2013. Phytoplankton Community Structure of a Mangrove Habitat in the Arid Environment of Oman: the Dominance of *Peridinium quinquecorne*. Journal of Fisheries and Aquatic Science, 8: 595-606.
28. Behar, Sharon, 1996. Testing the waters: chemical and physical vital signs of a river. Montpelier, VT: River Watch Network.
29. Khalil, M. K. and A.E. Rifaat, 2013. Seasonal Fluxes of Phosphate Across the Sediment-Water Interface in Edku Lagoon, Egypt. Oceanologia, 55 (1) :219-233.
30. Golez, N.V. and I. G. Borlongan, 2010. Hydrological Characteristics Assessment of Jalaur River System and its Bottom Sediments, Province of Iloilo, Panay Island. Silliman Journal, 51 (1): 160.
31. Ongley, E., 1996. Sediment Measurements. In Water Quality Monitoring - A Practical Guide to the Design and Implementation of Freshwater Quality Studies and Monitoring Programmes (eds J. Bartram and R. Balance). Published on behalf of UNDP & WHO Chapman & Hall, London.
32. Buzer, J. S., 1981. Diatom Analyses of Sediments from Lough Ine, Co. Cork, Southwest Ireland. New Phytol., 89: 511-533.
33. Spaulding, S.A., Lubinski, D.J. and M. Potapova, 2010. Diatoms of the United States. Accessed on June 9, 2016 from http://westerndiatoms.colorado.edu.
34. Kempter, A. T. Gaedt, V. Boyko, S. Nied, M. Kley and K. Huber, 2013. Controlling Silica in Water Treatment Applications. In the Proceedings of the International Desalination Association World Congress on Desalination and Water Reuse, Tianjin, China, p. 1.
35. Malik, D.S. and U. Bharti, 2012. Status of Plankton Diversity and Biological Productivity of Sahastradhara Stream at Uttarakhand, India. Journal of Applied and Natural Science, 4 (1): 96-103.
36. Bhat, N. A., Wanganeo, A. and R. Raina, 2015. Variability in Water Quality and Phytoplankton Community During Dry and Wet Periods in the Tropical Wetland, Bhopal, India. J. Ecosys. Ecograph, 5, 160.

37. Pundhir, P. and K.S. Rana, 2002. Population dynamics of phytoplankton in the wetland area of Keoladeo National Park, Bharatpur (Rajasthan). Ecol. Environ. Conser., 8:253-255.
38. Trigueros, J. and E. Orive, 2000. Tidally Driven Distribution of Phytoplankton Blooms in a Shallow, Macrotidal Estuary. J. Plankton Res., 22 (5): 969-986.
39. Maclean, J.L., 1989. An Overview of *Pyrodinium* Red Tides in the Western Pacific. In Biology, epidemiology and management of *Pyrodinium* red tides ICLARM Conference Proceedings 21, p. 286 (eds. G.M. Hallegraeff and J.L. Maclean) pp. 1-8. Fisheries Department, Ministry of Development, Brunei Darussalam, and International Center for Living Aquatic Resources Management, Manila, Philippines.
40. Gonzales, C.E., 1989. *Pyrodinium* Blooms and Paralytic Shellfish Poisoning in the Philippines. In Biology, epidemiology and management of *Pyrodinium* red tides ICLARM Conference Proceedings 21, p. 286 (eds. G.M. Hallegraeff and J.L. Maclean) pp. 39-47. Fisheries Department, Ministry of Development, Brunei Darussalam, and International Center for Living Aquatic Resources Management, Manila, Philippines.
41. Fouillanda, E., A. Trotteta, C. Bancon-Montignyb, M. Bouvya, E. Le Floc'hc, J.L. Gonzale, E. Hateya, C. Mas, B. Mostajira, J. Nouguiera, D. Pecqueura, E. Rochelle-Newalle, B. Rodierb, C. Roquesa, C. Salles, M.G. Tournoudb and F. Vidussia, 2012. Impact of a River Flash Flood on Microbial Carbon and Nitrogen Production in a Mediterranean Lagoon (Thau Lagoon, France). Estuarine, Coastal and Shelf Science, 113:192-204.
42. Caturao, R. D., 2001. Harmful and Toxic Algae. In: Health Management in Aquaculture (eds Lio-Po, G.D., C. R. Lavilla, and E. R. Cruz-Lacierda) pp. 159-172. SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines.
43. Sazon, R.R. and V.P. Migo, 2016. Environmental impacts of mining operations in the riverine ecosystem of Sta. Cruz, Zambales, Central Luzon, Philippines, Ph.D. thesis, University of the Philippines Los Baños, College, Laguna, Philippines.
44. Al-Hashmi, K., Al-Azri, A., Claereboudt, M. R., Piontkovski, S. and S.M.N. Amin, 2013. Phytoplankton Community Structure of a Mangrove Habitat in the Arid Environment of Oman: The Dominance of *Peridinium quinquecorne*. Journal of Fisheries and Aquatic Science, 8, 595-606.
45. Weber-Scannell, P.K. and L.K. Duffy, 2007. Effects of Total Dissolved Solids on Aquatic Organisms: A Review of Literature and Recommendation for Salmonid Species. American Journal of Environmental Sciences, 3 (1): 1-6.
46. Hussian, A. M., Napiórkowska-Krzebietke, A., Toufeek, M.E.F., Abdel-Monem, A.M. and H.H. Morsi, 2015. Phytoplankton Response to Changes of Physicochemical Variables in Lake Nasser, Egypt. J. Elem., 20 (4), 855-871.

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Matching/Mismatching of Teaching and Learning Styles; and Its Effect on Students' Academic Achievement at Tertiary Level

Javed Khan[1] and Hafiz Muhammad Inamullah[2]

[1]Ph.D Scholar, Institute of Education and Research, University of Peshawar, Pakistan.
[2]Associate Professor, Institute of education and research, University of Peshawar, Pakistan.

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ABSTRACT

The overall purpose of the study was to explore the effect of matching/mismatching of teaching and learning styles on academic achievement in higher education. The study was causal comparative in nature to study the cause and effect relationships between matching/mismatching of teaching learning styles and students' academic achievement. The sample for this study, selected through multistage sampling design, consisted of 120 teachers and 240 students of BS-4 year program in four disciplines (Physics, Chemistry, Botany and Mathematics) from six public sector universities of Khyber Pakhtunkhwa, Pakistan. Felder-Solomon Index of Learning Style (FSILS) was used for the identification of learning styles of students while Teaching Style Instrument developed by Letele et al. (2011) was used to identify teachers' teaching styles. These styles of students and teachers were then analyzed to see if they matched or mismatched. The results showed that Visual learning style was the most favorite learning style followed by Balanced and Sensing learning style. Teaching style analysis showed that Visual teaching style was the most favorite style followed by Abstract and Sequential teaching styles. Group statistics indicated 42.75% matched cases and 57.25% mismatched cases. T-test for independent samples revealed that the students with matched learning styles performed significantly better than students with mismatched learning styles. In the light of these results, recommendations were forwarded for teachers, students, educationists, researchers and policy makers.
KEYWORDS*:* Matching, Mismatching, Teaching Style, Learning Style, Academic Achievement

INTRODUCTION

Matching/Mismatching of teaching and learning style has proved to be somewhat divisive subject in research cultures as there are research findings that favor the idea of matching and those that do not [22]. According to Coffield et al [6, 7], nine research studies found learning to be more effective when there is match while the same number of studies favored the idea of mismatch. According to Larkin-Hein, the teacher who teaches in the classroom keeping learning style of students in view and uses various strategies to cater for all the students, results in improved conditions in terms of interest, motivation and academic performance [31].

This study is planned to determine the influence of matching/mismatching on students' performance regarding their academic achievement. Matching/Mismatching illustrates the extent to which students' learning style preferences are similar/dissimilar to teachers' instructional style preferences indicated by the two questionnaires in the study.

Academic achievement is defined as "the attainment of knowledge, competencies, and higher-level status, as reflected in grades, degrees, and other forms of certification or public acknowledgment" [8, 43]. For this research study academic achievement is the mean score attained by the student at the end of semester examination in the subject taught by the teacher participating in the study.

Learning styles

The Cambridge Advanced Learner's Dictionary [4] defines style as "a way of doing something especially typical of a person, group of people, place or period". In the context of education, a teaching style may be defined as "methods, procedures and strategies in instruction and interpersonal relations that have developed and matured through years of personal and professional experience" [8, 43]. According to Grasha [25], teaching style is a combination of manners, tactics and behaviors inherent in the personality of a teacher that immensely influence the teaching learning process.

To date, various definitions of the term learning style exist in research literature. Learning style is described and interpreted in many different ways depending upon one's conception about the term. Some consider it to be relatively stable while some are of the opinion that learning styles have a complex nature and varies according to the context of teaching learning process. These different ideas of learning styles have given birth to various different definitions.

***Corresponding Author:** Javed Khan, PhD Scholar, Institute of Education and Research, University of Peshawar, Pakistan Email:javed_ier@yahoo.com)

"The term learning style refers to the general approach preferred by the student when learning a subject, acquiring a language, or dealing with a difficult problem [37]. According to Ellis [16], learning style is a consistent way of a person's perception, conceptualization, organization and recalling information. It is the composite of cognitive, affective and physiological behaviors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment [30]. Learning style also tells about the ways a person learns from and adapts to environment, and how a person's mind operates [26].

Curry [10] categorizes learning into four dimensions just like the four layers of an onion namely personality traits, information processing, social interaction; and the instructional environment and students learning preferences. Felder and Silverman [19] developed a learning style instrument called the Index of Learning style. Initially this instrument comprised five dimensions namely Processing (Active/Reflective), Perception (Sensing/Intuition), Input (Visual/Verbal), Organization (Inductive/Deductive) and Understanding (Sequential/Global). Later the organization dimension Inductive/Deductive was dropped from the instrument and presently it consists of four dimensions each with 11 items forming a total of 44 items each having dichotomous nature with two opposite poles.

Active and Reflective learners: Active learners learn best when they are engaged in learning process actively by generating discussion, applying and understanding information through sharing it with others i.e. peers, adults and group members. They enjoy group study and activity based learning while reflective learners like to work alone and think about a problem quietly first before getting physically involved. Listening to lectures and taking notes is greatly favored by reflective learners while disfavored by active learners.

Sensing and Intuitive learners: This dimension was developed on the basis of Jung's theory of psychological types in which sensing and intuition are the two ways through which people perceive the outer world. People with sensing learning style gather information through senses while people with intuitive style perceive things indirectly by the way of unconscious i.e. speculation, imagination, hunches etc. Sensors prefer data, facts and experimentation whereas intuitors prefer theories and principles. Sensors mostly rely on standard methods for solving problems through step-by-step procedure and they do not like wonders. On the other hand intuitors dislike repetitions and like innovations. Sensors prefer factual where as intuitors prefer conceptual information [19].

Visual and Verbal learners: People receive information in three ways called sometimes modalities, visual-----sights, pictures, charts, diagrams, symbols; auditory-----sounds, words; kinesthetic -----taste, touch and smell. Visual learn best when materials are presented in diagrams, flow-charts, images, films and demonstrations. Contrary to visual learners, verbal learners like spoken and written information in the form of lectures. They memorize those information best which they hear and then explain it to others.

Sequential and Global learners: Sequential learners understand best when problems are solved in orderly and linear steps; global learners solve problems in large heaps but cannot explain how they came up with the solution. Sequential learners are strong in analysis and convergent thinking whereas global learners are best in synthesis and divergent thinking. Sequential learners would like the problem to be solved in small incremental steps where precise, detailed and orderly sequence is involved, on the other hand global learners like situations where information are presented in a holistic form without enough details.

Teaching styles

Teaching style is formed on the basis of various distinctive teaching behaviors, approaches and strategies that are applied in promoting students' learning [11]. Teaching styles is the collection of various instructional approaches used by the teacher with ease and comport; and is highly related to the context of learning rather than the content [9]. As described by Hoyt and Lee [28], teaching style is the amalgamation of a range of instructional approaches while instructional approach is a combination of different teaching methods. Kaplan and Kies [29] specify teaching style to be a method specific to teacher personal behavior and the media that teacher use to covey and get information. One's teaching style is the result of the way one learnt and not the way he/she was taught [15]. For Zinn [46] teaching style is based on the teaching philosophy and value system held by the teacher regardless of the method and material. Teaching styles characterize a belief system along with the needs and behaviors that teachers display in class-rooms [25].

According to Felder and Silverman Model of Teaching [19], a teacher may either emphasize concrete, factual information or abstract, conceptual and theoretical information. A teacher may either present information through pictures, diagrams, demonstration or it may be verbal through lectures, reading and discussion. A teacher may either encourage students to actively participate in discussions and activities or remain passive simply watching and listening. Lastly, a teacher may prefer a sequential mode of presenting the material in a systematic manner; or they could prefer to present a global picture first and then proceed to break it down.

Matching/mismatching of teaching and learning styles

The need for investigating teachers' teaching styles and learners' learning styles is felt to avoid mismatches in style between teachers and learners [13, 31, 47, 12, 24, 1, 32]. The teacher ought to assist students in identifying their learning styles for building their confidence and making teaching learning process more effective [14, 28]. Learning style can influence teacher's approach to planning, implementing and evaluating the teaching learning process. The teacher should develop teaching strategies in the light of students' learning preferences to cater for all their needs and to compensate their weaknesses [27].

While research shows that a greater learning occurs when teaching and learning styles match, Felder and Brent [21] are of the opinion that the teacher should adopt a balanced teaching style to facilitate all the students having diverse learning styles, otherwise, some students will be satisfied while some will feel dissatisfied with the instructional process.

Making teaching congruent with the learning style of students is well supported by the case study of a teacher teaching English to the 11th grade students as described by Dunn [15]. In this study it was evident that the score of those students who had been taught the curriculum in accordance with the learning style of students was relatively very high as compare to those students who had been taught in the traditional way.

The concept of teaching, with learning style in view, is getting popularity across all disciplines particularly in the fields of Engineering and Physics. In a study, Tobias [44] reported that the failure and dropout on the part of the students in science education in most of the cases were caused by the instruction not congruent with the students' learning styles. In this study he also noticed that a match between the styles of students and teachers give positive results in terms of students' motivation, interest, conceptual understanding and retaining information for a longer period of time. On the contrast, mismatching between students and teachers leads to mistrust, losing interest and even changing to other fields by the students [18].

Among various scales and instruments used for the identification students' learning styles, the Index of Learning Styles (ILS) developed by Felder and Solomon based on Felder and Silverman learning style model, is the most comprehensive (covering all the essential aspects and dimensions of the learning style), short, valid and reliable instrument [24, 20, 33, 34, 45, 48]. The ILS is a self-report dichotomous scale with four dimensions, each representing two opposite learning styles. Each dimension comprises 11 items forming a total of 44 items. The first dimension Sensing/Intuition is related to how student perceives information. The second dimension Active/Reflective is concerned with the way student processes the information. The third dimension Visual/Verbal is about the way student intakes information and the fourth Sequential/Global is related to understanding and organization of information.

METHOD

In this study a Causal-Comparative Research design was used, in which data was collected with the help of two questionnaires to achieve the mentioned objectives. In causal comparative design, two groups differing on independent variable (the cause) without manipulation are compared for dependent variable (the effect), to determine cause and effect relationship [23, 35]. In this study, independent variable called the cause was the matching of teaching and learning styles and the dependent variable called the effect, was the academic achievement. Learning style, in this study, can be operationally defined as any one of the eight learning styles identified by FSILS. Similarly, teaching style is defined as any one of the eight teaching styles identified by teaching style questionnaire. Matching/mismatching illustrates the extent to which students' learning style preferences are similar/dissimilar to teachers' instructional style preferences indicated by the two questionnaires in the study. Academic achievement in this study is the mean score attained by the student at the end of semester exanimation in the subject taught by the teacher participating in the study.

Objectives of the Study

The main purpose of the intended study was to investigate "Matching/Mismatching of teaching and learning styles and its effect on academic achievement at tertiary level. The objectives of the study were:

- To identify teaching styles of teachers at Tertiary level;
- To identify learning styles of learners at Tertiary level;
- To point out matching and mismatching between teacher's teaching style and learner's learning style at Tertiary level; and
- To determine the effect of matching/mismatching between teachers' teaching style and learners' learning style on academic achievement at Tertiary level.

Hypotheses of the Study

- H_1: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Physics.
- H_{01}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Physics.
- H_2: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Mathematics.
- H_{02}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Mathematics.
- H_3: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Chemistry.
- H_{03}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Chemistry.
- H_4: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Botany.
- H_{04}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Botany.

Population and Sample

Population for this study consisted of all the teachers and students of 19 public sector universities of Khyber Pakhtunkhwa, Pakistan. A sample of 360 (240 students and 120 teachers) respondents, was selected through multistage sampling design. In the first stage six public sector universities were purposively selected from Khyber Pakhtunkhwa, namely Hazara University (HU), Mansehra, University of Malakand (UOM), Dir (L); University of Peshawar (UOP), Abdul Wali Khan University (AWKU), Mardan; Kohat University of Science and Technology (KUST), and University of Science and Technology Bannu (USTB). From each of these six universities four disciplines or departments namely Physics, Mathematics, Chemistry and Botany; and from each of these departments 10 students and 5 teachers of BS (4-years program) were selected through Stratified and Quota sampling.

Instrumentation

The data was collected with the help of two questionnaires to achieve the mentioned objectives. Felder and Solomon Index of Learning Style (FSILS) was used to identify students' learning style while teaching style inventory developed by Letele et al. (2013) based on Felder and Silverman theory of teaching style, was used to identify teachers' teaching style. FSILS has 44 items with four dimensions (active/reflective, sensing/intuitive, visual/verbal, and sequential/global), each dimension with 11 items. Like FSILS teaching style instrument has also 44 items with four dimensions (active/passive, concrete/abstract, visual/verbal, and sequential/global), each dimension with 11 items. All items in FSILS have dichotomous nature with two opposite poles (a) and (b) indicating two learning styles on one dimension with contrasting styles.

Matching/mismatching between teachers' teaching style and students' learning style was conducted according to the following scheme as shown in the Table1.

Table 1: Preferred Learning Style and Corresponding Teaching Style

Preferred Learning Style	Corresponding Teaching Style
Active/Reflective	Active/Passive
Sensing/Intuitive	Concrete/Abstract
Visual/Verbal	Visual/Verbal
Sequential/Global	Sequential/Global

(Adopted from Felder and Silverman, 1988)

Analysis of Data

The data was analyzed with the help of SPSS-17 in the form of frequencies and percentages. T-test for independent samples was used for comparing the groups. For matching/mismatching, the most dominant learning and teaching styles were considered on all four dimensions for both instruments. Analysis included the distribution of learning and teaching styles, group and t-statistics results regarding matching/mismatching of teaching-learning styles and significance.

RESULTS

Table 2: Distribution of Learning Styles

Dimensions	Learning style	Frequency	Percentage (%)
1	Sensing	23	9.58
	Intuitive	19	7.92
2	Active	16	6.67
	Reflective	13	5.42
3	Visual	42	17.50
	Verbal	15	6.25
4	Sequential	13	5.42
	Global	16	6.67
	Mixed Styles	44	18.32
	Balanced Style	39	16.25
	Total (N)=	**240**	**100**

Table 2 shows that among single styles, the most dominant learning style was Visual (17.50%) followed by Sensing learning style (9.58%). Moreover, 18.32% students were using mixed learning styles while balanced learning style was preferred by 16.25% students.

Table 3: Distribution of Teaching Styles

Dimensions	Teaching Style	Frequency	Percentage (%)
1	Concrete	8	6.67
	Abstract	11	9.17
2	Active	5	4.17
	Passive	10	8.33
3	Visual	33	27.50
	Verbal	8	6.67
4	Sequential	11	9.17
	Global	8	6.67
	Balanced	8	6.67
	Mixed Styles	18	15.00
	Total (N)=	**120**	**100**

Table 3 shows that majority of teachers (27.5%) were using Visual teaching style followed by Abstract and Sequential styles used by 9.17% teachers each. Moreover, 8.33% teachers were using Passive teaching style while Concrete, Verbal, Global and Balanced teaching styles were being used by 6.67% teachers each. In addition, 15% teachers had mixed teaching styles.

Table 4: T-Test for matched and mismatched groups of students of Physics in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	111	73.98	6.89	298	0.001*
SStudents with mismatched styles	189	70.71	8.34		

* Significant at α=.05

Table 4 shows that the mean achievement score of the matched group of students is 73.98 while that of mismatched group is 70.71 and p=0.001<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subjects of Physics, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Physics.

Table 5: T-Test for matched and mismatched groups of students of Chemistry in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	120	75.18	10.08	298	0.001*
Students with mismatched styles	180	70.76	9.23		

*Significant at α=.05

Table 5 shows that the mean achievement score of the matched group of students is 75.81 while that of mismatched group is 70.76 and p=0.001<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subjects of Chemistry, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Chemistry.

Table 6: T-Test for matched and mismatched groups of students of Mathematics in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	115	76.93	9.22	298	0.000*
Students with mismatched styles	185	70.60	12.78		

*Significant at α=.05

Table 6 shows that the mean achievement score of the matched group of students is 76.93 while that of mismatched group is 70.60 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subject of Mathematics, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Mathematics.

Table 7: T-Test for matched and mismatched groups of students of Botany in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	167	76.46	10.80	298	0.000*
Students with mismatched styles	133	70.03	10.61		

* Significant at α=.05

Table 7 shows that the mean achievement score of the matched group of students is 76.46 while that of mismatched group is 70.03 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subject of Botany, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Botany.

Table 8: T-Test for matched and mismatched groups of all the students in all four disciplines in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	513	75.73	9.583	1198	0.000*
Students with mismatched styles	687	70.56	10.336		

*Significant at α=.05

Table 8 shows that the mean achievement score of the matched group of students is 75.73 while that of mismatched group is 70.56 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles.

DISCUSSION

The findings of this study is in line with the findings of various other researchers like Zenhui [47], Tamimi & Shuib [3] and Felder and Silverman [19], who came up with similar results in their studies where majority of learners were reporting Visual style as their most dominant learning style. Zenhui [47] added that Visual learning style was popular

among most of the Korean, Japanese and Chinese Students. Similarly a study conducted by Moallem [36], revealed findings similar to this study who also found that percentage of students with Visual style was the highest.
The most important finding of the study that matching-mismatching of teaching-learning style do affect the academic achievement of students positively, is in complete agreement with the findings of the studies conducted by Letele et al. [32], Dasari [12], Ford and Chen [22], Fazarro, D. E., Pannkuk, T., Pavelock, D., & Hubbard, D. [17] and Raines [39]. As findings of this study revealed that matching of teaching-learning styles had a positive and mismatching a negative impact on academic achievements of students, is well supported by Felder and Brent [21]. In contrast, the study conducted by Spoon and Schell [42] gave contrary result where mismatched students outperformed the matched students. Similar results were also reported by Scerba [41], Ruhnau [40] and Campbel [5],where matching of teaching-learning styles had no or very small impact on students' performance. One possible cause of these contrasting results may be the factors like culture, environment, prior experiences, students' effort, disciplines, history and other physical and psychological factors related to students and teachers. Among other possible causes for these contrasting results might include various learning and teaching style instruments, research methods and samples. However, one thing is evident that matching of teaching and learning styles results in greater satisfaction, motivation and self-efficacy on both the part of students and teachers [2, 21, 31, 38].

Conclusion

Research findings revealed that Visual learning style was the most dominant learning style used by majority of students followed by balanced and mixed learning styles. In case of teachers, after Visual style, the mixed and Sequential were the most preferred teaching styles used by most of the teachers. Analysis of data regarding matching-mismatching of teaching-learning styles revealed that the percentage of students with mismatched styles was higher than percentage of students with matched styles. Most importantly, from over all data analysis it was concluded that there was a significant difference between the mean scores of matched students and mismatched students; and that the mean score of matched students was significantly higher than the mean score of mismatched students.

Recommendations

In the light of these findings and conclusions, following are some of the recommendations

- As evident from conclusions that majority of teachers and students were using Visual style so institutional administration should provide teachers with AV aids and other teaching materials so that they may be able to fully utilize these resources to address all issues in classrooms regarding learners' learning styles.
- Educational practitioners, policy-makers and curriculum designers should revise course contents, academic programs and other training programs keeping learning style of students in view.
- Teachers are recommended to direct their presentation, evaluation and planning to learning styles of students during teaching learning process in classrooms to accommodate all the students with various learning styles in order to develop a peaceful, conducive and harmonious environment for learning.
- School administration and teachers should form classroom sections and students' groups on the basis of students' learning styles and those teachers should be assigned to those sections and groups of students where teachers' teaching style match students' learning style to enhance students' motivation, satisfaction and academic achievement.
- Government is recommended to take initiative to search out further empirical evidences by funding various organizations and agencies across the country to conduct extensive researches related to the concept of teaching learning styles.

REFERENCES

1. Alaka, A. M. (2011). Learning styles, what difference do the differences make? Charleston Law Review 5(2), 133-172.
2. Alumran, J. I. A. (2008). Learning styles in relation to gender, field of study, and academic achievement for Bahraini University students. Individual Differences Research, 6(4), 303-316.
3. Al-Tamimi, A. & Shuib, M. (2009). Motivation and attitudes towards learning English: A study of petroleum engineering undergraduates at Hadhramout University of Sciences and Technology. GEMA Online Journal of Language Studies, 9(2), 29-55.
4. Cambridge Advanced Learner's Dictionary. 3rd ed. Cambridge: Cambridge University Press, 2008. Print.

5. Campbell, B. W. (1989). A study of the relationship between teachers' and students' learning styles and students' achievement in business communications (Doctoral dissertation, University of Illinois at Urbana-Champaign).
6. Coffield, F., Moseley, D., Hall, E. & Ecclestone, K. (2004a). Should we be using learning styles? What research has to say to practice. London, Learning and Skills Research Centre, Learning and Skills Development Agency.
7. Coffield, F., Moseley, D., Hall, E. & Ecclestone, K. (2004b). Learning styles and pedagogy in post-16 learning: a systematic and critical review. London, Learning and Skills Research Centre, Learning and Skills Development Agency.
8. Collins, J. W., & O'Brien, N. P. (2011). The Greenwood dictionary of education. ABC-CLIO.
9. Conti, G. J. (1989). Assessing teaching style in continuing education. New directions for adult and continuing education, 1989(43), 3-16.
10. Curry, L. (1990). A critique of research on learning styles. Educational Leadership, 56(2). 50-56.
11. Darkenwald, G. G. (1989). Enhancing the adult classroom environment. New Directions for Adult and Continuing Education, 1989(43), 67-75.
12. Dasari, P. (2006). The influence of matching teaching and learning styles on the achievement in science of grade six learners. Unpublished M.Ed dissertation. Bloemfontein: University of South Africa.
13. De Bello, T. C. (1990). Comparison of eleven major learning styles models: variables, appropriate populations, validity of instrumentation, and the research behind them. Reading, Writing, and Learning Disabilities, 6(3), 203-222.
14. Doyle, W., & Rutherford, B. (1984). Classroom research on matching learning and teaching styles. Theory into practice, 23(1), 20-25.
15. Dunn, R., & Dunn, K. (1978). Teaching students through their individual learning styles. Reston, VA: Reston.
16. Ellis, A.K., (2001). Research on Educational Innovations. 3rd edition. New York: Eye on Education, Inc.
17. Fazarro, D.E., Pannkuk, T., Pavelock, D., Hubbard, D. The effectiveness of instructional methods based on learning style preferences of agricultural students: a research tool for continuous improvement for faculty in career and technical programs. J. Ind. Teacher Educ. 2009;45:84–104.
18. Felder, R.M. and Silverman, L.K. (1988). Learning and teaching styles in engineering education. Engr Education. 78(7), 674 – 681.
19. Felder, R.M. (1993). Reaching the second tier: Learning and teaching styles in college science education. Journal of College Science Teaching, 23(5), 286-290.
20. Felder R.M. and Spurlin, J.E. (2005). "Applications, Reliability, and Validity of the Index of Learning Styles" Intl. Journal of Engineering Education, 21(1), 103-112.
21. Felder R.M. and Brent, R. (2005). "Understanding Student Differences" J. Engr. Education, 94(1), 57-72.
22. Ford, N. and Chen, S.Y. (2001). Matching/mismatching revisited: An empirical study of learning and teaching styles. British Journal of Educational Technology, 32(1), 5–22.
23. Gay, L. R. (1996). Educational research: Competencies for analysis and application (fifth edition). Englewood Cliffs, NJ: Prentice-Hall.
24. Graf, S., Viola, R. S., LEO, T. & Kinshuk. (2007). In-depth Analysis of the Felder-Silverman learning style Dimensions. Journal of Research on Technology in Education, 40(1): 79-93.
25. Grasha, A, F. (1996). Teaching with style. Pittsburgh PA: Alliance Publishers.
26. Gregorc, A. F. (1979). Learning/Teaching styles: Potent forces behind them. Educational Leadership, 36(4), 234-236.
27. Herod, L. (2000). Learning Styles & Strategies. Viewed on 14 November 2013 at www.edu.gov.mb.ca/ael/.../learning_styles_and_strategies_aug_2004.pdf
28. Hoyt, D. P. & Lee, E. J. (2002). Teaching styles and learning outcomes. IDEA Research report #4.Viewed on 30 November 2013 at http://www.idea.ksu.edu/reports/research4.pdf.
29. Kaplan, E.J. & Kies, D.A. (1995). Teaching and learning styles : Which came first? Journal of Instructional Psychology, 22(1), 29-33.

30. Keefe, J. W. (1979). Learning style: An overview. In NASSP's Student learning styles: Diagnosing and prescribing programs (pp. 1-17). Reston, VA: National Association of Secondary School Principals.
31. Larkin-Hein, T. (2000). Learning styles in introductory physics: Enhancing student motivation, interest and learning. In Proceeding of International Conference on Engineering and Computer Education. August 2000. Sao Paolo, Brazil (pp. 1-6).
32. Letele, M.J. and Alexander, G. and Swanepoel, Z.I. (2013). Matching/Mismatching of Teaching and Learning Styles in Rural Learning Ecologies of Lesotho: Does it Enhance Academic Achievement, Journal of Human Ecology, 41(3), 263-273.
33. Litzinger, T. A., Lee, S. H., & Wise, J. C. (2005). A study of the reliability and validity of the Felder-Soloman Index of Learning Styles. In Proceedings of the 2005 American Society for Education Annual Conference & Exposition (pp. 1-16).
34. Livesay, G. A., Dee, K. C., Nauman, E. A., & Hites Jr, L. S. (2002, June). Engineering student learning styles: a statistical analysis using Felder's Index of Learning Styles. In Annual Conference of the American Society for Engineering Education, Montreal, Quebec.
35. McMillan, James H & Schumacher, Sally (1989). Research in education: a conceptual introduction (2nd ed). Scott, Foresman, Glenview, Ill.
36. Moallem, M. (2007). Accommodating individual differences in the design of online learning environments: A comparative study. Journal of Research on Technology in Education, 40(2), 217-245.
37. Oxford, R. L. (2003). Language learning styles and strategies: Concepts and relationships. International Review of Applied Linguistics in Language Teaching Journal, 41(4), 271-278.
38. Peacock, M. (2001). Match or mismatch? Learning styles and teaching styles in EFL. International Journal of Applied Linguistics, 11(1), 1-20.
39. Raines, R. H. (1978). A comparative analysis of learning styles and teaching styles of mathematics students and instructors. Unpublished doctoral dissertation, Nova University, Ft. Lauderdale, FL.
40. Ruhnau, K. (2006). An Analysis of Learning Outcomes of Adult Students: Learning Styles. Statistics [NCES], 2002, 0-12.
41. Scerba, J. R. (1979). Compatibility of teaching strategies and learning styles as a determinant of academic success. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, California. (ERIC Document Reproduction Service No. Ed171752).
42. Spoon, J.C., & Schell, J. W. (1998). *Aligning student learning styles with instructor teaching styles*. Journal of Industrial Teacher Education, 35(2), 41-56.
43. The Greenwood Dictionary of Education (2011), Santa Barbara, California, *Publisher*, ABC-CLIO.
44. Tobias, S. (1990). They're not dumb, they're different: Stalking the second tier. Tucson, Ariz. (6840 E. Broadway Blvd., Tucson 85710-2815: Research Corp.)
45. Van Zwanenberg, N., Wilkinson, L. J., & Anderson, A. (2000). Felder and Silverman's Index of Learning Styles and Honey and Mumford's Learning Styles Questionnaire: how do they compare and do they predict academic performance?. Educational Psychology, 20(3), 365-380.
46. Zinn, L. M. (1990). Identifying your philosophical orientation. Adult learning methods, 2, 37-56.
47. Zhenhui, R. (2001). Matching teaching styles with learning styles in East Asian contexts. The Internet TESL Journal, 7(7), 1-9.
48. Zywno, M. S. (2003, June). A contribution to validation of score meaning for Felder-Soloman's index of learning styles. In Proceedings of the 2003 American Society for Engineering Education annual conference & exposition (Vol. 119, pp. 1-5). Washington, DC: American Society for Engineering Education.

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Blood Type Synchronization Using Dipstick Membrane in Domestic Cats (*Felis domestica*) on the Persian Cat (*Felis silvestris*) in Surabaya

Andreas Berny Yulianto[1], Dian Ayu Kartika Sari[1], Widya Paramita Lokapirnasari[2*], Era Harimudji[1]

[1]Faculty of Veterinary Medicine, Wijaya Kusuma Surabaya University, Indonesia
[2]Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia

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ABSTRACT

This research objective was to identify blood type polymorphism in domestic cats (*Felis domestica*) and Persian cats (*Felis silvestris*) using dipstick membrane and to know a blood cross match between domestic cats (*Felisdomestica*) and Persian cats (*Felissilvestris*). A total of 10 male domestic cats, 10 female domestic cats, 10 male Persian cats and 10 female Persian cats were studied. The cats were clinically healthy, one year of age and blood was collected intravenously. The result of blood type test showed that a total of 60% female domestic cats had blood type A and 40% blood type B. A total of 70% male domestic cats had blood type A and 30% blood type B. A total of 70% male Persian cats had blood type A and 30% blood type B. A total of 60% female Persian cats had blood type A and 40% blood type B. The Cross match blood test between male domestic cats and male Persian cats revealed 50% match and 50% did not match, while between female domestic cats and female Persian cats, 70% match and 30% did not match.
KEY WORDS: Blood type, domestic cats, Persian cats

INTRODUCTION

Anemia or a low number of red blood cells also occurs in cats due to several factors. Those factors are parasites; fleas (*Ctenocephalidesfelis*); worms (*Dipylidium caninum, Toxocaracati*); protozoa ((*Haemobartonela felis, Cytauxzoon felis*); virus such as Feline Leukemia Virus (FeLV) and Feline Immune Mediated Virus (FIV); poisons such as eating paracetamol and chocolate; PKD (Polycistic Kidney Disease); trauma such as fractures, wide incision wound; medical action such as surgery and nutrient imbalance, such as, rarely, iron deficiency. For an anemic cat or that with a low number of red blood cells, blood transfusion is the right choice to replace the blood loss. However, there is no animal blood banks, especially for cats, blood donors, blood typing test kit in Indonesia and there is also the lack of human resources who know about the process of blood transfusion.

Before doing a blood transfusion, we need to see the blood matches between the donors and the recipient [1]. According to Wardrop [2], cross match blood test should be used before performing blood transfusions in cats, although they have a history of blood transfusion before, because rejection will occur naturally from the antibodies in cats and cause serious effects if blood type A transfusion is given to cats with blood type B.

Blood is a liquid which composed of two parts, the blood plasma and blood cells. Blood cells were made up of three types, erythrocytes, leukocytes, and platelets [3]. Blood flows and circulates through the vascular system. Blood carries a variety of necessities of life to all cells in the body and brought the results of metabolic waste to secrete on the excretion organ [4].The main functions of blood in the circulatory system are as a transports medium, temperature regulator, and controlling liquid and bases balances. Blood volume of cats revolves between 4.7% - 9.65% of the cat's weight, and the factors that affect blood volume i.e. age, health status, diet, body size, activity, and the environment [5]. Erythrocytes (red blood cell) has the main functions to transport hemoglobine and to carries oxygen from lungs to the tissues [6]. Erythrocytes in domestic cats (*Felis domestica*) has biconcave disc-shape with diameter of 5.5 - 6.3 µm and they are in the circulation for around 120 days [4]. Total erythrocytes in cats is up to 7.3 million per mm^3 [5].

In blood transfusion, the first thing we need to do is to look for donors, then we perform the blood typing test. After the blood is available for transfusion, blood matching test is done between the blood of the donor and the recipient (cross matching blood test) to reduce and avoid the risk of allergic reaction and rejection in blood transfusions[2]. Not only in humans, cat also has blood type. There are three blood typesin a cat, A, B, and AB. There is no relationship of serologic antigens A and antigens B with antigens ABO in humans [7].

Almost 95% of cats has blood type A, including those in the United States [8]. On the blood type test of 139 non-pedigree cats and 2017 pedigree cats, it was found that 87.15% of non-pedigree cats had blood type A, 7.9%

***Corresponding Author:** Widya Paramita Lokapirnasari, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia. email: widyaparamitalokapirnasari@gmail.com

blood type B and 0.55% blood type AB. While in pedigree cats, 54.6% had blood type A, 40.1% of blood type B, and 1.6% blood type AB [9]. Domestic cat's (*Felisdomestica*) blood types from different countries indicate that the frequency of blood type A is more than B and AB [10,11].

Blood type antigen is characterized by specific proteins in erythrocytes membrane, i.e. NueGc-NueGc-Glucose-Galactose-Ceramide (NueGc as N-Glicolilneuraminic acid) as a major constituent of blood type A glycolipids (carried by gene A) and NueAc-NueAc-Glucose-Galactose-Ceramide as a constituent of blood type B (carried by gene B). Blood type AB is a form between blood type A and B[12,13].

The latest blood test on the cats and dogs using the technique of dipstick membrane (Alvedia ®, Villeurbanne, France). The work principle, by mixture the monoclonal antibodies type A and B on the cat, which can be seen on the membrane that has been mixed by buffer and blood. In a positive reaction,the red blood cells will be agglutinated by the antibodies, causing the appearance of a line on the membrane [9].

The best treatment for anemia is blood transfusion. To conduct the blood transfusions, we need blood identification and cross blood categorization. This research aims was to identify blood type polymorphism in domestic cats (*Felis domestica*) and Persian cats (*Felis silvestris*) using dipstick membrane and whether each blood type has a blood cross match between domestic cats (*Felis domestica*) and Persian cats (*Felis silvestris*).

MATERIALS AND METHODS

This was a descriptive study, in which the results were outlined in theory based on the results of the identification of blood type and cross-match between the blood of domestic cats (*Felis domestica*) and that of Persian cats (*Felis silvestris*).

Blood Type Test

To identify the blood type, used the quick test blood typing from Alvedia (Alice Veterinary Diagnostic). The cat name was written on the label of the quick test, then three drops of buffer was added on the holes provided on the package of the quick test. The blood collector strip was dipped intothe tube containing blood, and then to the hole containing the buffer. It was stirred evenly, then the membrane was placed into the hole, moved and stood until the blood suspension meet the membrane. The line of control became visible, and then the membrane was lifted to revealthe results of the blood test.

The Cross Match Blood Test

Blood sample as much as 2 ml,which remained in blood collection tube with EDTA (ethylenediamine tetraacetic acid), was subsequently used for cross match blood tests. The tube was put into the centrifuge machine, then it was centrifuged for 1 minute at 3000 rpm. Then, the blood plasma was taken and suspended in 2% red blood cells by mixing 0.1 ml red blood cells and 5 ml 0.9% solution. The suspension was subsequently mixed by centrifugationin 1 minute and the the supernatant was removed. It was resuspended in 5 ml of 0.9% saline solution, then centrifuged again and repeated three times.

Major cross match was done as follows: two drops of Persian cat's (*Felis silvestris*) plasma and two drops of red blood cells of the domestic cats (*Felis domestica*) were put on the tube. They were mixed with the whisk with the number of 8, and then incubated in room temperature for 30 minutes.

Minor cross match was as follows:Two drops of red blood cells of Persian cats (*Felis silvestris*) and two drops of domestic cats (*Felis domestica*) plasma was put in another tube. Mixed with the whisk with the number of 8, and then incubated in room temperature for 30 minutes.

For the first control, two drops of Persian cat(*Felis silvestris*) plasma and two drops of red blood cells of domestic cats (*Felis domestica*) were placed in the tube, and two drops of red blood cells of Persian cats (*Felis silvestris*) and two drops of domestic cats plasma (*Felisdomestica*) put in another tube, were centrifuged for one minute at 300 rpm.

For the second control,two drops of Persian cat (*Felis silvestris*) plasma and two drops of domestic cats (*Felis domestica*) whole blood were put into the tube, and two drops of Persian cat (*Felis silvestris*) whole blood and two drops of the domestic cats (*Felis domestica*) plasma were put in another tube, then being centrifuged for one minute at 300 rpm. Then, the agglutination and hemolysis were checked by puttinga drop of blood on the object glass, then the examination under a microscope was carried out.

RESULTS

Blood type test

The results of blood type test to 10 female-domestic-cats, 10 male-domestic-cat, 10 male-Persian-cats, 10 female-Persian-cats were shown in Table 1.

Table 1. Blood type test of male and female domestic-cats

No	Sample	Blood type	No	Sample	Blood type
1	Male-domestic-cat	A	1	Female-domestic-cat	A
2		A	2		A
3		B	3		A
4		A	4		B
5		A	5		A
6		B	6		A
7		A	7		A
8		A	8		B
9		B	9		A
10		B	10		B

The results of Blood Type Test of 10 male-Persian-cats and 10 female-Persian-cats were shown in Table 2.

Table 2. Blood type test of female and male Persian cats

No	Sample	Blood type	No	Sample	Blood type
1	Male-domestic-cat	B	1	Female-domestic-cat	A
2		B	2		A
3		A	3		A
4		A	4		B
5		A	5		B
6		A	6		A
7		A	7		A
8		A	8		B
9		B	9		B
10		A	10		A

Cross match blood test

The results of cross match blood test of male-domestic-cats and male-Persian-cats were shown in Table 3.

Table 3. Cross match blood test of male-domestic-cats and male-Persian-cats

NO	Sample	Blood type	NO	Sample	Blood type	Cross match blood test result
1	Male-domestic-cats	A	1	Male-Persian-cats	B	+
2		A	2		B	+
3		B	3		A	+
4		A	4		A	-
5		A	5		A	-
6		B	6		A	+
7		A	7		A	-
8		A	8		A	-
9		B	9		B	-
10		B	10		A	+

The results of cross match blood test of male-domestic-cats and male-Persian-cats were shown in Table 4.

Table 4. Cross match blood test of female-domestic-cats and female-Persian-cats

No	Sample	Blood type	No	Sample	Blood type	Cross match blood test result
1	Female-domestic-cats	A	1	Female-Persian-cats	A	-
2		A	2		A	-
3		A	3		A	-
4		B	4		B	-
5		A	5		B	+
6		A	6		A	-
7		A	7		A	-
8		B	8		B	-
9		A	9		B	+
10		B	10		A	+

Description:
- = cross match blood test results, there were no reaction of agglutination and hemolysis
+ = cross-match blood test results, there were agglutination and hemolysis

DISCUSSION

The formation of erythrocytes (erythropoiesis) is stimulated by the erythropoietin hormone, i.e. the glycoproteins, ninety percent were produced in interstitial cell of the peritubular renal and the other 10% in the liver. The formation of erythropoietin is stimulated by hypoxia or tissuestate changes in atmospheric pressure, reduced arterial blood oxygen levels, and reduced Hb concentrations. Erythropoietin induced erythropoiesis by increasing progenitor cell which bound to the erythrocytes formation process.

Based on the results, there was a little differencein the results of the reaction, i.e. at the level of its agglutination. Degree of agglutination were seen from blood clots on the tube after shaking until blood deposition in a control tube dissolved perfectly.

Agglutination rate which in the results of the reaction is not related to genotype composition in its erythrocyte, but resulting from biological differences existsin each individual. Blood type antigen is characterized by specific proteins on the membrane of the erythrocytes i.e. NeuGc-NeuGc-Glucose-Galactose Ceramide (NeuGcsebagai N-Glycolilneuraminicacid) as a major constituent of blood type A glycolipids (carried by gene A) and NeuAc-NeuAc Glucose-Galactose-Ceramide as a constituent of blood type B (carried by gene B) [14,15].

Gene A more is dominant than gene B [14, 15,16]. Thus,cats with blood A could be either homozygous A (AA), or heterozygous A (AB), so that the protein in its erythrocyte was a combination of gene A and gene Aor gene A and gene B.Cats that have blood type B, the genotype of the composition of blood type is only homozygous (BB).

Quick test of blood typing (dipstick membrane) is a mixture of monoclonal antibodies type A and B in cats that can be seen on the membrane that has been mixed by buffer and blood. Positive reaction of erythrocytesagglutination with secondary antibody appearson the dipstick membrane [2]. This is influenced by the level of sensitivity and superior specificity of monoclonal antibodies dipstick membrane itself.

The accuracy ofa sensitivity assay tool to detect or diagnose a disease or conditiondepends on monoclonal antibody dipstick membrane that detectsantigens from the tested blood.The specificity of the tools is the accuracy ofthe assay to detect negativeness or diagnose a disease and conditions. This monoclonal antibody belong to antigens membrane that can bind onlyto specific dipstick from cats.

The interaction of antigen and antibody has two categories. The primary category is the beginning of the reaction and antibody-antigen binding at the molecular level. The second category leads to precipitation or agglutination. The degree of agglutination in the reaction outcome is not related to the composition of the genotypes contained in its erythrocyte. Different rate of agglutination is because of biological differences existing in each individual [17].

The frequency of blood type A is more dominant than the blood type B, while blood type AB is very rare. Domestic cats from various countries have also shown that the frequency of blood type A is more than blood type B and AB. Cat blood AB classification system has three different phenotypes. The phenotype of A and B inheriting Madeline allele simple genetic. The alleles 'a' is more dominant than allele 'b', thus all blood type B is homozygous alleles 'b' (genotype b/b), whereas cats with blood type A mayhave both homozygous alleles of ' a ' (genotype a/a) and heterozygous allele (genotype a/b) [16, 17].

In this research, blood plasma of male and female local cats when given erythrocytes of male or females Persians with the same blood group A or B does not show agglutination and haemolysis, but when given erythrocytes from different blood groups A with B or B with A showed agglutination and haemolysis.

In cross-match blood test, if the precipitates dissolve again (hemolysis), result is stated as having negative reaction. Iif the precipitationdissolves into grains or not soluble at all, the reaction is expressed aspositive agglutination reaction. Before the transfusion, the main reason for conducting cross match blood test is to identify the hemolytic reactions in transfusion, providing optimal period of erythrocytes in transfusion, to prevent failure of subsequent blood transfusions and prevent neonatal isoerytrolysis [2].

CONCLUSION

The conclusion of this result were that a total of 60% female domestic cats had blood type A and 40% blood type B. A total of 70% male domestic cats had blood type A and 30% blood type B. A total of 70% male Persian cats had blood type A and 30% blood type B. A total of 60% female Persian cats had blood type A and 40% blood type B. The Cross match blood test between male domestic cats and male Persian cats revealed 50% match and 50% did not match, while between female domestic cats and female Persian cat, 70% match and 30% did not match.

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REFERENCES

1. Giger, U, 1992. Feline transfusion medicine. *Probl. Vet. Med.*,4(4):600-611.
2. Wardrop, K.J, 2010. Clinical blood typing and crossmatching. In: Schalm's. VeterinaryHematology. 6th ed. Wiley-Blackwell ;.pp.1101-1104.
3. Stockham, S.L., M.A. Scoot, 2002. Fundamental of veterinary clinical pathology. 1st ed. USA : IOWA State Press;.
4. Jain, N.C, 1993. Essential of veterinary hematology. Philadelphia : Lea & Febriger;.
5. Mitruka, B.M., H.M. Ranswley, 1977. Clinical biochemical and haematological refference value in normal experimental animals. USA : Mason Publishing Inc. New york;.pp 82-109.
6. Guyton and Hall, 1992. Medical Physiology. 9th ed. Jakarta. Medical book publishers EGC.
7. Holmes, R, 1950. Blood groups in cats . *J Physiol.*,111(3-4): 61P.
8. Giger, U., C.G. Kilrain., and L.J. Filippich, 1989. Frequencies of feline blood groups in the United States . *J Am Vet Med Assoc.*, 195:1230-1232.
9. Knottenbelt, C.M, 2002. The feline AB blood group system and its importance in transfusion medicine. *J. Feline Med. Surgery.*,4:69-76.
10. Giger, U., J.Bucheler., D.F. Patterson, 1991. Frequency and inheritance of A and B blood types in feline breeds of the United States. *J. Hered.*,82(1):15-20.
11. Knottenbelt, C.M., D.D. Addie., M.J. Day., A.J. Mackin, 1999. Determination of the prevalence of feline blood types in the UK. *J. Small Anim. Pract.*,40(3):115-118.
12. Griot-Wenk M., P.Pahlsson., A.Chisholm-Chait., P.F. Spitalnik., S.L. Spitalnik., U.Giger, 1993. Biochemical characterization of the feline AB blood group system. *Anim. Genet.*,24(6):401-407.
13. Andrews, G.A., P.S. Chavey, J.E. Smith, 1992. N - Glycolylneuraminic acid and N - acetylneuraminic acid define feline blood group A and B antigens. *Blood.*,79 : 2485 – 2491.
14. Knottenbelt, C.M, 2002. The feline AB blood group system and its importance in transfusion medicine.*J. Feline Med. Surgery.*,4:69-76.
15. Callan, M.B, 2010. Red Blood Cell Transfusion in the Dog and Cat. In: Schalm's. Veterinary Hematology. 6th ed. Wiley-Blackwell.. pp 738-743.
16. Giger, U, 1992. Feline transfusion medicine. *Probl. Vet. Med.*,4(4):600-611.
17. Gunanti., D. Endrawati, H.R. Supriadi, R. Siswandi, S. Agungpriyono, 2013. Identification of blood type and possibly its relation to hair color on domestic cat (*Felis familiaris*). *Jurnal Kedokteran Hewan.*,7: 61-64.

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Emotional Problems as Predictor of Emotions Related Outcomes among Adolescents of Central Punjab

Muhammd Akbar[1], Dr. M. Tahir Khalily[2]

[1]Ph.D, Scholar, Department of Psychology International Islamic University; Islamabad
[2]Ph.D, Department of Psychology, International Islamic University Islamabad

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ABSTRACT

The study aims to investigate the role of emotional problems in the prediction of emotion related outcomes including emotional intelligence, emotional empathy, emotional regulation, and emotional expressivity. For this purpose a sample of 1000 adolescents was enlisted from diverse areas of Central Punjab by using purposive sampling technique. For the data collection Urdu version of the scales including School Children Problem Scale, Big Five Personality Inventory, Emotional Intelligence Scale, Emotional Empathy Scale, Emotional Expressivity Scale and Emotional Regulation Scale were used. Data was analyzed by using SPSS software version-21. Descriptive statistics, simple linear regression were used for hypotheses testing. The findings of the research exposed that emotional problems negatively predicted emotional outcomes (emotional intelligence, emotional empathy, emotional regulation, and emotional expressivity), in adolescents. The current study contributed significant addition to the existing body of knowledge.
KEYWORDS: Emotional problems, emotions related outcomes, demographic factors.

1. INTRODUCTION

Adolescence is actually a transitional phase of psycho physiological development that typically happens during the period from puberty to late adulthood. The time of adolescence is most nearly connected with the early years of life; however, its physical mental and social outflows may start prior and end later. In spite of the reality that pubescence has been verifiably related with the beginning of youthful enhancement, it now typically begins with earlier the adolescent years and there has been a standardizing movement of it occurring in preadolescence, particularly in females. Physical development, as different from adolescence (particularly in male), and cognitive development by and big seen in adolescence, can similarly draw out into the early twenties. Consequently sequential age gives just an insensitive indicator of adolescence, and investigators have considerate tough to agree upon an accurate significance of adolescence. [1]

Emotional problems incorporate side effects of sadness, tension, withdrawal and are described by intropunitive feelings, for example: distress, blame, apprehension, and stress. Externalizing problems in preadolescents have genuine simultaneous outcomes; they can, for example: hamper scholarly achievement [2] and peer relations [3]. The presence of these issues at an early age might likewise foresee higher danger of mental and physical problems in middle age. In this way, it is essential to have the capacity to identify and treat emotional issues as ahead of schedule as soon as possible. [4]

Emotional outcomes are related to emotional problems. [5] Emotional problem (depression) and its correlation with emotional outcomes (emotional intelligence) was investigated in prior research work.[6] The result of the study shows the same result as early studies concluded that individuals high in emotional intelligence accounted little levels of depression which can be generalized that those people who have more emotionally intelligent they have less emotional and behavioral problems. In the same way, this study has revealed that minimal capacity of emotional intelligence may possibly lead to some behavioral and emotional issues in adolescences, such as conduct problems, hostility, rule-breaking, inadequate academic performance Moreover emotional problems were associated with lack of emotional regulation [7] and emotional expression.[8]

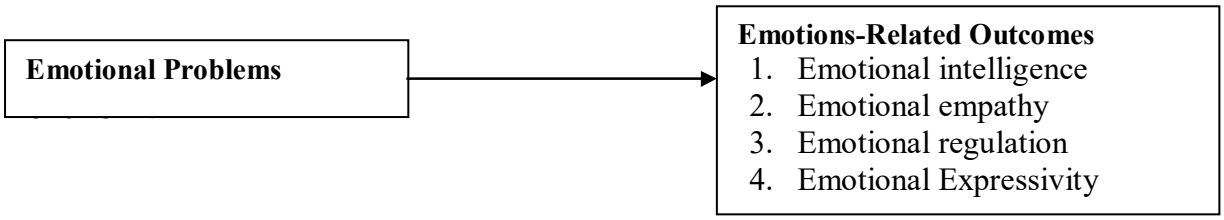
Experts researched on the degree of dispositional emotional empathy aimed the relationship between parental help support and anti-social adolescent. Large amount of emotional empathy has been attached along with less chaotic behavior. Results showing did not illustrate that adolescents with big amounts of emotional empathy were dependent towards parental backing.[9] Even though pro-social treatments and empathy to other people have got discovered with marginal scores on detrimental emotionality or Neuroticism.[10] Several observational work has verified that youngsters' practice of suppression with anxiousness and dissatisfied emotions are prediction of bigger amounts of disguising signals.[11] The approach thought of suppression has been associated with depression in younger's, while the procedures of thoughtfulness about emotions exhibit to oneself negative

Corresponding author: Muhammad Akbar (PhD Scholar), Department of Psychology International Islamic University; Islamabad. Email: romman_akbar@yahoo.com Contact :- +923457585660

emotions have got determined with the lack of stress. [12] Investigators researched the relationship between cognitive emotion regulation and high self-esteem in men. Scientific studies demand people to demonstrate their particular face current expression find out that women report mingling their personal feelings more than men do.[13] Emotional evoking undertaking's claimed that females report encountering emotions more than men.[14]

In Pakistan, most of the past researches conducted on emotional intelligence, emotional empathy on lecturers but not on emotional regulation and emotional expressivity in adolescent students. [15, 16] It was the need to investigate emotional problems with reference to emotional related outcomes. So the present research is an attempt to bridge this gap.

Conceptual Framework



To investigate the role of emotional problems in the prediction of emotional intelligence, emotional empathy, emotional regulation, and emotional expressivity among adolescents.

2.1 Hypotheses

- Emotional problems will negatively predict emotional intelligence among adolescents.
- Emotional problems will negatively predict emotional empathy among adolescents.
- Emotional problems will negatively predict emotional regulation among adolescents.
- Emotional problems will negatively predict emotional expressivity among adolescents.

2.2 Sample

A sample comprised of adolescents (N = 1000) including males (n = 500) and females (n = 500). Their age ranged from 16 to 18 years. Data was collected from universities and colleges of the Punjab. Their education level was Intermediate to Masters. The purposive convenience sampling technique was applied.

2.3 Instruments The instruments used in this study are School Children Problem Scale, [17] Emotional Intelligence Scale,[18] Emotional Empathy Scale,[19] Emotional Expressivity Scale[20] and Emotional Regulation Scale[21].

2.4 Procedure and data Analysis

Informed consent in writing form was obtained from the administration, class teachers and the respondents. Participants were instructed regarding the nature, objectives and the importance of the research. The data were collected in individual settings. The data was analyzed by using SPSS software (Version-21). The psychometric properties were established. For this purpose, descriptive statistics, alpha reliability, and Pearson correlation were computed to see the basic trends in the variables.

3. RESULTS

Table 3.1 *Psychometric Properties of the Study Variables*

				Range			
Variables	***n***	***M***	***SD***	**Min**	**Max**	**Skew**	***α***
1. Emotional problems	1000	53.01	14.96	7	109	.26	.82
2. Emotional expressivity	1000	48.75	8.68	12	85	.18	.71
3. Emotional empathy	1000	85.16	12.19	48	125	-.07	.76
4. Emotional regulation	1000	54.59	1088	20	108	.37	.78
5. Emotional intelligence	1000	206.97	36.69	98	300	.24	.81

*p <.05, **p< .01

Table3.1 shows psychometric properties of the study variables. Results show that all the scales were normally distributed with satisfactory level of alpha reliability.

Table 3.2 *Psychometric Properties of the Study Variables*

Variables	1	2	3	4	5
1. Emotional problems	--	-.28**	-.42**	-.36**	-.80**
2. Emotional expressivity		--	.75*	.57**	.87**
3. Emotional empathy			--	.44**	.61**
4. Emotional regulation				--	.33**
5. Emotional intelligence					--

*p <.05, **p< .01

Table 3.2 shows that emotional problems have significant negative correlation with emotional expressivity r (998) = -.28, p < .01, emotional empathy r(998) = -.42, p < .01, emotional regulation r(998) = -.36, p < .01, and emotional intelligence r(998) = -.36, p < .01.

Table 3.3 *Emotional problems as predictor of Emotional Intelligence*

	Outcome: Emotional Intelligence	
		95% CI
Predictor	*B*	*LL, UL*
(Constant)	.67	[-.33, 1.10]
Emotional Problems	-.39**	[.04 , .19]
R^2	.16	
F	52.49***	

Note .B = un-standardized regression coefficient; CI = confidence interval; LL= lower limit, UL=upper limit, *p< .05, **p < .01, ***p < .001

The first hypothesis of the present study was that emotional problems will negatively predict emotional intelligence. To check this hypothesis, linear regression (enter method) was used. When variable of emotional problems was added in the model, it produced a significant R square of .16 and uniquely added a significant variance of 16% to the model. Hence emotional problems negatively predicted emotional intelligence F(1, 998) = 52.49, p< .001.

Table 3.4 *Emotional problems as predictor of Emotional Empathy*

	Outcome: Emotional Empathy	
		95% CI
Predictor	*B*	*LL, UL*
(Constant)	1.32	[-.67, 1.01]
Emotional problems	-.50**	[.23 , .19]
R^2	.26	
F	40.45***	

Note .B = un-standardized regression coefficient; CI = confidence interval; LL= lower limit, UL=upper limit, *p< .05, **p < .01, ***p < .001

The second hypothesis of the present study was that emotional problems will negatively predict emotional empathy. To check this hypothesis, linear regression (enter method) was used. When variable of emotional problems was added in the model, it produced a significant R square of .26 and uniquely added a significant variance of 26% to the model. It is evident from the results of regression analysis that emotional problems negatively predicted emotional empathy F(1, 998) = 40.45, p< .001.

Table 3.5 *Emotional problems as predictor of Emotional Regulation*

	Outcome: Emotional Regulation	
		95% CI
Predictor	*B*	*LL, UL*
(Constant)	2.12*	[.32, .11]
Emotional Problems	-.43**	[.05 , .09]
R^2	.24	
F	56.31***	

Note .B = un-standardized regression coefficient; CI = confidence interval; LL= lower limit, UL=upper limit, *p< .05, **p < .01, ***p < .001

The third hypothesis of the present study was that emotional problems will negatively predict emotional regulation. To check this hypothesis linear regression (enter method) was used. When variable of emotional problems was added in the model, it produced a significant R square of .24 and uniquely added a significant variance of 24% to the model. The results reveal that emotional problems negatively predicted emotional regulation F(1, 998) = 56.31, p< .001.

Table 3.6 *Emotional problems as predictor of Emotional Expressivity*

	Outcome: Emotional Expressivity	
		95% CI
Predictor	*B*	*LL, UL*
(Constant)	.43	[.31, -.67]
Emotional Problems	-.36**	[.88, .21]
R^2	.37	
F	40.46***	

Note .B = un-standardized regression coefficient; CI = confidence interval; LL= lower limit, UL=upper limit, *p< .05, **p < .01, ***p < .001

The fourth hypothesis of the present study was that emotional problems will negatively predict emotional expressivity. To check this hypothesis linear regression (enter method) was used. When variable of emotional problems was added in the model, it produced a significant R square of .37 and uniquely added a significant variance of 37 % to the model. The results reveal that emotional problems negatively predicted emotional expressivity $F(1, 998) = 40.46$, $p< .001$.

4. DISCUSSION

The present study aimed to measure emotional problems as predictors of emotional related outcomes among adolescents. The study also aimed to find out the moderating role of personality types between emotional problems and emotional related outcomes among the adolescents. For this purpose, Urdu version of the scales i.e. School Children's Problem Scale, Emotional Intelligence Scale, Emotional Empathy Scale, Emotional Expressivity Scale Emotional Regulation Scale and big five personality scale were used.

The assumption that emotional problems will negatively predict emotional intelligence was supported by results. Through story writing, painting and solving ability of any problem leads directly to the assessment of emotional intelligence level in people. [22] In addition, both men and women with psychopath and youngsters with psychopathic traits, demonstrate reduced autonomic reactions to the depressing expressions of others.[23] Several scientific studies have analyzed the capability of individuals with psychopath to recognize the facial or vocal emotional expressions of others. [24, 25]

Emotional problems will negatively predict emotional expressivity was also supported in current results. Emotional expression has deep importance in adaptive human functioning. Articulating emotion has been shown benefit to physical health in the normal population[26] as well as distinct populations, such as women diagnosed with breast cancer [27] and older adults.[28] Emotional expression also plays a central role in psychopathology, including depression [29] schizophrenia[30] and borderline personality disorder[31] Emotional problems will negatively predict emotional regulation and emotional empathy were supported by our findings. In general, the results propose that by utilizing cognitive styles such as rumination, catastrophizing and self-blame people may be more susceptible to emotional problems than others, although other outcomes recommend that by using other styles, such as positive reappraisal people may be less insecure. [32]

CONCLUSION

Findings of the study revealed, emotional problems significantly negatively predicted emotional related outcomes including emotional intelligence, emotional regulation, emotional expressivity and emotional empathy. The findings have important implications for the adolescents and practitioners who are working in metal health settings.

REFERENCES

[1] Hashmi S. Adolescence: An Age of Storm and Stress. Review of Arts and Humanities. 2013 June; 2(1):19-33.

[2] Kessler RC, Foster CL, Saunders WB, Stang PE. Social consequences of psychiatric disorders I: Educational attainment. The American Journal of Psychiatry.1995; 152:1026-1032.

[3] McLeod JD, Nonnemaker JM. "Poverty and Child Emotional and Behavioral Problems: Racial/Ethnic Differences in Processes and Effects." Journal of Health and Social Behavior. 2000; 41: 137-61.

[4] Prinstein MJ. Moderators of peer contagion: A longitudinal examination of depression socialization between adolescents and their best friends. Journal of Clinical Child and Adolescent Psychology. 2007; 36:159-170.

[5] Fan CK, Olson SL. A Longitudinal Examination of Children's Emotion Regulation Problems, Negative Parenting Behaviors, and the Development of Internalizing Behavior Problems. Unpublished Ph. D Dissertation; The University of Michigan, 2001.

[6] Ghorbani N, Watson P. Relationship of experimental and reflective self- knowledge with trait meta-mood scale and the five factors in Iranian managers. Psychological reports. 2006; 98(1): 253-260.

[7]Larsen JK, Vermulst AA, Geenen R, Middendorp HV, English T, Gross JJ, . . .Engels CME. Emotion Regulation in Adolescence. The Journal of Early Adolescents. 2013; 33(2):184-192.

[8] Schreiter S, Pijnenborg GHM, Rot MH. Empathy in adults with clinical or subclinical depressive symptoms. Journal of Affective Disorders. 1013; 12(6): 12-15.

[9] De Kemp, R., Overbeek, G., De Wied, M., Engels, R., & Scholte, R. (2007). Early adolescent empathy, parental support, and antisocial behavior. *Journal of Genetic Psychology, 168*, 5 18.

[10] Shiner, R., &Caspi, A. (2003). Personality differences in childhood and adolescence: Measurement, development, and consequences. *Journal of Child Psychology and Psychiatry,* 44, 2-32.

[11] Zeman, J., Shipman, K., & Suveg, C. (2002). Anger and sadness regulation: Predictions to internalizing and externalizing symptoms in children. *Journal of Clinical Child and Adolescent Psychology, 31*(3), 393–398.

[12] Rude, S. S., & McCarthy, C. T. (2003). Emotional functioning in depressed and depression. *Directions in Psychological Science, 10*, 214–219.

[13] Perviaz, A., & Naz, F. (2013).Cognitive Emotion Regulation and Self-Esteem in Patients with Major Depression. *Journal of Behavioral Sciences, 13*(4), 55-56.

[14] Grossman, M., & Wood, W. (1993). Gender differences in intensity of emotional experience: A social role interpretation. *Journal of Personality and Social Psychology, 65*, 1010_1022.

[15] Yasmeen H, Najma N. Relationship between emotional intelligence and academic achievement among adolescents. Journal of Behavioral Science. 2009; 12(3): 13-15.

[16] Saleem, S., & Mahmood, Z. (2011). Development of a scale for assessing emotional and behavioral problems of school children. *Pakistan Journal of Social and Clinical Psychology*, *9*(2), 73-78.

[17] Wong, C. S., & Law, K. S. (2002). The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. *The leadership quarterly*, *13*(3),

[18] Ashraf. S. (2004). Development and validation of the emotional empathy scale and the dispositional predictor and positional outcomes of emotional empathy. Dissertation National institute of Psychology Quaid- e- Azam university Islamabad.

[19] Kring, A. M., Smith, D. A., & Neale, J. M. (1994). Individual differences in dispositiona expressiveness: Development and validation of the emotional expressivity scale. *Journal of Personality and Social Psychology*, *66*(5), 934–949.

[20] Sawar, T., (2005). Self-Regulation Scale. Developed at national institute of Psychology Quaid –E-Azam University Islamabad.

[21] Perviaz A, Naz F. Cognitive Emotion Regulation and Self-Esteem in Patients with Major Depression. Journal of Behavioral Sciences. 2013; 13(4): 55-56.

[22] Geher G. Measuring emotional intelligence: common ground and controversy. Hauppauge, New York: Nova Science Publishers, 2004.

[23] Blair RJR. Responsiveness to distress cues in the child with psychopathic tendencies. Personality and Individual Differences. 1999; 27:135–145.

[24] Blair RJR, Budhani S, Colledge E, Scott SK. Deafness to fear in boys with psychopathic tendencies. Journal of Child Psychology and Psychiatry, 2006a, in press.

[25] Stevens GWJM, Vollebergh WAM. Mental health in migrant children. Journal of Child Psychology and Psychiatry. 2008; 49:276-294.

[26] Sloan DM, Marx BP. A closer examination of the structured written disclosure procedure. Journal of Consulting and Clinical Psychology. 2004a; 72:165–175.

[27] Stanton AL, Kirk SB, Cameron CL, Danoff-Burg S. Coping through emotional approach: Scale construction and validation. Journal of Personality and Social Psychology. 2000; 78: 1150-1169. doi:10.1037/0022-3514.78.6.1150

[28] Shaw FE, Bond J, Richardson DA, Dawson P, Steen IN, McKeith IG, Kenny RA. Multifactorial intervention after a fall in older people with cognitive impairment and dementia presenting to the accident and emergency department: randomized controlled trial. Br Med J. 2003; 326: 73–75.

[29] Sloan DM, Strauss ME, Wisner KL. Diminished response to pleasant stimuli by depressed women. J Abnorm Psychol. 2001 Aug; 110(3):488-93.

[30] Earnst KS, Kring AM. Emotional responding in de®cit and non-de®cit schizophrenia, 1999, Manuscript under review.

[31] Herpertz SC, Werth U, Lukas G, Qunaibi M, Schuerkens A, Kunert HJ, et al. Emotion in criminal offenders with psychopathy and borderline personality disorder. Arch Gen Psychiatry. 2001b; 58:737–745.

[32] Garnefski N, Boon S, Kraaij V. Relationships between cognitive strategies of adolescents and depressive symptomatology across different types of life event. *Journal of Youth and Adolescence.* 2003; 32(6): 401-408.

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Relationship between Emotional Intelligence and Performance among Cricketers in Pakistan

Muhammad Umar Fayyaz[1], Amira Amjad[2], Fayyaz Ahmed Anjum[3]

[1]Department of Professional Psychology, Bahria University, Islamabad Campus
[2]Lecturer, Department of Professional Psychology, Bahria University, Islamabad Campus
[3]Department of Psychology, Government College University, Lahore.

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ABSTRACT

Relationship between Emotional Intelligence and Performance among Cricketers in Pakistan. Cricketers were administered Scale of Emotional intelligence and Test of Performance Strategies. Considering the ethical guidelines, permission was taken from the authors as well from the management of the Pakistan Cricket Board to conduct study on the international/domestic cricketers. Purposive sampling was used in the study, sample included 70 cricketers from National Cricket Academy and Model Town Green Cricket Club, Lahore. Results were calculated using spearman brown correlation (SPSS-21). The results showed that emotional intelligence had positive correlation with performance and its sub scales. Interpersonal skills are positively correlated with self-regard, assertiveness, empathy, flexibility, problem solving and stress tolerance. Performance is positively correlated with the variables of competition, skill, performance, routine, workout and visual. Experience and income from demographic variables revealed high performance. There were limitations like time constraints, tough schedules of the cricketers and not getting enough data from International cricketers. It was concluded that Emotional Intelligence plays significant contribution towards better performance of the cricketers.

KEY TERMS: Emotional Intelligence, Performance

INTRODUCTION

The stressful and competitive environment in sports requires tough demands from athletes[15] The term Emotional Intelligence(EI) has attracted a lot of researcher's attention during the last decade while athletes and coaches strive for high performance, they go through series of different emotions [4].Emotional intelligence focuses on recognizing and using of an individual own emotional state as well as the states of others to solve problems and regulating behaviour [22]. Emotional intelligence can therefore polish team interactions, and can hence bring betterment in the performance. [17]. [11] asserted that emotional intelligence accounts for 80-95% success in life in comparison to intelligence for 10 to 30 % [6]. Influence of trait emotional intelligence when they face stress of competition, tend to show high trait emotional intelligence, less stress was exhibited by male players in comparison to low trait of emotional intelligence [19]. The things that have been the reason for successful performance in sportsmen include psychological wellbeing of athletes, coaches, and sport psychologists [12].

History of Sports Psychology as a discipline

Sports psychology as a field has still a long way to go. First historical research with reference to sports psychology was conducted [10] performance of cyclists was noticed where they were given help socially. He concluded from this "milestone" research that healthy competition was able to get better performance out of the cyclists. Griffith developed the first laboratory in sports psychology at the University of Illinois in 1925, he was the one who examined nature of psycho motor skills, motor learning and its link amongst domains of personality and motor performances. Coleman, Griffith and Roberts are said to father of Sports Psychology in America [18]. There was another land mark in the history of sports psychology in 1960's with the publication of Problems Athletes have to face and how to cater them by Bruce [21]. Numerous professional sport psychology organizations emerged after 1960's. International society of sport Psychology was formed in 1965 which sponsors worldwide meetings and publishes the International Journal of Sport Psychology, first meeting was held in Rome. The aim of this organization was to give knowhow about sport psychology's trainings around the globe. A society was formed with the name of NASPSPA, it was formed in 1966, first meeting of this society was held before 1967 and it turned out to be the most contributing academic society having its emphasis on sport psychology[21].

***Corresponding Author:** Muhammad Umar Fayyaz, Department of Professional Psychology, Bahria University Islamabad Campus. Email: Umarfayyaz.1991@gmail.com +923244529716

Emotional Intelligence

According to [22], EI is capability to predict, assess and transfer one's feelings; and can help a person in achieving his goals; the ability to comprehend feelings which are related to information and to can also manage feelings as to give strength to emotional and logical growth. The definition means that emotions and intelligence are linked with each other, Use of the emotions may lead an individual to act intelligently in different scenarios.

Emotional intelligence skills make a person capable to handle difficult situations and make them manage the daily life stress, it gives an individual different perspective to deal with and they behave differently from others who are of the traditional concept of intelligence, the perspectives help a person to know his own self and other people feelings in context of communication and relationship, day to day life and at work [25]. Individuals who have high emotional intelligence are better leaders and can have a persona to motivate their subordinates [5]. Researches have revealed emotionally intelligent people are also liable to their commitments and can maintain a relation of trust with their staff which also increase the effectiveness within the teams working under same organization [5].

There was this Research on genius Taekwondo and Judo players by [7] which asserted that EI has a considerable impact on physical image and performances. Athletes who have the better EI and who can accept the responsibility of what went wrong about them and their teammates can show excellent performance.

Models of Emotional Intelligence

In definitions of EI considerable discrepancy exists, by means of both expressions and operationalization. Three models were proposed which are Ability model, mixed model and Trait model

Mixed Model Approach

[11] gave this model (1995). Five main constructs of Goleman model are given below

1. Self-awareness: Distinguish between emotions of oneself, strength, blemishes, motives, morals and objectives and in addition ability to perceive their effect on others while utilizing them.
2. Self-regulation: The ability to control or redirect an individual's problematic emotions, wishes and adjusting to evolving situations.
3. Social skills: Sorting out interpersonal relations in social settings.
4. Empathy: Putting oneself in other's shoe, to imagine in a same manner one goes through facing any tough situation.
5. Motivation: To achieve the purpose of accomplishment.

Each construct of EI with a set of emotional abilities is represented by [11]. Emotional abilities are not intrinsic abilities, yet very learned capacities that ought to be taken a shot at and might be produced to accomplish uncommon execution. It is guessed by [11] that people with innate EI competencies creates their potential for learning emotional skills.

[11] model was based on two measurement scales. The Emotional scale that is developed in 1999, known as Competency Inventory (ECI) and the other one is known as The Emotional and Social Competency Inventory was developed in 2007.

Emotional Intelligent Behavior in Sport

[13], established the Individual Zones of Optimal Functioning (IZOF) model and its basic purpose was to predict that individual athlete's performances have a link with their emotional conditions. He emphasized on the subjective emotional experiences of sportsmen which consisted of their emotions, feelings, mood and affect. The model explained that emotional-performance was related to the different patterns of the athletes. Healthy and unhealthy emotions were identified. Healthy emotions were the emotions that generated best performance and unhealthy emotions contributed in the negative performance of an individual. Different athletes showed uniqueness in these patterns [13].

Researches have revealed that healthy and unhealthy emotions in sports competitions are experienced in form of pleasure, rage, fear and joy. [14] Emotions have a significant effect on sport performance in either positive or negative manner. [13] asserted that players who played hockey at junior level accepted their positive as well as negative sentiments, they were also of the view that it has a connection with their performance. Emotions can affect the performance in positive or negative manner.

The emotions during sports competitions which can get poor results are fear and anger, and they are the leading causes of athletes who lose their temperament in a situation. Relevant [14].

Every sportsman has got unique abilities and they are connected to factors like regulation and management of emotions which plays an integral part in sports performance. The intention of the athlete should be to positively learn effective coping strategies during participation in a sport [16]. In this manner expression, management and

control of the different emotions experienced in sport, the sportsmen challenge his emotions to get better performance. When a sportsman cannot control his emotions during a performance, emotions experienced can have a considerable impact on the performance of a sportsmen.[16] If a sportsman can control his emotions during a competition, he can give optimal performance, and this is possible when emotional intelligence is applied.

LITERATURE REVIEW

A study was conducted to find out comparison of emotional intelligence and psychological skills and their relationship with experience among individual and team athletes in superior league by [23]. The focus of the study was to check differences between emotional intelligence and mental skills and their relationship with how much experience a sportsman has. Psychological skills of the participants were evaluated using [24] test of strategic performance (TOPS), emotional intelligence test was used to assess emotional intelligence. Significant results were found between Emotional intelligence sub scales however results did not show significant difference in self-awareness and empathy scales.

A study was carried out on Life satisfaction and emotional intelligence of participants/nonparticipants in outdoor sports: Turkey case [1]. The study aimed to define the relation between Life Satisfaction (LS) and Emotional Intelligence (EI) of the athletes. Sports participants and the non-participants of outdoor sports (NPOS), the difference of Life satisfaction and Emotional intelligence with respect to the gender, marital status, education level and age was assessed. Sample consisted of sports participants (n=1181) and non-sports participants (n=538). Data was collected through electronic questionnaire form. Positive relation of sports participants was found with LS. EI showed positive correlation with LS.

A comparison study was conducted between indoor and outdoor sports by [2]. The focus of the study was to find cognitive or psychological differences during the match or practice, it was to check difference of indoor sports with outdoor sports. They gave a try to find the reasons which can differentiate a good performance from a bad one in some football game and indoor gymnastics. 60 students from different universities participated where 20 out of them played football and 20 were gymnasts who were from indoor sports. Tools used in the study were emotional intelligence questionnaire (EIQ16). The EIQ16 assesses 16 emotional competencies. Difference was found in self-analysis.

Rationale of Research

After searching literature, it was found that emotional intelligence has a relationship with successful performance. Previously not more researches are done in Pakistan on Cricketers. Not much work has been done in field of sports in Pakistan. It was found that there have been researches in other sports with relation to emotional intelligence but not many studies have been done on cricketers. It has relation with other sports, emotional intelligence might contribute towards successful performance of cricketers in Pakistan. With Cricket the most widely sport followed, this study can be an enhancement in the literature in Pakistan.

Objectives

The current study aims to find out the role of Emotional intelligence performance of domestic/international cricketers. To highlight how significantly emotional intelligence can contribute in the better performance of the cricketers.

Hypotheses

- There is likelihood to be a significant relationship among variables of Emotional intelligence and performance in cricketers.

METHOD

Research Design

Cross sectional research design was used in this study as participants from different age groups were administered at the same progression of time.

Sample and Sampling Strategy

The sample was determined through g power analysis with medium effect and it consisted of 70 openers, middle order batsmen and bowlers including International test cricketer's as well domestic cricketers. The purposive sampling technique was used in the study.

Instruments

Permission was taken from author as per the ethical requirement of APA guidelines. After taking the permission, following instruments were used.

Emotional Intelligence scale

Emotional Intelligence (SEI) developed by [3], has 56 items with ten well defined sub scales. SEI evaluates self-regard, assertiveness, interpersonal skills, emotional self-awareness, empathy, flexibility, impulse control, problem solving, optimism and stress tolerance. This instrument was made on 4-point Likert format with 1=never true, 2=true sometimes, 3=more often true and 4 as always true. Ten items needed reverse coding 7,9,13,17,26,30,42,47,48 and 49. Cronbach's alpha coefficient for scale of emotional intelligence is alpha=.95 and split half reliability is.92. The computed alpha value of this scale is .88. Reliability coefficient for present study came out to be on the higher side which is .85.

Test of Performance Strategies

Tops were used to measure the performance of cricketers. The Test of Performance Strategies consists of a 68-item self-report instrument that assesses the frequency with which psychological skills are used in practice. It has six sub scales in total which are competition that assesses individual's performance in the tournaments, skill which checks out the specific element of a sports performance, performance assesses execution of a skill in a competition, routine assesses the preparation a sportsman had to undergo before going into the competition, workout where practice sessions are done in a structured environment to work on various elements of the sports and the last sub scale is visualization, imagery and rehearsal where sportsman pictures aspect of the performance in mind. Tool consists of a Likert scale (i.e., 1 = never to 5 = always). [24] found strong psychometric properties for the test i.e. coronach alphas of subscales ranged from 0.66 to 0.81. With one exception (the practice activation subscale at .56).

Statistical procedures and results are calculated on Statistical Package for Social Sciences -21 (Spss- 21). To find relationship between variables Correlation analysis was run. Linear regression was done for prediction among variables, independent sample t-test was done to compute differences of married and single cricketers.

Keeping in view the ethical guidelines of a research project, the permission for using the Emotional intelligence, competitive anxiety and Performance strategies were taken from the author. Permissions from the regulating body of cricketers i.e. Pakistan Cricket Board was also taken prior before data collection. Cricketers were asked for written consent on whether they voluntarily want to take part in the project, they shall be free to withdraw from the research at any time they want. Cricketers needing psychological assistance were provided with counselling sessions after permission from Pakistan Cricket Board. The information will be used only for the study purpose Cricketers were ensured about the confidentiality of their responses.

Procedure

Permission was taken from the authors to use tools for the administration on cricketers. To assess Emotional intelligence of the cricketers, Scale of Emotional Intelligence [3] was used and to measure the Performance strategies used by cricketers. Test of Performance Strategies by [24] was used. After taking permission from the Authors, permission was also taken from National Cricket Academy of Pakistan Cricket Board and a local club of Lahore for the data collection. In the next phase, data was collected from National Cricket Academy Lahore and Model Town Green Cricket Club. Cricketers were asked for informed consent. Confidentiality was assured to them, they were informed about all their rights as a participant of the research and were given full freedom to withdraw from the study. Following data collection, results were synthesized using SPSS-21 (Statistical Package for Social Sciences-21), Independent sample t-test and Pearson product moment correlation analysis was run to calculate the results.

RESULTS

The research was done to see whether high emotional intelligence predicts high performance in domestic/international cricketers. Permission to use tools was taken from the respective authors. Permission from the owners of clubs was also taken. Data was collected from National cricket academy, Lahore and Model town green cricket club, Lahore. Data was collected from the players and they were given the authority to withdraw from the study at any point without telling any reason, they were also intimated that the results will be shared with officials of Pakistan cricket board. Informed consent was signed and they were ensured that their data will be solely used for the research purpose. Results of the study are synthesized and interpreted.

Table 1: Frequencies and Percentages of the Demographic characteristics of the sample

Characteristics of Participants		Frequencies (f)	Percentages (%)
Age			
	12 to 19	5	7.1
	20 to 25	32	45.7
	26 to 50	33	47.1
Marital Status			
	Married	28	40
	Single	42	60
Education			
	Under Matric	1	1.4
	Matric	17	24.3
	Intermediate	30	42.9
	Graduation	16	22.9
	Masters	6	8.6
Socio Economic Status			
	up to 30,000	27	38.6
	up to 50,000	14	20
	up to 100,000	17	24.3
	up to 150,000	4	5.7
	up to 200,000	4	5.7
	above 200,000	4	5.7
Experience			
	2 to 5 years	8	11.4
	5 to 10 years	33	47.1
	10 to 15 years	19	27.1
	15 to 20 years	6	8.6
	more than 20 years	4	5.7
Category			
	Batsman	24	34.3
	Bowler	24	34.3
	All-rounder	19	27.1
	Wicketkeeper	3	4.3

The results were synthesized by using (SPSS 21). Results are bifurcated into three major domains i.e. demographics, descriptive and inferential statistics. Table 1 outlines the demographic characteristics of the sample whereas the table 2 outline the descriptive characteristics of the sample. The participant's age ranges from 15 years to 50 years. The mean age of the sample came out to be 28.07 years. 42 participants (60%) were single whereas 28 (40%) of the participants were married. Education wise only 1 participant (1.4%) was under matric. 17(24 %) of the participants were matriculate. 30 (42.9%) were educated up to intermediate. 16(22.9%) of them were graduate and 6 (8.6%) of them were educated up to master's level. Socio economic wise cricketers were divided by the contracts which were given to them by Pakistan Cricket Board from domestic level. 27(38.6%) of the participants were getting 30,000 Rupees monthly. 14 (20%) of the participants were getting 50,000 Rupees monthly. 17 (24.3%) participants were earning 100,000 Rupees monthly whereas 4 (5.7%) participants were getting up to 150,000, up to 200,000 and above 200,000 Rupees respectively. Experience wise 8(11.4%) participants belonged to amateur level of 2 to 5 years, 33 (47.1%) participants belonged to rookie experience level of 5 to 10 years, 19 (27.1%), 6(8.6%) and 4 (5.7%) participants belonged to professional categories of 10 to 15, 15 to 20 and above 20 years of experience categories respectively. 24 (34.3%) participants were batsman and bowlers.19 (27.1%) participants were all-rounders and 3 (4.3%) of the participants were wicketkeepers.

Table 2

Descriptive Statistics and Results of Independent Sample T-Test for Mean Differences in Responses of Married and Single Participants on Sub Scales of Emotional intelligence, Test of performance strategies and Sports competition anxiety Test.

	Married		Single				95% CI		Cohen's d
	M	SD	M	SD	t (70)	P	LL	UL	
Measures									
Scale of Emotional Intelligence	117.25	13.10	110.40	15.33	1.99	0.05	0.00	13.68	0.48
Interpersonal Skill	13.11	2.60	11.50	3.16	2.32	0.02	0.22	2.99	0.55

Note: CI= confidence interval; LL= lower limit; UL= upper limit

Independent Sample t- test was done to compute the difference in responses on the scales of Emotional Intelligence and Test of Performance Strategies between Married and Single Cricketers. The above table depicts that mean score obtained by Married participants on scale of emotional intelligence and interpersonal skills was significantly high as compared to single participants. Difference in scale of emotional intelligence was highly significant in married participants (M=117.25, SD= 13.10); t (70) =1.99, p<0.05 two tailed, 95%, d=0.44. Significant mean differences were also observed in married participants as compared to single participants in interpersonal skills i.e. (M=13.11, SD=2.60) t (70) =2.32, p< 0.05, two tailed, 95%, d= 0.55.

Table 3

Pearson Product Moment Correlation, Mean and Standard Deviation between scores of Emotional Intelligence test and its sub scales and Test of Performance Strategies and its sub scales.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
SEI		--	.69**	.58**	.79**	.43**	.69**	.42**	.76**	.74**	.63**	.66**	-.19	-.22	-.10	-.02	-.23	.12	-.28*
I-SKILLS			--	.36**	.43**	.03	.46**	.15	.51**	.50**	.31**	.39**	-.17	-.20	-.07	.03	-.32**	.07	-.11
S-REGARD				--	.31**	.17	.45**	.45**	.28*	.32**	.22	.33**	-.21	-.25*	.01	-.20	-.17	-.04	-.22
ASSERTIVENESS				.	--	.47**	.53**	.31**	.48**	.45**	.57**	.50**	-.04	.05	-.17	.02	-.13	.07	-.04
E-AWARENESS						--	.31**	.06	.26*	.20	.19	.21	-.04	-.13	-.02	.05	-.02	.05	-.09
EMPATHY							--	.20	.49**	.42**	.25*	.33**	-.13	-.06	-.11	-.02	-.19	.04	-.22
I-CONTROL								--	.23	.12	.24*	.12	.04	-.09	.09	-.03	.15	.04	-.00
FLEXIBILITY									--	.68**	.50**	.45**	-.18	-.26*	-.12	.02	-.17	.18	-.32**
P-SOLVING										--	.45**	.54**	-.29*	-.30*	-.12	.01	-.32**	.07	-.34**
S-TOLERANCE											--	.40**	-.01	-.04	-.01	.04	-.03	.25*	-.23
OPT												--	-.15	-.19	-.03	-.05	-.14	.11	-.25*
TOPS													--	.81**	.71**	.79**	.81**	.37**	.47**
COMPETITION														--	.327**	.512**	.653**	.027	.434**
SKILL															--	.58**	.46**	.43**	.11
PERFORMANCE																--	.54**	.44**	.30*
ROUTINE																	--	.17	.42**
WORKOUT																		--	-.23
VISUAL																			--
M	15.00	113.14	12.14	11.79	14.81	11.26	9.23	12.03	9.74	9.44	11.39	9.83	234.07	87.36	24.34	30.99	33.61	10.67	17.79
SD	2.93	14.77	3.03	2.13	2.85	1.84	2.07	1.93	2.13	2.45	1.91	1.88	22.68	8.78	4.28	3.93	4.16	2.93	3.15

*p<0.05, **p<0.01

Note: SEI= Scale of Emotional Intelligence, TOPS= Test of Performance Strategies, I SKILLS=Interpersonal Skills, S-REGARD=Self Regard, E-SELF AWARENESS=Emotional Self Awareness, I-CONTROL=Impulse Control, S-TOLERANCE=Stress Tolerance

Correlation analysis was run to find out the correlation between variables of Emotional Intelligence scale and its sub scales and Test of Performance Strategies and its sub scales.

The table is showing a positive correlation between emotional intelligence and interpersonal skills which is a sub scale of emotional intelligence, which means increase in emotional intelligence will give rise to interpersonal skills of an individual as well.

The table is also showing a positive relationship among sub scales of emotional intelligence: s-regard, assertiveness, emotional self-awareness, empathy, impulse- control, flexibility, problem solving, and stress tolerance. This means that if the emotional intelligence of a person is increasing than, self-regard, assertiveness, emotional self-awareness, empathy, impulse control, flexibility, problem solving, and stress tolerance will increase as well.

Table shows that interpersonal skills is positively correlated with self-regard, assertiveness, empathy, flexibility, problem solving and stress tolerance which means that higher the emotional intelligence would be, greater self-regard, assertiveness, flexibility, problem solving and stress tolerance a person will have.

Table is showing a negative correlation between interpersonal skills and performance of an individual which mean that the higher the interpersonal skills of an individuals, lower the performance of an individual.

Results also reveal that self-regard has positive correlation with assertiveness, empathy, impulse control and flexibility which means that if self-is high, assertiveness, empathy, impulse control and flexibility will also be high.

Table shows that self-regard has a negative correlation with test of performance strategies that means if the individual has high self-regard he will be low on performance. Results indicate a positive correlation between sub scales of assertiveness, emotional self-awareness, empathy, impulse control, flexibility, problem solving and stress tolerance which reveals that cricketers with assertive skills, emotional self-awareness, empathy, impulse control, flexibility, problem solving, and stress tolerance will tend to perform better.

Results reveal a positive correlation between emotional self-awareness and empathy, emotional self-awareness and flexibility. This means that the individual with high emotional self-awareness will have empathy and flexibility as well.

Table shows that there is a positive correlation between empathy and flexibility, problem-solving, stress tolerance and optimism. This shows that participants with high empathy will also have more flexibility, problem solving, stress tolerance and optimism as well.

Table shows that there will be a positive correlation between impulse control and stress tolerance that means the better the impulse control the more he will have stress tolerance.

Table shows that there will be a positive correlation between the variables of problem solving with flexibility, stress tolerance and optimism that means the higher the problem-solving skills are, more the flexible, more stress tolerance and with more optimism.

Problem solving will have positive correlation with stress tolerance and optimism that means high problem-solving skills will lead to stress tolerance and optimism as well. Problem solving will have negative correlation with test of performance strategies competition and visual that means high problem solving will lead them to less performance strategies, competition and visual imagery in sports as well.

Table shows that the stress tolerance will have positive correlation with optimism and routine as well, that means the more the stress tolerance, and likelihood of optimism along with following the routine will increase as well.

Optimism is negatively correlated with visual performance that means more optimism will decrease the visual performance of an athlete.

Table shows that the test of performance strategies will have positive correlation among the variables of competition, skill, performance, routine, workout and visual. This depicts that the athletes having better strategies will also have better competition, skill, performance, routine, workout and visual performance as well.

Table 3 reveals that the competition will have positive correlation with skill, performance, routine and visual performance that shows if the individual has better competition skills, his skill, performance, routine and visual performance will increase as well.

Table shows that skill will have positive correlation with, performance, routine and workout that means that participants with high skill will show high performance, will have better routine and workout as well.

Table shows that performance will have positive correlation with routine, workout and visual performance, this depicts that higher the performance, better the routine, workout and visual performance will be.

Table 3 also is showing that routine will have a positive correlation with visual performance that means better routine will lead to better visual imagery exercise as well.

DISCUSSION

The study aimed to find out relationship between Emotional intelligence and performance in Domestic/International cricketers. Permission to use the tools from their respective authors was taken. Emotional intelligence was assessed through Scale of emotional intelligence [3]. The computed alpha value of this scale was .88. Reliability coefficient for present study was high as .85. Test of performance strategies by [24] was used to assess performance of the cricketers, reliability of the scale was strong, the reliabilities of the subscales ranged from 0.66 to 0.81, with one exception (the practice activation subscale at .56). Data was collected from National cricket academy, Lahore and Model town green cricket club, Lahore. Participants were approached and were informed about their rights. Results of the research were computed synthesized using SPSS (Statistical package for social sciences).

Independent sample t-Test revealed that married cricketers scored higher in Scale of emotional intelligence as compared to single participants, in this regard there was a study done on the relationship between emotional

intelligence and marital status in sample of college students by [20], they aimed to investigate relationship between Emotional intelligence, happiness and marital status of shahed's university students. 240 participants (110 single and 130 married) were randomly selected. The emotional quotient was administered and their marital status were also investigated. Married individuals scored higher as compared to the single individuals in self-regard, empathy, responsibility, impulse control, self-actualization and reality testing. In the present study the results are in line with the literature as the married cricketers have scored more on Emotional intelligence as compared to the single cricketers. In the same manner Interpersonal skills which is the sub scale of emotional intelligence was higher in married cricketers as compared to the single cricketers. Results of independent sample t-test are in line with the literature.

Hypotheses states that emotional intelligence will have positive relationship with performance in cricketers. A study was found specifically in line with the sport of cricket in South Africa, the topic of the study was Emotional Intelligence Scores Predict Team Sports Performance in a National Cricket Competition, and it was done by [8]. Six cricket teams were assessed over two seasons for emotional intelligence in the context of their performance. MSCEIT ability test and averages of the players during the season were used as measures to assess performance and it was correlated with team sports performance measure, Results showed that emotional intelligence was a significant predictor with 61% improvement in the table points at the end of the season.

In the demographics, Visualization (sub scale of Test of Performance Strategies) experience showed positive relationship with performance, Scale of Emotional Intelligence and Its Sub Scales. This can be related to a previous study in which determinants of emotional intelligence, experience had positive relation with emotional intelligence. [9] insisted that EI had a positive correlation with experience, more the experience of an employee, higher the EI will be. There is a positive relationship between EI, age and job experience, investigated by [11]. A study carried out by Mayer et al. (1999) infers that if EI is considered be a standard intelligence, it will increase with the age.

Conclusion

The aim of the current study was to find out relationship between emotional intelligence and performance in cricketers. Independent sample t-test showed differences between married and single cricketers and that married individuals scored high on emotionally intelligence and had better interpersonal skills as compared to the single cricketers. This research is a gate way for the new researchers in Pakistan to work in the line of sports psychology as there is still a long way to go. Psychology can help sportsmen cope up with their issues on field and off the field as well.

Recommendations

- This study can be extended to more set of samples to make it more representative of the true population. Randomized sampling technique and larger sample will facilitate generalization of the results.
- The study can be done on cricketers at under- 19 level which might help cricketers identify on how they can polish their skills through emotionally intelligent behaviour.

REFERENCES

[1] Ardahan, F. (2012). Life satisfaction and emotional intelligence of participants/nonparticipants in outdoor sports: Turkey case. Procedia-Social and Behavioral Sciences, 62, 4-11.

[2] Bal, B. S., Singh, K., Sood, M., & Kumar, S. (2011). Emotional intelligence and sporting performance: A comparison between open-and closed-skill athletes. Journal of Physical Education and Sport Management, 2(5), 48-52.

[3]Batool, S. S., & Khalid, R. (2011). Development of Indigenous Scale of Emotional Intelligence and Evaluation of Its Psychometric Properties. Pakistan Journal of Social & Clinical Psychology, 9(1).

[4] Chan, J. T., Mallett, C. J., (2011). The Value of Emotional Intelligence for High Performance Coaching. International Journal of Sports Science & Coaching, 6, 315-328.

[5] Cooper, R. K., Sawaf, A., Labovitz, G. H., & Rosansky, V. (1997). Executive EQ. Audio-Tech Business Book Summaries.

[6]Crabbe, R.C., (2007). Emotions in Sports

[7] Costarelli, V., & Stamou, D. (2009). Emotional intelligence, body image and disordered eating attitudes in combat sport athletes. Journal of Exercise Science & Fitness, 7(2), 104-111.

[8] Crombie, D., Lombard, C., & Noakes, T. (2009). Emotional intelligence scores predict team sports performance in a national cricket competition. International Journal of Sports Science & Coaching, 4(2), 209-224.

[9] Day, A. L., & Carroll, S. A. (2004). Using an ability-based measure of emotional intelligence to predict individual performance, group performance, and group citizenship behaviours. Personality and individual Differences, 36(6), 1443-1458.

[10] Davis, S. F., Huss, M. T., & Becker, A. H. (1995). Norman Triplett and the dawning of sport psychology. The Sport Psychologist, 9(4), 366-375.

[11] Goleman, D. P. (1995). Emotional intelligence: Why it can matter more than IQ for character, health and lifelong achievement.

[12] Gucciardi, Daniel F., Gordon, Sandy. & Dimmock, James A. (2009). Developmental and preliminary validation of a mental toughness inventory for Australian football. Psychology of Sport and Exercise, 10, 201-209.

[13] Hanin, Y. L. (2000b). Individual zones of optimal functioning (IZOF) model: Emotion-performance relationships in sport. In Y. L. Hanin (Ed.), Emotions in sport (pp. 65-89). Champaign, Illinois: Human Kinetics.

[14] Jackson, S. A., & Csikszentmihalyi, M. (1999). Flow in sports: The keys to optimal experiences and performances. Champaign, Illinois: Human Kinetics.

[15] Jones, G. (1995). More than just a game: research developments and issues in competitive anxiety in sport. British Journal of Psychology, 86, 449-478.

[16]Jones, M. V., Taylor, J., Tanaka-Oulevey, M., & Daubert, M. G. (2005). Emotions. In J. Taylor & G. S. Wilson (Eds.), Applying sport psychology: Four perspectives (pp. 65-81). Champaign, Illinois: Human Kinetics.

[17] Koch, C., Christopher, M., Schanzenbach, B., (2010). Emotional Intelligence among American and Chinese Basketball Players. Poster presented at the 90th Annual Western Psychological Association Convention in Cancun. Mexico.

[18] Kroll, W., & Lewis, G. (1970). America's first sport psychologist. Quest, 13(1), 1-4.

[19] Laborde, S., Brüll, A., Weber, J., & Anders, L. S. (2011). Trait emotional intelligence in sports: A protective role against stress through heart rate variability? Personality and Individual Differences, 51(1), 23-27

[20] Madahi, M. E., & Samadzadeh, M. (2013). The relationship between emotional intelligence and Marital Status in sample of college students. Procedia-Social and Behavioral Sciences, 84, 1317-1320.

[21]Ogilvie, B. (1966). Problem athletes and how to handle them. Pelham.

[22] Salovey, P., & Mayer, J.D. (1990). Emotional intelligence. Imagination, cognition and personality, 9, 185-211.

[23] Soflu, H. G., Esfahani, N., & Assadi, H. (2011). The Comparison of emotional intelligence and psychological skills and their relationship with experience among individual and Team athletes in superior league. Procedia-Social and Behavioral Sciences, 30, 2394-2400.

[24] Thomas, P. R., Murphy, S. M., & Hardy, L. E. W. (1999). Test of performance strategies: Development and preliminary validation of a comprehensive measure of athletes' psychological skills. Journal of sports sciences, 17(9), 697-711.

[25] Van Jaarsveld, P. (2003). The heart of a winner: Developing your emotional intelligence. Lux Verbi.

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Characterization of Mekerra River waters used in irrigation of farmland in Sidi Bel Abbes Country (West of Algeria)

Nadjoua Zaghib Zouita, Mohamed Benyahia and Mohamed Ali Bouzidi

Laboratory of Spaces Ecodevelopment , Faculty of Nature and Life sciences, Djilali Liabes university of Sidi Bel Abbes , 22000 , Algeria

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ABSTRACT

Known by its lands with agricultural vocation and by a deficit of irrigation water, the region of Sidi Bel Abbes in the Algerian west see its farmers used the well water near the Mekkera River like source of irrigation of the cultures. But unfortunately, this river is an outdoor sewer loaded with matter and polluting elements. These accumulate in the soil and reach the groundwater affecting well water.
The aim of this work is to demonstrate the dangers using of Mekerra river waters (country of Sidi Bel Abbes, west of Algeria) in irrigation of farmland, which is the site of drainage of industrial and urban waste water in the region.
The result of the physic-chemical and bacteriological analyzes indicate microbiological contamination and presence of trace heavy metals such as Chromium, Cadmium, and Nickel in water.
Consequently, the direct use of these waters or waters of nearby wells for irrigation water by these few have a detrimental effect to consumers that foods derived from these agricultural lands may accumulated amounts of harmful contaminants for human health.
Consequently, the direct use of these waters or waters of nearby wells to irrigate some have a detrimental effect to consumers that foods derived from these agricultural lands may accumulated amounts of contaminants harmful to human health.
KEYWORDS: Mekerra river, pollution, wastewater, irrigation, impact, health, environment.

INTRODUCTION

Like the countries of west Algerian department, Sidi Bel Abbes country suffers from water shortage. In this region, where the flows are characterized by a considerable seasonal and irregularity, the water potentials are low. Water resources in ground or surface are insufficient to meet the needs and growing demands of the urban or rural population [1, 2].
Formerly, the Mekerra River in Sidi Bel Abbes country was used for irrigation of farmland about 30 km long. The river also feeds a part of the groundwater, but currently and unfortunately, it drains the industrial and urban waste water of the city of Sidi Bel Abbes and these localities for order flow 200-300 l/s during peak. During the rainy season flow is more important. Therefore, Mekerra River became a place of open dump which caused him the loss of his previous role (feeding the ancient city) despite having wealth huge natural [3]
Indeed, industrial effluents contributes significantly to the pollution of streams and dam in Algeria and cited as an example Oued Mekerra which partially feeds the groundwater of Sidi Bel Abbes, which contains high levels of nitrate in the order of (60 - 196 mg / l) [4].
Thus, the objective of our work is to characterize the quality of water drained by Oued Mekkera and are used in irrigation of surrounding farmland

MATERIALS AND METHODS

Study area

Situated in the Northwest of Algeria, the pond overturning of Mekerra is a part of the big pond of Macta (Figure 1). There are between the latitude 34°31'-35°21' North and the longitude 1°16'-0°58' West, on a surface about 3114km2 and the 249km perimeter, directed by the South (upstream, 1097m to Ras El MA) in the North (downstream, 500 m, of the city of Sidi Bel Abbes). The average slope of the river until Sidi Ali Benyoub is about 1 in 1,5 %. She is no more than from 3 to 8 % between Boukhanifis and Sidi Bel Abbés, in the part swallows of the paying pond [3, 5].

***Corresponding Author:** Mohamed Ali Bouzidi, Laboratory of Spaces Ecodevelopment, Faculty of Nature and Life sciences, Djilali Liabes university of Sidi Bel Abbes, 22000, Algeria.
Email: medalibouzidi@yahoo.fr

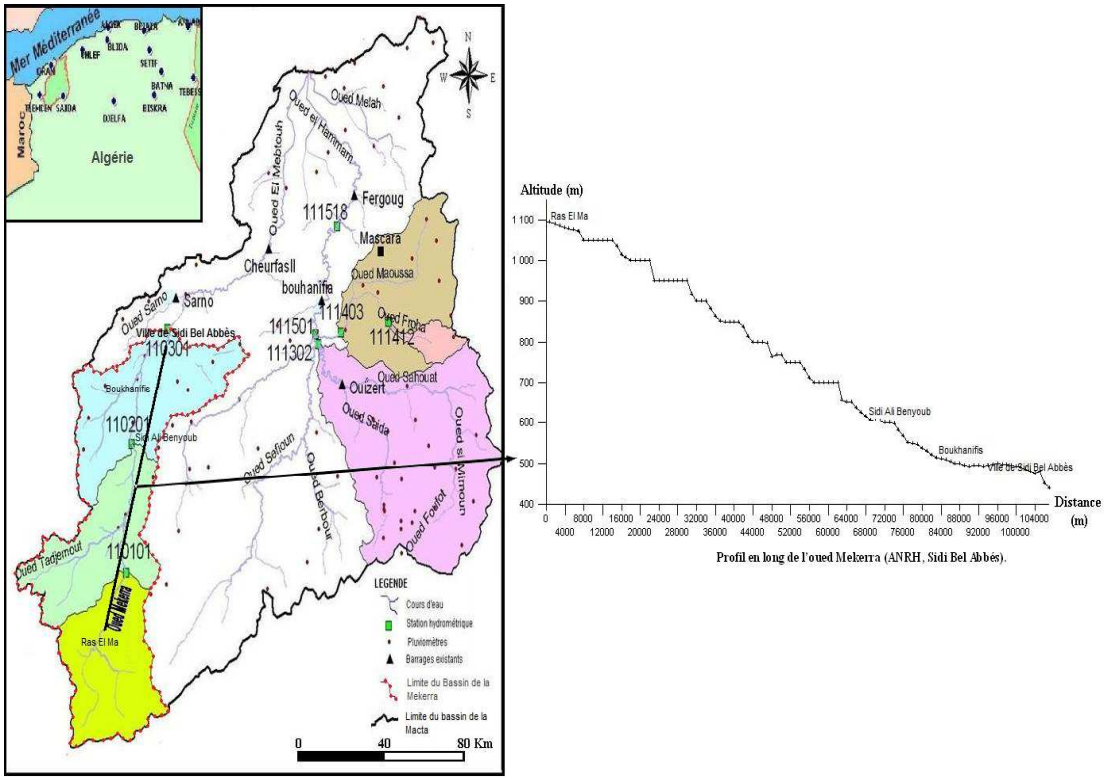

Figure 1 - Geographical situation of the pond overturning of Mekerra [3].

Sampling method

Four stations were selected a long of Mekerra river from the south to the north (TABLE 1).

Table 1 - Geographic situation of different stations

	Geographic coordinates
Station 1	N : 35°13'32" W : 0°36'17"
Station 2	N : 35°13'31" W : 0°36'15"
Station 3	N : 35°12'08" W : 0°36'34"
Station 4	N : 35°11'35" W : 0°38'25"

Physicochemical and bacteriological analyzes

The levies are each time bet in clean bottles for samples intended for physicochemical analysis, and previously sterilized glass bottles for samples for microbiological analyses, all bottles are in a cooler, and thereafter they will be taken over by the laboratory with analytical techniques which differs according to the desired element. The required parameters are: temperature, hydrogen potential, DOB_5, COD, NO_3^-, NO_2^-, PO_4^{3-}, NH_4^+, Fe and Cu. The required germs are: Totals Coliform, Fecal Coliform, E. Coli, Fecal Streptococci and Clostridium.

Statistical processing

Taking into account the available data, the statistical analysis being able to answer our treatments is: the analysis in principal components (PCA) which accounts for affinities between statistically characterized sets. In our case, it is between the microbiological stations and parameters on the one hand and between the stations and the physicochemical parameters of another share for each station along the Mekerra river.

RESULT

From the observed results of physicochemical parameters characterize the water in the studied stations; we found the following results:

the temperature of the water varies slightly at the sampling wells, it is equal to 14.2 ° C in S3 and 16 ° C in S2 (Figure 2).

During our study, we note slight pH variability with values from 8.35 in station S3 to 8.85 at station S1 (Figure 2). pH is a parameter that measures acidity or alkalinity or water [6].

Pollution indicators such as BOD_5 and COD exceed the standards allowed according to the Algerian norms for clean water used for irrigation purposes. In our result we found 117mg/l, 53mg/l and 42mg/l in different station, while the standards are in the order of 30 mg/l [7].
The COD exceeds the standards for 2 samples S2 and S3 with values that are in the order of 145mg/l and 110 mg/l, respectively, while the standards are in the order of 90 mg/l.
For these two parameters, it is noted that there is a decrease in pollution in 2017 compared to 2008 based on the results of the analyses carried out by [7].
At the exit of the purification station (purified water) The BOD_5 was in the order of 52mg/l in 2008 exceeding the standards, while in the same point in our work the BOD5 and the Order of 117mg/l (Figure 2).
For COD in 2008 it was in the range of 420mg/l while in our work it is 35.43 mg/l (Figure 2). This comparison proves that the efficiency of the purification is more important in 2017 than on 2008 for organic matter.
The same remark is made on the suspended material and according to [7] which was 59 mg/l and which 9 mg/l is in 2017.

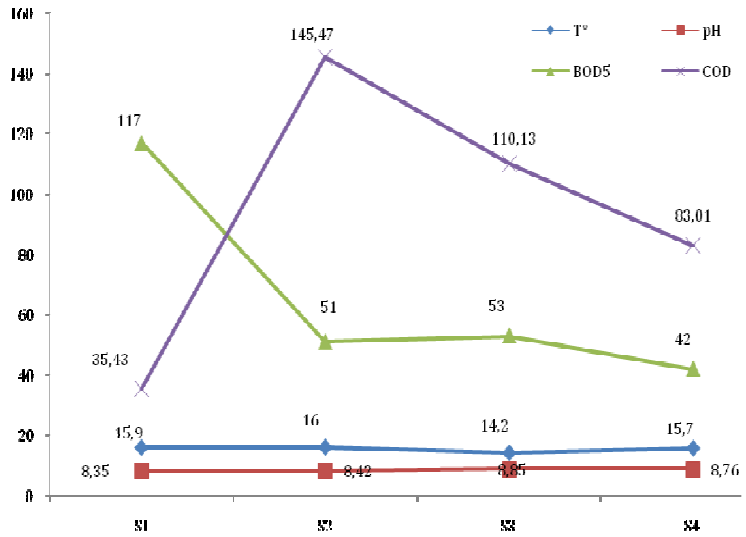

Figure 2 – Values of Temperature, pH BOD5 and COD of different stations

According to the results of the physicochemical analyzes, we find that the nitrates (NO_3^-) and the ammonium (NH_4^+) are in high concentration in the wells of the station S1 with respectively 128mg/l and 23,168mg/l. Copper (Cu), iron(Fe), nitrites (NO_2^-) and phosphates (PO_4^{3-}) are in smaller quantities (Figure 3).

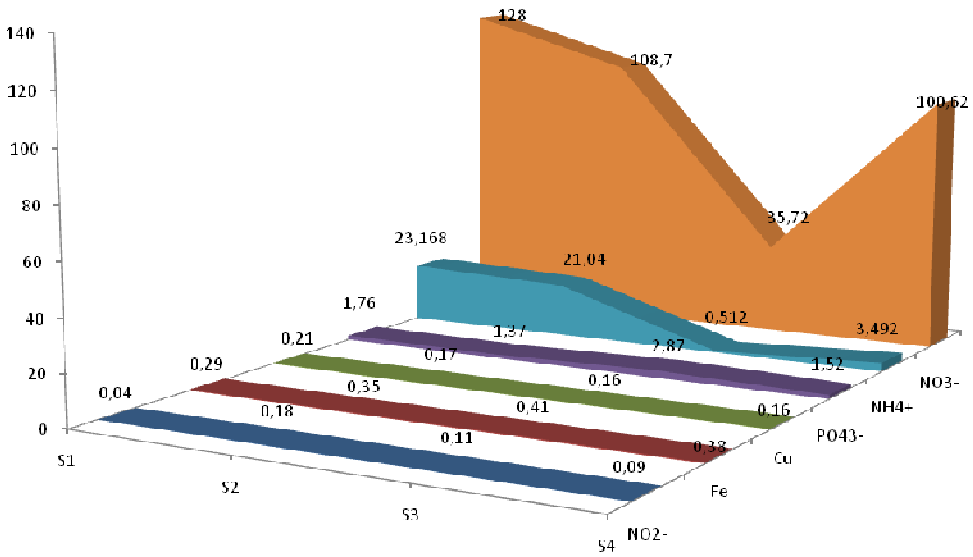

Figure 3 – Values of No_2^-, Fe, Cu, PO_4^{3-}, NH_4^+, NO_3^- of different stations

The results of the bacteriological analysis of the water of the sampling stations indicate a contamination by the different germs, in particular the first and the third station where we recorded respective rates equal to 3320

germs/100ml and 3400 germs/100ml for total coliforms, 3200 germs/100ml and 3330 germs/100ml for fecal coliforms at 22 ° C (Table 2).

Table 2 – Bacteriological analysis results

	Total Coliforms	Fecal Coliforms	E.Coli	Fecal Streptococci	Chlostridium
S1	3320	3200	320	2010	30
S2	332	121	3,4	1000	19
S3	3400	3330	220	220	22
S4	1800	145	5,1	75	11

DISCUSSION

Figure 4 presents the circle of correlation between the variables, where the information is represented on the axis factorial 1 with 53,83% of inertia against 36,49% of inertia represented by the axis factorial 2, show a correlation between temperature and phosphate between pH, nitrates and ammonium BOD5 and iron which are closely related, thus characterizing a group indicating the role which plays this elements in the process of transformation of the organic matter. Indeed,

The temperature of the water is an important factor. It plays a role in the solubility of the gas in the separation of salts, the change in pH, knowledge of the origin of the water and any mixtures, etc. In addition, this measure is important in limnology and in general, it is influenced by the source from which they come superficial or deep [8].

The superposition of the correlation circle on the factorial plane explains the relationship that exists between the different parameters of the water analyzed. Each well is characterized by factors; the well of station S1 and S3 is attached to ammonium, nitrates, iron, copper, phosphates, BOD5 and to the different pathogens in which they record their maximum values.

In fact, ammonium in water usually represents a process of incomplete degradation of organic matter. Ammonium comes from the reaction of minerals containing iron with nitrates. It is therefore an excellent indicator of water pollution by organic discharges of agricultural, domestic or industrial origin. More, ammonium itself is not very toxic but it can cause several problems such as bacterial reviviscence, the decrease in the effectiveness of chlorine treatment and the development of microorganisms responsible for unpleasant odors [9].

Naturally occurring nitrate levels in surface and ground water are generally a few miligrams per litre. In many ground waters, an increase of nitrate levels has been observed due to the intensification of farming practice. Concentrations can reach several hundred miligrams per litre. Nitrate is less toxic than nitrite, which is in higher rate in the well Station S2, and is used as a food source by live plants [10].

On the other hand, phosphates can be of organic or mineral origin, most often their content in natural waters results from their use in agriculture. Their presence in the water of some wells indicates the proximity of manure, septic tanks or the possibility of infiltration of agricultural runoff, rich in fertilizer [11].

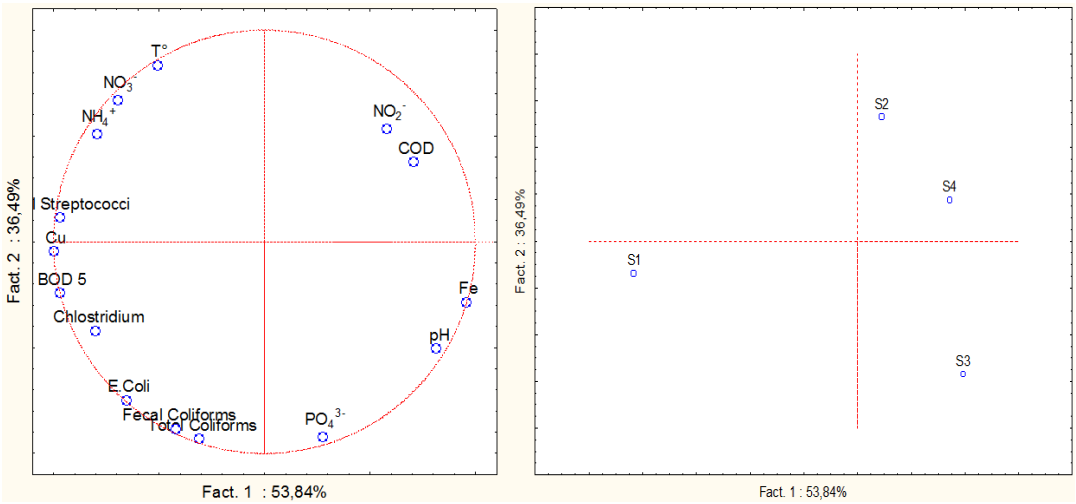

Figure 4 – CPA analyses of physicochemical and bacteriological results

CONCLUSION

Through our results we conclude that the pollution of the Mekerra River is a source of contamination of the groundwater of the plain of Sidi Bel Abbes. The use of well water to its proximity by farmers for irrigating crops is not without effect because harmful elements accumulate in the food grown and will have a negative effect on human health.

It will be necessary to solve the problem of pollution of Mekerra River based on workable and categorical solutions as soon as possible;

- ✓ Connect the part of the Mekkera River not taken on consideration by the sewage treatment plant.
- ✓ To envisage the construction of a pre-treatment station at the exit of the industrial zone and to sensitize each polluter to manage this waste in a definitive way according to the laws of the Algerian Official journal.
- ✓ To envisage in the long term the development of an irrigation system for the Sidi Bel Abbes Plains using purified and treated wastewater after connecting the unpurified part of the River to the Sidi Bel Abbes Sewage Treatment plant.

The treated and purified flow will be intended for irrigation of the agricultural zone of the Sidi Bel Abbes Plain, knowing that agriculture in this country and livestock are socio-economic solutions; Water needs are very important in these areas.

Reuse of wastewater treated and purified and a suitable solution to conserve drinking water from hydric resources. Knowing that the reuse of treated and purified wastewater is recommended in agriculture because these waters are nutrient rich so minimize the use of fertilizers. But the choice of irrigation technique and speculation is done after previous studies.

Farmers in Sidi Bel Abbe are obliged to irrigate their crops; It is time to substitute irrigation with wastewater from treated and purified waters coming out of the country sewage treatment plant which are discharged into the River. To make a study to establish an irrigation system by treated and purified waters coming out of the sewage treatment plant of the city of Sidi Bel Abbes; For the benefit of the agricultural area such as; Sidi Hamadouch, Sidi Brahim and Ain El Berd...

This act will preserve water resources and protect the environment and human beings from the side effects of wastewater use for irrigation.

REFERENCES

1. Bennabi, F., L. Hamel, S.E. Bachir Bouiadjra and S. Ghomari, 2012. Hydric stress and issues for the sustainable development in the Sidi Bel Abbes wilaya (west Algeria). Méditerranée, 118: 105-111.
2. Mekhloufi, M.B. and K. Benabdeli, 2017. The Breeding, Pastoralism, the Sedentary and the Sustainable Development of the Steppe in the Region of El-Bayadh (Algeria). J. Appl. Environ. Biol. Sci., 7 (11): 15-21.
3. Benyahia, M., M.A. Bouzidi, K. Mouedden, B. Hallouch, I. Attaoui, H. Meliani and F. Dernouni., 2011. Understanding of the plain floods of Sidi Bel Abbes by Mekkera River (western Algeria). Le Journal de l'eau et de l'environnement, 18: 27-46.
4. Anonyme, 1961. Master Plan of the municipality of Sidi Bel Abbes. Prepared by the departmental department of urban planning, Bd. Marechal de Lattre de Tassigny – ORAN.
5. Hallouche, B., M. Benyahia, K. Moueddene and A. Marok., 2010. Contribution of hydrogeomorphology in the mapping of flood zones. Example of the plain of Sidi Bel Abbés (North West Algeria). Rev. Sécheresse, 21 (3): 219-24.
6. Meliani, H., M.A. Bouzidi, M.M. Dif and M. Benyahia., 2016. Physicochemical and Bacteriological Water Analyses in Ain Temouchent Beaches (Algeria, NW). Advances in Environmental Biology, 10 (2): 19-27.
7. Bensalam, M.B, 2009. Contribution to the study of the efficiency of sewage treatment in the city of Sidi Bel Abbes, M. G. thesis, Djillali Liabes Univ., Sidi Bel Abbes, 120p.
8. Benaricha, B., A. Khaldi, and A. Elouissi, 2017. Physico-chemical Characterization of Irrigation Water Foggaras of Aougrout (Southwest of Algeria). J. Appl. Environ. Biol. Sci., 7(1): 19-29.
9. Lenntech, 2017, Impact of ammonium on health and the environment, https://www.lenntech.fr/francais/ammonium-environnement.htm#ixzz51vct7l7M.
10. Lenntech, 2017, Nitrate and nitrite, https://www.lenntech.com/hazardous-substances/nitrate-and-nitrite.htm
11. Hakmi, A., 2006, treatment of source water of bousfer in Oran country, Bachelor's degree, Oran university, https://www.memoireonline.com/02/09/1994/m_traitement-des-eaux-quot-traitement-de-de-leau-de-source-bousfer-ORAN8.html

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The Role of Business Relational Capital in Development of Small Business Communities in Peshawar

Mujib ur Rahman[1], Syed Arshad Ali Shah[2], Dr Mohammad Daud Ali[3], Anwarul Mujahid Shah[4], Muhammad Abdual Haseeb[5]

[1]Ph.D Research Scholar, Department of Economics, University of Peshawar
[2]Department of Management Sciences, Bacha Khan University, Charsadda
[3]Department of Management Sciences, University of Haripur
[4] Department of Sociology and Gender Studies, Bacha Khan University Charsadda
[5]Ph.D Research Scholar, Institute of Management Sciences, Peshawar

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ABSTRACT

This paper investigates the role of social capital as business relational capital in the development of handlooms business community in Peshawar. For this purpose data has been collected from169 handlooms firms out of total 300 manufacturing handloom weavers through purposive sampling method. The findings of the study reveals a significant role of the business relational capital in form of customer relational capital, supplier relational capital and internal network relational capital in the development of handlooms business in the area. The findings suggest that investment in business relational capital improves firm performance with a positive impact on the wellbeing (development) of overall handlooms business community. It is suggested that managers should employ a viable relational capital composition that includes building strong social relational ties with the community and government and pay attention to customers and employees in order to identify their needs and provide them with optimal values. Extending this result, to the whole small and medium enterpriser's sector in the study area, it has been maintained that entire entrepreneurial communities in the province could be developed through social capital as relational capital.
KEY WORDS: Social Capital, Business Relational Capital, Community Economic Development.

1. INTRODUCTION

Social capital is a new and missing indicator in the theory of economic and development. The twentieth century marked the significance of social institutions to economic exchange and development by a dynamic debate about social capital formations. From Simmel (1971), Weber (1969) and Polanyi (1957) to Granovetter (1973; 1985), Putnam (1993; 1995; 1998; 1999; 2000), Portes & Landolt (1996) and Woolcock (1998), argue that for economic development and entrepreneurship social relations are resources and liabilities. In their studies they expressed social capital such as trust, norms and solidarity as base for growth of entrepreneurship and economic development.

A number of studies have been undertaken in different parts of the world to investigate the role of social capitals in firm performance and development. The results from the studies show different variations between variables. For example, Robert Putnam (1993) recommended social capital as key determinant toward strong communities. Moreover to clear the meaning of social capital is a debatable issue. Usually it is clearly implicit to submit trust-based networks. Putnam argues that "high level of social capital in any community improve the performance of the community while low level of social capital in community makes political disconnection and a host of social harms". Krishna (2000) argues that the lack of relational capital is the main reasons behind poor flow of information which is negatively the affecting the initiatives of community economic development. Spence et al. (2003) find evidence that the long term performance of small and medium enterprise is based on their networking such as the ability to build relationship with stakeholders, to generate trust, authority, reciprocity and consensus. They further submitted that the small and medium enterprises are mostly a community base concept and strongly rooted into local community in which they work. Similarly Putnam (1993, 2000) again submitted that social capital is accelerating community economic development. The communities with low level of social capital suffer with backwardness and political disengagement whiles those with have high levels of social capital are growing. This research also attempts the arguments of Putnam in the sense that for healthy families and communities social capital is an important determinant.

***Corresponding Author:** Mujib ur Rahman, Ph.D. Research Scholar, Department of Economics, University of Peshawar
email: mujib@awkum.edu.pk

Stam, Arzlanian, &Elfring, (2014) investigated 61 small firms in Hong Kong. He observed a positive relationship between social capital and small firm development. Also Rouziès, &Hulland, (2014) studies 503 small and medium enterprises in US cities however a weak relationship has been observer between social capitals and business performance.

The World Bank (2004) also gained the importance of the notion of social capital in the development assistant trough a broad work in its analysis. Meanwhile the World Bank initiated number of studies to evaluate social capital in selected countries in order to show its impact on the development outcomes. An objective of such programs is to make the valid frame work and stronger methodological technique for measuring social capital. The recent study in Tanzania of 750 household from 45 villages reported that social capital is most important to household benefit. Group membership, networking and level of trust was taken as measurement tools of social capital. Similarly multivariate regression analysis was used to recognize village level social capital. Resultantly social capital was determined the key supplier to household welfare. In several cases the village level social capital emerged to be more significance than household level social capital.

Jean M. Twenge et al. (2014) analyzed Americans institutions and different organization, they that submitted that confidence, rate of growth, and income inequality has direct relationship with trust known as social relations. Similarly Hans Westlund et al. (2016) in their book, titled "Handbook of Social Capital and Regional Development" analyzed the complex issue of social capital and development. They concluded that social capital has positive role in regional development. Recent study of Jung Hyun Song (2016) at Florida International University concluded that organizations development and performance is determined by the higher level of structural, relational, and cognitive social capital.

In Pakistan, Small Business Enterprises (SMEs) represent about 90% of the total firms contributing over 30% to the GDP and account 25% of exports of manufactured goods besides sharing 35% in manufacturing (Subhan, Mehmood, &Sattar, 2013). The role of SMEs cannot be ignored when they provide services and supplies not only to customers of a locality but also act as supplier and distributor to the big business (Perks &Oosthuizen, 2013). In SME, small businesses being the most dynamic firms, considered as the most important catalysts to the economies worldwide. Small businesses are recognized as the backbone of economies (Njoku et al., 2014). In terms of the contribution of small business to GDP in Pakistan, the contribution was gradually decrease for the period from 2007-2008 to 2010- 2011 from 3.37 % to 3.24 %. But little bit increase in 2011-2012 from 3.24% to 3.36%. Also in column fifth the percentage of small business GNP was 3.30% for the period from 2007-2008 and then decreases gradually for the period 2010-2011 it was 3.08%. If we look in column fourth the no of small business increase almost 100% from2007-08 to 2011-12 but the contribution to the GDP and GNP is almost decreased.

Table-1, Contribution of small business to GNP and GDP to the economy of Pakistan

Years	GDP	GNP	Small Business	Small business as % of GDP	Small business as % of GNP
2007-08	9921584	10130500	334610	3.30	3.37
2008-09	12110462	12456743	395005	3.17	3.26
2009-10	14033629	14599876	449933	3.08	3.20
2010-11	17092903	17913128	552977	3.08	3.24
2011-12	19436825	20461935	653312	3.19	3.36
Similarly, Pakistan Economic Survey (2013-14) indicated that the manufacturing sector accounts 13.3 percent of Gross Domestic Product (GDP) and 14.2 percent of total employed labor force. Also this sector, including textiles, contributed for 13.6 and provides employment opportunities of 15.3 percent to the total labor force (Pakistan Economic Survey 2015-16).					

Source: Economic Surveys of Pakistan

The declining trend of small and medium enterprise contribution to national income is due to the war and terror in the region, as especially the operations "RAHI HAQ" has been started in the sampled province in 2007. As results the norms and trust known as social capital has been diminished between individuals, organizations and communities. Now the prosperities in the region need to be restored as the war era been finished. Before restorations of norm, trust and solidarity, known as investment in social capital, it's needed to investigate the role of social relational capital in development of communities. Hence within this view, this study attempts to fill the gap in the current knowledge by focusing on those determinants of small business, such as social capital, which could assist in achieving better firm performance and healthier communities. This research attempts to build the strong mechanism to measure social capital in the development of business communities in the sample area.

Research Gap

There is a silent literature on social capital and in fact, to many people in the World Bank, social capital has become "the missing link" in global economic development (Harriss & Renzio 1997). A very rare work has been done on the issues of social capital in Pakistan. This research seems the first study, in the sample area, which

accelerated the role of social capital as business relational capital in development of business communities. As the war and conflict been finished and prosperities and peace seem to be restored in the sampled area, hence the establishment of trust and solidarity between the communities, organizations and individual is the need of time. Hence this study is an attempt to analyze the importance of these intangible assets known as social capital in development process in an area where the residents relocated to a walk-able community. This study and its follow-up analyses can help further understand the link between community design and healthier promotion of its members. This is an important, yet understudied, area with significant implications for future planning and peace in the area.

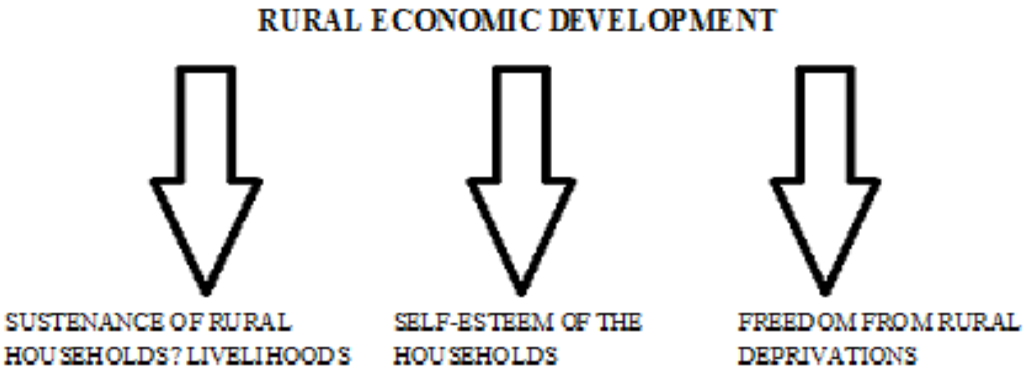
Objectives

i. To investigate the effects business relational capital management on community economic development.
ii. To outline strategy, that policy makers can use to foster healthier families and communities.

LITERATURE REVIEW

The concept of economic development developed by Smith (1776), he states that development is the aspiration of all communities. Societies and communities at every stage, from the smallest unit of a household to communities, nations, regions and the globe, wish to progress. Economists in common and development economists in particular, have constantly required answers to critical questions occurring from these disparities in levels of development between communities. Key among these questions is the expression question of why some societies and communities have highly developed at a faster rate than others. According to Meier (2001), economic development ought to be understood as economic growth plus economic change. This change is observed as a rescheduling of economic associations that impact on people's wellbeing in a manner that compose them amenable to the coherent trials of those whose wellbeing they influence and is called community economic development. Sen (1999) regard as such development, of community well-being, to include of three core components, namely: sustenance (ability to meet basic needs); self-esteem (to be a person); and freedom from servitude (to be able to choose). According to Sen (1999) therefore, development is defined as advancement in the quality of life. In this analysis the Sen (1999) definition of economic development has been regarded as measurement of community well-being used by of Emunal (2009).

Figure-1: Research Dimension of Assets-based Model of Rural (Community) Economic Development



Source: Adapted from Pretty (2003) pp. 14

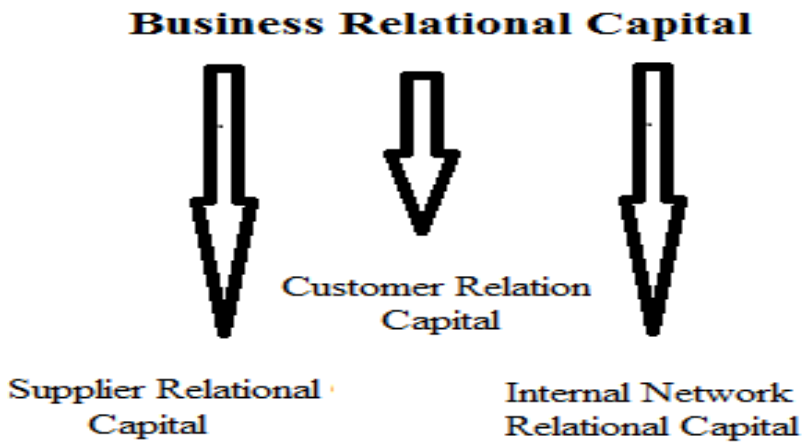
Hence Emuanal (2009) used the model for rural economic development while in this study the same technique has been used for rural community development. The main indicators are common in both community and rural development. Both maintains the quality of life of the rural or community member as well their power to attain the maximum basic need as well their freedoms.

Relational Capital Method, Modified from the Literature of Euroform (1998)

The role of relational capital in development process has been given focus by different scientist of the world. Kohil & Jaworski (1990) argue that in order to get feedback, the elements of relational capital such as costumer's relationship are often referred to the market orientation concept. Market orientation is the most important aspect of performance and is related to the current and future needs of customers. Market orientation is also the

creations of market intelligence. According to Ordonez de Pablos (2003) the external and internal associations of firm with organization relation is known as relational capital. This includes customer, suppliers, employees; strategic alliance partner's stakeholders, and industry associations. Tomasz &Kijek, (2008) argues that the interactions of external and internal factors create trust and respect, the level of the friendship based on mutual understandings, which is the main focus of relational capital. The trust within the organization creates internal interconnections and environment bond for long term relationships and confidence. Thus, in the internal and external stakeholder framework, it can be argued that the relationship among employees with customers and suppliers is the concern enterprise relational capital.

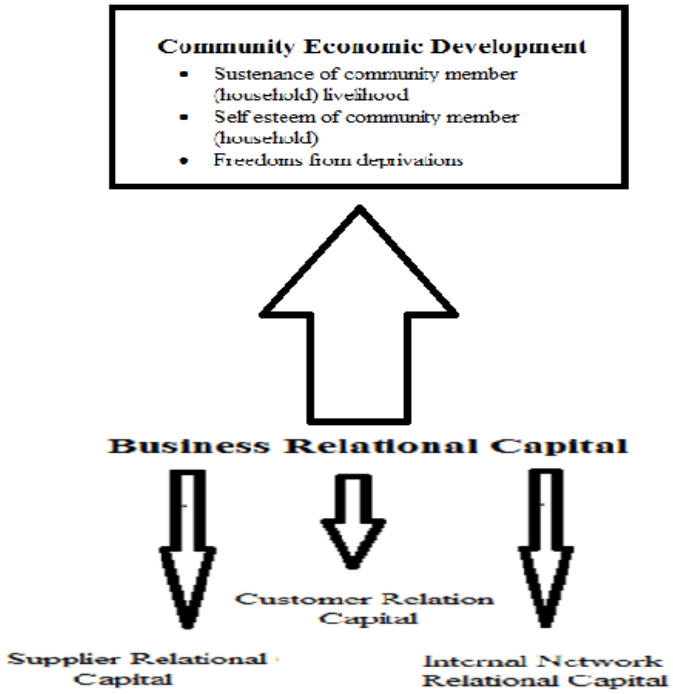
Figure-2 Research Dimensions of Social Capital as a Business Relational Capital



Source: Modified from the Literature of Euroform (1998), Cic (2003), Kijek (2008)

Hence as an analysis of business community economic development, this study is concerned with the use of business relational capitals assets of the firms toward their development and performance. After the important and required modifications from the literature the final framework of this research has been developed.

Figure-3 Conceptual Framework of this Research Study



Seungyoon Lee. et al. (2015) examined different forms of cultural capital with subjective well-being (development) and social support; they concluded that when social capital was positively associated with subjective well-being and social support. Ricardo D. et al. (2016) submitted that social capital and social network both accelerate community based opportunities.

DATA AND METHODOLOGY

This research study is mainly based on primary data. Data has been collected through a well-designed questionnaire. Direct investigation method is used.

Sampled Community

Handlooms cloth community is the sampled community. They have been working indifferent districts of Peshawar valley but with common goals using unique method of production and producing the same commodity known as the community of practice.

Pilot Study

A pilot study was undertaken two months prior to the full study. Factor analysis is used and reliability of data as well as viability of the research instruments is checked. Hence the research was made reliable.

Selection of the Sampled Respondents in the Study Area

As the members of community have been working in different regions hence purposive sampling technique has been used to select the sampled respondents after pilot study. As an analysis of the community of practice, an eligibility criterion has been developed to shortlist the household for interview. Only those weavers were selected who have been working in different regions with same goal, using the same method of production and producing the same commodity, known as community of practice. Hence out of 300 weavers 169 small firms have been considered eligible. The entire colonies have been and spin out cloth on handlooms and power looms, sealing the places reputation for some of the best homespun cloth west of Indus (The News, 2014).

Household as a unit of analysis and data collection at household level is widely recognized in literature, similarly in this research study data has been collected at household level from the head of the clusters.

Table-2, Variables and its implications

Var	Definitions	Sources	Symbol
Community Development	The weighted index comprised measures of sustenance, freedom and self-esteem of members of community. The aggregate index (Devi) is given: Devi = 0.4*(Susi) + 0.7(Semi) +0.8(Frmi)	Emmanuel o. Manyasa, 2009	Devi
Sustenance	Sustenance is one of indicator of community economic development and is defined as the ability of the community members (household) to meet its basic needs. It has proxied by the household income in this study.	Emmanuel o. Manyasa, 2009	Susi
Self Esteem	Self-esteem is defined by as measure of self-worthiness by head of household It has proxied by quality of life, which is an index computed on the basis of scores attached to various types of main house occupied by household (toh) and type of toiled facilities (toti).	Emmanuel o. Manyasa, 2009	Slfest
Freedom	Freedom is defined as the ability of household to meet its basic needs. It has been proxied by household income		FRMI
Household	The household means the supervisor of the Khaddar business unit. Household is also called the weaver, who was mixing the raw material and producing the cloth Household has been the main proxied by the earner of family using the Khaddar handlooms		Hsz

Firm Performances	Firm performance is the profitability, size and future viability of firm is known as firm performance. 1 Profitability and future viability has taken as a measure of firm performance. 2	1. Edward (2004) 2. (TumwineSu lait, 2007).	PF
Social Capital	Social capital refers to the norms and networks of civil society that lubricate cooperative action among both citizens and their institutions. 1 Being a business community the business relational capitals have been taken as the main indicators of social capital. 2	1. Robert Putnam (1993 to 2000) 2. (Euroform, (1998), Cic, (2003), Kijek (2008)	SC
Business Relational Business Relational Capital	Business relational capital is the internal network of weavers/firm within the community. It has been peroxide by supplier relation capital, Internal Network Relation Capital and Customer relation Capital.	Cousins, Handfield, Lawson & Petersen, 2006	BRC
Supplier Relation al Capital	Is defines as the level of supply chain relational capital of the firm. It has been measured as the trust, mutual reverences and communications between handloom firms and their suppliers	Cousins, Handfield, Lawson & Petersen, 2006	SRC
Internal Network Relation Capital	The relationship among employees within organization based on common interest, mutual trust and collaborations. Internal Relational Capital has been measured as the relationship among employees within a handloom business unit.	Jenkins, 1994	INRC
Customer Relation Capital	In this study customer relational capital has characterized as the particular relationship the handloom firm has with the external surroundings.	Narver and Slater (1990)	CRC

Model Specification

Relational capitals are instrumental and hence enhance customer benefits. It creates value for customers through increase quality, reliability and flexibility. The instrumental relational capitals also increase production and service delivery process innovations and then customer values. Furthermore the more important is the effectiveness of such networking and which not only better identify customer‘s choices but also satisfy customer needs. Relationship with supplier and customers identify the needs of marketing as well as satisfy their needs through novel solutions Kijek, (2008).

Utilizing the following multiple linear regression model, for the relational capital impact, this has been modified from the work of Kijek (2008) and Cic (2003).

$$CED = \alpha + \beta 1\ CRC + \beta 2\ SRC + \beta 3\ INC + \varepsilon \text{----------} 1$$

Where

CED= Community Economic Development
CRC= Customer Relation Capital
SRC= Supplier Relation Capital
INC= Internal Network Capital
ε = Error term

The explanatory variables and error term (ε) will follow the least square.

EMPIRICAL RESULTS

The empirical results obtained are acceptable and significant on the basis of R-squared (R2) and Adjusted R-squared values. Factor analysis has been executed to spot the patterns in data and to reduce data to convenient levels (Field, 2006). In order to explore the variables contained in each component rotational Varimax method has

been used. Those factors with factor loading greater than 0.5 are computed and coefficients below 0.49 have considered being useless and hence deleted from the matrix. The composite reliability and composite extraction values are given in table-2. The factors of Business Relation Capital such as Customer Relation Capital (CRC), Supplier Relation Capital (SRC) and Internal Network Relation (IRC) Capital have been considered reliable with composite reliability of 0.85%, 0.82% and 0.70%, respectively.

Table-3 Rotated Component Matrix

S.No	Items	Mean	Std. Dev	Item reliability	Factor Loading	Composite reliability	Average composite extraction
1.	SRC1	.61	.216	.804	0.646416	0.82	0.61
2.	SRC2	.61	.203	.823	0.677329		
3.	SRC3	.63	.201	.777	0.603729		
4.	SRC4	.65	.196	.779	0.606841		
5.	SRC5	.65	.201	.721	0.519841		
6.	CRC1	.63	.243	0.896	0.802816		
7.	CRC2	.59	.232	0.769	0.591361	0.85	0.65
8.	CRC3	.58	.271	0.825	0.680625		
9.	CRC5	.59	.210	0.734	0.538756		
10.	CRC6	.61	.215	0.827	0.683929		
11.	CRC7	.62	.192	0.764	0.583696		
12.	INRC1	.65	.199	.791	0.625681	0.70	0.54
13.	INRC2	.63	.203	.776	0.602176		
14.	INRC3	.62	.204	.679	0.461041		
15.	INRC4	.64	.213	.700	0.49		

Source: Primary data

Table-4, the correlation coefficients indicate that there is statistically significant correlation among variables indicating there is association between variables. Hence all of these variables are kept for regression.

Table-4 Correlation

Variable	Development	CRC	SRC	INRC
Development	1.00			
CRC	0.7402	1.00		
SRC	0.6624	0.7521	1.0000	
INRC	0.6494	0.6809	0.7391	1.0000

From the correlation matrix, shows (table-4) co-linearity between the independent variables. Stata hereby suggest the correlations of the estimated coefficient method to check the co-linearity hence vce, corr command was used after regression to get the correlations of estimated coefficient (Richard Williams, 2015).The correlations between the pairs of coefficients are low (less than 0.80) indicating no co-linearity between the variables (Richard Williams, 2015).

Table- 5Correlation Matrix of Coefficients of Regress Model

e(V)	CRC	SRC	INRC	_cons
CRC	1.0000	-	-	-
SRC	0.5044	1.0000	-	-
INRC	-0.2815	-0.4704	1.0000	-
_cons	0.0095	-0.2436	-0.4109	1.0000

Breusch-Pagan test Chi2 test has been applied and the problem of Heteroscedasticity is detected. Robust regression has been used to remove the problem, table-3.

Table-6 Heteroscedasticity and Robust Regressions

The Breusch-Pagan test Chi2(1)	52.71 (Prob>Chi2)
F(3, 165)	71.04
Root MSE	15294
R-squared (Robust)	0.4713
N	169

Variant infant test (VIF) has been used and almost Multicolinearity problem has been dropped, table-4.

Table-7 Multicolinearity

Ind. Variable	VIF	1/VIF
CRC Customer Relational Capital	2.96	0.3382
SRC Supply Relation Capital	2.50	0.3999
INRC Internal Network Relational Capital	2.39	0.4177

The estimated regression equation of social capital indicators on community economic development is as:

CED = f (CRC, SRC, INRC) ----------1

CED=.0522457 + .5762555CRC+.1709332SRC+.2978695INRC

Table-8 Business Relational Capital management on Community Economic Development

Ind. Variable	Composite reliability	Average composite extraction	Coef.	t-stat	Std. Err.	P>|t|
Constant	-	-	.0522457	1.12	.0513475	0.310
CRC Customer Relational Capital	0.85	0.65	.5762555	6.31	.0528963	0.000
SRC Supply Relation Capital	0.82	0.61	.1709332	1.53	.0607891	0.006
INRC Internal Network Relational Capital	0.70	0.54	.2978695	2.81	.099039	0.003
R-squared (Robust)	0.4713	-	-	-	-	-

Table-9 Implicative Analysis

Model-1 (BRC)	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]		R^2	Adj- R^2	Root MSE	F (1, 167)
	1.075417	.0711322	15.12	0.000	.934983	1.215851	0.5778	0.5753	.13584	228.57
Con.	.024616	.0451877	0.54	0.587	-.0645967	.1138287				
Model-2 (CRC)	.8613905	.0605474	14.23	0.000	.7418535	.9809274	0.5479	0.5452	202.40	.14057
Con.	.180447	.0373643	4.83	0.000	.1066796	.2542143				
Model-3 (SRC)	.8681602	.0759871	11.43	0.000	.7181411	1.018179	0.4387	0.4354	.15663	130.53
Con.	.1441287	.0492122	2.93	0.004	.0469705	.241287				
Model-4 (INRC)	.8962384	.0812209	11.03	0.000	.7358864	1.05659	0.4217	0.4182	.15899	121.76
Con.	.1197096	.0530453	2.26	0.025	.0149838	.2244353				

The study reveals that the firm's customer capital strength significantly influences community economic development; that a change or boost in customer capital leads to a positive change in community economic development. The results imply that firms which invest capital to strengthen their relationships with customers increase their performance, by way of building strong quality and having wider distribution channels. The increasing rate of profitability hereby increases their power to participate in the development of community.

Similarly the supplier relational capital is another element measuring business relational capital. From the study findings, it is found that the level of community economic development increased by the firm engaging in a relationship with the suppliers. The firm relationship with supplier makes things available on short demand and sometime provides the material to these poor firms in off season. The supplier can help the community by providing

raw material on mortgage when the firms are in losses or recession. According to household Mr. Abdur Rahman, when the Chinese product destroyed their business in 2005, many weavers shut downed their business. The supplier then helped the community and provided the raw material at low price and on mortgage. That was the supplier‘s contribution who secured this business community.

The third element of business relational capital is internal network capital. Results from the study revealed that a significant and positive associations between employees (internal networks) and community economic development. This result is supported by Tsai, Ghoshal (1998) who argued that the relationships among employees facilitate a common understanding of collective goals and proper ways of acting in a social system.

CONCLUSIONS AND SUGGESTIONS

This research paper concentrated and explored the role of social capital as business relational capital in the development of handlooms business clusters in Peshawar. The paper concludes that social capital as business relational capital boost positive associations with community economic development by 47.13%. The findings suggest that investment in business relational capital improves firm performance with a positive impact on the wellbeing (development) of overall handlooms business community. It is suggested that managers should employ a viable relational capital composition that includes building strong social relational ties with the community and government and pay attention to customers and employees in order to identify their needs and provide them with optimal values. Extending this result, to the whole small and medium enterpriser’s sector in the study area, it has been maintained that entire entrepreneurial communities in the province could be developed through social capital as relational capital. These findings are in line with the earlier made conclusions by Gratton and Ghoshal (2003), Hinge (2006). Thus, developing relationships with both internal and external stakeholders is an important necessity in the development of infant private sector in less developed countries to deliver and match stakeholder’s expectations.

REFERENCES

Amini, A. (2004). The distributional role of small business in development. *International Journal of Social Economics*, 31,4, 379-383

Aluisius Cousins, P. et al. (2006). Creating supply chain relational capital: the impact of formal and informal socialization processes. *Journal of Operations Management*, 24, 6, 851-863.

Coleman J. (1988). Social Capital in the Creation of Human Capital. *American Journal of Sociology*, 94, S95–S120.

Edwards, W. (2004).Interpreting financial performance measures. *Journal of Business Finance & Accounting*, 23-56

Fibercopia (2007). The Khaddi and village base business. *World Press.2007-10-04/khadi.*

Sumantra Ghoshal et al. (1998).Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review, 23, 2, 242-266*

Granovetter, and Mark. (1973). The strength of weak ties. *American Journal of Sociology*, 78, 6,1360–1380.

Jean M et al. (2014). Declines in trust in others and confidence in institutions among American adults and late adolescents, 1972–2012, *SADE Journals*, 25, 10, 1914-192

John Hulland (2014). Does marketing and sales integration always pay off? Evidence from a social capital perspective**.** *Journal of the Academy of Marketing Science*, 42, 5, 511-527

Jung H. S. (2016). The effect of social capital on organizational performance in different cultures: A cross national comparison of the United States and South Korea. *Florida International University, Electronic Theses and Dissertations, 2613*

Jenkins, A. (1994). Teams: From “ideology” to analysis, Organization studies. *SAGE Journalas,*15, 6, 849-860.

Kohil, A.K. et al.(1990). Market orientation: the construct, research proposition, and managerial implications. *Journal of Marketing*, 54, 1-18

Krishna, and Anirudh. (2000). Organizing in Support of CDD: Information Is the Key Resource. *Cornell University, Ithaca, N.Y.*

Meier, G. M. (2001). The Old Generation of Development Economists. *Published by Oxford University Press, Inc. 198 Madison Avenue, New York, N.Y. 10016*

Nahapiet J, Ghoshal S (1998). Social capital, intellectual capital and the organizational advantage. *Acad Manage*, 23, 2, 242-266.

Narver, J. C. & Slater, S. F. (1990).The effect of marketing orientation on business profitability. *Journal of marketing*, 54, 20-35.

Ordonez de Pablos, P. (2003). Intellectual capital reporting in Spain: a comparative view. *Journal of intellectual capital*, 4, 1, 61-81.

Pakistan Economic Survey (2005-2016). Government of Pakistan, Ministry of finance.

Pretty, J. (2003). Social capital and connectedness: Issues and implications for agriculture,

rural development and natural resource management in ACP Countries. *Technical Centre for*

Agricultural and Rural Cooperation (CTA) Working Document No. 8032, http://www.cta.int/pubs/wd8032/WD8032.pdf, accessed on 04.06.2005.

Putnam, R. et al. (1993). Making Democracy Work: Civic Traditions in Modern Italy. *Princeton, NJ: Princeton University Press*.

Putnam, R.D. (1993). The prosperous community, social capital and public life. *The American Prospect, 4, 13*

Putnam, R. (1995). Tuning in, tuning out: The strange disappearance of social capital in America. *Political Science and Politics*, 28, 4, 664-683.

Ricardo D. et al. (2016).Contributions of social capital theory and social network models in advancing the connection between students' school-based learning and community-based opportunities for pursuing interest-driven learning. *Power Brokers Conference: Building Youth Social Capital through Connected Learning, University of California, Irvine Student Center / Emerald Bay A Wednesday*, October 5, 2016

Sen, A. (1999). Development as Freedom, *New York, Oxford University Press*

Sender, J. (1999), Africa's economic performance: Limitations of the current consensus, *Journal of Economic Perspectives*, 13, 89-114.

Seungyoon Lee et al, (2015), Linking cultural capital with subjective well-being and social support: The Role of Communication Networks. *Social Science Computer Review*, 34, 2, 172-196

Simmel, and Georg. (1971, 1908). Group expansion and the development of individuality, On Individuality and Social Forms Chicago: University of Chicago Press

Stam W. (2014).Social capital of entrepreneurs and small firm performance: A meta-analysis of contextual and methodological moderators. *Journal of Business Venturing,* 29, 1, 152-173

Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations, *http://www.econlib.org/library/Smith/smMS.html, accessed on 15.05.2007.*

Smith, M. K. (2001). Social capital, the encyclopedia of informal education, *www.infed.org/biblio/social_capital.htm, accessed on 20.05.2007.*

Spence, L. J. & Rutherfoord, R. (2003). Small business and empirical perspectives in Business Ethics: Editorial. Journal of Business Ethics 47, 1, 1-5.

Subhan, Q.A., Mehmood, M.R., and Sattar, A. (2013). Innovation in small and medium enterprises (SME's) and its impact on economic development in Pakistan. *Proceedings of 6th International Business and Social Sciences Research Conference,* 3 – 4

Tomasz Kijek, A. K. (2008). Relational capital and its impact on performance. The case of Polish enterprises. *Journal of Intellectual Capital*, 48, 1,105-131.

Westlund H (2016). The Handbook of Social Capital and Regional Development. *EE Publishing*, www.e-elgar.com

Woolcock, M. (1998). Social capital and economic development: Toward a theoretical synthesis. *Theory and Society*, 27, 151–208.

World Bank. (2004). Indigenous Knowledge: Local Pathways to Global Development. African region: World Bank

Xuemei Zhu (2014). A retrospective study on changes in residents' physical activities, social interactions, and neighborhood cohesion after moving to a walkable community, *PMC, US public library of medicine, National Institute of Health, PMCID: PMC4268044*

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Exploration of Currently Activated Schema Modes among Individuals with Above Average Intellectual Ability

Meh Para Siddique[1], Muhammad Tahir Khalily[2] and Kehkashan Arouj[3]

[1]PhD fellow, National Institute of Psychology, Quaid-i-Azam University Islamabad, Pakistan
[2]Professor of Clinical Psychology Department of Psychology International Islamic University Islamabad, Pakistan
[3]Assistant Professor of Clinical Psychology Department of Psychology International Islamic University Islamabad, Pakistan

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ABSTRACT

The present study aims to explore currently activated schema modes among individuals with above average intellectual ability. The sample of this study included (N=100) intellectually above average individuals with a mean age of 23 years (*SD* = 3.29), in a range of > 18 and < 35 years. All participants were Pakistani nationals and native Urdu speakers. The data used after the criterion data screening comprised of 83 individuals' including (n=49) males, (n= 34) females. Standard Progressive Matrices was administered to assess the intellectual ability of the participants, afterward Schema Mode Inventory Urdu was used to evaluate different schema modes. The results indicated considerable gender differences on punishing parent, detached protector, and detached self-soother modes. Meanwhile significant negative correlation was found between intellectual ability and dysfunctional Schema modes. In addition, moderating role of gender was significant for two Schema Modes (Enraged Child Mode and Detached Protector Mode) where relationship is eventually stronger in females.

KEY WORDS: Schema Modes, Intellectual Ability.

1. INTRODUCTION

Ever since the antiquity thinkers have been trying to explore the importance of mental health and its causal relationship with physical health. Associations were built between the distinct abilities such as inclined intelligence, adaptive functioning, personal-social abilities and mental health in the context of psychopathology. It has been established that psychological disorders such as psychosis, neurosis and personality disorders could be explained in physiological perspective as well as in psychological and socio-cultural perspectives, which include early childhood experiences and unconscious unmet core emotional needs. Such needs possibly will appear as an activated emotional state of a person known as Schema modes .These Schema modes demonstrate an individual's predominant emotional condition based on the existing schemas that are generally stimulated through life situations toward which individuals are sensitive[1, 2]. Merely such schema modes characterizes those schemas, coping responses or healthy behaviors that are currently active in a person [2]. Meanwhile the Schema is trait (covered up, hidden); and mode depicts a "state" of an individual which is at present vigorously managing the emotion and behavior schema mode being currently activated is directly detectable [3, 4]. This an activated schema could be adaptive or maladaptive, positive or negative, constructive or destructive, could have its foundation in early childhood or developed during lifespan afterward [39]. Subsequently these schema modes play a causal role in the development of later psychopathology[2]. Such Schema Modes are one of the three pillars of Schema Therapy, i.e. Early Maladaptive Schemas, Coping Response and Schema Modes [2].

In line with the proposition there are several recognized schema modes, clustered within four general domains: Child, Maladaptive Coping, Pathological Parent, along with Healthy Adult mode[3]. The 14 known schema modes within these domains are Angry Child, Vulnerable Child, Enraged Child, Undisciplined Child, Impulsive Child, Happy Child, Detached Protector, Compliant Surrender, Detached Self-Soother, Bully and Attack, Self- Aggrandizer, Demanding Parent, Punitive Parent and Healthy Adult mode. The *first* cluster of schema modes is the pathological child mode that builds up as a result of specific fundamental emotional desires, which are not sufficiently fulfilled during childhood. Basically they are primary emotions such as happiness, anger, fear, disgust, grief and surprise [5]; closely related to bodily sensations[6]. Such child modes are crucial emotions related to spontaneous physiological reactions that are not yet altered by any cognition or not complemented by secondary emotions like feeling proud or superior, guilty, ashamed or worthless. They arise if core needs are not adequately met and they are stored in the implicit memory[7]. Conversely, if childhood needs were amply met, an individual nurtures a Happy Child mode, expressing the ability to

***Corresponding Author:** Meh Para Siddique, PhD fellow, National Institute of Psychology, Quaid-i-Azam University Islamabad, Pakistan. (mehpara1612@gmail.com)

experience and symbolize playful happiness [3]. The *second* category of schema modes is the pathological coping modes which reflect an excessive use of the handling techniques of avoidance, overcompensation or surrender. These Coping Modes consist of visible behavior as managing reactions to early childhood experiences (accompanied by secondary emotions) such as disgust, superiority, shame or guilt. The *third* category of Schema Modes is Maladaptive Parent Modes which results due to the internalization of significant figures, inducing core beliefs and reoccurring as negative automatic thoughts [8]. In these modes individual thinks, feel and perform as their parent did to them during their childhood. *Lastly*, there is a Healthy Adult mode that takes account of useful cognitions, feelings as well as behaviors[2]. Such Healthy Adult includes adaptive self-regulating function composed of three steps: mindfulness, detached reappraisal and functional self-instructions [7].

These respective Schema modes develop early in childhood, are shaped by the selective filtration of incoming experiences and continue to change and mature throughout one's lifetime [9]. Most individuals operate several different schema modes [10]in response to certain situations. Thus it could be presumed that individuals repeatedly change and assort schema modes in return to environmental transformation.

Although the recent research literature about mode theory describes the swift variations of emotions plus behavior within chronic personality disorder patients [11, 12], presence of dysfunctional schema modes in diverse clinical (psychiatric) disorders [13],implication of schema mode assessment and therapy in forensic clinical practice[14,8,3], Schema Mode therapy utilization for the treatment of complex clinical agora phobia where the traditional therapeutic approaches fail to accomplish [1]; perhaps little noteworthy empirical work [15] has been done to assess the schema modes in non-clinical individuals i.e. those having no history of any psychiatric disorder [16]. Thus current study is an effort to fill up this gap in literature i.e. to address pattern of schema modes in high intellectual ability individuals. For now it could be established that person having inclined intellectual abilities but before any psychiatric diagnosis is a member of non-clinical community. In the interim it is having psychiatric disorder that effects individuals' intellectual abilities or vice versa.

As established it is that emotional complaint that could hinder the intellectual ability, thought processing, decision making and optimal functioning which could be a hazardous aspect during personality enhancement [17]. Accordingly psychologists for a very long time are trying to comprehend the association of intellectual ability with that of emotional adjustment[18,19,20,21,22,23,24,25,26]. As historically Terman (1925, 1947& 1954) in his longitudinal study with inclined intellectual individuals recognized that majority of his sample student had developed into well-adjusted adults, while amongst the sample cluster, in fact, there were also the individuals that had undergone mental as well as the intellectual disorders. Correspondingly at high intellectual functioning level, there were additional emotional disorders than anticipated level within an accepted normal group. [27, 28, 29].Thus consensus found that emotional and psychological health of the above average intellectual ability individuals is dually effected by the individual's IQ, gender, age, socio economic status, area of specialized functioning (talent area), self-esteem, and self-concept [30].

Likewise social- emotional adjustment, cognitive development [31] and behavioral patterns [32]of high intellectual are significant to address in order to assess the patterns of psychopathology at an earlier stage. As schema modes elucidate about emotional, cognitive and behavioral state that is at moment active in an individual[2], thus an alliance is established, to assess schema modes during young adulthood of high intellectual ability individuals to address signs and pattern of later on personality pathology.

Based on the literature cited the primary goal of current investigation is an assessment of schema modes currently activated among individuals with above average intellectual ability. Meanwhile in perspective research aside from basic 14 schema modes, the first three clusters i.e. Child, Maladaptive coping and maladaptive parent are grouped together to constitute dysfunctional Schema modes; while healthy adult along with happy child mode forms healthy mode. Broadly current study measures: *firstly* the relationship (positive/negative) between high intellectual ability and schema modes (dysfunctional/ healthy). *Secondly* to address the gender differences in the expression of certain schema modes.

METHOD

Participants

The sample was purposively selected with a screening criteria of academic performance i.e. CGPA > 3.5 or previous exam percentage > 80% followed by assessment on SPM (for recruiting above average intellectual ability individuals). The participants were University students (N=100) i.e.(n=50) males& (n= 50)females having mean age 23 years (*SD* = 3.3), in a range of > 18 and < 35 years. They were all Pakistani nationals and native Urdu speakers. Specific exclusion criteria was: existence of lifetime psychosis or mood disorder, or at present taking any sort of psychiatric rehabilitation or treatment, instant suicide possibility or the incidence of substance utilization along with instantaneous planned demand for clinical detoxification. The data used after the criterion screening comprised 83 individuals i.e. (n=49) male and (n=34) female.

Instruments

Schema Mode Inventory (SMI). The endurance of schema modes among above average intellectual ability individuals was assessed with the aid of Schema Mode Inventory-Urdu version[10]. SMI contains 124 items rated on a six point Likert scale with a range of 'never or almost never' to 'always'. The SMI (Urdu) measures the presence of 14 schema modes: Angry Child, Vulnerable Child, Impulsive Child, Enraged Child, Happy Child, Undisciplined Child, Detached Protector, Compliant Surrender, Detached Self-Soother, Bully and Attack, Self- Aggrandizer, Demanding Parent, Punitive Parent, and Healthy Adult modes. An elevated score reveals to have dominant respective schema mode. A psychometric study of SMI (Urdu) illustrated good construct validity and good internal consistency of subscales ranging from α = 0.34 to α= 0. 83 with a mean of Cronbach's α= 0. 91[10].

Standard Progressive Matrices (SPM). The Standard Progressive Matrices [33]was used to screen out desired study participants. It is a measure of general intelligence within which an individual being tested is required to respond to a sequence of pattern achievement tasks having escalating difficulty level. The SPM consists of five sets of twelve incomplete matrices problems: a total of 60 matrices. It could be administered to individuals as well as group within the age ranges of 6 to 80 years. Time required for its administration is 20- 45 minutes. SPM have good Content, convergent and Criterion related validity. The internal consistency for the Standard Progressive Matrices total raw scores was α= 0.88 in the standardization sample of 793 individuals[33].

Procedure

The above average intellectual ability individuals were scrutinized after the prior permission from the university concerned authorities. No identifying data regarding the individuals was included in this study to keep their confidentiality intact. If the inclusion and exclusion criteria were met, then each participant was being tested individually in two steps. During step I, the informed consent was signed from the participant. After rapport building the researcher filled the demographic sheet while questioning the participant. Next the Raven's SPM was administered on the participants via filling record form by developing a systematic reasoning to grasp the idea of finding a missing part to complete the pattern. Scoring higher on SPM was followed by the step II i.e. administration of short SMI (Urdu version) on them. Finally participants were thanked for their participation.

RESULTS

Table 1: *Alpha coefficient Reliability of subscales of Schema Mode Inventory among individuals with above average intellectual ability (N=83)*

Scale/Subscales	No. of Items	Alpha coefficient
Schema Mode Inventory	124	.88
Vulnerable Child	10	.84
Angry Child	10	.80
Enraged Child	10	.76
Impulsive Child	09	.72
Undisciplined Child	06	.28
Happy Child	10	.46
Compliant Surrender	07	.45
Detached Protector	09	.55
Detached Self Soother	04	.62
Self Aggrandizer	10	.40
Bully and Attack	09	.46
Punishing Parent	10	.70
Demanding Parent	10	.61
Healthy Adult	10	.56

Table 1 indicates the internal consistency of subscales of SMI for the present study sample. Alpha Coefficient of 09 subscales of the Schema Mode Inventory was satisfactory ranging from 0.55 to 0.84 with a mean of .68. At the same time for the rest of 05 subscales (Undisciplined Child, Happy Child, Complaint Surrender, Self-Aggrandizer, Bully and Attack) it falls below the acceptable index i.e. "α" range from 0.28 to .46 with a mean value of 0.41. However, the overall reliability of SMI for the current sample is high i.e. 0.88.

Table 2: *Mean, Standard Deviation and t values of above average intellectual ability individuals on Schema Mode Inventory (SMI).*

	Male (n=49)	Female (n=34)					
Sub-Scales	***M (SD)***	***M (SD)***	***T***	***p***	***LL***	***UL***	**Cohen's *d***
Vulnerable Child	25.59 (9.0)	23.41(11.9)	0.95	0.3	-2.39	6.75	0.20
Angry Child	26.81(10.6)	25.6(10.18)	0.51	0.6	-3.44	5.84	0.11
Enraged Child	19.55(8.16)	19.52(8.91)	0.01	0.9	-3.74	3.78	0.00
Impulsive Child	28.10(7.14)	27.35(9.22)	0.42	0.6	-2.83	4.32	0.09
Undisciplined Child	18.08(5.23)	17.88(4.45)	0.18	0.8	-1.99	2.39	0.04
Happy Child	42.57(5.58)	43.14(7.22)	.41	0.6	-3.38	2.23	0.09
Compliant Surrender	29.33(5.5)	27.82(5.75)	1.19	0.2	-0.99	4.0	0.27
Detached Protector	22.65(6.41)	19.67(6.67)	2.04	0.04	0.08	5.87	0.46
Detached Self Soother	13.65(4.8)	15.7(4.05)	2.03	0.04	-4.06	-0.04	0.46
Self Aggrandizer	33.43(6.8)	33.4(5.2)	0.01	0.9	-2.73	2.77	0.00
Bully and Attack	24.7(6.78)	23.02(5.59)	1.19	0.24	-1.13	4.49	0.27
Punishing Parent	24.1(6.99)	19.79(6.91)	2.77	0.00	1.22	7.4	0.62
Demanding Parent	43.08(7.68)	41.76(7.21)	0.79	0.43	-2.01	4.64	0.17
Healthy Adult	43.53(7.1)	42.02(7.67)	0.91	0.36	-1.77	4.77	0.20

Note. CI - Confidence Interval; LL - Lower Limit; UL - Upper Limit
*p < .05.**p < .01.

Table 2 shows the mean, standard deviation and *"t"* value of the male and female above average intellectually ability individuals on subscales of SMI. There are significant gender differences on punishing parent (p<0.01), detached protector, and detached self-soother modes (p<.05). In addition these significant gender differences are also cross verified by *cohen's d* effect size i.e. magnitude of difference, which ranges from medium (0.46) to high (0.62). While the results indicate that there is non-significant gender difference in the presence of other Schema Modes.

Table 3: *Inter Scales Correlation Matrix of Schema Mode Inventory among above average intellectual functioning ability (N=83)*

	VC	AC	EC	IC	UC	HC	CS	DP	DSS	SA	BA	PP	DP	HA
VC		.66**	.58**	.66**	.38**	-.42**	.08	.65**	.08	.34**	.45**	.76**	.08	-.3**
AC			.75**	.7**	.48**	-.10	.11	.52**	-.09	.38**	.51**	.58**	-.05	-.25*
EC				.71**	.52**	-.22*	-.02	.41**	-.16	.38**	.46**	.6**	-.25*	-.49**
IC					.43**	-.2	-.04	.41**	.01	.45**	.44**	.53**	-.1	-.38**
UC						-.14	.41**	.43**	-.26*	.14	.43**	.38**	-.5**	-.4**
HC							.22*	-.27*	.03	.04	-.10	-.22	.01	.35**
CS								.16	-.22*	-.15	.29**	.21	-.11	-.05
DP									-.12	.10	.51**	.57**	-.1	-.25*
DSS										.31**	-.08	-.12	.42**	.15
SA											.17	.17	.25*	.05
BA												.41**	-.06	-.28*
PP													-.01	-.36**
DP														.44**
HA														

**p>.01, *p>.05

SMI Scales: *VC = Vulnerable Child; AC = Angry Child; EC = Enraged Child; IC = Impulsive Child; UC = Undisciplined Child; HC = Happy Child; CS = Complaint Surrender; DPT = Detached Protector; DSS = Detached Self Soother; SA = Self Aggrandizer; BA = Bully and Attack; PP= Punitive Parent; DP = Demanding Parent; HA = Healthy Adult*

Table 3 depicts the correlation matrix of subscales of SMI. The matrix reflects distinct pattern of significant positive as well as significant negative relationships between different modes. At the same time differences in the magnitude of relationship were also depicted. As shown Vulnerable child, angry child, enraged child, impulsive child, undisciplined child, detached protector, detached self-soother, self-aggrandizer, bully and attack, punishing parent mode, and demanding parent mode have significant positive relationship with one another while have significant negative relationship with happy child and healthy adult mode. Meanwhile happy child and healthy adult are significantly positively related with one another.

Table 4: *Correlation Coefficient of Subscales of Adaptive Schema Modes, Dysfunctional Schema Modes and Intellectual Ability (N=83)*

SMI (Subscales)		Intellectual Ability
Adaptive Schema Modes		.15
	Happy Child	.10
	Healthy Adult	.15
Dysfunctional Schema Modes		-.28*
	Vulnerable Child	-.23*
	Angry Child	-.28*
	Enraged Child	-.29**
	Impulsive Child	-.17
	Undisciplined Child	-.20
	Compliant Surrender	.00
	Detached Protector	-.24*
	Detached Self Soother	.09
	Self Aggrandizer	.00
	Bully and Attack	-.14
	Punishing Parent	-.39**
	Demanding Parent	.05

**p <.01, *p < .05

Table 4 depicts the magnitude and direction of relationship between intellectual ability and distinct schema modes. Negative significant relationship was found between the adaptive schema modes and dysfunctional schema modes i.e. -.34 (p< .01), while relationship was found to be non-significant between adaptive schema modes and intellectual ability. Meanwhile negative significant relationship is evident between intellectual ability and dysfunctional schema (-.28 < .05) modes i.e. Vulnerable Child (-.23< .05), Enraged Child (-.29<.01, Angry Child (-.28< .05), Detached Protector (-.24< .05), and Punishing Parent (-.39<.01).

Schema Modes, Gender and Intellectual Ability

To find out either gender affect the strength or direction of relationship between Intellectual Ability (predictor variables) and the Schema Modes (outcome variables), moderation analysis was carried out. Moderation was significant for two Schema Modes (Enraged Child Mode and Detached Protector Mode), while for the rest of Schema Modes the moderation analysis was non-significant. The significant results are shown below.

Table 6: *Moderating effect of Gender on Enraged Child Mode and Intellectual Ability*

		Enraged Child Mode	
		Model 2	
Variable	**Model 1 *B***	***B***	***95%CI***
(Constant)	29.89*	13.22	[-8.88, 35.318]
Age	0.013	-0.158	[-.77, .45]
SES	4.34	4.828	[-3.594,13.25]
Siblings	0.051	0.156	[-.77, 1.08]
Intellectual Ability	-0.49*	-0.563**	[-.92, -.21]
Gender	1.861	2.299	[-1.68,6.28]
Gender * Intellectual Ability		-0.78*	[-1.56, -.003]
R^2	0.106	0.15*	
F	1.817	3.99*	
ΔR^2		0.045*	

Note. N = 83. C I = confidence interval, SES= Socio Economic Status
p <.0 5. *p < .01.

Table 6 presents moderating role of gender for the relationship between Enraged Child Mode and Intellectual ability. Age, number of sibling and Socio Economic Status of respondents were controlled as covariates. Predictor i.e., high intellectual ability, outcome i.e. enraged child mode, covariates and moderator (Gender) were entered in the process macro model[34]. Result presented shows that intellectual ability significantly negatively predicted Enraged child mode (i.e., β= -.51, p<.05) explaining a total of 10% variance in Enraged Child Mode. Gender also moderated effect of intellectual ability on Enraged Child Mode (i.e., β Interaction= -.22, p<.05)

explaining additional 4.5% variance in Enraged Child Modes. Moderating effect of Gender for the relationship between Intellectual ability and enraged child Mode is further explained with Figure 1.

Figure 1. *Modgraph for moderating effect of Gender on the relationship between intellectual ability and Enraged Child Mode*

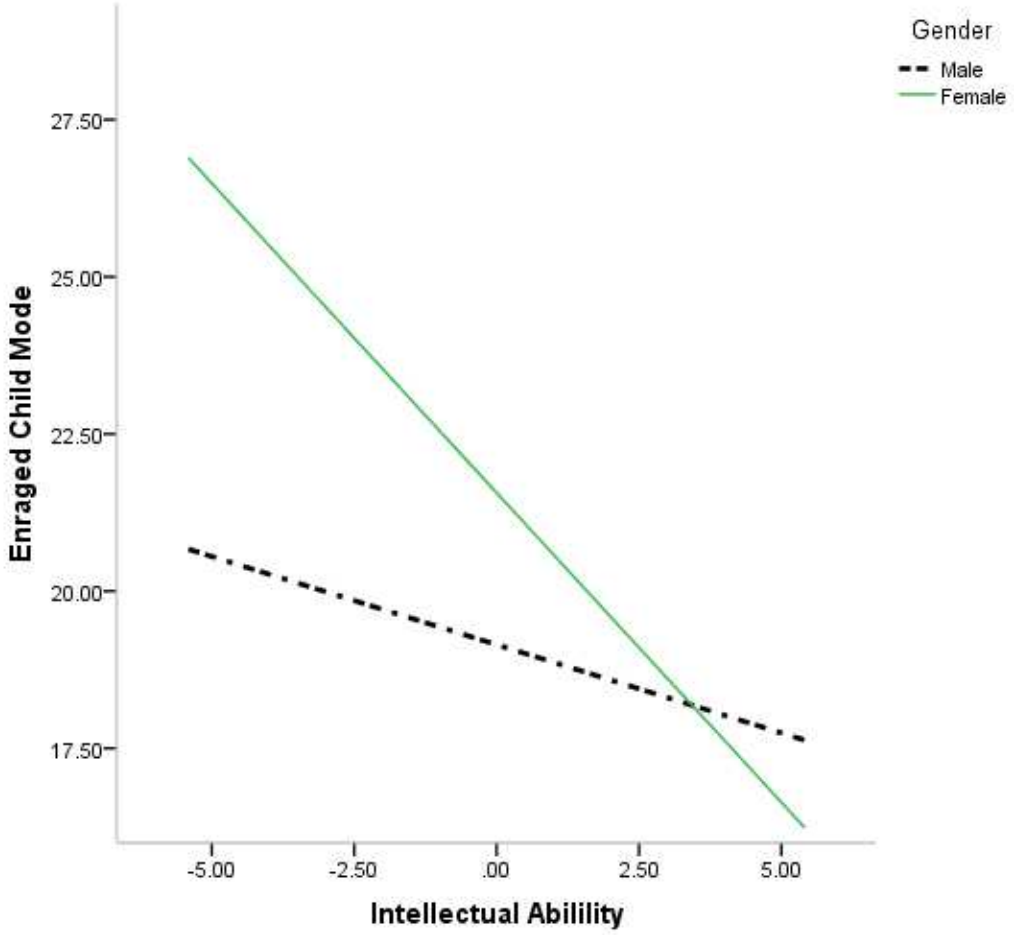

Figure 1 presents moderating effect of Gender on the relationship between intellectual ability and Enraged Child Mode. The graph presents a clear moderation by gender, and an interesting pattern of relationship between intellectual ability and Enraged Child Mode. As was expected, there is a negative relationship between intellectual ability and Enraged Child Mode. The relationship is eventually stronger in females as compared to males.

Table 7: *Moderating effect of Gender on Detached Protector Mode and Intellectual Ability.*

		Detached Protector Mode	
		Model 2	
Variable	**Model 1 B**	***B***	***95%CI***
(Constant)	22.41*	12.433	[-4.930,29.795]
Age	.071	-.078	[-.554, .399]
SES	4.626	5.048	[-1.57,11.67]
Siblings	.122	.213	[-.513,.939]
SPM	-.218	-.281*	[-.561,.00]
Gender	-1.92	-1.542	[-4.67,1.59]
Gender * SPM		-0.67*	[-1.29,-.064]
R^2	0.103	0.16*	
F	1.77	4.85*	
ΔR^2		0.054*	

Note. N = 83. C I = confidence interval
p <.0 5. *p < .01.

Table 7 illustrates moderating role of gender for the relationship between intellectual ability and detached Protector Mode. Age, number of sibling and Socio Economic Status of respondents were controlled as covariates. Predictor i.e., high intellectual ability, outcome i.e. detached Protector Mode, covariates and moderator (Gender) were entered in the process macro model [34]. Result presented shows that intellectual ability significantly negatively predicted detached Protector Mode (i.e., β= -.72, $p<.05$). Gender also moderated the effect of intellectual ability on detached Protector Mode (i.e., β Interaction= -.33, $p<.05$) explaining 48.5% variance in detached Protector Mode. Moderating effect of Gender for the relationship between Intellectual ability and detached Protector Mode is further explained with Figure 2.

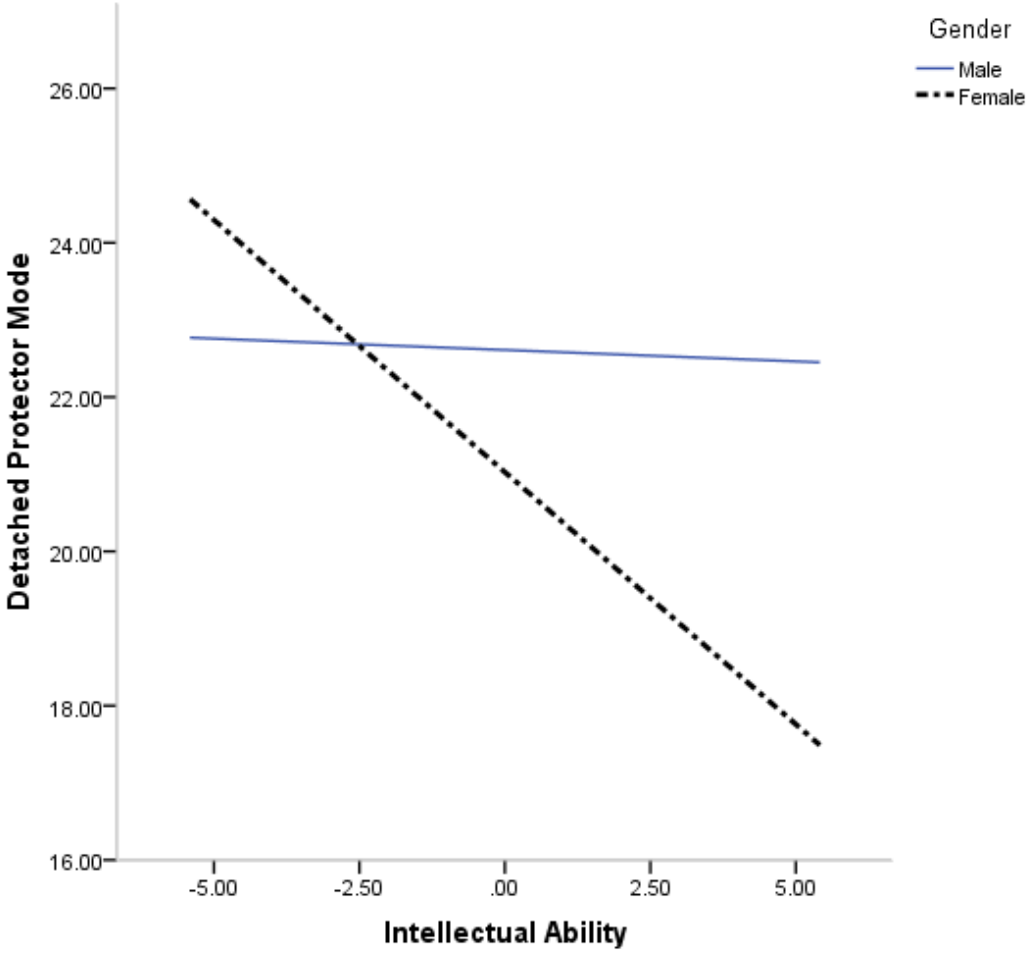

Figure 2 presents moderating effect of Gender on the relationship between intellectual ability and detached Protector Mode. The graph presents a clear moderation by gender. There is a negative relationship between relationship between intellectual ability and detached Protector Mode only for female respondents. The graph shows that for male respondents' intellectual ability has no influence on Detached Protector Mode.

DISCUSSION

This paper has sought to develop on existing knowledge of current predominant emotional state of above average intellectual ability individuals. Moreover, relevant adaptive and vulnerability markers were also assessed by examining activated schema modes.

For the current study The Schema Mode Inventory was reliable with an alpha coefficient of 0.88 for the total scale. It was also found that there was a low reliability of few individual sub scales such as Undisciplined Child, Compliant Surrender, Self-Aggrandizer, along with Bully and Attack mode. These consistency differences were dually supported by research work of Riaz, et al[10], as they explain that in Pakistani population these differences occur because of the differences in child rearing practices, culturally unique role of authority figure, conceptual differences in the context of protection and extreme loyalty to parents and culture, custom specific coping strategies, specific roles and responsibilities of the active, intelligent child differential to that of his siblings, and the cultural differences in the bully and attack happening.

Primarily Standard Progressive Matrices [33] was used to identify the high intellectual ability individuals. Further Schema modes were explored among distinguished individuals. In the mean while gender differences were also seen, thus significant gender differences were found on Punitive Parent, Detached Self-Soother and Detached Protector, i.e. males having higher scores on all these scales, with exception to that of Detached Self-Soother on which the females score rarely higher. This variation is the indicator of differences in acceptance of parents, guardians or the elder ones as the authority figures, and the differences in the coping methods to that of conflicting situations, correspondingly respective differences in gender specific child rearing practices according to societal customs. Meanwhile the Bully and Attack mode also surfaced considerably stronger in male than in female high intellectual individuals. As aggression could be associated a commonly more distinguishing trait of males compared to that of females. In the same way it could be the SMI's item construction of the Bully and Attack mode, which explains clearly that hard line aggressive actions are additional trait of men as compared to that of women. This is only partially in line to the universal idea that females express internalizing problematic behaviors while males' exhibits more externalizing problematic behaviors [36], while at the same interim depicts that the respective schema modes are not identical to problem behaviors within youth[15]. Rest of the modes under study are not gender conscious, suggestive that the schema mode theory pertains equally to men and women [40, 41].

Meanwhile the presence of specific schema modes is illustrative of being adjusted in the social setting. The current study sample comprised intellectually high functioning class of the society so it could be said that they at current are adequately well adjusted as significant negative relationships were found between high intellectual ability and dysfunctional schema modes i.e. Vulnerable Child, Angry Child, Enraged Child, Detached Protector, and Punitive Parent schema modes. This relationship supports the evidence that as a child they believe more to be loved, at peace, safe and spontaneous. Thus they have the ability to experience and symbolize playful happiness [11].

In line with the proposition moderating role of gender in relationship between schema modes and intellectual ability was also assessed. As the demographic features of an individual i.e. gender, age, and tenure are quite important variables within psychological research [36, 37, 38]but the effects of gender on a variety of outcomes is especially still salient. Therefore to ponder out either gender effect the strength or direction of relationship between Intellectual Ability (predictor variables) and the Schema Modes (outcome variables), moderation analysis was carried out. Moderation was significant for two Schema Modes (Enraged Child Mode and Detached Protector Mode), while for the rest of Schema Modes the moderation analysis was non-significant. In addition moderation analysis illustrates an interesting pattern of significant negative relationship between intellectual ability and distinct schema modes i.e. Enraged Child mode and Detached Protector mode. In case of Enraged Child mode the negative relationship is eventually stronger in females as compare to male. This is suggestive that as the intellectual abilities increases, lessen would have feelings of intense anger and rage. Meanwhile the tendencies to hurt people and damage objects would also decrease. Eventually this relationship is stronger in female comparatively. Similarly in Detached Protector (DP) mode distinct negative relationship is evident for female however for male respondents' intellectual ability has no influence DP Mode. This pattern is an illustrative of fact that in female intellectuals the coping tendencies to withdraw psychologically, binge eating, and substance abuse decrease as the level of intellectual ability increases. While in males the detachment coping is least effected by the rise in intellectual ability.

Conclusion and Strengths

The present study has a few distinguished strengths: the sample consisted of all the participants of the same age group, religion and nationality. Similarly sample included does not have any diagnosed psychiatric ailment. Furthermore this study laid the basis to assess the association of intellectual ability to that of activated schema modes and thus establishing the connection of intellectual ability with the currently identified schema modes. Thus; this study is a small effort for identifying and finding the solutions of distinguished schema modes; such as personal, social and occupational maladjustment within Schema Mode therapy. Meanwhile in a nut shell it could be said that Schema therapy is equally effective for individuals with above average intellectual ability.

Limitations and recommendations

Despite much effort the present study has some limitations. Results of the current study need to be considered within the restrictions of its design and sample. Due to certain situational constraints, random sampling technique was not used in sample selection of the present study; the sample is only taken from the Islamabad Capital Territory and Khyber Pukhtunkhwa Province, so in future selection of the sample from a diverse population is needed. Meanwhile next with reference to current cross sectional research, longitudinal pattern of Schema Modes also need to be assessed in upcoming researches.

This study could also be replicated for; creative individuals, artists and people belonging to different domains of society, this replication would be irrespective of the educational background.

REFERENCES

1. Bamber, M. (2004). 'The good, the bad and defenseless Jimmy'-a single case study of Schema Mode Therapy. Clinical Psychology & Psychotherapy, 11(6), 425-438.
2. Young, J.E., Klosko, J.S., & Weishaar, M.E. (2003).Schema therapy. A practitioner's guide. New York: The Guilford Press
3. Lobbestael, J. (2008). Lost in fragmentation. Schema modes, childhood trauma, and anger in borderline and antisocial personality disorder.
4. Loose, C. (2011). Motivational Concept.: Six stage schema and mode driven behavior therapy for children and adolescents. Retrieved from www.schematherapy-for-children.de
5. Ekman, P. (1999). Basic emotions. Handbook of cognition and emotion, 98, 45-60.
6. Damasio AR (1999). The feeling of what happens. Body and Emotion in the Making of Consciousness. New York: Harcourt Brace.
7. Roediger, E. (2012). Basics of a dimentional and dynamic Mode Model. IST- Frankfurt.
8. Beck AT (1967).Depression. Causes and Treatment. Philadelphia: University Press.
9. Lobbestael, J., Arntz, A., & Cima, M. (2009).A comparative study of patients and therapists' reports of schema modes. Journal of behavior therapy and experimental psychiatry, 40(4), 571-579.
10. Riaz, M. N., &Khalily, T. (2013). Translation, Adaptation, and Cross Language Validation of Short Schema Mode Inventory (SMI). Pakistan Journal of Psychological Research, 28(1).
11. Lobbestael, J., Van Vreeswijk, M. F., &Arntz, A. (2008).An empirical test of schema mode conceptualizations in personality disorders. Behaviour research and therapy, 46(7), 854-860.
12. Lobbestael, J., &Arntz, A. (2010). Emotional, cognitive and physiological correlates of abuse-related stress in borderline and antisocial personality disorder. Behaviour Research and Therapy, 48, 116-124.
13. Khalily, M. T., Wota, A. P., &Hallahan, B. (2011). Investigation of schema modes currently activated in patients with psychiatric disorders. Irish Journal of Psychological Medicine, 28(02), 76-81.
14. Bernstein, D. P., Arntz, A., &Vos, M. d. (2007). Schema focused therapy in forensic settings: Theoretical model and recommendations for best clinical practice. International Journal of Forensic Mental Health, 6(2), 169-183.
15. Roelofs, J., Muris, P., & Lobbestael, J. (2015). Acting and Feeling like a Vulnerable Child, an Internalized "Bad" Parent, or a Healthy Person: The Assessment of Schema Modes in Non-Clinical Adolescents. Journal of Personality Disorders, 1-14.
16. Chang, J. S., Kim, Y., Kim, S. H., Hwang, S., Kim, J., Chung, I.-W. . . Jung, H.-Y. (2015). Differences in the internal structure of hallucinatory experiences between clinical and nonclinical populations. Psychiatry research, 226(1), 204-210.
17. Masi, G., Marcheschi, M., & Pfanner, P., (1998).Adolescents with borderline intellectual-functioning - psychopathological risk, Adolescence, 33(130), 415-424.
18. Berndt, D. J., Kaiser, C. F., & Van Aalst, F. (1982).Depression and self-actualization in gifted adolescents. Journal of Clinical Psychology, 38(1), 142-150.
19. Eysenck, H. J. (1995). Genius: The natural history of creativity (Vol. 12). Cambridge University Press.
20. Freeman, J. (1995). Recent studies of giftedness in children. Journal of Child Psychology and Psychiatry, 36(4), 531-547.
21. Holling worth, L. (1942). Children above 180 IQ. The Teachers College Record, 44(1), 56-56.
22. Parker, W. D., & Mills, C. J. (1996).The incidence of perfectionism in gifted students. Gifted Child Quarterly, 40(4), 194-199.
23. Ramaseshan, P. H. (1957). The social and emotional adjustment of the gifted.
24. Reynolds, C. R., & Bradley, M. (1983).Emotional stability of intellectually superior children versus nongifted peers as estimated by chronic anxiety levels. School Psychology Review.
25. Richards, R. (1990). Everyday creativity, eminent creativity, and health: "Afterview"; for CRJ Issues on creativity and health. Creativity Research Journal, 3(4), 300-326.
26. Strang, R. (1950). Inner world of gifted adolescents. Journal of Exceptional Children, 16(4), 97-101.
27. Terman, L.M. (1925). A new approach to the study of genius. Psychological Review, 29(4), 310-318.
28. Terman, L. M., & Oden, M. H. (1947).Genetic studies of genius: (4). The gifted child grows up. Stanford, CA: Stanford University Press.

29. Terman, L. M. (1954). The discovery and encouragement of exceptional talent. American psychologist, 9(6), 221.
30. Neihart, M. (1999). The impact of giftedness on psychological well-being: What does the empirical literature say? Roeper Review, 22(1), 10-17.
31. Altman, R. (1983). Social-emotional development of gifted children and adolescents: A research model. Roeper Review, 6(2), 65-68.
32. Reis, S. M., & Renzulli, J. S. (2004). Current research on the social and emotional development of gifted and talented students: Good news and future possibilities. Psychology in the Schools, 41(1), 119-130.
33. Raven, J., Raven, J.C., &Court, J.H. (2000, updated 2004).Raven manual: Section 3, standard progressive matrices, including the parallel and plus versions, 2000 edition. Oxford, UK: Oxford Psychologists Press Ltd.
34. Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford Press.
35. Gjone, H., & Stevenson, J. (1997). A longitudinal twin study of temperament and behavior problems: common genetic or environmental influences. .Journal of the American Academy of Child & Adolescent Psychiatry, 36(10), 1448-1456.
36. Cohen, J., Mac Whinney, B., Flatt, M., & Provost, J. (1993). PsyScope. Behavior Research Methods, Instruments, & Computers, 25(2), 257-271.
37. Griffeth, R. W., Hom, P. W., & Gaertner, S. (2000). A meta-analysis of antecedents and correlates of employee turnover: Update, moderator tests, and research implications for the next millennium. Journal of management, 26(3), 463-488.
38. Sturman, M. C. (2003). Searching for the inverted U-shaped relationship between time and performance: Meta-analyses of the experience/performance, tenure/performance, and age/performance relationships. Journal of Management, 29(5), 609-640.
39. Young, J. E., (1990) Cognitive therapy for personality disorders: A schema focused approach .Sarasota, FL: Professional Resource Exchange.
40. Arntz, A., Tiesema, M., & Kindt, M. (2007). Treatment of PTSD: A comparison of imaginal exposure with and without imagery rescripting. Journal of behavior therapy and experimental psychiatry, 38(4), 345-370.
41. Arntz, A., & Van Genderen, H. (2011). Schema therapy for borderline personality disorder. John Wiley & Sons.

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Numerical Modeling of SEIQV Epidemic Model with Saturated Incidence Rate

Nauman Ahmed[1*], Naveed Shahid[1], Zafar Iqbal[1], Muhammad Jawaz[1], M Rafiq[2], Tahira S. S.[3], M. O. Ahmad[1]

[1]Department of Mathematics & Statistics, University of Lahore, Lahore, Pakistan
[2]Faculty of Engineering, University of Central Punjab, Lahore, Pakistan
[3]Department of Mathematics, Lahore College for Women University, Lahore, Pakistan

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ABSTRACT

In this paper, a competitive non- standard finite difference (NSFD) numerical scheme is constructed to solve the continuous dynamical model of population dynamics. The developed numerical model remains consistent with the continuous model for all values of parameters used. The proposed NSFD scheme preserves all the essential properties like positivity of the solution, boundedness of sub populations and convergence to the equilibrium of the continuous model. Results are compared with the standard finite difference RK-4 numerical scheme. Numerical experiments show that RK-4 scheme is conditionally convergent and may lose some very important properties of the continuous system for certain value of step size h. The proposed scheme is independent of step size and converges to true equilibrium unconditionally.

KEY WORDS: SEIQV epidemic model; Nonstandard finite difference method; Convergence analysis; Positivity; RK-4 method.

1. INTRODUCTION

Mathematical models play an important role in the understanding of the real-world problem. Mostly mathematical models involve the system of differential equations for the study of physical phenomenon. Using mathematical modeling various epidemic diseases of the human beings have been modeled successfully [1-3,5-7,9-10,19-20,24-28]. These epidemic models help to study the propagation and control of the disease [1, 11-13,15,18] in the community for certain time period. Some infectious diseases disturb the economy of the country in a serious manner. To overcome these types of problems some constraints are imposed on the citizens by the other countries of the world. Specific epidemic models are developed and applied for different infectious diseases.

In these models dynamics of disease is studied subject to the different factors and parameters effecting the propagation of certain disease. Different contagious diseases can be controlled by adopting different modes. Some of the diseases can be controlled by vaccinating the contaminated individuals, while in some cases desired results are obtained by making the infected individual quarantine [15,18,23]. Some diseases can also be controlled by adopting precaution measures along with the treatment. Liu et al. [27] discussed a general SEIQV model and studied the factor of vaccination and quarantine for the epidemic disease.

In some cases, the model becomes convoluted and its analytical solution becomes difficult or impossible. To overcome this type of drawback, some numerical schemes are used and results are verified via simulation[14,16,21-22]. Existing schemes in the literature have some downsides, for instance, they do not have positivity property or some of them are conditionally stable with restricted step size and some are unbounded. Some of them converge to the false solutions.

In this work, SEIQV epidemic model is solved by nonstandard finite difference (NSFD) scheme which is structure preserving, that is, it preserves positivity property and boundedness of the solution. Also the proposed NSFD method is unconditionally convergent and dynamically consistent with the SEIQV continuous system with saturated incidence rate.

The incidence rates [2-4,8,10,27] play a vital role in the study of the infectious disease dynamics. Bilinear incidence rate βSI is also discussed in the scenario of dynamic models [8,17-19,23-25], where β is the transmission coefficient, S is number of susceptible individuals, I is infectious individuals. Saturated incidence rate $\frac{\beta SI}{1+\alpha I}$ was introduced by Capasso and Serio [26], where $\frac{\beta I}{1+\alpha I}$ approaches to saturation level when I is sufficiently large.

The mathematical model is given as following: [27]

***Corresponding Author:** Nauman Ahmed, Department of Mathematics & Statistics, University of Lahore, Lahore, Pakistan

$$\left.\begin{aligned}
\frac{dS(t)}{dt} &= b - \frac{\beta S(t)I(t)}{1+\alpha I(t)} - (\omega+\mu+q_3)S(t)\\
\frac{dE(t)}{dt} &= \frac{\beta S(t)I(t)}{1+\alpha I(t)} - (\sigma+\mu+q_2)E(t)\\
\frac{dI(t)}{dt} &= \sigma E(t) - (\mu+\varepsilon+\gamma+q_1)I(t)\\
\frac{dQ(t)}{dt} &= q_3S(t) + q_2E(t) + q_1I(t) - (\mu+\varphi)Q(t)\\
\frac{dV(t)}{dt} &= \omega S(t) + \varphi Q(t) + \gamma I(t) - \mu V(t).
\end{aligned}\right\} \qquad (i)$$

2. MATHEMATICAL MODEL

2.1. Variables and parameters

$S(t)$: Number of susceptible individuals at time t
$E(t)$: Exposed individuals but not yet infectious at time t
$I(t)$: Infectious individual at time t
$Q(t)$: Quarantined-treated individuals at time t
$V(t)$: Total population of recovered individuals and vaccinated-treated individuals at time t.
b: The recruitment rate of the population.
β: The disease transmission coefficient.
μ: The natural death rate of the population.
ε: The death rate for the disease of infectious individuals.
α: The parameter measures the psychological or inhibitory effects.
γ: The rate at which infected individuals are vaccinated.
σ: The rate at which exposed individual become infected.
ω: The rate at which susceptible individuals are vaccinated.
φ: The rate at which quarantine individuals are vaccinated.
q_1: Effective quarantine probability for infected individuals.
q_2 , q_3: Effective quarantine probability for susceptible and exposed individuals.

2.2. Analysis of the model

The two equilibrium points of the system can be obtained, that is, disease free equilibrium and endemic equilibrium. The points$\xi_1(S_0, 0, 0, Q_0, V_0)$ and $\xi_2(S_*, E_*, I_*, Q_*, V_*)$ are equilibrium points of system (i), where $S_0 = \frac{b}{\omega+\mu+q_3}$, $\quad Q_0 = \frac{q_3S_0}{\mu+\varphi}$, $\quad V_0 = \frac{\omega S_0+\varphi Q_0}{\mu}$

And
$$\left.\begin{aligned}
S_* &= \frac{(\sigma+\mu+q_2)(\mu+\varepsilon+\gamma+q_1)(1+\alpha I_*)}{\sigma\beta}\\
E_* &= \frac{(\mu+\varepsilon+\gamma+q_1)I_*}{\sigma}\\
Q_* &= \frac{q_3S_*+q_2E_*+q_1I_*}{\mu+\varphi}\\
V_* &= \frac{\omega S_*+\varphi Q_*+\gamma I_*}{\mu}\\
I_* &= \frac{\sigma\beta b-(\omega+\mu+q_3)(\sigma+\mu+q_2)(\mu+\varepsilon+\gamma+q_1)}{(\sigma+\mu+q_2)(\mu+\varepsilon+\gamma+q_1)(\beta+\alpha(\omega+\mu+q_3))}
\end{aligned}\right\} \qquad (ii)$$

and S_*, Q_*, V_* satisfies (ii) with I_*
Thus ξ_1 is disease free equilibrium (DFE) and ξ_2 is endemic equilibrium (EE)

2.3. Basic Reproductive Number

Here $\mathcal{B}_o = \frac{\alpha\beta\sigma}{(\omega+\mu+q_3)(\sigma+\mu+q_2)(\mu+\varepsilon+\gamma+q_1)}$ is represented by a basic reproductive number which is an average of number of secondary infections activated by the initial infections. $\mathcal{B}_o$ is a vestibule quantity which will conclude about the spreading of the infection. If $\mathcal{B}_o < 1$ then the continuous dynamical system (i)will examine the disease free equilibrium (DFE) and if $\mathcal{B}_o > 1$ then the system (i)will observe the endemic equilibrium (EE).

3. NUMERICAL MODELING

In this section, two finite difference (FD) methods are used to solve the system (i), i.e Runge-Kutta method of order 4 (R-K 4) and nonstandard finite difference (NSFD) method. We propose NSFD method for the numerical solution of (i) and then we will compare our results with a standard R-K 4 method in this paper.

3.1 Runge-Kutta Method of order 4

First we develop R-K 4 Finite difference(FD) scheme for the system (i) as

$$S^{n+1} - S^n = h\left[b - \frac{\beta S^n I^n}{1+\alpha I^n} - (\omega+\mu+q_3)S^n\right]$$

$$S^{n+1} = S^n + h\left[b - \frac{\beta S^n I^n}{1+\alpha I^n} - (\omega+\mu+q_3)S^n\right]$$

$$E^{n+1} = E^n + h\left[\frac{\beta S^n I^n}{1+\alpha I^n} - (\sigma+\mu+q_2)E^n\right]$$

$$I^{n+1} = I^n + h[\sigma E^n - (\mu+\varepsilon+\gamma+q_1)I^n]$$

$$Q^{n+1} = Q^n + h[q_3 S^n + q_2 E^n + q_1 I^n - (\mu+\phi)Q^n]$$

$$V^{n+1} = V^n + h[\omega S^n + \phi Q^n + \gamma I^n - \mu V^n]$$

Step-I

$$K_1 = h\left[b - \frac{\beta S^n I^n}{1+\alpha I^n} - (\omega+\mu+q_3)S^n\right]$$

$$m_1 = h\left[\frac{\beta S^n I^n}{1+\alpha I^n} - (\sigma+\mu+q_2)E^n\right]$$

$$n_1 = h[\sigma E^n - (\mu+\varepsilon+\gamma+q_1)I^n]$$

$$O_1 = h[q_3 S^n + q_2 E^n + q_1 I^n - (\mu+\phi)Q^n]$$

$$r_1 = h[\omega S^n + \phi Q^n + \gamma I^n - \mu V^n]$$

Step-II

$$K_2 = h\left[b - \frac{\beta\left(S^n+\frac{k_1}{2}\right)\left(I^n+\frac{n_1}{2}\right)}{1+\alpha\left(I^n+\frac{n_1}{2}\right)} - (\omega+\mu+q_3)\left(S^n+\frac{k_1}{2}\right)\right]$$

$$m_2 = h\left[\frac{\beta\left(S^n+\frac{k_1}{2}\right)\left(I^n+\frac{n_1}{2}\right)}{1+\alpha\left(I^n+\frac{n_1}{2}\right)} - (\sigma+\mu+q_2)\left(E^n+\frac{m_1}{2}\right)\right]$$

$$n_2 = h\left[\sigma\left(E^n+\frac{m_1}{2}\right) - (\mu+\varepsilon+\gamma+q_1)\left(I^n+\frac{n_1}{2}\right)\right]$$

$$O_2 = h\left[q_3\left(S^n+\frac{k_1}{2}\right) + q_2\left(E^n+\frac{m_1}{2}\right) + q_1\left(I^n+\frac{n_1}{2}\right) - (\mu+\phi)\left(Q^n+\frac{O_1}{2}\right)\right]$$

$$r_2 = h\left[\omega\left(S^n+\frac{k_1}{2}\right) + \phi\left(Q^n+\frac{O_1}{2}\right) + \gamma\left(I^n+\frac{n_1}{2}\right) - \mu\left(V^n+\frac{r_1}{2}\right)\right]$$

Step-III

$$K_3 = h\left[b - \frac{\beta\left(S^n+\frac{k_2}{2}\right)\left(I^n+\frac{n_2}{2}\right)}{1+\alpha\left(I^n+\frac{n_2}{2}\right)} - (\omega+\mu+q_3)\left(S^n+\frac{k_2}{2}\right)\right]$$

$$m_3 = h\left[\frac{\beta\left(S^n+\frac{k_2}{2}\right)\left(I^n+\frac{n_2}{2}\right)}{1+\alpha\left(I^n+\frac{n_2}{2}\right)} - (\sigma+\mu+q_2)\left(E^n+\frac{m_2}{2}\right)\right]$$

$$n_3 = h\left[\sigma\left(E^n+\frac{m_2}{2}\right) - (\mu+\varepsilon+\gamma+q_1)\left(I^n+\frac{n_2}{2}\right)\right]$$

$$O_3 = h\left[q_3\left(S^n+\frac{k_2}{2}\right) + q_2\left(E^n+\frac{m_2}{2}\right) + q_1\left(I^n+\frac{n_2}{2}\right) - (\mu+\phi)\left(Q^n+\frac{O_2}{2}\right)\right]$$

$$r_3 = h\left[\omega\left(S^n+\frac{k_2}{2}\right) + \phi\left(Q^n+\frac{O_2}{2}\right) + \gamma\left(I^n+\frac{n_2}{2}\right) - \mu\left(V^n+\frac{r_2}{2}\right)\right]$$

Similarly

Step-IV

$$K_4 = h\left[b - \frac{\beta(S^n+k_3)(I^n+n_3)}{1+\alpha(I^n+n_3)} - (\omega+\mu+q_3)(S^n+k_3)\right]$$

$$m_4 = h\left[\frac{\beta(S^n+k_3)(I^n+n_3)}{1+\alpha(I^n+n_3)} - (\sigma+\mu+q_2)(E^n+m_3)\right]$$

$$n_4 = h[\sigma(E^n+m_3) - (\mu+\varepsilon+\gamma+q_1)(I^n+n_3)]$$

$$O_4 = h[q_3(S^n+k_3) + q_2(E^n+m_3) + q_1(I^n+n_3) - (\mu+\phi)(Q^n+O_3)]$$

$$r_4 = h[\omega(S^n+k_3) + \phi(Q^n+O_3) + \gamma(I^n+n_3) - \mu(V^n+r_3)]$$

finally,

$$S^{n+1} = S^n + \frac{1}{6}[k_1 + 2k_2 + 2k_3 + k_4]$$

$$E^{n+1} = E^n + \frac{1}{6}[m_1 + 2m_2 + 2m_3 + m_4]$$

$$I^{n+1} = I^n + \frac{1}{6}[n_1 + 2n_2 + 2n_3 + n_4]$$

$$Q^{n+1} = Q^n + \frac{1}{6}[O_1 + 2O_2 + 2O_3 + O_4]$$

$$V^{n+1} = V^n + \frac{1}{6}[r_1 + 2r_2 + 2r_3 + r_4]$$

3.2. Non-Standard Finite Difference Model

In the current section, we demonstrate unconditionally convergent non-standard finite difference scheme which is based on Micken's non-standard finite difference modeling theory [29]. NSFD schemes has been efficiently used [30-33] because of preserving the properties of continuous model. Convergence analysis of our proposed scheme is also presented here. The NSFD model for continuous dynamical system is given by:

$$\frac{S^{n+1}-S^n}{h} = b - \frac{\beta S^{n+1} I^n}{1+\alpha I^n} - (\omega+\mu+q_3)S^{n+1}$$

$$S^{n+1} = S^n + bh - \frac{\beta h\, S^{n+1} I^n}{1+\alpha I^n} - h(\omega+\mu+q_3)S^{n+1}$$

$$\left[1 + \frac{\beta h\, I^n}{1+\alpha I^n} + h(\omega+\mu+q_3)\right] S^{n+1} = S^n + bh$$

$$S^{n+1} = \frac{S^n + bh}{1 + \frac{\beta h\, I^n}{1+\alpha I^n} + h(\omega+\mu+q_3)}$$

$$E^{n+1} = \frac{S^n + \frac{\beta h\, S^n I^n}{1+\alpha I^n}}{1 + h(\sigma+\mu+q_2)}$$

$$I^{n+1} = \frac{I^n + h\sigma E^n}{1 + h(\mu+\varepsilon+\gamma+q_1)}$$

$$Q^{n+1} = \frac{Q^n + h(q_3 S^n + q_2 E^n + q_1 I^n)}{1 + h(\mu+\varphi)}$$

$$V^{n+1} = \frac{h(\omega S^n + \varphi Q^n + \gamma I^n) + V^n}{1+\mu h}$$

Table 1 (Disease Free Equilibrium $R_0 < 1$)

Parameter	b	μ	σ	β	γ	q_1	q_2	q_3	φ	ε	α	ω
Value	0.7	0.06	0.7	0.35	0.15	0.2	0.2	0.1	0.4	0.05	2	0.30

Table 2 (Endemic Equilibrium$R_0 > 1$)

Parameter	b	μ	σ	β	γ	q_1	q_2	q_3	φ	ε	α	ω
Value	0.7	0.06	0.7	0.35	0.15	0.2	0.2	0.1	0.4	0.05	2	0.06

3.3. Convergence Analysis of Proposed NSFD Scheme

Suppose that

$$F = \frac{S + bh}{1 + \frac{\beta h\, I}{1+\alpha I} + h(\omega+\mu+q_3)}$$

$$G = \frac{E + \frac{\beta h\, SI}{1+\alpha I}}{1 + h(\sigma+\mu+q_2)}$$

$$H = \frac{I + h\sigma E}{1 + h(\mu+\varepsilon+\gamma+q_1)}$$

$$I_1 = \frac{Q + h(q_3 S + q_2 E + q_1 I)}{1 + h(\mu+\varphi)}$$

$$J = \frac{h(\omega S + \varphi Q + \gamma I) + V}{1+\mu h}$$

and

$$F = \frac{S + bh}{1 + \frac{\beta h\, I}{1+\alpha I} + h(\omega+\mu+q_3)}$$

$$\frac{\partial F}{\partial S} = \frac{1}{1 + \frac{\beta h\, I}{1+\alpha I} + h(\omega+\mu+q_3)}$$

$$\frac{\partial F}{\partial E} = 0$$

$$\frac{\partial F}{\partial I} = \frac{-(S+bh)\,\beta h}{(1+\alpha I)^2 \left(1 + \frac{\beta h\, I}{1+\alpha I} + h(\omega+\mu+q_3)\right)^2}$$

$$\frac{\partial F}{\partial Q} = 0$$

$$\frac{\partial F}{\partial V} = 0$$

$$G = \frac{E + \frac{\beta h\, SI}{1+\alpha I}}{1 + h(\sigma + \mu + q_2)}$$

$$\frac{\partial G}{\partial S} = \frac{\beta h\, I}{(1 + \alpha I)\{1 + h(\sigma + \mu + q_2)\}}$$

$$\frac{\partial G}{\partial E} = \frac{1}{1 + h(\sigma + \mu + q_2)}$$

$$\frac{\partial G}{\partial I} = \frac{\beta h\, S}{(1 + \alpha I)^2\{1 + h(\sigma + \mu + q_2)\}}$$

$$\frac{\partial G}{\partial Q} = 0$$

$$\frac{\partial G}{\partial V} = 0$$

$$H = \frac{I + h\sigma E}{1 + h(\mu + \varepsilon + \gamma + q_1)}$$

$$\frac{\partial H}{\partial S} = 0$$

$$\frac{\partial H}{\partial E} = \frac{h\sigma}{1 + h(\mu + \varepsilon + \gamma + q_1)}$$

$$\frac{\partial H}{\partial I} = \frac{1}{1 + h(\mu + \varepsilon + \gamma + q_1)}$$

$$\frac{\partial H}{\partial Q} = 0$$

$$\frac{\partial H}{\partial V} = 0$$

$$I_1 = \frac{Q + h(q_3 S + q_2 E + q_1 I)}{1 + h(\mu + \varphi)}$$

$$\frac{\partial I_1}{\partial S} = \frac{hq_3}{1 + h(\mu + \varphi)}$$

$$\frac{\partial I_1}{\partial E} = \frac{hq_2}{1 + h(\mu + \varphi)}$$

$$\frac{\partial I_1}{\partial I} = \frac{hq_1}{1 + h(\mu + \varphi)}$$

$$\frac{\partial I_1}{\partial Q} = \frac{1}{1 + h(\mu + \varphi)}$$

$$\frac{\partial I_1}{\partial V} = 0$$

$$J = \frac{h(\omega S + \varphi Q + \gamma I) + V}{1 + \mu h}$$

$$\frac{\partial J}{\partial S} = \frac{h\omega}{1 + \mu h}$$

$$\frac{\partial J}{\partial E} = 0$$

$$\frac{\partial J}{\partial I} = \frac{h\gamma}{1 + \mu h}$$

$$\frac{\partial J}{\partial Q} = \frac{h\varphi}{1 + \mu h}$$

$$\frac{\partial J}{\partial V} = \frac{1}{1 + \mu h}$$

Now the Jacobian matrix is

$$J_1 = \begin{bmatrix} \frac{\partial F}{\partial S} & \frac{\partial F}{\partial E} & \frac{\partial F}{\partial I} & \frac{\partial F}{\partial Q} & \frac{\partial F}{\partial V} \\ \frac{\partial G}{\partial S} & \frac{\partial G}{\partial E} & \frac{\partial G}{\partial I} & \frac{\partial G}{\partial Q} & \frac{\partial G}{\partial V} \\ \frac{\partial H}{\partial S} & \frac{\partial H}{\partial E} & \frac{\partial H}{\partial I} & \frac{\partial H}{\partial Q} & \frac{\partial H}{\partial V} \\ \frac{\partial I_1}{\partial S} & \frac{\partial I_1}{\partial E} & \frac{\partial I_1}{\partial I} & \frac{\partial I_1}{\partial Q} & \frac{\partial I_1}{\partial V} \\ \frac{\partial J}{\partial S} & \frac{\partial J}{\partial E} & \frac{\partial J}{\partial I} & \frac{\partial J}{\partial Q} & \frac{\partial J}{\partial V} \end{bmatrix}$$

After setting $\xi_1(S,E,I,Q,V) = \xi_1(S_0,0,0,Q_0,V_0)$

$$J_1^*(\xi_1) = \begin{bmatrix} \frac{1}{1+h(\omega+\mu+q_3)} & 0 & \frac{-(S+bh)\,\beta h}{(1+\alpha I)^2\left(1+\frac{\beta h\, I}{1+\alpha I}+h(\omega+\mu+q_3)\right)^2} & 0 & 0 \\ 0 & \frac{1}{1+h(\sigma+\mu+q_2)} & \frac{\beta h\, S_0}{\{1+h(\sigma+\mu+q_2)\}} & 0 & 0 \\ 0 & \frac{h\sigma}{1+h(\mu+\varepsilon+\gamma+q_1)} & \frac{1}{1+h(\mu+\varepsilon+\gamma+q_1)} & 0 & 0 \\ \frac{hq_3}{1+h(\mu+\varphi)} & \frac{hq_2}{1+h(\mu+\varphi)} & \frac{hq_1}{1+h(\mu+\varphi)} & \frac{1}{1+h(\mu+\varphi)} & 0 \\ \frac{h\omega}{1+\mu h} & 0 & \frac{h\gamma}{1+\mu h} & \frac{h\varphi}{1+\mu h} & \frac{1}{1+\mu h} \end{bmatrix}$$

Three eigen values of the above matrix are $\frac{1}{1+\mu h}, \frac{1}{1+(\mu+\varphi)h}, \frac{1}{1+(\omega+\mu+q_3)h}$ which are less then 1.

The remaining two eigen values can be found from the matrix $A = \begin{bmatrix} \frac{1}{1+(\sigma+\mu+q_2)h} & \frac{h\beta S_o}{1+(\sigma+\mu+q_2)h} \\ \frac{\sigma h}{1+(\mu+\varepsilon+\gamma+q_1)h} & \frac{1}{1+(\mu+\varepsilon+\gamma+q_1)h} \end{bmatrix}$

The spectral radius of Jacobian matrix A for each time step 'h', $0 < h \leq 10000$ is plotted in figure 1. This figure shows that for each time step the spectral radius remains less than 1. This implies that all the eigenvalues of Jacobian matrix at disease free equilibrium will be within a unit disc which guarantees the fact that proposed NSFD scheme is convergent for each time step selected.

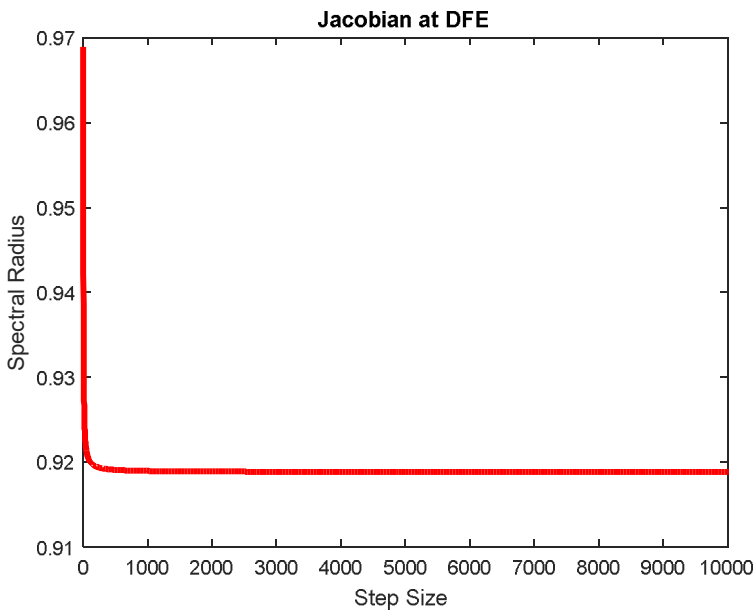


Figure 1

Now after setting for endemic free equilibrium at$\xi_2(S,E,I,Q,V) = \xi_2(S_*,E_*,I_*,Q_*,V_*)$, we have

$$J_1^*(\xi_2) = \begin{bmatrix} \frac{S+bh}{1+\frac{\beta h I}{1+\alpha I}+h(\omega+\mu+q_3)} & 0 & \frac{-(S_0+bh)\,\beta h}{\left(1+h(\omega+\mu+q_3)\right)^2} & 0 & 0 \\ \frac{\beta h I}{(1+\alpha I)\{1+h(\sigma+\mu+q_2)\}} & \frac{1}{1+h(\sigma+\mu+q_2)} & \frac{\beta h S_0}{\{1+h(\sigma+\mu+q_2)\}} & 0 & 0 \\ 0 & \frac{h\sigma}{1+h(\mu+\varepsilon+\gamma+q_1)} & \frac{1}{1+h(\mu+\varepsilon+\gamma+q_1)} & 0 & 0 \\ \frac{hq_3}{1+h(\mu+\varphi)} & \frac{hq_2}{1+h(\mu+\varphi)} & \frac{hq_1}{1+h(\mu+\varphi)} & \frac{1}{1+h(\mu+\varphi)} & 0 \\ \frac{h\omega}{1+\mu h} & 0 & \frac{h\gamma}{1+\mu h} & \frac{h\varphi}{1+\mu h} & \frac{1}{1+\mu h} \end{bmatrix}$$

The spectral radius of Jacobian matrix $J_1^*(\xi_2)$ for each time step 'h', $0 < h \leq 10000$ is plotted in figure 2. This figure shows that for each time step the spectral radius remains less than 1. This implies that all the eigenvalues of Jacobian matrix at endemic equilibrium will be within a unit disc which guarantees the fact that proposed NSFD scheme is convergent for each time step selected.

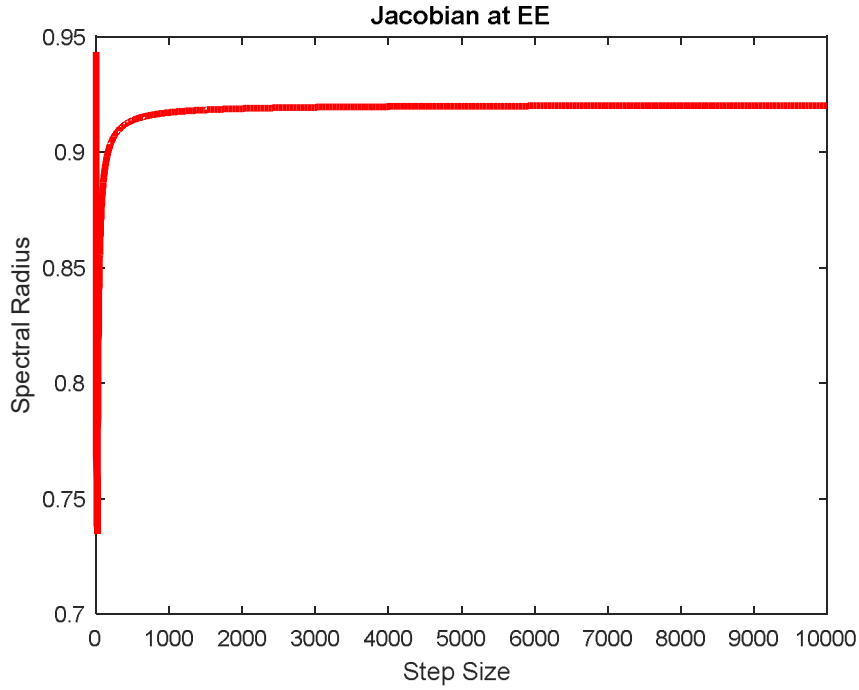
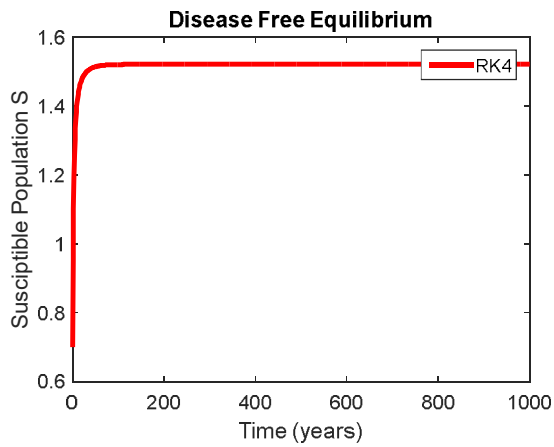


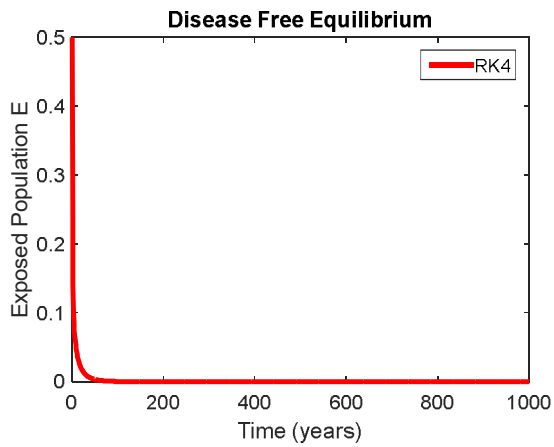
Figure 2

4. Numerical experiment:

Now with the help of the values of parameter given in the table 1 and table 2we perform numerical experiment for both of the numerical schemes.

First we present the graphs of RK-4 for both disease free equilibrium and endemic equilibrium at different time steps. The graphs of RK-4 for disease free equilibrium are given below,





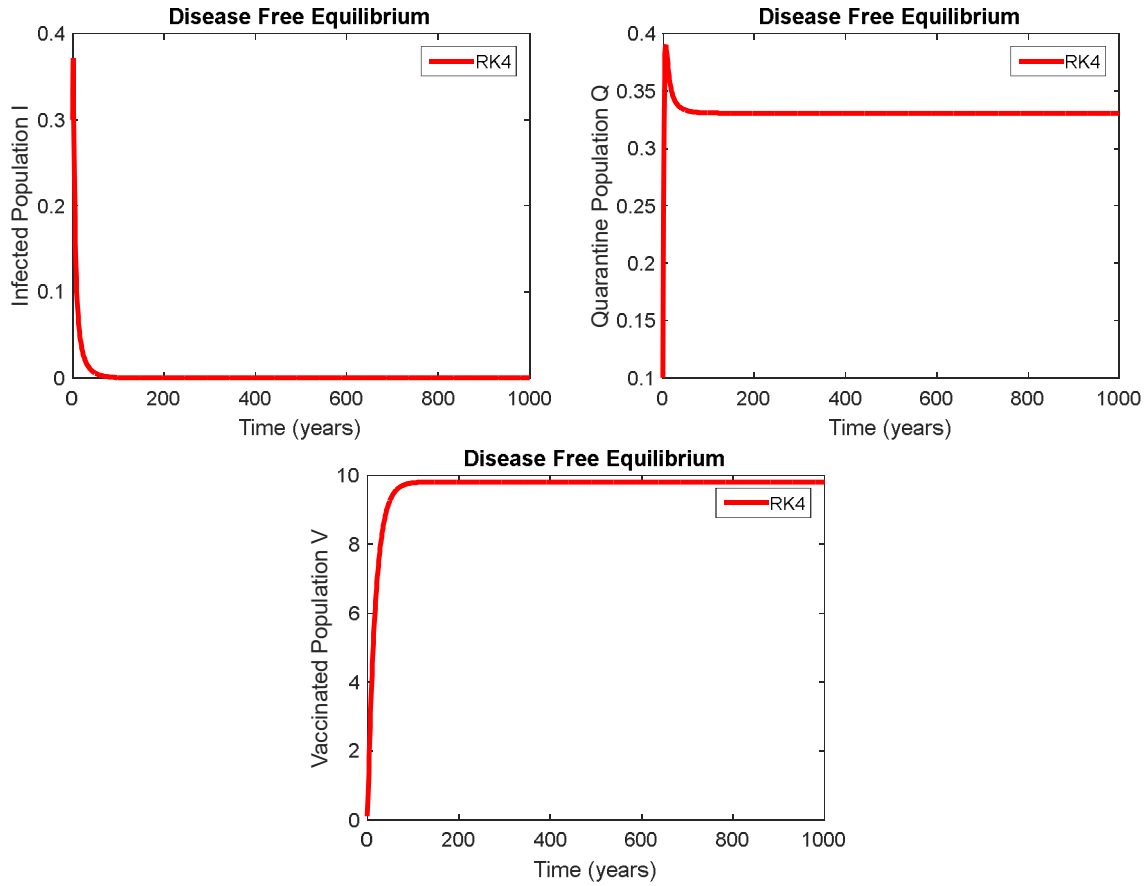
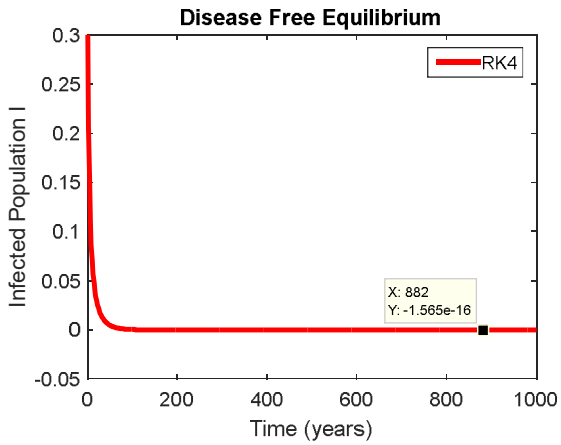


Figure 3

Figure 3 shows the convergence of RK-4 for disease free equilibrium at $h = 1$. Now we observe the behavior of RK-4 scheme for various values of time step.



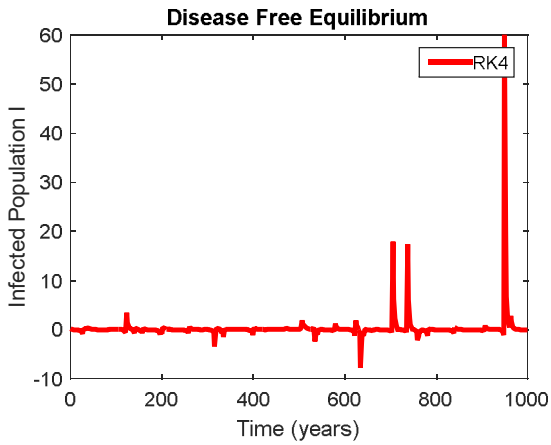


Figure 4a **Figure 4b**

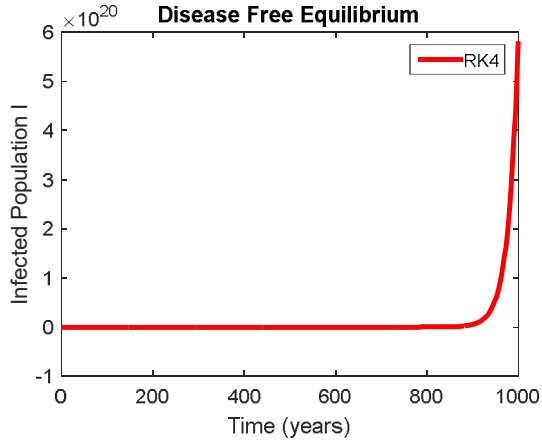


Figure 4c

Figures 4a-4c show the graphs of infected population for disease free equilibrium using RK-4 at $h = 2, h = 2.143$ and $h = 3$ respectively.
Figure 4a shows that RK-4 scheme lose the positivity property and produce negative values of infected individuals. Negative values of infected individuals are meaningless and they are due to the drawback of RK-4 scheme. Figure 4b shows the non-physical behavior of infected individuals which is not consistent with the continuous dynamical system. Figure 4c shows the overflow of RK-4 scheme at $h = 3$.

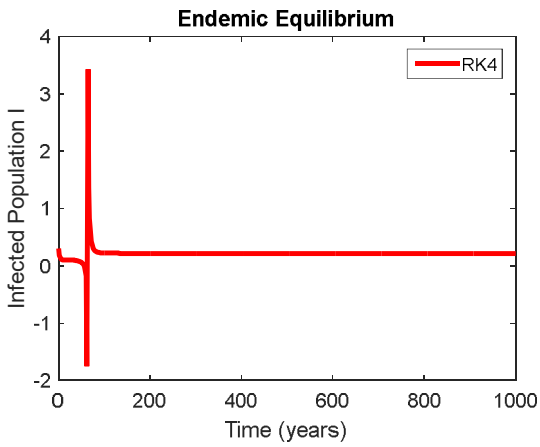


Figure 5a

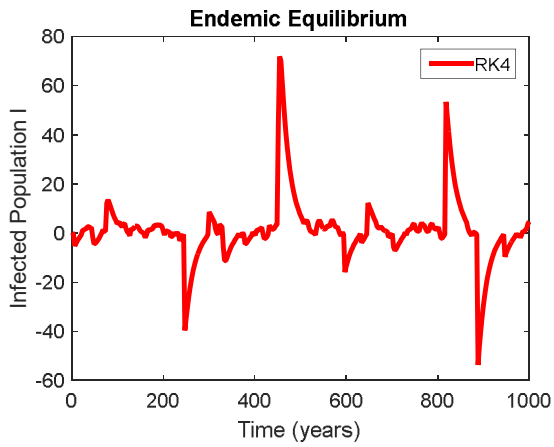


Figure 5b

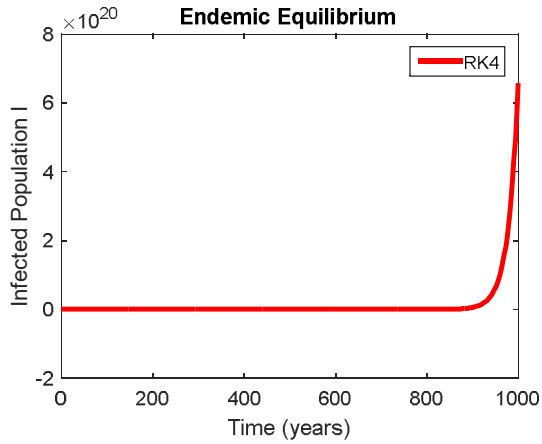


Figure 5c

Figure 5a-5c possess the graphs of infected population using RK-4 method at $h = 2.057, h = 2.8$ and $h = 3$ respectively. Graph at $h = 2.413$ shows that RK-4 FD scheme fails to preserve positivity property. Figure 5b

shows the nonphysical oscillations and Figure 5c shows that Rk-4 method at time step $h = 3.5$ overflows and do not converge to the steady states of the continuous model.
Next we present the simulations for our proposed nonstandard FD scheme for the same time steps as used in the RK-4 method.

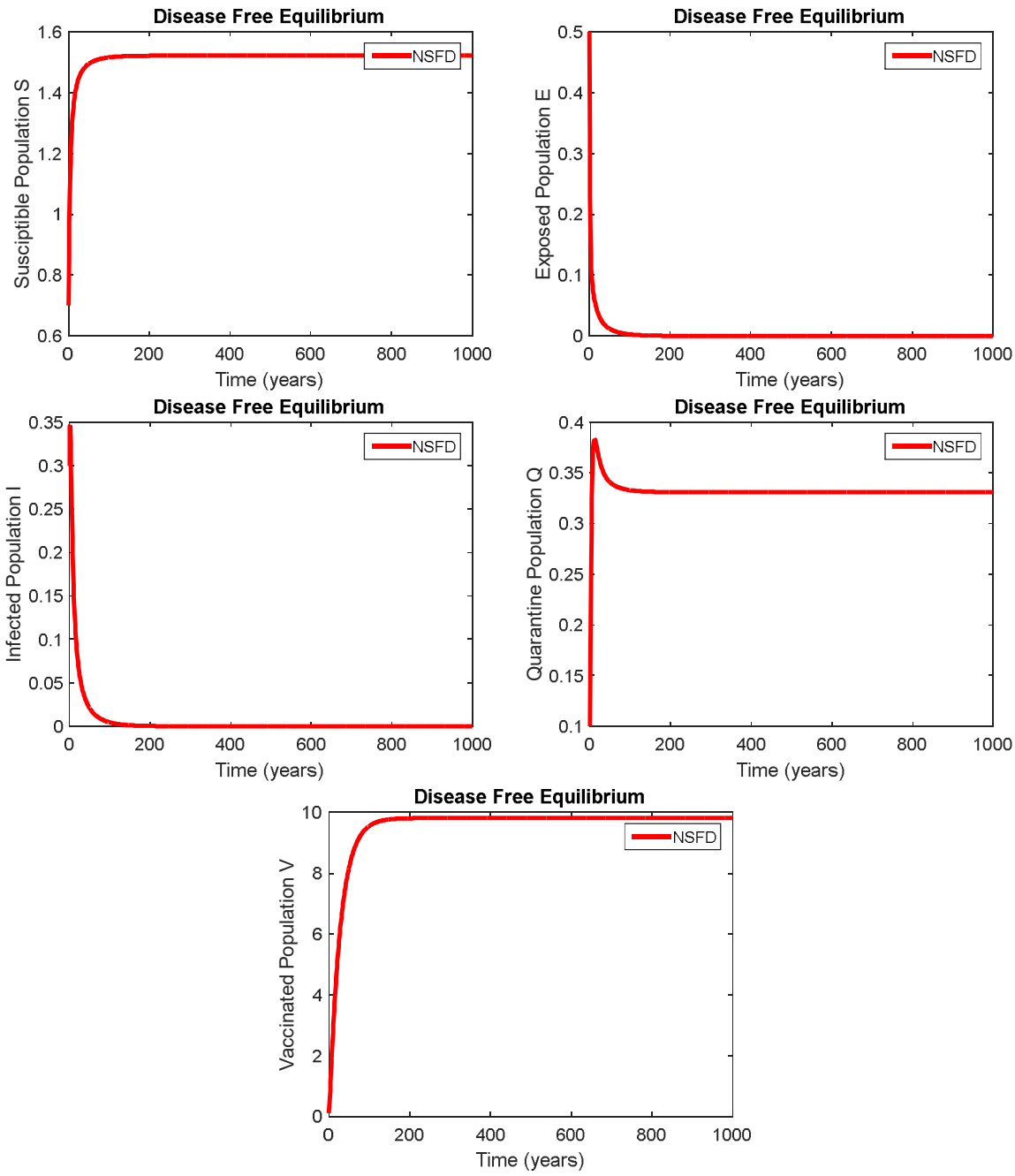


Figure 6

Figure 6 verify the convergence of proposed NSFD scheme to the disease free equilibrium point $\xi_1(S_0, 0, 0, Q_0, V_0)$ at time step $h = 1$.

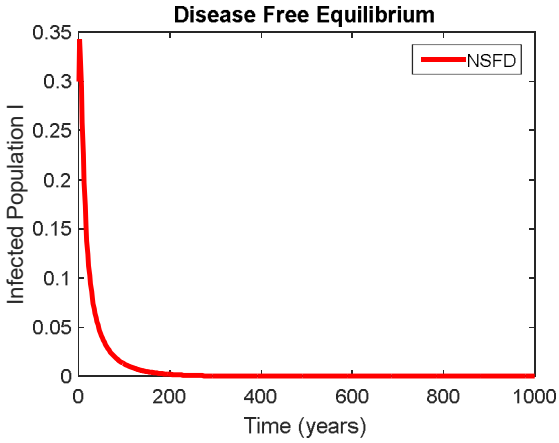


Figure 7a

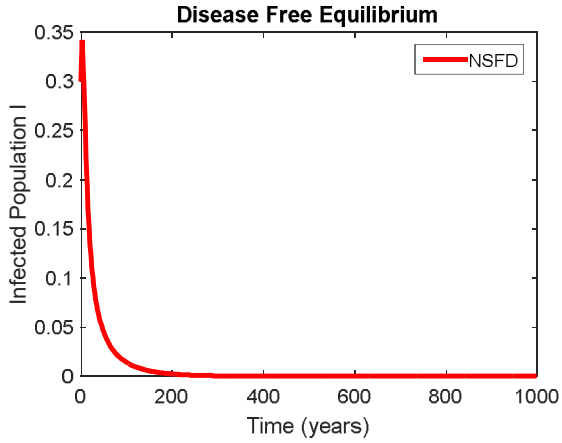


Figure 7b

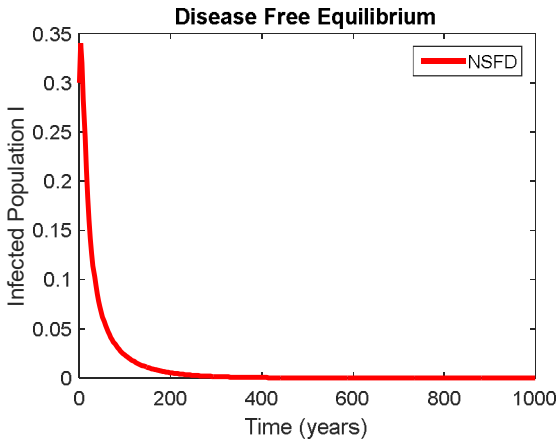
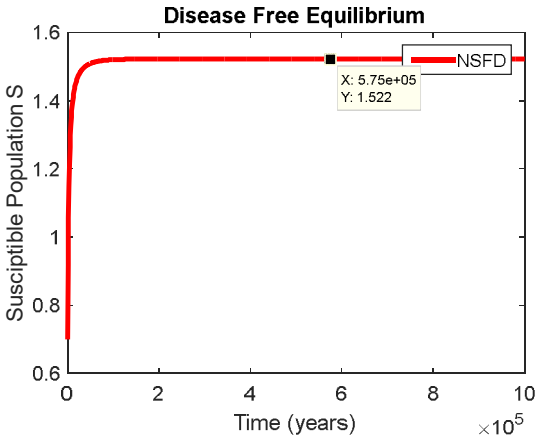
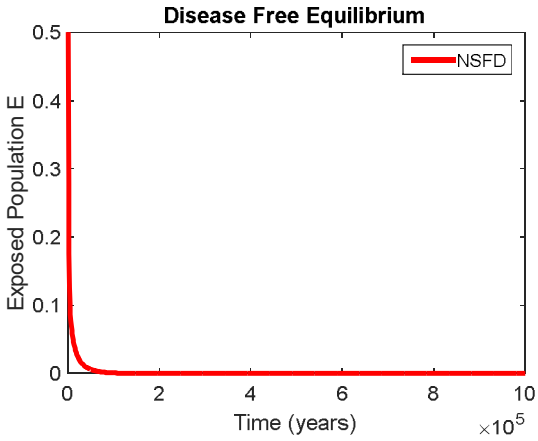


Figure 7c

Figures 7a-7c show the graphs of infected population using NSFD at $h = 2, h = 2.143$ and $h = 3$ respectively. Graphs in figures 7a-7c reflect that proposed NSFD scheme preserves positivity property and converges to the true steady state of the continuous model for each value of the time step h.

Following graphs in the figure 8 indicate that proposed NSFD scheme is independent of time step. For the verification of our claim, we have chosen h as large as 1000.





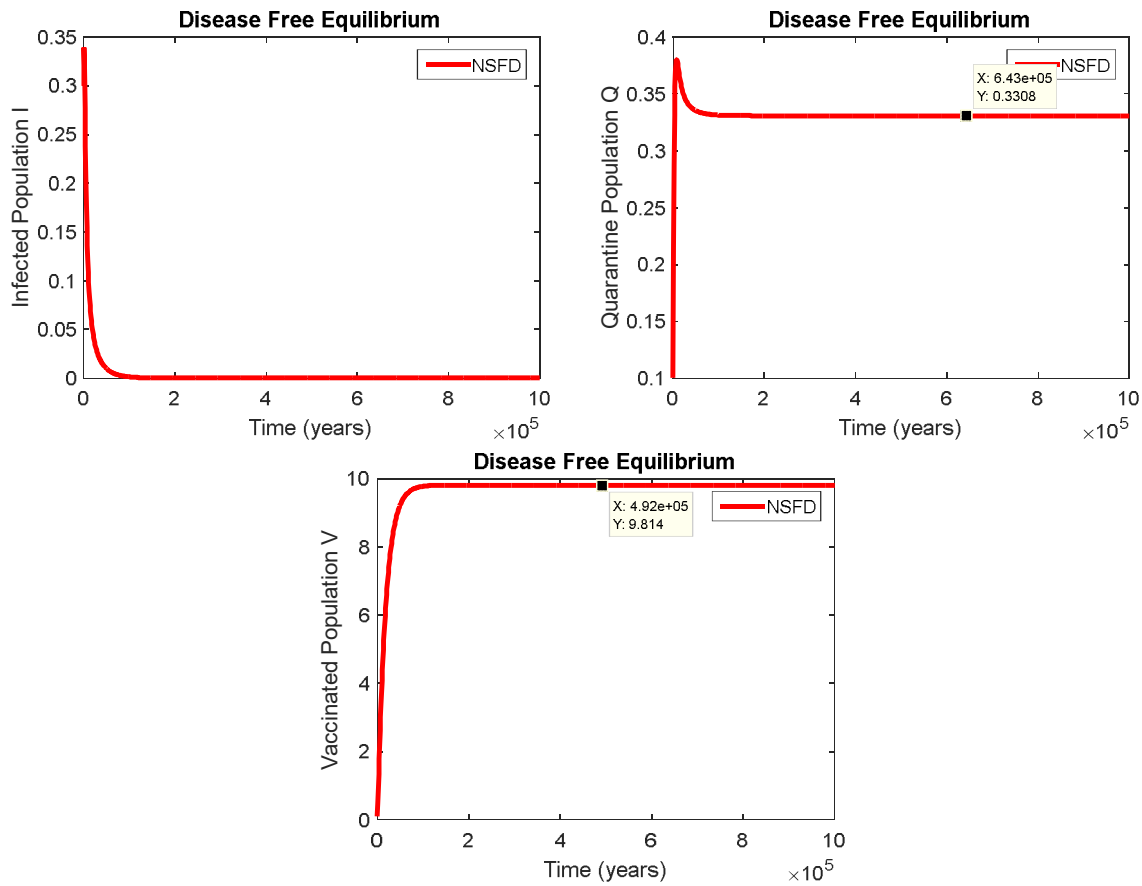


Figure 8

Figure 8 represents the graphs of disease free equilibrium using NSFD scheme at considerably very large time step $h = 1000$. Graphs show that proposed NSFD scheme converges to disease free equilibrium point $\xi_1(S_0, 0,0, Q_0, V_0)$unconditionally and preserves positivity property.

Following graphs in figure 9 indicate the endemic equilibrium for the infected individuals by applying proposed NSFD scheme.

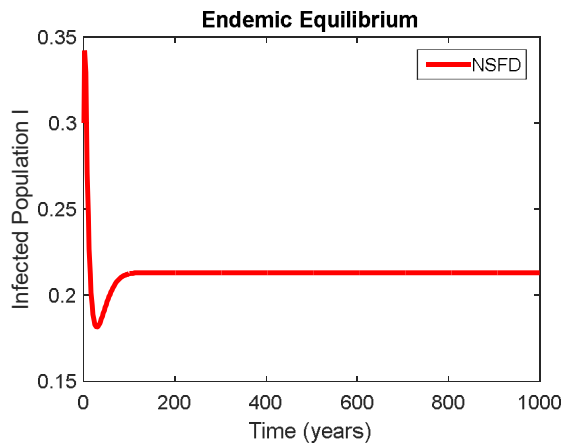


Figure 9a

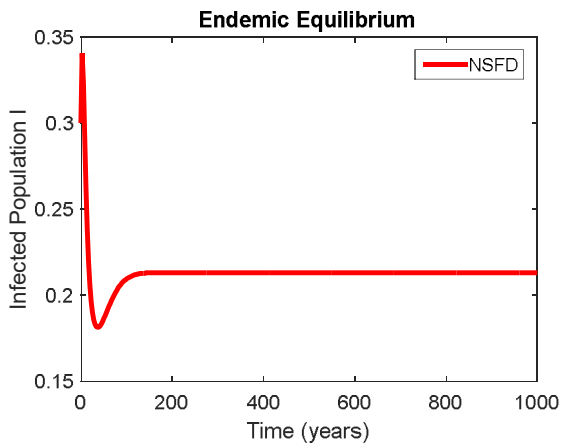


Figure 9b

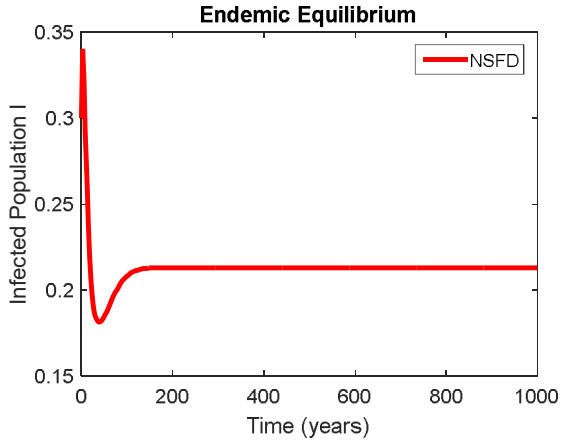
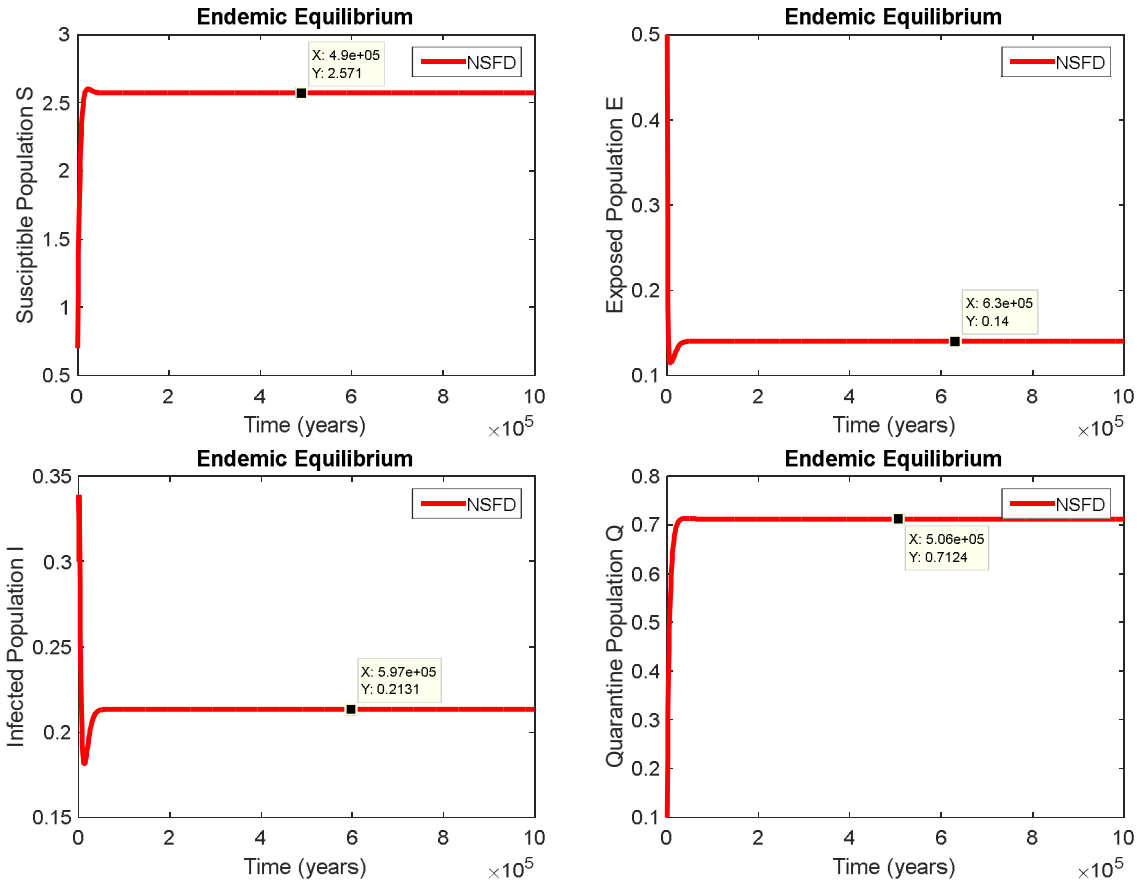


Figure 9c

Figures 9a-9c are the graphs of infected population by using NSFD scheme at $h = 2.057, h = 2.8$ and $h = 3$ respectively. Graphs indicate that NSFD method is unconditionally convergent for all time steps and preserves positivity property.

Graphs in figure 10 present the endemic equilibrium for the different subpopulations, by adopting very large time step for proposed NSFD scheme.



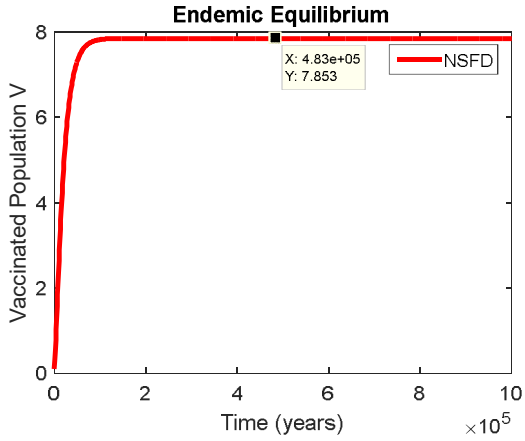


Figure 10

In figure 10, we found the endemic equilibrium by applying NSFD scheme with time step $h = 1000$. Graphs depict that proposed NSFD scheme preserves the positivity property and converges to endemic equilibrium point$\xi_2(S_*, E_*, I_*, Q_*, V_*)$ even for a very large time step.
Now the vaccination effect on the control of disease is shown graphically. The following graphs (figure 11)indicate the vaccination effect for infected and quarantine individuals.

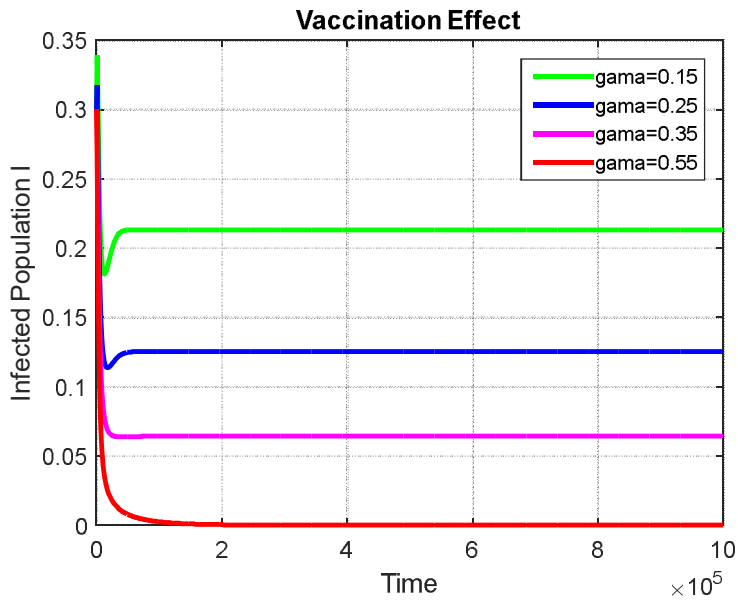


Figure 11

In figure 11, we plotted the graphs of infected individuals verses time, for different values of γ. It is observed that the number of infected individuals $I(t)$ and γ are inversely proportional to each other, which reflects that by increasing the rate of vaccination γ, disease can be eradicated.

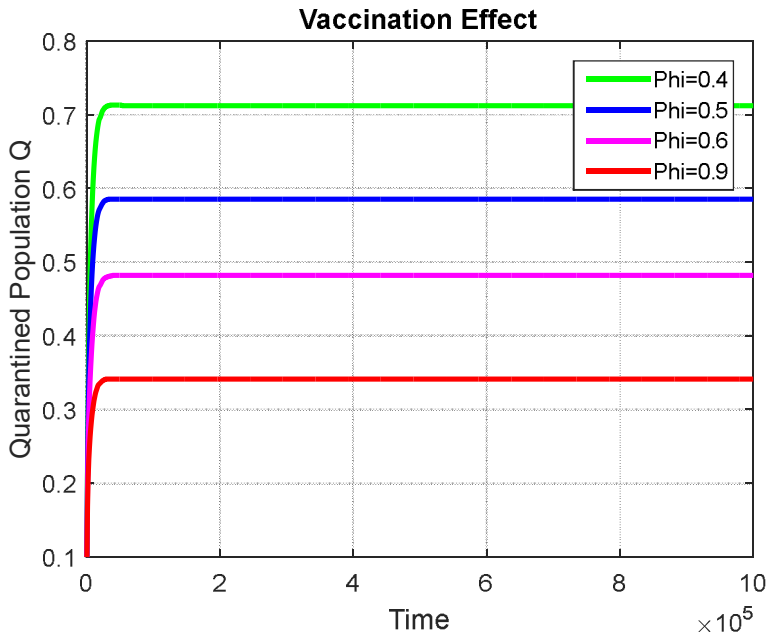


Figure 12

In figure 12, the effect of rate of vaccination φ is discussed for the quarantine population. It is evident from the graph that increase in the value of φ gives the disease free equilibrium for quarantine population.

5. CONCLUSION

This paper is concerned about the numerical solution of SEIQV epidemic model with saturated incidence rate. In this article, we developed a nonstandard finite difference scheme for SEIQV epidemic model with saturated incidence rate. The proposed NSFD scheme is not only preserve the positivity property but also unconditionally converges to the true steady states of the continuous model. We also presented the convergence analysis of the proposed NSFD scheme and proved that proposed NSFD scheme is unconditionally stable. The results are compared with the well-known RK-4 FD method. RK-4 FD method fails to preserve positivity property, gives non-physical oscillations, converges to false steady states and diverges even at a small step size. On the other side proposed NSFD scheme is unconditionally convergent to all step sizes. Simulations are done to verify all the attributes of the proposed NSFD scheme. The effect of vaccination is also discussed graphically and showed that if vaccination is increased in the infected, susceptible or quarantined population, the disease is controlled efficiently. Following the same lines, the theory will be enhanced for the PDE's models and fractional models in different field of sciences and engineering.

REFERENCES

[1] Bacaër N. and S. Guernaoui, (2006). The epidemic threshold of vector-borne diseases with seasonality. The case of cutaneous leishmaniasis in Chichaoua, Morocco.J. Math. Biol. 53 (3): 421–436.

[2] Liu, W. M., H. W. HethcoteandS. A. Levin, (1987). Dynamical behavior of epidemiological models with nonlinear incidence rates, J. Math. Biol. 25: 359–380.

[3] Xiao, D. M. and S. G. Ruan, (2007). Global analysis of an epidemic model with nonmonotone incidence rate, Math. Biosci. 208: 419–429.

[4] Alexander, M. E. and S. M. Moghadas, (2005). Bifurcation analysis of an SIRS epidemic model with generalized incidence, SIAM J. Appl. Math. 65: 1794–1816.

[5] Roman, U., M. N. Shah, S. Khan, S. Mukhtar, G. Zaman, S. Islam, (2016). Transmission Dynamics of Hepatitis B Model. J. Appl. Environ. Biol. Sci. 6 (9): 100-104.

[6] Roman, U., F. Ali, M. Adil, A. A. Shah, Z. Hussain, G. Zaman, M. A. Khan, S. Islam, (2016). Stability Analysis of a General SEIRS Epidemic Model. J. Appl. Environ. Biol. Sci. 6 (9): 38-45.

[7] Roman, U., M. Khan, G. Zaman, S. Islam, M. A. Khan, S. Jan, T. Gul, (2016). Dynamical Features of a Mathematical Model on Smoking. J. Appl. Environ. Biol. Sci. 6 (1): 92-96.

[8] Korobeinikov, A. andP. K. Maini,(2005). Nonlinear incidence and stability of infectious disease models, Math. Med. Biol. 22: 113–128.

[9]Roman, U., S. Jan, G. Zaman, S. Khan, S. Islam, M. A. Khan, H. Ullah, (2016). Mathematical Modeling of Vector-Borne Disease. J. Appl. Environ. Biol. Sci. 6 (1): 57-62.

[10] Liu, S. Q., S. K. Wangand L. Wang,(2011). Global dynamics of delay epidemic models with nonlinear incidence rate and relapse, Nonlinear Anal. RWA 12:119–127.

[11] Van den Driessche, P. and J. Watmough, (2002). Reproduction numbers and sub-threshold endemic equilibria for compartmental models of disease transmission, Math. Biosci. 180: 29–38.

[12] Panum, P., L. (1988). Observations made during the epidemic of measles on the Faroe Islands in the year 1846.

[13] Roueché, B. (1963), Curiosities of medicine: An assembly of medical diversions 1552–1962.Little: Brown & Co, Boston, USA pp 210–236.

[14] Arqub, O., A., and Ajou, E., L., A (2013). Solution of the fractional epidemic model by homotopy analysis method. Journal of King Saud University-Science, 25(1): 73-81.

[15] Wang, L., M., L. S. Chenand J. Nieto, (2010). The dynamics of an epidemic model for pest control with impulsive effect, Nonlinear Anal. RWA. 11:1374–1386.

[16] Ebenezer, B., A. Khan, M. A. Khan, S. Islam, (2016). Analytical Solution of the Ebola Epidemic Model by Homotopy Perturbation Method. J. Appl. Environ. Biol. Sci. 6 (6): 41-49.

[17] Fan, M., M. Y. Liand K. Wang, (2001). Global stability of an SEIS epidemic model with recruitment and a varying total population size, Math. Biosci. 170:199–208.

[18] Li, J. and Z. Ma, (2002) Qualitative analysis of SIS epidemic model with vaccination and varying total population size, Math. Comput. Modelling. 20:1235–1243.

[19] Nakata, Y. and T. Kuniya, (2010). Global dynamics of a class of SEIRS epidemic models in a periodic environment, J. Math. Anal. Appl. 363: 230–237.

[20] Kermack, W., O. and A. G. Mc. Kendrick, (1933) Contributions of mathematical theory to epidemics, Proc. Roy. Soc. London - Series A. 14(1): 94-122.

[21] Easton, A., M. Singhand G. Cui,(1997)Solutions of two species reaction–diffusion systems, Canadian Applied Mathematics Quarterly. 5: 359–373.

[22] Singh, M., A. Easton, G. CuiandI. Kozlova, (1998). A numerical study of the two-dimensional spruce-budworm reaction-diffusion equation with density dependent diffusion, Natural Research Modelling. 11: 143–154.

[23] Anderson, R., M. and R., M. May,(1992) Infectious Diseases of Humans: Dynamics and Control, Oxford University Press, Oxford, UK.

[24] Hethcote, H., W.,(2000). The mathematics of infectious diseases, SIAM Rev. 42: 599–653.

[25] Acedo, L., G. FD. González-Parra and J. A. Abraham, (2010). An exact global solution for the classical epidemic model, Nonlinear Anal. RWA. 11: 1819–1825.

[26] Capasso, V. andG. Serio(1978). A generation of the Kermack–McKendrick deterministic epidemic model, Math. Biosci. 42: 43–61.

[27] Liu, X. and L. Yang,(2012).Stability analysis of an SEIQV epidemic model with saturated incidence rate, Nonlinear Analysis: Real World Applications. 13: 2671–2679.

[28] Anderson, R., M. and R. M. May,(1999). Population biology of infectious disease I, Nature 180, 361-367.

[29] Mickens, R., E.,(2000) Advances in applications of non-standard finite difference schemes. World Scientific Publishing Company, Singapore.

[30] Cresson, J. and F. Pierret, (2016). Nonstandard finite difference schemes preserving dynamical properties, J. Comput. Appl. Math. 303: 15-30.

[31] Anguelov, R., J. Dumont, J. Lubuma and E. Mureithi, (2013). Stability analysis and dynamics preserving nonstandard finite difference schemes for a malaria model, Mathematical Population Studies. 20: 101-122.

[32] Arenas, A., J., G. Gonzalez and B. C. Charpentier, Construction of nonstandard finite difference schemes for all SI and SIR epidemic models of fractional order, Mathematics and Computers in Simulation 21: 48-63.

[33] Gonzalez-Parra, G., A. J. Arenas and B. C. Charpentier (2010). Combination of nonstandard schemes and Richardson's extrapolation to improve the numerical solution of population models, Mathematical and Computer Modeling. 52: 1030-1036.

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Factor Influencing Resiliency of Efficacy Diabetes Mellitus Patients

Nian Afrian Nuari[1*], Syiddatul Budury[2], Theresia Anita Pramesti[3]

[1]STIKes Karya Husada Kediri, Kediri, Indonesia
[2]STIKes Insan Se Agung Bangkalan, Bangkalan, Indonesia
[3]STIKes Wira Medika Bali, Denpasar, Indonesia

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ABSTRACT

Resiliency of efficacy means the ability of a person to rise from adversity that occurs in the problems that occur in his life especially if the patient Diabetes Mellitus who must maintain blood sugar levels for life so that no complications occur. The goal of this research is to analyze the factors related to resiliency of efficacy Diabetes Mellitus Patient's. The design of this study was explanatory with cross sectional approach. Sampling technique used purposive sampling got 100 respondents. Data collected by using questionnaire and analyzed with multiple linear regression ($\alpha = 0.05$). The results show that the majority of respondents Diabetes mellitus obtained that 31% of respondents have aged 60 to 70 years and has female gender of 65%. This results acquired long suffering Diabetes Mellitus at most for 3-5 years. Respondents get information about Diabetes Mellitus disease as much as 44%. For adherence to the medication as much as 54% have good adherence to treatment. While in the management of Diabetes mellitus dietary, consider half of respondents have diet according to Diabetes Mellitus. Based on the results as well as 52% have good adherence to activity management. The majority of respondents Diabetes mellitus captures high resiliency of efficacy. The multiple linear regression test analysis obtained there are influence of resiliency of efficacy with gender, education information about diabetes, long suffering diabetes mellitus, medication obedience, dietary adherence and activity adherence in Diabetes Mellitus Patients. The Resiliency of efficacy Diabetes mellitus needs to be improved by providing support to patients who can do family and community, so that patients are able to achieve a good quality of life.
KEYWORDS: resiliency, efficacy, factor, Diabetes Mellitus.

INTRODUCTION

Diabetes Mellitus patients need a high commitment to the disease because they have to maintain blood sugar levels to remain stable. This resulted in Diabetes Mellitus patients falling on conditions that make him must continue to maintain blood sugar so that it can become a burden in his life. This triggers the patient to experience psychological burdens other than the patient having to take medication for his illness. Psychological problems in Diabetes Mellitus patients can exacerbate metabolic disorders either directly through hormonal stress or indirectly through poor compliance. This condition needs to be done effective handling so that patients are able to perform the management of DM disease to prevent the occurrence of complications [1].

Based on the results of Basic Health Research 2013 mentioned an increase in prevalence in patients with Diabetes Mellitus who obtained the number of patients from the proportion of Diabetes Mellitus 5,7% to 6,8%[2]. Riskesdas reported that people with diabetes mellitus in East Java province as much as 2,1% . Data from Riskesdas East Java, Diabetes Mellitus ranked 6th with 5.8% in rural areas. Based on preliminary study on Kediri districts that have Diabetes Mellitus disease in 2016 as much as 16760 and 2017 until August as much as 2923.

Resiliency is needed by the individual for his ability to survive and rise again so that he can feel happy again after going through unpleasant issues in his life. Resiliency of efficacy is needed by individuals in adapting to the problems of disease to become a better individual in order to manage the disease Diabetes Mellitus. Based on Nuari, management of Diabetes Mellitus is to encourage patients to take greater responsibility for their care, and to perform self-care[3]. Patients suffering from Diabetes Mellitus disease have a great responsibility to regulate their behavior to always control their blood sugar.

Resilience is influenced by many factors. In conducting education to the patient, the nurse must pay attention to the physical and psychological aspects of the patient. Psychological support to these patients is very important in forming self-resiliency in solving problems. The nurse must be able to mediate the patient's condition by balancing the

Corresponding Author: Nian Afrian Nuari, STIKes Karya Husada Kediri, Kediri, Indonesia. Email: nian.afrian@yahoo.co.id

physical condition and psychological condition of the patient[4].

In the management of Diabetes mellitus there are several focus that must be implemented include the treatment, diet, physical activity, and blood glucose examination periodically. This must be done by diabetes mellitus patient during his life. Therefore it is necessary to analyze the resilience of efficacy of patients with diabetes Mellitus has a relationship with adherence in the management of Diabetes mellitus. This research aims to identify factors affecting the resilience of efficacy in Diabetes Mellitus in Kediri.

RESEARCH METHODS

The design this research was explanatory design with cross sectional approach. The population in this study were Diabetes Mellitus Type II patients without complications of diseases such as kidney failure and heart failure. Sample in this research was part patient of Diabetes Mellitus Type II by using purposive sampling with 100 respondents in Kediri. The dependent variables is resilience of efficacy. While the independent variables in this study are gender, education information diabetes mellitus, long suffering diabetes mellitus, medication obedience, dietary adherence and activity adherence. Research instruments for independent and dependent variables using questionnaires. Data collection was conducted at 2017 in Kediri. Data were analyzed with multiple linear regression test ($\alpha = 0.05$).

RESULTS

Table 1. Analysis of Variable

Variable	Characteristic	N	%
Age	30-40	6	6
	41-50	25	25
	51-60	27	27
	60-70	31	31
	>70	11	11
Gender	Male	35	35
	Female	65	65
Long Suffering Diabetes Mellitus	1-3 years	50	50
	3-5 years	23	23
	5-8 years	22	22
	8-11 years	5	5
	➢ 11 years	0	0
Education Information about DM	Ever	44	44
	Never	56	56
Medication Obidience	Obidience	54	54
	Not Obidience	46	46
Dietary Adherence	Adherence	50	50
	Not Adherence	50	50
Activity Adherence	Adherence	52	52
	Not Adherence	48	48
Resiliency of Efficacy	High	51	51
	Low	49	49

Source: data analysis, 2017

Based on the above data obtained that 31 people (31%) of respondents have aged 60 to 70 years, and the majority of respondents Diabetes mellitus has female gender of 65 respondents. Based on the above results obtained long suffered DM at most for 3-5 years. Respondents get information about Diabetes Mellitus disease as much as 44%. For adherence to the treatment of Diabetes mellitus disease as much as 54% have good adherence to treatment.

For adherence to the diet obtained half of respondents to diet according to Diabetes Mellitus patients. Based on the results also obtained as much as 52% have good adherence to management activities. Resiliency of efficacy Diabetes Mellitus Patients obtained 51 respondents have high resiliency.

Table 2. Summary Data Analysis

R	R square	Adjusted R Square	Standard of error	Score Durbin-Watson
.738[a]	.544	.515	.35006	2.067

Table 3. Summary Model Data Annova

Model	Sum of Square	Freedom of Square	Average	F count	Significant value degree
1 Regression	13.594	6	2,266	18.488	.000[b]
Residual	11.396	94	.123		
Total	24.990	100			

Based on the result, dependent variable is resiliency of efficacy. The predictor variable is gender, education information diabetes mellitus, long suffering diabetes mellitus, medication obedience, dietary adherence and activity adherence. Based on Durbin-Watson score can be concluded this research suitable with multiple linear regression model. The data above it can be seen that the significance value of 0.000 is lower than the alpha of 0.05, it can be concluded there are influence in this model.

Table 4. Data Analysis

Model	Significant value
Constant	0.047
Gender	0.016
Education information Diabetes Mellitus	0.000
Long Suffering	0.035
Medication Obidience	0.027
Dietary Adherence	0.018
Actvity Adherence	0.015

The table above shows significance below 0.05 then this gender, education information diabetes mellitus, long suffering diabetes mellitus, medication obedience, dietary adherence and activity adherence have correlation with resiliency of efficacy in Diabetes Mellitus Patients.

DISCUSSION

Analysis Between Age and Resiliency Of Efficacy In Diabetes Mellitus Patients

The majority of Diabetes Mellitus patients are between 60 and 70 years old and 27% have 51 to 60 years of age. This is in accordance with research that Diabetes Mellitus disease suffered by many elderly people. Patients who have Diabetes mellitus have low sensitivity to insulin. With the passage of age can affect the sensitivity of insulin receptors to be less good. However, Nuari's (2015) studied that gender has no relationship to self-empowerment, in contrast to the resilience of efficacy[5].

Analysis Between Gender and Resiliency Of Efficacy In Diabetes Mellitus Patients

Based on the research found that as many as 35 women respondents have a high resiliency of efficacy. This is an important note for nurses who will educate patients need to provide a psychological approach to provide support for better patient resilience. Psychological approach is very important to improve patient confidence so that can adapt in managing the disease[4].

Analysis Between Long Suffering Diabetes Mellitus and Resiliency Of Efficacy In Diabetes Mellitus Patients

Based on the research found that as many as 11 respondents have high resilience of efficacy with the period of Diabetes disease mellitu mellitu for 2 years and 6 years. This suggests that long suffering also contributes to the resilience level of Diabetes Mellitus patients. Long suffering Diabetes can be the benchmark of a person whether

able to adapt to the illness experienced.

Analysis Between Education Information about Diabetes Mellitus and Resiliency Of Efficacy In Diabetes Mellitus Patients

Based on the data of 39 respondents have received educational information about Diabetes mellitus disease. It is supported that the education strategy to Diabetes Mellitus patient can improve patient understanding about the management of the disease[6]. Patients who have a good intellectual ability to understand something will affect the ability of individual acceptance. Understanding of the disease Diabetes mellitus can as mediation in improving the component of resilience[7].

Analysis Between Medication Obedience and Resiliency Of Efficacy In Diabetes Mellitus Patients

Based on this research, it is found that the majority of patients have good adherence to treatment. The results of the study were 37 respondents who had high resilience and had good adherence to treatment. This is in accordance with the intervention done to improve patient resilience resulting in the patient's blood sugar level to be controlled[8]. This is also similar to Park's (2010) study which states that self efficacy of patients with diabetes mellitus also has an effect on adherence to treatment. The higher the self efficacy the more obedient the patient to the management of treatment[9].

The results also found that patients who have good medication adherence also have good knowledge. This is suitable with Omar's study (2014) that patients who have a good cognitive understanding of the treatment of Diabetes Mellitus disease have a high degree of adherence to the treatment of the disease [10].

Analysis Between Dietary Adherence and Resiliency Of Efficacy In Diabetes Mellitus Patients

Based on the data found that as many as 38 patients who have high resiliency have adherence to diet. Diet is important in the management of Diabetes mellitus. Through good diet management able to stabilize the patient's blood sugar levels. Respondents with high resilience of efficacy are able to manage the diet in accordance with the recommended portion. This is in accordance with research Ganiyu (2013) that the cause of diet adherence due to the lack of psychological support so that caused resiliency of patients to be low[11].

Analysis Between Activity Adherence and Resiliency Of Efficacy In Diabetes Mellitus Patients

Based on the data found that as many as 38 patients who have high resiliency have adherence to the implementation of regularly activities. Physical activity done regularly can improve blood sugar control. Patients who have high resiliency will be free from stress so that the desire to perform physical activities for the better. This is in line with Qiu research (2012) that improving self efficacy and psychological support from families can support Diabetes Mellitus patients to perform continuous physical activity[12]. Physical activity is done regularly also can reduce the risk of Diabetes Mellitus disease, so that physical activity can be used as a preventive risk of Diabetes Mellitus disease [13] .

CONCLUSION

The results show that the majority of respondents Diabetes mellitus obtained that respondents have aged 60 to 70 years and has female gender, long suffering Diabetes Mellitus at most for 3-5 years and respondents ever get information about diabetes mellitus disease. For adherence to the medication as much as 54% have good adherence to treatment. While in the management of Diabetes mellitus diet, consider half of respondents to diet according to Diabetes Mellitus and 52% have good adherence to activity management. There are influence of resiliency of efficacy with gender, education information about diabetes, long suffering diabetes mellitus, medication obedience, dietary adherence and activity adherence in Diabetes Mellitus Patients.

REFERENCES

1. American Diabetes Association. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care [Internet]. 2011;34(Supplement_1):S62–9. Available from:

http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3006051&tool=pmcentrez&rendertype=abstract%5Cnhttp://www.ncbi.nlm.nih.gov/pubmed/9118500%0Ahttp://care.diabetesjournals.org/cgi/doi/10.2337/dc11-S062

2. Badan Penelitian dan Pengembangan Kesehatan. Riset Kesehatan Dasar (RISKESDAS) 2013. Lap Nas 2013. 2013;1–384.
3. Nuari NA. Pengembangan Model Peningkatan Pemberdayaan Diri dan Kualitas Hidup Pasien Diabetes Mellitus Tipe 2. J Ners Lentera. 2016;4(2):152–65.
4. Bradshaw BG, Richardson GE, Kulkarni K. Thriving with diabetes: An introduction to the resiliency approach for diabetes educators. Diabetes Educ. 2007;33(4):643–9.
5. Nuari NA. Analisis Korelasi Personal Factor , Perceived Benefit Dan Perceived Barrier Dengan Pemberdayaan Diri Pasien Diabetes Mellitus Tipe Ii Berbasis Teori Health. J Ilmu Kesehat Gaster. 2014;XI(2).
6. Nuari NA. Strategi Manajemen Edukasi Pasien Diabetes Mellitus. 1st ed. Yogyakarta: Penerbit Deepublish; 2017. 178-181 p.
7. Perfect MM, Jaramillo E. Relations between resiliency, diabetes-related quality of life, and disease markers to school-related outcomes in adolescents with diabetes. Sch Psychol Q. 2012;27(1):29–40.
8. Pesantes MA, Lazo-Porras M, Abu Dabrh AM, Ávila-Ramírez JR, Caycho M, Villamonte GY, et al. Resilience in Vulnerable Populations With Type 2 Diabetes Mellitus and Hypertension: A Systematic Review and Meta-analysis. Can J Cardiol. 2015;31(9):1180–8. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26239007
9. Park K-A, Kim J-G, Kim B-W, Kam S, Kim K-Y, Ha S-W, et al. Factors that Affect Medication Adherence in Elderly Patients with Diabetes Mellitus. Korean Diabetes J [Internet]. 2010;34(1):55. Available from: https://synapse.koreamed.org/DOIx.php?id=10.4093/kdj.2010.34.1.55
10. Omar MS, San KLAI. Diabetes knowledge and medication adherence among geriatric patient with type 2 diabetes mellitus. Int J Pharm Pharm Sci. 2014;6(3):4–7.
11. Ganiyu AB, Mabuza LH, Malete NH, Govender I, Ogunbanjo GA. Non-adherence to diet and exercise recommendations amongst patients with type 2 diabetes mellitus attending extension II clinic in Botswana. African J Prim Heal Care Fam Med. 2013;5(1).
12. Qiu S-H, Sun Z-L, Cai X, Liu L, Yang B. Improving patients' adherence to physical activity in diabetes mellitus: a review. Diabetes Metab J [Internet]. 2012;36(1):1–5. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3283821&tool=pmcentrez&rendertype=abstract
13. Gill JMR, Cooper AR. Physical activity and prevention of type 2 diabetes mellitus. Sports Med. 2008;38(10):807–24. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18803434

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An Investigation of the Psychological and Institutional Factors Impeding Individuals Becoming Business Entrepreneurs: Evidence from Public Sector Universities of Province Punjab, Pakistan

Muhammad Imran Siddique[1], Dr. Babak Mahmood[2], Muhammad Shahzad Iqbal[3], Muhammad Tayyeb Riaz[4]

[1]Lecturer, Preston University Faisalabad
[2]Associate Professor, Department of Sociology, GC University Faisalabad, Pakistan
[3]Assistant Professor, School of Management Studies, the University of Faisalabad, Faisalabad. Pakistan
[4]Assistant Professor, School of Management Studies, the University of Faisalabad, Faisalabad. Pakistan.

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ABSTRACT

This study was conducted in order to investigate if psychological and institutional factors have any impact on individual's decision to become business entrepreneurs. Some 288 business education students were taken as sample by using simple random sampling from public sector universities operating in Punjab. A well structured questionnaire comprising 30 questions was used to collect the data. Multiple linear regression analysis was then applied to find the impact of psychological and institutional factors on student's decisions about entrepreneurship. Results revealed that institutional factors have more impact than psychological factors on student's decision to become business entrepreneurs. Given the significance of entrepreneurship necessary measures have been suggested.
KEY WORDS: psychology, sociology, entrepreneurs, evasion, barriers, university students, Punjab, Pakistan.

INTRODUCTION

Since the inception of this century, serious devotion has been given to entrepreneurship due to its ability to create employment, boost economic growth and incite innovation and productivity [1]. Entrepreneurship is widely known to be the major catalyst for the economic growth of a country [2]. Most researchers including [3] and [4] have supported the claim that entrepreneurial endeavors contribute to job creation, economic growth and competitiveness of the country.

In province Punjab, out of total 101.4 million population, 62% belongs to working class which accounts for 63 million people in which only 3.7% population is self employed. It means only every 26th person is self employed (Institute Of Policy Reforms, 2016). It is also seen that recent trends of entrepreneurship have not been very much favorable for Pakistan. Knowing the fact that entrepreneurship have driven an upsurge in prosperity in several parts of the developing world, the Pakistani economy remained stuck at low gear. In 2015, country was ranking at 123 on the Global Entrepreneurship Index (GEI) among 130 countries of the planet [35]. Country continued dropping down and in 2016, it was ranked 138 out of 189 countries on the index of world bank's doing business rankings [6]. Report revealed by [7] claimed that country's GEDI score was 20.1 ranking at bottom positions, needs 17% improvement in 'entrepreneurial efforts' and 3% 'cultural support'. This report says that the main hindrance in the country for nurturing entrepreneurial activities is bureaucratic red tape. Country is along with factor driven countries like Bangladesh and Uganda and is still in its nascent stages [5].

In order to promote entrepreneurship, both at government as well as at private level, several efforts have been made in last ten years. Currently, *APNA ROZGAR* Scheme and *Interest Free Loan* for TEVTA skilled students are being offered through Skill Development Council and TEVTA. In addition to this government funds are also being distributed through well performing entrepreneurship development private organizations such as 'AKHUWAT'. Currently, there are over 60 private institutions and NGOs working for the development of entrepreneurship in Punjab. The biggest incubator *plan9;* a product of Punjab Information Technology Board (PITB) has graduated 102 new companies. Since 2014, Lahore University of Management Science (LUMS) has been hosting a prominent business incubator 'Center for Entrepreneurship' and has graduated 42 new startups successfully. Moreover,

Corresponding Author: Muhammad Imran Siddique, Associate Professor, Department of Sociology, GC University Faisalabad, Pakistan. Email: babakmahmood@gmail.com.

corporations working in Pakistan have showed keen interest in contributing their role for promoting entrepreneurship. Telenor introduced 'Velocity', Mobilink is going to support new 'National Incubation Center', Engro foods, Coca Cola and Unilever have also projects to support new startups in country [6].

LITERATURE REVIEW

PSYCHOLOGY AND ENTREPRENEURSHIP INTENTIONS

Researchers have no an identical definition about individual's entrepreneurship intension. However, in this paper the definition of [8] has been adopted; it is a mental orientation in the shape of desire, wish and hope which influences an individual in her choice of entrepreneurship.

Several studies have been conducted on how various elements of personality and psychology have impacted on individual's desire to take a start up. It is seen that more a person is creative, more he is exposed as entrepreneur. However, it is not a final condition, as many innovative minds do not take risk in their life and thus use their creative skills for the businesses of others. A study conducted at CIPUTRA university, Indonesia by [9] checked three characteristics of students; intelligence, creativity, and personality and their relationship with their entrepreneurship achievement in their life. This cross sectional study used Minnesota Multiphase Personality Inventory Test, Culture Free Intelligence Test and Verbal and Figural Creativity Test. Study disclosed that there was no significant relationship between creativity and entrepreneurship achievement (EA) as well as between intelligence (IQ) and entrepreneurship achievement. However, the relationship between (EA) and personality had been significant. This work however, did not consider the size and nature of businesses where psychology impacts significantly.

[10] mentioned that there is no area in which the interface between psychology and business becomes more obvious than small scale entrepreneurship. This work largely gives importance to small and medium sized businesses for promoting entrepreneurship. According to this study, one of the hurdles of starting a business is the individual's strong desire to work for a large organization.

A very recent study conducted by [11] revealed that among psychological barriers; risk aversion and fear of failure are the most impacting hindrances in Pakistan. [12] resulted after an exploratory research conducted at Romania that some psychological factors such as achievement motivation, independence and internal locus of control have significant impact on individual's decision to become entrepreneurs.

[13] emphasized the need for preparing students of universities by using psychology. He argued that having confidence is highly inevitable in order to effectively handle and accomplish a particular task. This confidence is actually 'self-efficacy' and 'can do attitude' (Bandura, 1997).

A study conducted by [14] of 'YES network Pakistan' also proved that the dominant factors are 'fear of failure' and 'lack of experience' which impede individuals to become business entrepreneurs. This is not simply a literary work but 'an applied experiment' in which over 1000 students were given Rs. 2500 each. The study confirmed that the subject of entrepreneurship should be more practical. The students should be assigned different tasks to do business and face the challenges of real world. The findings of [15] have also evidenced that locus of control, self efficacy [16], subjective norms and instrumental readiness have positive impact on entrepreneurship inclination.

In a study conducted in Poland, [17] reported that individual's predictive value of beliefs regarding one's problem solving skills; strong will and their persistency have positive influence on entrepreneurial spirit. [18] reported a positive impact of independence of work on entrepreneurial attitude. [19] reported that in Pakistan among other notable barriers, fear of failure was a significant element restraining people becoming entrepreneurs. Interestingly, the fear of failure percentage in Pakistan had been lesser than those of factor driven countries. This was also endorsed by [36] [20] who proved in a university study that dominant factors impeding students towards entrepreneurship had been psychological; internal locus of control, self efficacy and fear of failure.

While reporting the findings of nine universities of Xi'an China, [8] suggested that student's risk propensity and self confidence have significantly positive impact on student's self efficacy which in turn leads to entrepreneurship intension. The same findings were emphasized in the study conducted at Turkish and American students by [21] claiming that optimism, innovativeness and risk bearing attitude have significantly positive impact on entrepreneurial intension. [22] proved that psychological factors such as need for achievement, self confidence and

personal attitude have significant while tolerance of ambiguity, risk taking attitude, locus of control and innovativeness have insignificant impact on entrepreneurial intention.

A recent study conducted at Malaysia by [23] revealed that personal attitude, perceived relational support and perceived behavioral control were the major predictor to entrepreneurial intention among undergraduate students.
Hypothesis 1: Psychological factors have positive impact on entrepreneurial evasion

UNIVERSITY EDUCATION AND ENTREPRENEURSHIP INCLINATION

A study conducted by [24] resulted that the university's role to promote entrepreneurship has been significant in shaping students mind towards entrepreneurship. Similarly, what they learn through subjects; their curriculum and content also affect on student's inclination towards or avoidance from entrepreneurship. Interestingly, what normally considered that father's occupation strongly influence individuals decision towards own business has been denied in this study, instead, their working experience, gender, and program of study affected most on their predilection towards own business. Study further revealed that internship programs, independent learning approach, image and role model also have lesser impact in their decision to become business entrepreneurs.

Another useful work performed by [25] claiming that the strongest factor impacting on willingness towards entrepreneurship of students of non business subjects at president university Indonesia is their 'own desires' based on their psychological condition followed by content of education and family background. This study was distinguishing from earlier works in a sense that it proved very little impact of family traditions and values. Azad Ivan University claimed that major factors affecting entrepreneurship of women in Iran were financial, social, educational, governmental, scientific and psychological. This is an interesting study which confirms the findings of [26] and [27]. [28] claim that there has been a significant growth witnessed in the studies of entrepreneurship education in institutions.

[29] say that the number of courses on entrepreneurship have gone to tenfold in USA between the period of 1979 and 2001 while this figure further has been tripled until 2014. As number of courses and number of learners of entrepreneurship increasing, the number of entrepreneurs must be increased proportionally. However, there has been contradiction among researcher on the stance if entrepreneurship education strengthens entrepreneurship culture or not. Generally, it is confirmed that entrepreneurship education has positive impact on entrepreneurship [30].

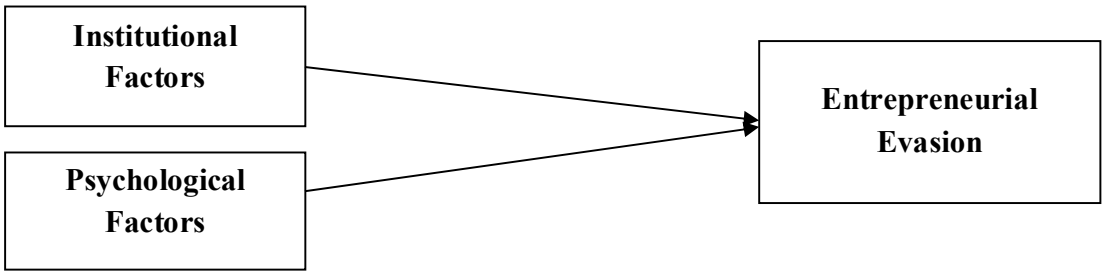
Under the supervision of World Bank Research Group an important study was conducted in Pakistani rural areas by [31] which reported that human capital, if sharpen through training and development, significantly increases the business knowledge, improves business practices and reduces failure rate. It further claimed that such trainings improve financial and labor allocation decisions, thus are very helpful in entrepreneurship adaptation and their successes.

[32] mentioned that poor training and personal interests have significant impact on student's decision regarding entrepreneurship in Pakistan. [15] also claimed that university role and parental income are the most decisive elements for entrepreneurship choices.

Hypothesis 2: Institutional factors have positive impact on entrepreneurial evasion.

CONCEPTUAL FRAMEWORK

Keeping in view, all the discussion on previous sections, the following model can be constructed;



Source: Author's own contribution

METHODOLOGY

The data was collected through self administered questionnaire. The respondents were approached physically and also through online. The sample consisted of 305 business students who were studying in their last semesters. Only 283 students responded resulting in 93% response rate. The dependent and independent instrumentation were partially adopted from previous studies such as [33], [11], [15], [32], [24], [34]) and [16], however, words and sentences were changed to enhance understanding in Pakistani context. All responses were measured using five point likert scale, ranging from '1' as 'strongly disagree' to '5' as 'strongly agree'.

DATA COLLECTION METHODOLOGY AND CHARACTERISTICS OF SAMPLE

The data was collected from the business students of last semesters at masters' level from 14 public sector universities of the province Punjab. Majority of the students were male, 75.3% or 217 students. Over 70% students were aged 23 or 24 years which totals to 198 students. 68% (197) students originally belonged to cities, 22% (63) belonged to towns and only 10% (28) students were from villages.

THE RESULTS AND ANALYSIS OF DATA

The data were analyzed using *multiple linear regressions.* The analysis and interpretation of this model was a two stage process. First is the assessment of the reliability and validity of the measurement scale and the second is the assessment of the statistical model to test the hypotheses under study. These assessments are being presented in next sub sections.

ASSESSMENT OF THE MEASUREMENT MODEL

In order to ensure if the measurement scale is reliable, internal consistency and indicator reliability check were performed. The results of internal consistency are above the threshold value which is 0.6. it ranges from 0.619 to 0.937 which shows that the used items are satisfactory reliable with internally consistency. In order to check the convergent validity, the most popular method *Average Variance Extracted* was used. The results show that all constructs have AVE ranging from 0.678 to 0.819, demonstrating fair convergent validity. Similarly, Discriminant validity which shows the extent to which one construct differs from the other; was checked by using Fornell Larcker's criterion. It was found that AVE of each of the latent variable has been higher than the highest squared correlation with other latent constructs. Based on this, Fornell Larcker's criterion was met.

ASSESSMENT OF THE STATISTICAL MODEL

The value of multiple correlation coefficient is represented by R in table 2. The value of 'R' is considered to be the prediction quality of dependent variable which is entrepreneurial evasion in this case. The value in this case is 0.580, which indicates reasonable good level of fitness of predictor. The coefficient of determination is shown with 'R^2' in table 2 which shows the variation in dependent variable due to independent variable. It is also called the fitness of model. The closer the value of 'R^2' to the 1, the greater is the level of confidence of prediction. Although the vale of 'R^2' is 0.336 which means it only explains the variation by 36% but in primary data, the value of 'R^2' is normally low. So, the results of the study are significant enough to be accepted.

Adjusted R2 is generally closer to the R2. It explains how the model generalizes. In this model, it is closer to R2 i.e. 0.331 which explains good value.

The *F*-ratio in the ANOVA table (see below) tests whether the overall regression model is a good fit for the data. The table shows that the independent variables statistically significantly predict the dependent variable, Here these are $F(2, 285)= 72.133$, $p< 0.0005$ (i.e. the regression model is a good fit for data).

Table 1: ANOVA Table

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	51.302	2	25.651	72.133	.000[b]
	Residual	101.348	285	.356		
	Total	152.650	287			
a. Dependent Variable: Entrepreneurial evasion						
b. Predictors: (Constant), Institutional and Psychological						

It is also seen from the table below that institutional factors (β= 0.442, p < o.o1) is the most significant predictor of the entrepreneurial evasion among chosen students, followed by psychological factors (β = 0.346, p < 0.01).

Table 2: Regression Analysis

Hypothesis	Relationship	Beta (β)	Significance	Supported
H1	Psychological factors and entrepreneurial evasion	.346	0.02	Yes
H2	Institutional factors and entrepreneurial evasion	.442	0.01	Yes
R= 0.580 and R2= 0.336				

DISCUSSION AND CONCLUSION

The implementation of this study was to verify if psychological and institutional factors hinder on student's intension towards entrepreneurship adaptation.. Knowing the vital importance of entrepreneurship for the economic and social growth of any country, this study was conducted so that student's concerns regarding adoption of 'own businesses' could be examined. The study found that both hypotheses formulated have significant impact on entrepreneurial evasion. Thus it is suggested that psychological and institutional issues need to be addressed in order to convince students towards entrepreneurship. In terms of psychological factors, this study has similar findings to the study conducted by [11], [12] and [20]. Similarly, the works of [15] and [32] are consistent with this study and showed positive significant impact of institutional role to develop entrepreneurial spirit in students.

The key contribution of this research is the acquiring of empirical evidence of the factors affecting student's evasion from entrepreneurship. The chosen individuals were nascent entrepreneurs and it was very important to understand their very needs, concerns and viewpoints regarding entrepreneurship.

The implication of this work to policy makers and educationist is, in addition to offer effective entrepreneurship developing opportunities in institutions, universities must consider other factors also in order to develop entrepreneurial attitude and motivation in students. These might be developing specialist courses of entrepreneurship, hiring of mentors, establishment of incubation centers, career counseling cells, more effective internship programs and creating in-large a healthy entrepreneurship culture in the business student's overall learning environment.

REFERENCES

[1]. Urbano, D. and Aparicio, S. (2015). Entrepreneurship capital types and economic growth: international evidence, *Social Science Research Networks*, 102(8), 34-44.

[2]. Mat, S.C., Maat, S.M. and Mohd, N. (2015). Identifying factors that affecting the Entrepreneurial intension among engineering technology students. *Social and Behavioral Sciences*, 25(8). Pp. 1016-1022.

[3]. Thurik, A. R. and Wennekers, A. (2004). Entrepreneurship, small business and economic growth, *Journal of Small Business and Enterprise Development*. 11(1).140-149.

[4]. Zelealem, T. (2004). A decision tree approach for integrating small business assistance schemes, *Journal of Management Development*, 23(6). Pp. 563-378.

[5]. Iqbal et. al. (2017). Economic Impact of Energy Crisis on the Textile Sector: A Case Study of Pakistan Journal of Applied Environmental and Biological Sciences 7(9): 39-46

[6]. Dodhy, M. (2016). *Here's what the Pakistan entrepreneurship ecosystem report 2016 revealed*. Retrieved from https://www.techjuice.pk/heres-what-the-pakistan-entrepreneurship-ecosystem-report-2016-revealed/.

[7]. Entrepreneurship in Pakistan (2016, 17 May), *Weekly Technology Times*, Retrieved from http://technologytimes.pk/post.php?title=Entrepreneurship+in+Pakistan++still+at+nascent+stages%3A+GEI

[8]. Peng, et al. (2012). Entrepreneurial intentions and its influencing factors: a survey of university students in Xi'an china. *Scientific Research*, 3(5). Pp. 95-100.

[9]. Antonio, T. et al. (2014). Correlation creativity, intelligence, personality and entrepreneurship achievement. *Procedia-Social and Behavioral sciences*. 115(7). Pp. 251-257.

[10]. Frese, M. and Rauch, A. (2000). Psychological approaches to entrepreneurship success. *International Review Of Individuals And Organizational Psychology*. 13(3). Pp. 101-142.

[11]. Ali, I. & Ajmal, A. Iqbal, M. (2016). Impact of psychological barriers on entrepreneurial inclination of business graduated in Pakistan. *Science Institute Review*, 28(1). Pp. 683-687. Retrieved from http://webcache.googleusercontent.com/search?q=cache:szOBLgzxJUsJ

[12]. Luca, M.R., Cazan, A. and Tomulescu, D. (2012). To be or not to be an entrepreneur. *Elsevier*, 13(7). 173-177. Malaysian university students. *International Journal of Business and Social Science*, 2(4), pp. 213-215.

[13]. Setiawan, J.L. (2012). Examining entrepreneurial self-efficacy among students. *Procedia-Social and Behavioral Sciences*, 115(23). Pp.235-242.

[14]. Raza, A.K. (2015, October 9). The entrepreneurial spirit of the marginalized youth of Pakistan. Retrieved from http://yesnetworkpakistan.org/2015/10/09/the-entrepreneurial-spirit-of-the-marginalized-youth-of-pakistan/.

[15]. Ali, A., Topping, K.j. & Tariq, R.H. (2013). Entrepreneurial attitudes among potential entrepreneurs. *Pakistan Journal of Commerce and Social Science*. 5(1). Pp. 12-46.

[16]. Turker, D. & Selcuk, S.S. (2008) Which factors affect entrepreneurial intentions of university students? *Journal of European Industrial Training*, 33 (2), pp. 142-159. Doi.org/10.1108/03090590910939049.

[17]. Awruk, K. & Staniewski, M. (2016). Start-up intentions of potential entrepreneurs- the contributing of hope and success. *Routledge*, 6(5). 87.

[18]. Jan,S., Arshad, M. and Nadeem,A. (2013). Determinants of the success factors for entrepreneurship business. *International Review Of Basic and Applied Sciences*, 1(7). P. 156.

[19]. Alam, K. (2011, December 25). Global Entrepreneurship Monitor: Pakistanis less enthusiastic about entrepreneurship. *The Express Tribune*, retrieved from https://tribune.com.pk/story/311603/global-entrepreneurship-monitor-pakistanis-less-enthusiastic-about-entrepreneurship/

[20]. Ahmed, I., Ramzan, M., & Usman, M. (2010). Impact of personality traits on entrepreneurial intentions of university students. *Journal of Independent Studies And Research*, 15(7), 89-93.

[21]. Ozaralli, N. & Rivenburgh, N.K. (2016). Entrepreneurial intention: antecedents to entrepreneurial behavior in the U.S.A and Turkey. *Journal of Global Entrepreneurship Research*. 6(3). Pp. 65-68. Doi: 10.1186/s40497-016-0047-x

[22]. Ferreira, J.J. et al. (2013). A model of entrepreneurial intension: an application of the psychological and behavioral approaches. *Journal of Small Business and Enterprise Development*. 8(3). Pp. 76-79.

[23]. Ambad, S.N., & Damit, D.H. (2016). Determinants of entrepreneurial intention among undergraduate students in Malaysia. *Economics and Science Review*, 37(6), 108-114.

[24]. Keat, O.Y., Selbarajah, C. & Meyer, D.(2011). Inclination towards entrepreneurship among university students: an empirical study of Kilby, P. (1971). Hunting the heffalump. In E*ntrepreneurship and Economic Development*. New York: The Free Press. 27-35.

[25]. Kumar, S., Vifenda, A.T., & Valerie, M.B. (2013). Student's willingness to become an entrepreneur: a survey of non-business students of president university, *Journal of Business and Management*, 15(2), 94-102.

[26]. Hasani, Z. (2013). Factors affecting the level of female employment in Iran, *Technical Journal of Engineering and Applied Science*, 14(3), 1424-1431.

[27]. Mirghafori, S., Sayadi, T., Taheri, H.(2009). Explanation and analysis of barriers affecting women's entrepreneurship: case study: Yazd Province. *Evaluation Management Research Letters*, No. 2.

[28]. Mately, H., & Carey, C. (2007). Entrepreneurship education in the UK: a longitudinal perspective. *Journal of Small Businesses and Enterprise Development*, 14(2), 252-264.

[29]. Katz, J. (2003). The chronology and intellectual trajectory of American entrepreneurship education*: Journal of Business Venturing, 18(2).pp. 283-300.*

[30]. Robinson and Sexton (1994). The effect of education and experience on self employment success. *Journal of Business Venturing*, 9(2). 141-156.

[31]. Mansuri, G and Gin'e, X. (2014). Money or ideas? A field experiment on constraints to enter in rural Pakistan. Policy research working paper, the World Bank department research group, WP no. 6959. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2461015

[32]. Azhar, A. et al. (2013). Entrepreneurial intensions among business students in Pakistan. *Journal of Business Systems, Governance and Ethics*, 5(1). 45-51. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1875081

[33]. Boso, N., Vicky, V.M., & Cadogan, J.W. (2013). Entrepreneurial orientation, market orientation, network ties, and performance: Study of entrepreneurial firms in a developing economy. *Journal of Business Venturing*. 28(7). 708-727.

[34]. Mahmood et.al. (2017). Textile Industry Socializing, Economic Gains and Capital Structure: A Case Study of Faisalabad, Pakistan. Journal of Applied Environmental and Biological Sciences 7(9): 39-46

[35]. Sir Lanka debuts (2015, November 24), *Daily FT, Retrieved from http://www.ft.lk/2014/11/24/sri-lanka-debuts-in-global-entrepreneurship-index-at-71/*

[36]. Khan, N., & Niaz M., (2017). Learning Environment Facilitations in Public and Private Universities for Science Students in Khyberpakhtunkhwa, Pakistan. of Applied Environmental and Biological Sciences 7(9)17-21

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Credit Risk, Liquidity Risk and Stock Return, (Evidence from Pakistan Stock Exchange)

Muhammad Nisar Khan[1], Arshad Alam[2], Syed Arshad Ali Shah[3], Muhammad Ilyas[4], Mohammad Daud Ali[5]

[1,3]Lecturer (Finance), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan
[2]MBA (Scholar), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan
[4]Lecturer (Finance), Institute of Business Studies and Leadership, Abdul Wali Khan University, Mardan
[5]Lecturer (Management Sciences), University of Haripur

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ABSTRACT

This research's work done to examine the financial risks (Credit Risk, Liquidity Risk) effects on companies' stock returns listed from Pakistan stock Exchange. There are narrow number of research studies passed out in the field of financial risks. The purpose of this study is to spread the work of Mehri Akhavi Babi (2015) and Mehri Akhavi Babi including the latest data, appropriate models, including panel data. There are two independent variables (Credit Risk and Liquidity Risk) and one dependent variable (Stock Returns) and one control variable (Company Size). This paper includes 50 non-financial companies listed in PSX-100 index for the period of 2010 to 2015. This study demonstrates the relationship among credit risk, liquidity risk, size and stock returns of the company. The results show that that Credit risk has significant but negative relationship with stock return of company, Liquidity risk has significant positive relationship with stock return of company and Size has positive and significant relationship with stock return of company.
KEY WORD: Credit Risk, Liquidity Risk, Size, Stock Returns

INTRODUCTION

For the profit and wealth maximization, the investment decision-making is almost certainly the utmost vital part of the investment, which required to investors. Consequently, for the decision-making process, the collection of information is a necessary and important feature. This information's are collected from many sources such as security market, company's annual reports and news etc. The utmost significant information source is the financial reporting, which deliver information for assisting decision-making process. Information is moreover measured as a planned tool in decision-making, and the superiority of decisions depend on the precision and suitability of the information accessible throughout decision-making process. (Mirnejad, Valipour& Alame-Haeri, 2013).
Raei and Saeidi, (2010) investigate to study the financial risk management, financial engineering. They study the concept of risk and returns that risk has vast importance in finance. All the investors wish to get greater return on their investment. The two-foremost principle of the investment-decision is risk& returnand the greater return, as per the lowest risk is a significant condition. Therefore, risk is a concept which claims that finance contributors ask about risk level of securities which they face in the market. Risk is a crucial condition for investment. Lastly, a certain share should be purchased after general analysis of the circumstances. The financial risks have straight effect on the earnings of businesses and could be prime of their disappointment.
Harry Markowitz,(1958) bring a solution, was CAPM. They investigate the stock returns and risks relationship. Black (1972), Sharp and Linter (1964) used a model to calculate risk-free rate and risk premium. They scale the stocks sensitivity by Beta factor, when financial crises cover all over the world in 1980's and 1990's.The new risk management techniques arose to control all type of risks and logically one risk manage another one. The risk is very appropriate for financial and non-financial organization are; (market, interest rate, liquidity, credit, foreign exchange and solvency risks). Risk recognition is an action of risk management which evaluate the risk and explanation of risk. In this research report, they examine on three types of risk that mostly faced such as credit risk, liquidity risk and solvency risk.
The rationality of the relationship between earnings and returns was first presented by Ball and Brown in 1968 in an article titled as "An empirical evaluation of accounting income numbers" and their null hypothesis stated that

***Corresponding Author:** Muhammad Nisar Khan, Lecturer (Finance), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan. Email: nisarmgnt@bkuc.edu.pk

accounting income numbers were not beneficial for stock exchange investors. Therefore, their research hypothesis appealed that these numbers were suitable for investors. The findings of their study resulted in the rejection of the null hypothesis and it showed that a general review of the stock prices, after the distribution of income reports verified that the information contained in the annual income number, was beneficial and the direction of changes in reported accounting income, had positive correlation with the changes in stock prices in comparison to the previous year. They also concluded that the information presented in capital market was beneficial on condition that it suggested investors' reactions to bring up changes in stock prices or in the volume of stock exchanges (Ball & Brown, 1968).

Shabahang, (2003) believes that the main pattern of earnings and returns is a hypothesis based on which the capital market achieves efficiency in comparison to the related information which is available to the public. He also claims that the hypothesis of efficient market refers to the reaction rate of the securities of capital market compared to the distribution of new information. Therefore, the definition of the efficiency of market consists of the fact that the capital market reflects the available information thoroughly and the market prices show immediate reaction to the new information; that is, the new information has immediate effect on the securities price.

There are basic principles in investment which stated that the capital loses through risk and pursued toward earning and returns. The result shows that the investors who take risk and impede the investment in business, that is risky and unsafe their return. Every investment is involving in risk.

Teimouri and Abzari, Samadi, (2008) claimed that risk and fear of loss in all business. But high and low level of risk depend on investment. Thus, investor imagine enough earnings based on invested capital.

Raei and Saeidi, (2010) reported that the earnings directly affected by financial-risk of the companies and what they are lending from the financial institution. Therefore, seeing that vital role of risks in investment, and this study was an attempt to inspect that two types of risks, liquidity and credit risks can affect the relationship of return and earning.

Unsystematic-risk factors (credit risk and liquidity risk) are the most vital component from past several years. The earlier researches exhibit that, its effect companies' stock return. The problem of this study was that the work done on unsystematic-risk factors were too much low in the context of Pakistan and there were no but little work has been done to identify the accurate effect of unsystematic-risk factors on companies' stock return. Different researchers worked on effect of financial-risk factors (systematic risk, unsystematic risks) on stock return but they used most of systematic-risk factors or both systematic and unsystematic risk factors mixed in researches. So, this study used only one side of financial-risk factors, was unsystematic risks: including credit risk and liquidity risk. This research main objectives, to determine the effect of financial risks such as Liquidity and credit risks on stock returns. To investigate the Credit risk and Liquidity risk effect on stock returns.

LITERATURE REVIEW

Hyoung Goo Kang and ChoongOh Kang, (2009) investigated the Credit risk's effect on stock return. They collected the data from Korea Composite Stock Price Index (KOSPI) covering period from 1995 to 2007. Crossing the Asian Financial Crisis in 1997-1999, Dot-com Bust in 2002 and Credit Card Crisis in 2002-2003 in Korea. They concepted a systematic risk factors in relation to credit risk by means of the credit blowouts of individual firms resulted from the Merton (1974) model. The credit factor captures a systematic risk from Korean SM.

Empirical tests and the Korean stock market show the credit risk factor exhibits meaningfully positive premiums even after controlling by Fama and French three factor.

Nasrin Moradi and Mohammad Mohebbi, (2015) researched on the relationship between the liquidity risk and stock return. Sample size, 6 oil companies were taken. That were active in 2011 to 2013 in Tehran stock exchange. Fama and French model was used to investigate the relationship among dependent and independent variable. Statistical analyses were done based on multi-choice regression and data was monthly and panel. The results show that the size of company doesn't significant effect on oil companies stock return, as result from investor point of view but book value to market value, market risk premium and liquidity risk has significant effect on stock return of oil companies, Tehran stock exchange that represents the importance of these variables in studied companies stock return.

Sadia Iqbal, (2015) investigated in her study that ROE and CCR have a significant& negative affect while the ROA and Current Ratio have positive& significant result on liquidity.

ROA and Current Ratio have positive affect on liquidity to the upward but ROE and CAR have negative affect on liquidity to the downward.

If the ROE and CAR Rises the risk of liquidity will decrease. If the ROA & Current Ratio increases the risk of Liquidity will increase.

Nasir Akram, (2014) they put Ask-bid-spread for variable proxies to investigate the risk of liquidity. Information has been gathered from ten companies registered on KSE Pakistan from 2005-2012.
For the information investigation, what they collect use two phase regressions. And among the liquidity and returns the results show a negative implication.
Mehri Akhavi Babi, (2015)they investigated the financial risk, earnings per share and stock returns (TSE Iran). 65 companies were selected, 2008 to 2013. The linear and multiple regressions were used to test the hypotheses. The consequences show that the EPS has a positive effect & significant effect on return. Furthermore, the consequences show that the solvency & credit risks were inverse & significant effect on EPS & stock returns. But the liquidity relation was insignificant.
Florian Steiger, (2010) They examined the prospect of applying derivative risk payments to describe return. There are several kinds of risk appear in the market because of fast developing derivatives market by trading, such as interest rate, credit and many more.
Trilochan Tripathy and Eshan Ahluwalia, (2015) Explained that the uncertainty and expectation are very interesting things in the market event to build it. They Examine the relationship among liquidity and equity return in financial system and day long effect of liquidity & Equity Return in the Day During Government budget notice. They used the OLS & ARDL Models. They revealed the route and magnitude of relationship among varies liquidity proxies & daily stock return in Indian stock market. The study shows that the returns have significant active relation with liquidity scales. More that the effect of liquidity on return is relative prominent in the date of budget speech than the date of post budget notice. The study reveals that the absolute spread test as a liquidity test, plays a vital role in ruling a day long equilibrium motion of daily stock returns in Indian market.
Sirine Chekilil and Nadia Abaoub, (2013) This study published to show the presence of the liquidity premium paid. Data has been collected from Tunisian stock Exchange and Twenty listed securities has been taken as sample size. The period of the sample size is twenty-four mounts from January 2003 to December 2004. The Martinez Nieto, Rubio and Tapia 2005 model has been used to examine the relationship among liquidity premium and stock returns. we decided that the Bid-ask spread is a scale of liquidity in the Tunisian market but the rotating ratio is a scale of liquidity. The recent scale of Amihud (2002), is a worthless tool to scale the Tunisian market and liquidity premium isn't distribute the month of January.
Cheng Fan Fah and Annuar Nasir, (2011) This study find the effect of financial, market and price risks on the ERC (Earning Response Coefficients) for Commercial Banks in china. They use the collective abnormal returns (dependent) and the unexpected earning (independent) variables. It shows that: i) Have a solid relation of Returns-to-Earnings with banks; ii) The liquidity risk has information content in the Returns-to-Earnings relation.
Isaac Mwaurah, Willy Muturi and Anthony Waititu, (2017) This study investigates the inspiration of financial risk on stock returns. Annual data of 9 banks listed from 2006 to 2015 has been used. Stock returns (dependent) and credit, market, liquidity plus capital risks (independent) and bank size (control and moderator) variables were taken. They assumed a multivariate least square regression modeling and absorbed two-dimension regression. i) Individual impact of financial risk on Stock Returns. ii) collective multivariate impact of financial Risk on Stock Returns. Individual regression of credit, market, liquidity plus capital risks show a statistical significant positive relationship with Stock Returns. Collective multiple (GLS) regression of financial risk with a control variable specified financial risk is negatively - significant on Stock Returns and bank size had a positive significant effect on stock returns. Moderating effect of bank size on the influence of financial risk on stock returns was found positively significant.
Shaun A. Bond and Qingqing Chang, (2013) they find the effect of innovations in liquidity on stock-return. Study find a positive low liquidity shock for business which have positive cash flow and expected-return news. The correlation among liquidity proxies and stock returns, rise from the association of liquidity proxies with the 3 stock return components. Regression of returns on liquidity proxies may minimize or maximize the importance of liquidity with stock-return variance. At the end, liquidity proxies tend to explain stock returns better in negative market liquidity shocks.
Mahdi Salehi, Ghodratallah Talebnia and Behzad Ghorbani, (2011) Current study investigate the relationship between stock returns and liquidity ability in companies, listed in Tehran Stock Exchange. Monthly data for the years 2002 - 2009 has been used. The study results indicate that there is a negative correlation between stock returns and liquidity. The outcomes ofcurrent study support negative relationship presumption between stock returns and its liquidity ability.
Waqas Bin Khidmat and Mobeen Ur Rehman (2014) Ten listed chemical companies of Pakistan has been selected and 9 years data ofthese companies from (2001-2009) has been used. Solvency ratio has negative and significant impact on the (ROA) and (ROE). Its show that the (DTE) ratio goes up then firm performance goes down. It is also concluded that the liquidity has high positive effect over Return on Assets of sector. Stakeholders also interested in solvency ratios of companies. Suppliers check the solvency position of the companies before delivering the goods.

The investors are interested in solvency position to know how much the company is risky. Liquidity, solvency and profitability are closely related because, if one of them increases the other one decreases.

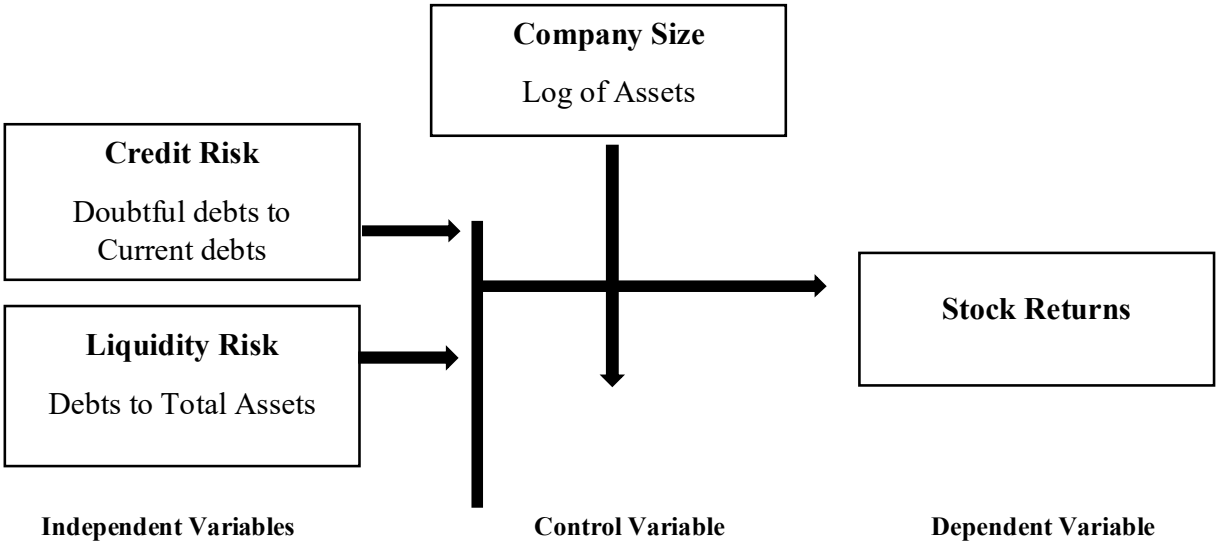
Research Hypotheses

The current research based on the following hypotheses:

- H_1: There is a significant effect of credit risk on stock returns.
- H_1: There is a significant effect of liquidity risk on stock returns.

Conceptual Framework

A conceptual framework busy in the study discusses the basis that influence of financial risk on stock returns. The dependent variable in the study includes company's stock returns while independent variables credit risk and liquidity risk. The study involved a control/moderator variable of company "size".



Credit Risk

In this study credit risk was measured using the ratio of Doubtful Debts to Current Debts. This measure conforms to following empirical study of (Mehri Akhavi Babi, 2015).

Liquidity Risk

Saleh (2014) defined liquidity risk as the inadequacy of the liability side of the company that restraints demand deposit and possibly triggers system fragility and company runs. It is the uncertainty that arise when a security cannot be liquidated in a market to avert a financial loss. This study adopted funding liquidity risk as a measure by the ratio of Debts to Total assets (Mehri Akhavi Babi, 2015).

Company Size

Berger and Brouwman (2011) determined that company size can be used as a control variable measured as a log of asset base. They described that company size is positively related to probability of survival. This explains that the effect of risk and returns in company is determined by the state of the economy. This observation was supported by Shariat and Khosvari (2008) who observed that firm size is negatively related to stock returns during periods of financial difficulties.

Stock return

Stock return is the change in capital or wealth due to an investment. The changes could occur due to cash flows such as earnings, dividends or interest or due to negative or positive changes in prices (Mehri, 2015). To determine stock returns the study employed formula applied by Purnamasari et al. (2012) and Predescu and Stancu (2011) in calculating the stock returns:

DATA COLLECTION RESEARCH METHODOLOGY

Introduction

This portion of the research includes the type of research, the sample used in this research and also the different sources from which the data is collected. The research methodology also discussed in this portion. This chapter also includes variables of the research.

Type of research

The study being based on secondary data therefore this study is quantitative in nature and as we are testing a hypothesis therefore a deductive approach being used. As according to Wilson (2010)"A deductive approach is concerned with developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis.

Population and Sample size

The population for the study comprises of all the non-financial companies listed at PSE. We selected about 50 non-financial companies randomly from the said population for the study. Moreover, we selected those non-financial firms whose data for the study period (2010 to 2015) were available.

Sources of data collection

This study based on the secondary data for the included variables and data collected from the following websites:

1. Official website of the State Bank of Pakistan (Balance sheet analysis)
2. Open doors for all.com
3. Annual Reports of the selected non-financial firms

Data

The data collected from companies' annual reports. The index price collected from the Pakistan stock exchange. The closing prices of the stock return's taken and calculated by log of today by previous returns. The log returns calculated by the formula.

$$RT = \ln (P1/Po)$$

RT = represents the return

P1 = represents the closing price on the given day

Po = represents the closing price on the day previous P1

RESEARCH METHODOLOGY

To examine the credit and liquidity risks effect on stock returns. covering period of 6 years from 2010 to 2015. Panel data used. The stock return of the companies calculated as follows

$$RT=\ln (P1/Po)$$

For the annually returns the Rt signify the annual returns, P1 show the closing price on the given year and P0showing the closing price on the previous year to P1.

Furthermore, this study analyzed to estimate the credit risk and liquidity risk. After these calculations, we regressed credit risk and liquidity risk with stock return of selected companies.

Regression Model

$$RT = \alpha + \beta 1\ (CR) + \beta 2\ (LR) + \varepsilon t$$

There are three different test models of panel data.

Common, fixed and random effect models used.

To select among common and fixed effect model, "F value" test used. If its value is greater than two we will use fixed effect model otherwise common effect model will used.

Variables

Independent Variables

Credit risk

This study assessed the ratios for credit risk by Doubtful Debts to Current Debts of the company. (Mehri Akhavi Babi, 2015).

Liquidity risk

This study, measured the ratios for liquidity risk by debt to total assets of the company.(Mehri Akhavi Babi, 2015).

Control Variable

Company Size

This study assessed the ratios for company size by log of total assets of the company. (Isaac Mwaurah, Willy Muturi and Anthony Waititu, 2017)

Dependent Variable
Stock Return

The stock return of the companies calculated as follows

RT=ln (P1/ Po)

RESULT AND DISCUSSION

The panel data set used in this study which is a combination of time series and cross section data. Data set covers a time period of 2010-2015. We used multiple regression analysis. To use multiple regression first of all we used appropriate model among the common effect regression model and fixed effect regression model F statistic test has used to select the best model among the common effect regression model and fixed effect regression model. To select among fixed effect and random effect model, "Houseman" test will use. if its result comes significant random effect model will use otherwise fixed effect model will be used.

First to select model among common effect model and fixed effect model F-value calculated by the following formula.

$$F= \{(R^2_{FE} -- R^2_{CE})/N-1\}/ \{(1--R^2_{FE})/NT-N-K\}$$

Where,

R^2_{FE}= fixed effect model R^2

R^2_{CE}= common effect model R^2

N= Number of used cross sections

T= Number of used time period

K= Number of used independent variables

By calculating the F-value with the help of above formula, the value is 5.17, which is greater than 2. Thus, the null hypothesis rejected and alternative hypothesis accepted that is fixed effect model used. Now we used Housman test for using best model between fixed effect model and random effect model.

The result of Housman test, as given below.

Housman Test Summary

Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
8.979559	5	0.1099

Dependent Variable = Returns			
Independent Variables	**Coefficients**	**t-value**	**p-value**
Credit risk	-0.001542	-2.938608	0.0036
Liquidity risk	0.00000181	0.197803	0.0434
Size	0.000482	0.948745	0.0237
R Square		0.193144	
F-value		1.137050	
Prob (F-statistic)		0.258114	

From the above result it is clear that the P-value is 0.1099 which greater than 0.05 so the result is not significant and we used fixed effect model for the analysis. The results of the fixed effect model, as given below.

Fixed effect model

The above table represents the explanatory power of model used which are, F-value 1.137050, P-value 0.258114and R square 19.3144.The coefficient of Credit risk is negative and its value is -0.001542, t-value is -2.938608and Probability value is 0.0036. This it shows that Credit risk has significant but negative relationship with stock return of company, it may also have interpreted as unit increase in credit risk brings -0.001542units decrease in stock return of firm, remaining other things constant.

The Liquidity risk coefficient is positive and its value is 0.00000181, t-value is 0.197803and Probability value is 0.0434. This result shows that Liquidity risk has significant positive relationship with stock return of company, it may also have interpreted as unit increase in size brings 0.00000181 units increase in stock return of firm, remaining other things constant.

If we look at the coefficient of Size which is 0.000482which is positive and t-value is 0.948745having probability value 0.0237, if we look at these values this shows that Size has positive and significant relationship with stock return of company, we can also interpret these results that one-unit increase in size will bring 0.00000633 units increase in stock return of firm keeping other things constant.

Conclusion

This study conducted on financial risks (Credit risk, Liquidity risk) on stock return of non-financial firm listed in Pakistan stock exchange. In this paper, we used panel data analysis to measure the relationship between financial risks and stock returns, listed non-financial companies for six-year period. We used two independent variables (credit risk, Liquidity risk) to measure their effect on stock return. The results exhibit that credit risk negatively correlated with stock return of company; though, this relationship is significant. This result is consistent to Mehri akhavi Babi, (2015). Liquidity risk positively correlated with stock return of company but, the relationship is significant. This result is inconsistent to Mehri akhavi Babi, (2015). and Size positively correlated with stock return of company but, the relationship is significant.

Recommendation

This study analyzed relationship between financial risks and stock return. its only two risks credit risk and Liquidity risk. However, the other major risk factors like market risk, capital risk and interest risk are factors of systematic risks and this research study conducted by only unsystematic risk factors.

Limitation

However, the limitation of the study must be included in this this research. My analysis is based on some limitation. The limitations are given below.

The first we consider only two financial risks, credit risk and liquidity risk.

Second refer to the fact that the research is only based on Pakistan which is a developing country. In previous literatures some researchers study these relationships based on developed countries. So, their results were different from this study.

This study is conducted in a limited span of time and to check the relationship. After studying the previous researches on correlation of financial risks on stock return especially in my selected sample there was little work being available in which these risks were studied together. Therefore, it could be a new topic for furthermore research to analyze correlation in these kinds of risks.

REFERENCES

Adrian, T., & Erkko, E. (2010). Funding Liquidity Risk and the Cross-Section of Stock Returns. *Federal Reserve Bank of New York Staff Reports*, *(464).*

Aghababaei, H. R., Ataei, S., & Azizkhani, H. (2013). Effects of credit Risk indicators on shareholders' value of commercial banks in IRAN. *International Research Journal of Applied and Basic Sciences*, *6*(8), *1143–1149. Retrieved from www.irjabs.com*

Akram, N. (2014). The Effect of Liquidity on Stock Returns: An Evidence from Pakistan. *IOSR Journal of Business and Management*, *16*(2), *66–69. https://doi.org/10.9790/487X-16216669*

Arif, A., Abrar, A., & Afzal, M. (2012). Credit Risk and Shareholders' Value in a Developing Economy: Evidence from Pakistani Banking System. *Journal of Economics and Behavioral Studies*, *4(2), 87–95*.

Balasemi, N., & Veiseh, S. M. (2015). Relationship between liquidity and stock returns considering company' s life cycle: The case study of Tehran stock exchange listed companies, *31*, *85–91*.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2007). Liquidity and expected returns: Lessons from emerging markets. *Review of Financial Studies*, *20(6), 1783–1831. https://doi.org/10.1093/rfs/hhm030*

Bond, S. A., & Chang, Q. (2013). Liquidity Risk and Stock Returns: A Return Decomposition Approach*, 1–44.*

Co, C., & Petrasek, L. (2014). Liquidity risk in stock returns: An event-study perspective. *Journal of Banking and Finance*, *45(1), 72 83 .https://doi.org/10.1016/j.jbankfin.2013.09.020*

Chekili, S., & Abaoub, N. (2013). Impact of Liquidity on Stocks Returns: Application on the Tunis Stock Exchange, *3(3), 23–32*.

Iqbal, S., Nasir, S., Iqbal, N., & Zia, M. (2015). Impact of liquidity risk on firm specific factors: A case of islamic banks of Pakistan, *9*(11), 256–260.

Kang, C., & Kang, H. (2009). The Effect of Credit Risk on Stock Returns. *Journal of Economic Research*, *14, 49–67*.

Li, B., Sun, Q., & Wang, C. (2011). Liquidity, Liquidity Risk and Stock Returns: Evidence from Japan. *European Financial Management*. *https://doi.org/10.1111/j.1468-036X.2011.00629*.x

Liang, S. X., & Wei, J. K. C. (2012). Liquidity risk and stock returns around the world. *Journal of Banking and Finance*, *36(12), 3274–3288. https://doi.org/10.1016/j.jbankfin.2012.07.021*

Moradi, N. (2015). The Relationship between Liquidity Risk and Stock Returns Case Study: Oil Companies in Tehran Stock Exchange, *3*.

Nielsen, C. Y. (2015). Hidden in the factors? The effect of credit risk on the cross-section of equity returns $, *46(October).*

Ogilo, F. (2012). The Impact of Credit Risk Management on Financial Performance of Commercial Banks in Kenya. *DBA Africa Management Review*, *3(1), 22–37*.

Resti, A., & Sironi, A. (2007). *Risk Management and Shareholders' Value in Banking*. *Wiley FinanceRetrievedfromhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:No+Title#0*

Salehi, M., Talebnia, G., & Ghorbani, B. (2011). A study of the relationship between liquidity and stock returns of companies listed in Tehran Stock Exchange. *World Applied Sciences Journal*, *12(9), 1403–1408. Retrieved from http://www.idosi.org/wasj/wasj12(9)/6.pdf*

Steiger, F. (2010). The Impact of Credit Risk and Implied Volatility on Stock Returns, *(May). Retrieved from http://arxiv.org/abs/1005.5538*

Tripathy, T., & Ahluwalia, E. (2015). Day Long Effect of Liquidity on Stock Return: An Empirical Investigation in a Day of Political and Economic Importance in India. *International Journal of Economics and Finance*, *7(10), 204–214*. https://doi.org/10.5539/ijef.v7n10p204

Vovchak, V. (2012). Liquidity and Liquidity Risk in the Cross-Section of Stock Returns. *Papers. Ssrn. Com*, *1–27. https://doi.org/10.2139/ssrn.2078295*

Watanabe, A., & Watanabe, M. (2008). Time-varying liquidity risk and the cross section of stock returns. *Review of Financial Studies*, *21(6), 2449–2486. https://doi.org/10.1093/rfs/hhm0542015*

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Impact of Agricultural Research on Economic Development in Punjab, Pakistan

Mohammad Ishaq Javed[1], Asghar Ali[3], Nasir Nadeem[2], Amna Gulzar[1], Shoaib Kamran[1]

[1]Ayub Agricultural Research Institute Faisalabad
[2]Muhammad Nawaz Shareef University of Agriculture, Multan.
[3]University of Agriculture, Faisalabad.

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ABSTRACT

In developing countries agricultural productivity from public investment in research is important especially when there are diminishing factor returns and the constraint of further expansion of cultivated land. The major objective of this study was to analyze the impact of rice varietal yield improvement research in Punjab. This study has employed Simple Economic Surplus Model for estimation of benefits attributable to rice varietal yield improvement research. The data on varietal distribution of rice in Punjab from 2004-05 to 2013-14 were used. The results of this study showed that share of rice varieties in total cultivation of rice in Punjab remained between 84 percent and 96 percent and Basmati Super remained the single largest rice variety during this period. Share of Basmati Super in total cultivation of rice in Punjab was 73 percent in 2004-05 while it was 51 percent in 2013-14. Economic benefits of Varietal Yield Improvement Research were averaged Rs.74 billion between 2004-05 and2013-14. Basmati Supper alone itself had been added annually Rs.57 billion as an additional gain during this period. The results suggested that in under developed countries investment in research could play a vital role in economic development through increasing productivity and maximizing exports.
KEY WORDS: Economic impact, Rice Variety, Basmati Super, Additional Gain, Simple Economic Surplus Model

1. INTRODUCTION

Rice is an important food crop and is the staple food of over half the world's population (FAO, 2004). It is the second staple food grain crop of Pakistan after wheat. It has emerged as a major foreign exchange earning source after cotton. During fiscal year 2013-14 rice export from Pakistan was of worth Rest. 222.9 billion [1]. Pakistan ranks 12th in the production and is 4th largest exporter of rice.

In Pakistan rice share in value addition is 3.1 percent and 0.7 percent of GDP. During 2013-14, rice cultivated areas was 2789 thousand hectares, 20.8 percent more as compared to previous year's area of 2309 thousand hectares. The production was 6798 thousand tons relative to the set target of 6200 thousand tones, showing a growth of 9.6 percent against the target [2]. Rice is grown in all the provinces of Pakistan. However major proportion of rice is grown in Sindh and Punjab. The share of Punjab in total rice cultivation of Pakistan is 74 percent while in basmati its cultivation is 94 percent.

In Pakistan, rice varietal yield improvement was started in Sindh in 1912 at Larkana. In Punjab varietal development was started in 1926 with the establishment of Rice Farm Kala Shah Kaku. Four varieties namely Basmati 370, Mushkan 7, Mushkan 41, Jhona 349 were released for general cultivation in 1933. Basmati 370 was widely accepted on account of its quality uniqueness, high fragrance, slim and long kernel, gelatinization, temperature and high degree of grain elongation on cooking. This variety is still being cultivated in the Province. Rice Farm was high to the level of Rice Research Station Kala Shah Kaku in 1965 and later upgraded to the status of Rice Research Institute Kala Shah Kaku in 1970. This institute is working under the umbrella of Ayub Agricultural Institute Faisalabad. Rice Research Institute Kala Shah Kaku has released 22 rice varieties including world famous Basmati 385 and Supper Basmati.

Numbers of studies have explored the impact of rice breeding research in the world.[3] studied adoption, spread and production impact of modern rice varieties in Asia has added nearly 4.5 billion dollars per year to the value of rice produced in eight Asian countries such as China, Indonesia, Thailand, Burma, India, Sri Lanka and Philippines. [4] calculated that initial replacement of traditional rice verities with modern varieties provided a net gain of 120, 156 and 170 dollar per hectare in Vietnam, Indonesia and Philippines respectively. [5]concluded that green revolution

***Corresponding Author:** Nasir Nadeem, Muhammad Nawaz Shareef University of Agriculture, Multan.

was the result of many forces. The average rice yields grew at a rate of 205 percent per year in Asia over the period of 1965-1982. The study also revealed that since 1965 to 1980 total 117379 thousand tons of paddy of worth 19367 million dollar was added on account of modern rice varieties.[6] have assessed the IRRI's rice variety yield improvement impact in South-East Asia and found that, IRRI's breeding work has added in three countries (Philippines, Vietnam and Indonesia) an additional $1.46 billion worth of rice every year from 1985-2009. Their study revealed a very high return on the investment made in IRRI's breeding research which was 28%. To best of our knowledge, not even a single study has been conducted to access the economic impact of rice breeding research of any research institute in Pakistan. Numerous empirical studies have also explored the relationship between public investment and agricultural productivity using different methodologies. Most focus on investment in agricultural research, agricultural extension and their combined effect.

[7] calculated MIRR to agricultural research and extension in Pakistan which was 65%. [8] estimated MIRR as 51%, 58%, 39% and 51% for HYV, general research and crop specific research respectively. [9] estimated MIRR for expenses on R&D and extension at 88%. [10] calculated the impact of numerous variables relating to investment on agriculture productivity. The results showed that agricultural research expenses, number of tractors, and tube-wells have positive and significant impact on Total Factor Productivity (TFP) in the crops sub-sector. The results also revealed attractive marginal rates of return to investments in agricultural research in Punjab.

The study in hand is the first ever attempt to assess the impact of AARI's rice varietal yield improvement in Punjab, Pakistan. Findings of this study would be helpful for rice researchers about the performance of their varieties in the field and also raises awareness of the importance of varietal yield improvement program of AARI, Faisalabad in Punjab in particular and in Pakistan in general.

Objectives of the study

Main objectives of this study are:

- To estimate additional paddy produced due to AARI's rice varieties in Punjab from 2000-2001 to 2013-14.
- To estimate economic benefits generated by Rice Breeding Research of AARI from 2000-2001 to 2013-14.
- To document farm level adoption of rice varieties released by this institute.
- To give policy recommendations

The remaining study is divided into four sections. Following this section, Section 2 describesdata used in this study. Section 3 is devoted for results and discussions. Section 3.1 explains the varietal distribution of rice varieties in Punjab. Section 3.2 sheds light over the additional gains attributable to AARI rice varieties. Section 3.3 elaborates the economic impact of rice breeding research of AARI Faisalabad. Section 4 winds up this study by drawing conclusions and suggestions. Literature cited and appendices are given at the end.

2. MATERIAL AND METHODS

2.1 Data

Data for the year 2003-04 to 2013-14on varietal distribution of rice in Punjab was obtained for Crop Reporting Service, Government of Punjab, Lahore. Data for varietal yield trials of each variety of rice were collected from Rice Research Institute Kala Shah Kaku. Net yield gain attributable to an individual rice variety is the difference between the yields of a particular variety over check variety in the breeder's trials. Using relative yield performance data from rice variety trails which are implicitly assumed that actual producer yields are equal to rice variety trails yields in rice research institute's experiments.[11] noted that the relative yields between varieties are likely to be similar in both experimental and producer fields. [12] stated, "The only trustworthy sources of relative yields are variety trials". Rice grain prices for years 2003-04 to 2013-14 were obtained from Agricultural Marketing Information Services (AMIS), Government of Punjab, Lahore.

2.2 Empirical Model

Varietal yield improvement research benefits are of two types: genetic or yield benefits and agronomic or non-yield benefits. The yield (genetic) benefits estimate the value of the additional gain production attributable to rice varietal yield improvement research. Non-yield or agronomic benefits are allocated with the improvement in agronomic practices. Agronomic benefits permit growers to enhance cropping intensity, abridged crop growth cycle, quality and quantity upgrading of byproducts, quality improvement of the crop and decline in chemical use for disease and insects/pests control. Non-yield or agronomic benefits may be very important and sometimes may exceed the value of yield benefits. This study in confined only to estimate genetic or yield benefits of varietal improvement research in rice. [14] used the same approach to assess the impacts of international wheat breeding research in the developing

world from 1988 to 2002. Therefore, Following [14], annual benefits generated by a rice variety " i " were estimated by using Economic Surplus Model of the following form:

$$B_{ti} = A_{ti}Y_{ti}P_{ti}$$

Where

B_i= Value of additional rice production attributable to the individual rice variety of AARI, Faisalabad

A_i= Area planted to the individual rice variety of AARI, Faisalabad

Y_i = Net additional yield gain attributable to the individual rice variety of AARI, Faisalabad

P_i = Price of rice grain

3. RESULTS AND DISCUSSION

Table 1indicates the spread or varietal distribution of rice crop in the Punjab Province. It is clear from the table that during crop year 2004-05 contribution of AARI rice varieties in total Punjab's rice cultivation was 96%.Basmati Super stood as the single largest variety as it covered 73 percent area of Punjab's total rice cultivation. In the same year Basmati 385, was sown on 15.0 percent rice area of the province. Share of Basmati 2000, Basmati Shaheen and Basmati was negligibly small. Same trend was witnessed during crop years 2005-06 to 2007-08. In these years Basmati Super remained the single largest rice variety sown in Punjab. The area under this variety remained almost same in Punjab's rice cultivation and its share remained about 73 percent between these years. Share of Basmati 385 was decreased from 14.65% in 2004-05 to 6.25 % in 2007-08, yet it was second largest variety of the province in terms of cultivation. Other basmati varieties could not attract the farmers' attention during this period. Amongst course varieties, IRRI-6 was cultivated on areas about 4.0 percent of Punjab's rice cultivation during these years. The overall area under rice cultivation in Punjab remained almost constant as it was 1664.5 thousand hectares in 2007-08 as compare to 1664.91 thousand hectares in 2004-05 while share of AARI rice varieties remained above 94 percent in Punjab's total rice cultivation.

In the crop year 2008-09, total rice cultivated area in Punjab was 1930.8 thousand hectares. Out of which AARI varieties were cultivated on94% of the total area. Moreover, the share of Basmati Superin rice cultivation of the Province was 73 % and Basmati-386, an unapproved strain, with percentage area of 9.0 percent was the second most dominant variety in 2008-09. From 2009-10 to 2011-12,rice area under Basmati Super decreased from 77.5 percent to 59 percent, yet it remained the most popular rice variety among the rice farmers.Basmati-386 gained popularity and its share in Punjab's rice increased from10 percent in 2008-09 to 17 percent in 2011-12. During the year 2013-14 total rice area in Punjab province was 1834.89 thousand hectares. Basmati Super was the leading rice variety in 2013-14 and was found to be cultivated on 50.53 percent of rice area of the province.Basmati-386 was second rice variety, with covering an area of13.94 percent of total rice area.

Table 2 envisages the additional gain attributable to AARI's rice varieties. Additional gain of an individual variety was estimated by multiplying area under that variety with its net yield gain. It is depicted from Table 2 that additional gain due to AARI rice varieties remained between 1564thousand tons and 1765 thousand tons from 2004-05 to 2013-14. Amongst AARI rice varieties, highest additional gain was of Basmati Supper. Additional gain attributable to Supper Basmati was 980 thousand tons in 2004-05 while it was recorded 1138 thousand tons in 2008-09. After this, additional gain due to this variety started to decrease and was 751 thousand tons in the last year analysis. Additional gain due to IRRI-6 remained almost same during the study period. Its contribution towards additional gain was 39 thousand tons in 2004-05 which was same in 2013-14. Additional gain due to Basmati-385 fell drastically during this period. Additional gain of Basmati-385 was 382 thousand tons and was 49 thousand tons in 2013-14.

Benefits of AARI's rice varietal yield improvement research in Punjab are presented in Table-3.Benefit of rice varietal yield improvement research of AARI as additional gain was about 40billion in 2004-05 and 2005-06.Additional gain of Basmati Super remained highest among all the AARI varieties during these years. Its economic impact towards national economy was about Rs. 27 billion in 2004-05 and was increased to Rs. 31 billion in the 2005-06.Additional gain of Basmati-385 was calculatedRs.10billion in 2004-05 andRs.7 billion 2005-06.

Additional benefit of AARI rice varieties jumped fromRs.47 billion in 2006-07 to Rs. 98billion in 2008-09.However, additional benefit of AARI varieties was decreased after 2006-07. It remained about Rs. 78 billion in the next couple of years. Additional benefits due to AARI's rice varietal yield improvement research were Rs. 80 billion in 2011-12 and 91 billion in 2012-13. Additional benefits generated by breeding research of AARI touched highest figure ofRs.117 billion in the final year of analysis. Additional benefit due to Supper Basmati showed the same trend and was Rs. 35 billion in 2006-07 and Rs. 79 billion in 2008-09. Additional benefit due to this variety decreased after 2008-09 there it was Rs. 62 billion in 2009-10 and Rs.60 billion in 2011-12. Additional benefit due

to Supper Basmati was estimated at Rs. 88.5 billion in 2013-14.Furthermore, Additional benefit of Basmati 385 was Rs.10.5 billion in 2004-05 and was Rs.6 billion in 2013-14. Additional benefit generated due to course variety IRRI-6 was Rs. 1.5 billion in 2013-14.

Table 1: Varietal Distribution of Rice Varieties in Punjab (2004-05 to 2013-14) (000Hec)

Year		Basmati 385	Basmati super	Basmati-2000	Basmati Shaheen	Basmati-370	Basmati kernel	IRRI-6	KSK282	Basmati 515	Basmati-386	PS-2	Others	Total AARI Varieties	Total
2004-05	Area	244	1209.6	6.88	0.4	1.62	4.1	65.6	6.48	0	152.57	0	63.13	1601.78	1664.91
	%age	14.65	72.65	0.41	0.02	0.10	0.25	3.94	0.39	0	9.16	0	3.79	96.20	100
2005-06	Area	149.3	1351.6	27.92	0	4.1	2	85	10.93	0	63.54	0	67.99	1698.9	1766.89
	%age	8.45	76.49	1.58	0	0.23	0.11	4.81	0.61	0	3.60	0	3.85	96.15	100
2006-07	Area	158.63	1271.5	36.83	1.21	4.04	2	73.65	26.71	0	62.32	0	91.46	1666.13	1757.59
	%age	9.02	72.34	2.09	0.07	0.23	0.11	4.19	1.52	0	3.54	0	5.20	94.80	100
2007-08	Area	104	1220	38	0.4	6.8	6.5	63	39	0.4	142.05	0	82.96	1581.54	1664.5
	%age	6.25	73.30	2.28	0.02	0.41	0.39	3.78	2.34	0.02	8.53	0	4.98	95.01	100
2008-09	Area	88.22	1404.4	44.51	1.21	1.6	7.2	101.81	33.66	2.43	165.92	0	118.98	1811.82	1930.8
	%age	4.57	72.74	2.30	0.06	0.08	0.37	5.27	1.74	0.12	8.59	0	6.16	93.84	100
2009-10	Area	55	1492.14	36.42	1.21	0	10.1	101.57	39.66	19.02	189.4	0	183.32	1742.22	1925.54
	%age	2.86	77.49	1.89	0.06	0	0.52	5.27	2.05	0.99	9.84	0	9.52	90.48	100
2010-11	Area	41.68	1292.18	10.12	0.81	1.21	3.6	88.22	38.44	32.38	167.95	53.01	138.41	1598.94	1737.35
	%age	2.40	74.38	0.58	0.05	0.07	0.21	5.08	2.21	1.86	9.67	3.05	7.97	92.03	100
2011-12	Area	49	976.5	6	0.81	0.8	15.8	74.05	33.18	26.31	277.22	45.73	140.52	1505.40	1645.9
	%age	2.98	59.33	0.36	0.05	0.05	0.96	4.32	2.01	1.59	16.84	2.78	8.76	91.24	100
2012-13	Area	30.35	835.26	5	0.4	0.8	0.4	63.13	43.7	34.4	351.68	79.32	261.43	1353.77	1615.2
	%age	1.88	51.71	0.31	0.02	0.05	0.02	3.91	2.70	2.13	21.77	4.91	16.18	83.81	100
2013-14	Area	31.56	927.155	3.64	0.4	0.8	6.9	66.37	19.02	7.68	255.75	214.48	278.83	1556.06	1834.89
	%age	1.72	50.53	0.20	0.02	0.04	0.38	3.62	1.04	0.42	13.94	11.69	15.20	84.80	100

Table2: Additional Gain of AARI Rice Varieties (2004-05 to 2013-14) (000 Tonnes)

Year	Basmati 385	Basmati super	Basmati-2000	Basmati Shaheen	Basmati-370	Basmati Karnal	Basmati-515	Basmati-386	Ps-2	IRRI-6	KSK282	Other AARI Varieties	Total
2004-05	382	980	3	0.13	3	3	0	114	0	39	3	37	1564
2005-06	234	1095	13	0	8	1	0	48	0	50	5	40	1494
2006-07	248	1030	17	0.4	9	1	0	47	0	43	13	54	1462
2007-08	163	988	18	0.1	26	4	1	107	0	49	19	49	1424
2008-09	138	1138	21	0.4	15	5	8	124	0	62	17	70	1598
2009-10	86	1047	17	0.4	0	7	54	142	0	60	20	108	1541
2010-11	65	966	5	0.3	0	2	102	126	13	52	19	82	1432
2011-12	77	790	3	0.3	6	10	95	208	11	44	16	124	1384
2012-13	48	676	2	0.1	5	0.3	165	264	19	35	22	155	1391
2013-14	49	751	2	0.3	64	5	435	192	51	39	12	165	1765

Table3: Economic Impact of AARI Rice Varieties (2004-05 to 2013-14) (Rs. Million)

Year	Basmati 385	Basmati super	Basmati-2000	Basmati Shaheen	PS-2	Basmati -370	Basmati-386	Basmati-515	Basmati karnal	IRRI-6	KSK-282	Other Varieties	Total
2004-05	10457.49	26831.82	87.04	3.62	0	2.97	1514.81	0	7.42	517.6	42.58	498.12	39963.48
2005-06	6568.56	30777.22	362.62	0	0	7.62	629.30	0	3.81	664.52	71.16	531.49	39616.30
2006-07	8388.57	34800.85	574.95	1353.32	0	9.16	669.98	0	4.58	624.95	188.74	776.06	47391.16
2007-08	9341.61	56717.74	1007.62	7.59	0	26.43	2685.27	1.11	24.90	940.06	484.62	1237.91	72474.86
2008-09	9612.72	79202.89	1431.74	27.88	0	15.10	3859.95	8.12	33.98	1869.48	514.72	2184.72	98761.3
2009-10	5136.43	62456.81	1004.07	23.9	0	0	3812.93	54.48	40.45	1614.03	524.84	2913.14	77581.09
2010-11	4294.82	63581.36	307.84	17.65	149.38	0	4256.55	102.32	16.07	1764.86	640.4	2768.78	77900.03
2011-12	5792.4	59745.54	209.38	20.25	128.85	6.14	8029.56	95.37	77.83	1698	631.74	4774.31	81209.37
2012-13	4744.55	67581.63	230.74	13.22	223.50	5.21	9898.04	164.93	2.71	1402.49	808.48	5807.83	90883.33
2013-14	5824.15	88538.79	429.40	15.79	6043.86	63.93	7216.17	435.13	543.43	1478.07	352.76	6210.26	117151.7
Average	**7016.13**	**57023.47**	**564.54**	**148.322**	**654.559**	**13.656**	**4257.256**	**86.146**	**75.518**	**1257.4**	**426.004**	**2770.262**	**74293.266**

4. SUMMARY AND CONCLUSIONS

The study in hand analyzes the AARI's rice varietal yield improvement research in Punjab, Pakistan from 2004-05 to 2013-14. Data of Crop Reporting Service, Government of Punjab, Lahore for the year 2003-04 to 2012-13 on varietal distribution of rice in Punjab were used in this study. Additional benefits rice varietal yield improvement research was estimated by using Simple Economic Surplus Model. It was found that the share of AARI rice variety remained between 84 percent and 96 percent during the study period. Basmati Supper was the single largest rice variety, which was cultivated over 50 percent of the total rice cultivation in Punjab. It was further found that rice varieties Basmati-2000, Basmati Shaheen, Basmati Karnal, Basmati 370 and Basmati 515 could not attract the attention of the rice growers of Punjab. Additional gain due to AARI's rice varietal yield improvement research remained between 1384 thousand tons to 1765 thousand tons during the study period. Additional benefit of AARI's rice yield improvement work was estimated at Rs. 117 billion in 2013-14. On an average, additional benefits generated due to AARI's rice yield improvement work in Punjab were found Rs. 74 billion annually during the study period. The results of this study lead to generate a conclusion that AARI's Rice Varietal Yield Improvement Research is generating huge benefits and is likely to do the same in the future as well. The results suggested that in under developed countries investment in research could play a vital role in economic development through increasing productivity and maximizing exports.

REFERENCES

[9] Ali, S. 2005.Total Factor Productivity Growth and Agricultural Research and Extension: An analysis of Pakistan's Agriculture, 1960-1996. *Pakistan Development Review*, 44, 729-746.

[13] AIMS. 2014. Monthly average prices of rice. Agriculture Marketing Information Service. Directorate of Agriculture (Economics & Marketing) Punjab, Lahore.

[11] Barkley, A., Nalley, L. L., &Crespi, J. M. 2008.*The Impact of the CIMMYT Wheat Breeding Program on Mexican Wheat Producers and Consumers: An Economic Welfare Analysis* (No. 6931): Southern Agricultural Economics Association.

[12] Brennan, J.P. 1984.Measuring the Contribution of New Varieties to Increasing Wheat Yields. Review of Marketing and Agricultural Economics, 52, pp.:175-195.

[6] Brennan J. P. and Malabayabas,A.2011. *International Rice Research Institute's contribution to rice varietal yield improvement in South-East Asia*. ACIAR IMPACT ASSESSMENT SERIES 74.

[1] GoP. 2015. Export by commodities of last five year. Bureau of Statistics. Government of Pakistan, Islamabad, (Accessed from Pakistan(www.bps.gov.pk)

[2] GoP. 2014. Economic Survey of Pakistan, Finance and Economic Affairs Division, Ministry of Finance, Govt. of Pakistan, Islamabad, Pakistan.

[5] Hazell P.B.R. 2010.The Asian Green Revolution. In Proven Success in Agricultural Development: a technical compendium to millions fed", ed. By D.J. Spielman and R. Pandya-Lorch.

[3] Herdt, R.W. and Capule, C. 1983.Adoption, Spread, and Production Impact of Modern Rice Varieties in Asia. International Rice Research Institute: Los Banos, Philippines.

[4] Hossain, M., Gollin, D, Cabanilla, V., Cabrera, E., Johnson, N., Khush, G.S. and McLaren, G. 2003.International Reserch and Genetic Improvement in Rice: Evidence from Asian and Latin America. Pp. 71-108 in "Crop Variety Improvement and its Effect on Productivity: The Impact of International Agricultural Research, ed. By Evenson and D. Gollin. CAB International, Wallingford, UK.

[10] Kiani, A.K.2008.Total Factor Productivity and Agricultural Research Relations: Evidence from Crops Sub-Sector of Pakistan's Punjab. European Journal of Scientific Research, 23, pp.87-97.

[14] Lantican, M.A., H.J. Dubin and Morris, M.L. 2005.Impacts of International Wheat Breeding Research in the Developing World, 1988-2002. Mexico, D.F.: CIMMYT.

[7] Nagy, J. G. 1991.Returns from Agricultural Research and Extension in Wheat and Maize in Pakistan. In *Research and Productivity in Asian Agriculture,* eds., R.E. Evenson and C.E. Pray. Ithaca: Cornell University Press.

[8] Rosegrant, M.W. and Evenson, R.E. 1993.Agricultural Productivity Growth in Pakistan and India: A Comparative Analysis. *Pakistan Development Review,* 32, PP 433-51

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Influence of Bottom-Ash Mixed with Gypsum as Concrete Bricks for Wall Construction Material

Mochammad Qomaruddin[1*]; Sudarno[2]

[1]Civil Engineering Study Program, Faculty of Science & Technology, Islamic University of Nahdlatul Ulama Jln Taman Siswa (Pekeng) Tahunan Jepara Central Java Indonesia.
[2]Department of Civil Engineering, Faculty of Engineering, Tidar University, Jalan Suparman No 39, Potrobangsan Magelang Utara 56116 Central Java Indonesia.

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ABSTRACT

There had been environmental issues regarding the storage management of coal combustion residuals (CCR) disposed by the PLTU Tanjung Jati B power plant in Jepara Indonesia where the abundant bottom-ash compounds are particularly unprocessable. In preparation of further projects responding to study the environmental effects, this experiment was to determine the compressive strength of bottom-ash as primary material used for a set concrete bricks tested with addition of gypsum in several portion of mixtures; 0 Gp, 2 Gp, 4 Gp, 6 Gp, 8 Gp, & 10 Gp. The compressive tests was conducted in accordance with SNI 03-0691-1996 standard. The result shows that the average of maximum strength was 158 kg/cm^2 (15.4945 Mpa) and 67 kg/cm^2 (6.57046 Mpa) at the lowest average which met the concrete brick standard required by the SNI on C and D types. The experiment also conluded that with more gypsum exercised in the mixture, although resulting in fairly lighter weight, they are less capable of withstanding the pressure.
KEYWORDS: concrete brick, bottom ash, gypsum.

INTRODUCTION

Coal combustion waste, comprising Bottom-ash and Fly-ash, contain a variety of hazardous chemicals such as; *Sulphur*, *Mercury* (Hg), *Hydrogen cyanide*/prussic acid (HCN), *Manganese* (Mn), *Sulfuric Acid* (H_2SO_4) that are harmful for human health. There are also issues of radioactive and air pollution. Concrete brick manufacturing which produce from the waste for building and construction material is a way to tackle the issue, reducing the negative environmental impact [1]. The use of environment-friendly materials in the construction industry is very alarming. One of the primary material used, in building constructions, is cement that contributes to global warming. Cement productions release a number of considerable *Carbon dioxide* (CO_2) emissions and are large consumer of energies. The replacement of cement with some pozzolanic materials such as fly-ash and bottom-ash will minimize the impact of making this dangerous cement [2: 15].

Electric Steam Power Plant Tanjung Jati B is a steam power plant located in Tubanan village, Jepara, Indonesia. It has four incenerator units which disposing coal combustion residuals of fly-ash and bottom-ash in continous operation. The waste is not processable and unwanted, except for the fly-ash compounds which are reliable for cement manufacturers. The bottom-ash compounds are stored on an open field, mounting in piles, creating dusty environment. The novelty of this study is to make use of neglected bottom-ash compounds, by which replacing sand material and cement as fine aggregates [3]. Portions of gypsum is added in certain amount of mix for casting a set of concrete brick samples,. The gypsums acquired were from the waste of limes used in neutralizing the acidic steam at the Tanjung Jati B power plant. The use of bottom-ash and gypsum, is a mixture of waste materials used for research on concrete bricks [4]. The purpose of this research is to disclose the behavior of adjustable gypsum's proportions mixed with bottom-ash to a number of compressive load tests that will provide the ideal amount of mixtures proposed for wall constructions as an alternative material.

MATERIAL AND METHOD

The materials used are acquired from Tanjung Jati B power plant. The test specimens are made from a mixture of cement, bottom-ash, and gypsum compounds. The method of this study is implementing six portions of gypsum varied in; 0 Gp, 2 Gp, 4 Gp, 6 Gp, 8 Gp, and 10 Gp. The compressive test of each concrete brick samples proceed after 28 days from castings [5; 16].

Gypsum is a mineral dominated by calcium. The most commonly known type is calcium sulfate hydrate with the formula $CaSO_4.2H_2O$. One of the mineral materials from chemical process that vaporized is gypsum. When in

***Corresponding Author:** Mochammad Qomaruddin; Civil Engineering Study Program, Faculty of Science & Technology, Islamic University of Nahdlatul Ulama, Jln Taman Siswa (Pekeng) Tahunan Jepara Central Java Indonesia. Email: qomar@unisnu.ac.id

hot water or in any water that has a high salt content, the gypsum turns into *Basanite* ($CaSO_4.H_2O$) or also becomes *Anhydride* ($CaSO_4$). In a balanced state, gypsum which over 108° F or 42° C in pure water will turn into anhydride [6].

Bottom-ash formed from the combustion of pulverized coal in the steam generator, which is larger in size and heavier compared to fly-ash. The bottom-ash gets fall off to the bottom of the boiler and collected in the ash hopper. It then taken out from the furnace by jet pumps or conveyors onto ash yard/storages through clinker grinders. Because of its physical resemblance to fine sand and/to coarse with a gradation of the size of various particles [7].

The casting of samples conducted in "dry concrete" mix method, the water-cement factor (ratio) decided at 0,3 (1:4) of the cement volume. The primary material used is bottom-ash mixed with volume of proportion; 1 PC : 5 BA : *n* Gp. Portions of gypsum to add is at 0 Gp, 2 Gp, 4 Gp, 6 Gp, 8 Gp, and 10 Gp for each sample accordingly [8; 9]. The following table will explain the proportion for each samples (table 1).

Table 1. Composition of concrete brick samples

No.	*Mix Design*
1	1Pc : 5 Ba : 0 Gp
2	1Pc : 5 Ba : 2 Gp
3	1Pc : 5 Ba : 4 Gp
4	1Pc : 5 Ba : 6 Gp
5	1Pc : 5 Ba : 8 Gp
6	1Pc : 5 Ba : 10 Gp

Equipments are; 4.76 mm sized sieve, 200 x 100 x 60 mm steel concrete brick molds, measuring cups, a concrete mixer and a 10 HP hydraulic compassion machine. After mixing all the ingredients and left for about 24 hours, concrete samples are treated with water to maintain a slow pace but steady dry, this will help to prevent a dryout that will result in a compressive failure. The pressure tests conducted after 28 days of treatment using the hydraulic compassion device capable of pressing up to 1000 psi load strength. The result estimation based on the Indonesian National Standard.

RESULTS AND DISCUSSIONS

The actual image of a concrete brick sample before the compression test is shown in Figure 1 below:

Figure 1. The concrete brick sample

In general, the brick samples are grayish and tend to have spotty surface, with white spots being the gypsums and the darker ones are the bottom-ashes. Figure 2 shows the compression apparatus compression apparatus 3000 KN and the testing mechanism.

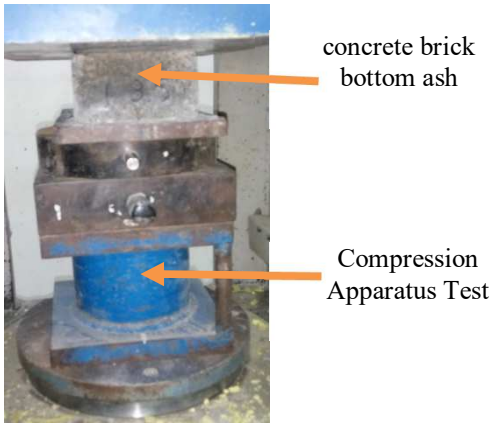

Figure 2. Setup of compressive strength testing

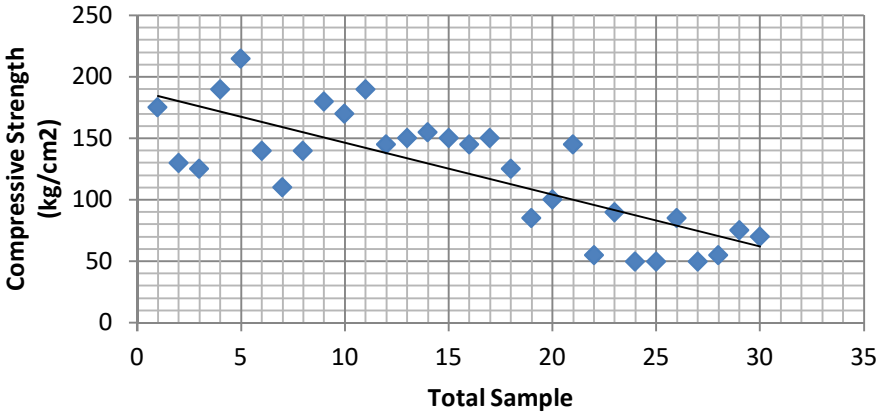

Figure 3. Samples testing result by increased gypsum mixture

The statistic shows the behavior of which the brick samples are tested. It indicates a comparable results of concrete bricks with less mixture of gypsum than those of more gypsum added. With the absence of gypsum, the mixture resulted in maximum strength compared to the others with gypsum added [10]. The highest compressive strength reach up to 215 kg/cm^2 with 1 Pc: 5 Ba: 0 Gp recipe. While the lowest is 50 kg/cm^2 with the proportion of 1 Pc: 5 Ba: 10 Gp. Table 4 illustrates the average of each recipe tested with the 163 kg/cm^2 at the highest (1 Pc: 5 Ba: 0 Gp) as the 67 kg/cm^2 is the lowest (1 Pc: 5 Ba: 10 Gp).

The addition of gypsum to the mixture is likely lowering the compressive quality and so it's capability to withstand any pressure than the others which are not at all. Gypsum fragility is that the elements consisted in it do not bind completely with bottom-ash, although it has been reacted (mixed) with cement and so does the hydraulic pressure [11]. The binding of the material is only due to the pressure between the bottom ash and gypsum particles during hydraulic compaction [12]. It seems that chemical bonding reaction occurs only between cement and bottom ash.

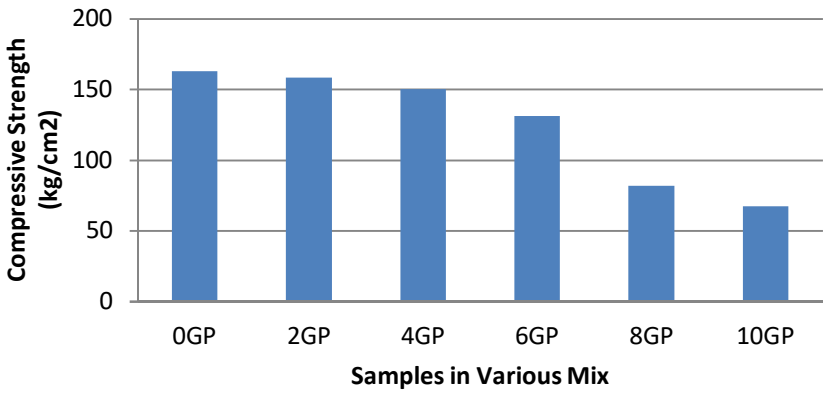

Figure 4. Average compressed strength against mix design

Figure 4 shows each mix design on the compressive strength. The more gypsum added in the mixture, the lesser quality of the concrete brick can get. Although the compressive behavior is deteriorating with more gypsum added, the samples shows different results in terms of content weights of each sample [13]. All samples of concrete bricks content weight with gypsum are identified in the Figure 5 below:

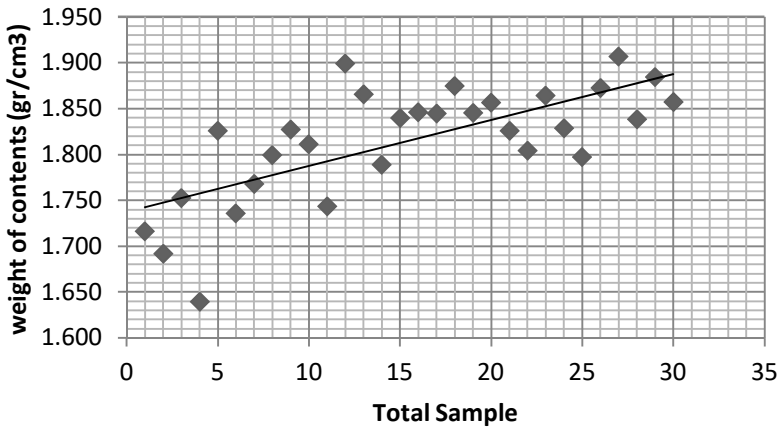

Figure 5. The content weight of samples comprised with portions of gypsum

Explanation as per graphic of the Figure 5 is that in each progress of the samples added with more portion of gypsum resulting in increasing value of it's content weight[14; 15]. This was affected by the smoothness nature and scale of the gypsum materials which able to fill the void fraction/porosity of bottom-ash compounds when pressed with hydraulic machine.

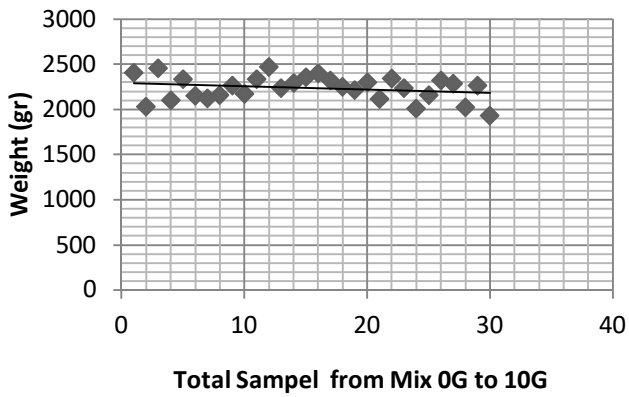

Figure 6. The weight of concrete brick against mix designs

In Figure 6, the scatter graph shows the tendency of the volume weight of each brick samples. It indicates that the bricks which containing more of gypsum are relatively lighter compared with the ones with smaller amount.

CONCLUSION

This study concludes:

a) The average of maximum compressive strength in which gypsum was exercised calculated at 158 kg/cm^2 make up a proportional mix of 1 Pc: 5 Ba: 2 Gp.
b) The compressive strength value of concrete brick samples tested ranging from 158 kg/cm^2 to 131 kg/cm^2 met the SNI C standard for concrete brick.
c) The more gypsum contained the more fragile the brick to withstand the pressure. Therefore is not suitable for floor filler, rather concrete brick or *batako*.
d) The compaction load with hydraulic engine power has an effect on the compressive strength of the concrete brick.
e) The mixture of gypsum in concrete bricks and *batako* can be applied and used for wall construction based on SNI.

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REFERENCES

1. Sumathi A, Mohan, K.S.R. 2015. Compressive Strength of Fly Ash Brick with Addition of Lime, Gypsum and Quarry Dust, International Journal of ChemTech Research CODEN (USA); 7 (1): pp 28-36.
2. Oruji S, Nicholas A., Brake, Nalluri L., Ramesh K. 2017. Guduru Strength Activity and Microstructure of Blended Ultra-fine Coal Bottom Ash-Cement Mortar, Construction and Building Materials; 153: 317–326, www.elsevier.com/locate/conbuildmat.
3. Naganathan N.S. Subramaniam and K. Nasharuddin Bin Mustapha. 2012. Development of Brick Using Thermal Power Plant Bottomash And Flyash, Asian Journal of Civil Engineering; 13 (1): 275-287.
4. Pan J.R., Huang C, Kuo J.J., Lin H.S. 2008. Recycling MSWI Bottom and Fly Ash as Raw Materials for Portland Cement, Waste Management; 28: 1113–1118.
5. Naik S.N., Bahadure B.M., Jejurkar C.L. 2014. Strength and Durability of Fly Ash, Cement and Gypsum Bricks, International Journal of Computational Engineering Research (IJCER); 4: 42250 – 3005.
6. Surender K. Verma, Deepankar K. Ashish, Singh J. 2016. Performance Of Bricks And Brick Masonry Prism Made Using Coal Fly Ash And Coal Bottom Ash, Advances in Concrete Construction; 4 (4): 231-242.
7. VidhyaK., Kandasamy S, Malaimagal U.S., KarthikeyanS.R., Basha G.S., H. Tariq Junaid. 2013. Experimental Studies on Pond Ash Brick, International Journal of Engineering Research and Development; 6 (5): 06-11.
8. Hanjitsuwan S., Ngernkham P.T., Damrongwiriyanupap N. 2017. Comparative Study Using Portland Cement and Calcium Carbide Residue as a Promoter in Bottom Ash Geopolymer Mortar, Construction and Building Materials; 133: 128–134.
9. Lessard M.J., Omran A., Hamou T.A., Gagne R. 2017. Feasibility of Using Biomass Fly and Bottom Ashes in Dry-Cast Concrete Production, Construction and Building Materials; 132: 565–577, journal home page:www. elsevier.com/locate/conbuildmat

10. Raghavendra T., Udayashankar C.B. 2015. Engineering Properties of Controlled Low Strength Materials Using Flyash and Waste Gypsum Wall Boards, Construction and Building Materials; 101: 548–557, www.elsevier.com/locate/conbuildmat

11. Sata V., Sathonsaowaphak A., Chindaprasirt P. 2012. Resistance of Lignite Bottom Ash Geopolymer Mortar to Sulfate and Sulfuric Acid Attack, Cement & Concrete Composites; 34 700–708, journal homepage: www.elsevier.com/locate/cemconcomp

12. Song Y., Li B., Yang H.E., Liu Y., Tian Ding T. 2015. Feasibility Study on Utilization of Municipal Solid Waste Incineration Bottom Ash as Aerating Agent for The Production of Autoclaved Aerated Concrete, Cement & Concrete Composites; 56: 51–58, journal homepage:www.elsevier.com/locate/cemconcomp

13. Tsakiridis E.P., Samouhos M., Peppas, N.S.A., Katsiotis, Velissariou D., Katsiotis S.M., Beazi M. 2016. Silico-Aluminous Bottom Ash Valorisation in Cement Clinker Production: Synthesis, Characterization and Hydration Properties, Construction and Building Materials; 126: 673–681, journal homepage: www.elsevier.com/locate/conbuildmat

14. Wu B., Zhang S., Yang Y. 2015. Compressive Behaviors of Cubes and Cylinders Made of Normal-Strength Demolished Concrete Blocks and High-Strength Fresh Concrete, Construction and Building Materials;78342–353,journal homepage:www.elsevier.com/locate/conbuildmat.

15. Singh H, bG.S.Brar G.S, Mudahar G.S. 2016. Evaluation of the Characteristics of Masonry Bricks Containing Waste Fly Ash, Journal of Applied Environmental and Biological Sciences; 6(6) :1-7.

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Relationship between Health Expenditure and GDP in an Augmented Solow Growth Model for Pakistan: A Multivariate Analysis of Short and Long Run

Irfan Hussain Khan[1], Prof Dr. Sofia Anwar[2], Saima Alyas[3], Amber Javaid[4]

[1](PhD Scholar) Government College University Faisalabad
[2](Head of Economics Department), Government College University Faisalabad
[3](MPhil Scholar) Allama Iqbal Open University Islamabad
[4](PhD Scholar) Hajvery university Lahore

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ABSTRACT

The purpose of this paper is to contribute to this debate. It is achieved by Relationship between Health Expenditure and GDP in an Augmented Solow Growth Model for Pakistan. This paper uses the 1985 to 2015 time series data to assess the relationship between the health expenditure and GDP. The Cobb-Douglas function is initially use than Augmented Solow Growth Model has been used to estimate the relationship between health Expenditure have been deployed. Data analysis shows that there is a positive correlation between the Health expenditure and GDP, which is conducive to all previous expectations
Thus, this evidence provides support for the "positive impact" of the debate and provides some guidance on how policy reform should focus on strengthening the performance of the Pakistani Health Expenditure through Augmented Solow Growth Model. In addition, the evidence for this study provides some guidance on policy reforms to improve Pakistan's microfinance performance.
KEY WORDS: Health expenditure, GDP, Solow Growth

INTRODUCTION

Background:

Endogenous growth model emphasizes the importance of human capital to economic growth and development. Health is an important determinant of economic development; a healthy population means higher productivity and hence higher per capita income. The importance of human capital to economic growth can not be overemphasized, because it is a catalyst for economic development. The contribution of health expenditure to economic development stems from the health-led growth hypothesis. It considers health to be capital; therefore, investing in health can result in increased labor productivity, which in turn increases income and thus increases the welfare of the population. Bloom and Canning emphasize that motivation for developing new skills and knowledge is higher when the workforce is healthy because they want long-term benefits. However, when the workforce is characterized by poorly healthy workers, productivity will be adversely affected, which explains the development gap between different regions of the world. Fifty percent of the economic growth gap between developing and developed countries is due to poor health and low life expectancy [14].

Health is not only its own priority but also an indispensable element for sustained economic growth and development. Not only policy analysts but also sub-Saharan African governments have greatly underestimated the importance of spending for health. The role of health in influencing economic outcomes has been well understood, especially at the micro level. For example, healthier workers may be able to work longer hours, generally more productive than healthy relatives, and thus be able to earn higher incomes than the latter, all else being equal; diseases and diseases shorten people's work life , Thus reducing their lifetime's income [7].

Unhealthy nations incline to be poor, and poor nations incline to be unhealthy. Through the comprehensive way of past, perfections in flourishing economy have come with improvements in health. Health is a sort of social assets along with an input to generating additional kinds of humanoid assets. Actuality unhealthily weakens the capability to work efficiently and the capability and encouragements to finance in human capital.

***Corresponding Author:** Irfan Hussain Khan (PhD Scholar) Government College University Faisalabad
Email: irfansial007@hotmail.com

An essential element of the development of human capital is to boost the health of the population. Life expectancy, increasing labor supply and its productivity can be achieved by enhancing the health of a country in all its segments, other forms of human capital particularly education investment and its productivity can be increased. Subsequently health and health enhancements are related to socioeconomic conditions, it is essential to assess the effects of these variables by providing of health services. Because of externalities, market failures and the capability of maximum of the population to pay, the health sector essentials government involvements [12].

Robert Solo is seriously taken by this study. It is offered by Solo in 1956 in his classic article that we started to examine economic growth by taking regular neoclassical production functions and lessening capital yields. The populace growth ratio and saving proportion are served as extraneous, and he recommends that these two variables analyzed the steady state of per capita income levels. Altered countries achieve different levels of constancy, as countries' savings and population growth amounts differ. It is simply predicted by Solow's model, that how income stability is affected by these variables. The greater the savings speed, wealthier the country. The poorer the country as greater the population growth rate [3].

Hence, by including the addition of human and material capital, Solow model can be enlarged. The omission of human capital from the typical Solow model can explicate why the assessed effect of savings and population growth seems to be more over huge because of two causes. Firstly, for somewhat specified rate of human capital accretion, lesser population growth, and more savings rate will raise income levels, thus income is affected by tangible capital and population growth. Secondly, ignoring the accumulation of human capital diverges from the assessed amounts of savings and population growth. Afterwards developing and estimating the improved Solow model, a problem has been come that has been taken critically in current years: the disaster of national per capita income. Convergences is not been expected in this study. By dissimilarity, it is predicted by Solow model that different countries frequently attain altered steady states. An extensive range of non-converged countries have been traditionally studied in the past. It is concluded that once the storage and population growth rate differences, then the amount of convergence the model is roughly the same [6].

Subsequently the classic initiating work by Solow (1956), substantial development has been made in the hypothetical and pragmatic literature of the endogenous growth model. By considering the savings rate and population growth rate exogenous, to examine economic growth by supposing a neoclassical production function and a reduction in the rate of return on capital, this preliminary work is done. Human capital has been added in the models known as the MRW models by [6]. Subsequently, human capital is a significant element in estimating growth has been found by [7].Likewise [3] have also investigated the important influence of the association amongst human capital and openness as an amount of the state's capability to rivet technical advancement and total factor productivity has been substantially affected. Developments in population health are an essential part of human capital formation has been considered as a critical issue by [12].

Research questions:

Many questions arise after study literature on Augmented Growth**.** How Augmented Growth Model effect GDP in Pakistan? How income (GDP) of the country effect Growth model? How Augmented play its role in the growth of developing country like Pakistan. This study tried to find out the answers of some of these questions.

Rationale of the study:

Problem statement:

Augmented Growth plays vital role in economic growth and development of a county. It is the supply of funds for investment projects of a country. If there is regular supply of Growth available for investors, there would be smooth business operations and hence would result in expansion of productive capacity of an economy. If there is expansion of productivity at higher sustained rate. With opening of new and new employment opportunities of a country, unemployed labor would be absorbed in production process and thereby increase the overall productivity of inputs. As standard of living directly depends on rate of expansion of national economy, therefore, national economy would share the aggregate prosperity among the neglected and marginalized segment of the society.

Significance of Study:

The healthiness of a country should be improved by enhancing the productivity of further kinds of human capital, especially investment in education, thus shifting the labor supply curve outer and increasing labor output [15].

The Health Capital Augmented Growth Model

We first specify two factors from the Cobb-Douglas production function, namely, capital and labor.

$Y_t = K_t^{\alpha} A_t L_t^{1-\alpha}$(1)

If Y_t is the actual income, K_t is the physical capital, $L_t$is the labor force, and $A_t$is the technical parameter level, reflecting how a country in the input into the output. At specified as

$lnA_t = \Pi X_t$(2)

Wherever the constraint trajectory to be estimated is $\Pi X_t$is the vector of the variable that determines the total factor productivity (TFP). The trajectory$X_t$comprises the logarithmic level of economic openness O_t ,because the countries that are much exposed to the respite of the sphere have more ability to engross the technological developments created by principal countries (Romer, 1992; Barro and Sala- i-Martin, 1995) .Then For simplicity, it is supposed that the labor force is defined as "a" for exogenous growth.

$L_t = L_o e^{at}$(3)

Explaining $k_t = (K_t / L_t)$ and $y_t = Y_t / L_t$ as the capital stock and level of yield each unit of labor correspondingly, the transformation of capital is done as

$\dot{K}_t = \omega_t^k y_t - (\alpha + \delta) k_t = \omega_t^k k_t^{\alpha} - (\alpha + \delta) k_t$(4)

Where a point shows change over time, ω_t^k is part of tangible capital investment in period t , and δ is depreciation rate. The capital stock (k_t) congregates to the stable state rate of assets (k_t^*) as

$k_t^* = [\omega_t^k / (n + g + \delta)]^{1/(1-\alpha)}$ (5)

Relieving the rate of $k_t^*$from (4) in (1) and by taking natural logs on equal edges, the firm state income each capita is inscribed as:

$lny_t = \beta_0 + \frac{\alpha}{1-\alpha} ln\omega_t^k - \frac{\alpha}{1-\alpha} \ln(n + g + \delta) + \varepsilon_t$(6)

Where β_0 is the intercept and $\varepsilon_t$is an error term. Equation (6) is a shortened arrangement of the Solow model, then is applied as a fundamental model in pragmatic norms (see, e.g [5]. Far along, social capital was incorporated into another investment. Increasing the human capital in the growth model demonstrated to be suitable for predicting the size of the capacity and the extent of the alpha, and the exclusion of human capital resulted in normative bias. From (1) production function could be inscribed as:

$Y_t = K_t^{\alpha} H_t^{\beta} A_t L_t^{1-\alpha-\beta} \alpha + \beta < 1$(7)

Adding to the physical capital in equation (3), H is the human capital stock (representing the mediocre level of education). The standard of humanoid capital growth depends on:

$\dot{h}_t = \omega_t^h y_t - (\alpha + \delta) h_t = \omega_t^h h_t^{\beta} - (\alpha + \delta) h_t$(8)

Where ω_t^hpart of the human capital investment is in the period t $h_t = \left(\frac{H_t}{L_t}\right)$ is the humanoid capital each unit of labor. Thus, equation (6) is now written as:

$lny_t = \beta_0 + \frac{\alpha}{1-\alpha-\beta} ln\omega_t^k + \frac{\beta}{1-\alpha-\beta} ln\omega_t^h - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n + g + \delta) + \varepsilon_t$(9)

Alike to humanoid capital appreciation, the Solow model could be expanded to healthiness investments. The advancement of health spending depends on.

$\dot{e}_t = \omega_t^e y_t - (\alpha + \delta) e_t = \omega_t^e h_t^{\gamma} - (a + \delta) e_t$(10)

In the period t, where part of the health capital investment ω_t^e is produced and $e_t = (\frac{E_t}{L_t})$ is the humanoid capital for each unit of labor. Equation (9) is inscribed as:

$$lny_t = \beta_0 + \frac{\alpha}{1-\alpha-\beta-\gamma} ln\omega_t^k + \frac{\beta}{1-\alpha-\beta-\gamma} ln\omega_t^h + \frac{\gamma}{1-\alpha-\beta-\gamma} ln\omega_t^e - \frac{\alpha+\beta+\gamma}{1-\alpha-\beta-\gamma} \ln(n+g+\delta) + \varepsilon_t \quad (11)$$

The model in equation (10) could be assessed using OLS. In the new theory of endogenous growth, some people think that the degree of technological progress has increased with the increase in the degree of openness of the country. Taking into account this view, openness variables (by trade intensity agents) are too encompassed in the model to capture the impact of technological advancement. It would also weaken the normative prejudice and rise the strength of the induced reasoning. Likewise, the increase in humanoid capital and health capital and physical capital also improved the enactment of the Solow model. Investment in human, health and physical capital is anticipated as having affirmative impact on each capita income. Correspondingly, openness variables are anticipated as having a progressive impact on each capita income. It supports to eliminate the deficiency of technical demand, increase the size of the marketplace or the accessibility of production expertise to the impact of revolution, resulting in higher per capita income.

REVIEW OF LITERATURE

The sequential relationship amongst GDP and health expenses each capita for Pakistan in an augmented Solow growth model proposed by [6] for the dated of 1973-2001 was estimated by Aurangzeb (2002).co-integration, ECM analysis and many investigative and condition tests have been used in this analysis. A substantial and positive association amongst gross domestic production and Health Expenses, both in the long- and short-run has been resulted in this study. The data has been attained from different publications of the Economic Survey of Pakistan and Arithmetical Additions issued by the Ministry of Finance. Co-integrating vectors between the variables of equation has been analyzed by estimating null hypothesis. The presence of a robust and constant long-run association between variables in the growth model has been confirmed by Johansen co-integration test. ECM technique has been applied to evade the specious regression phenomenon and its estimations, presence of a short- and long-term positive and important association amongst health expenses and economic growth. The measurements and diagnostic test give suitable consequences. Henceforth an addition of health expenses as a substitution for investment in health capital also increase the importance of the measurements of humanoid and physical assets in the growth model.

[3] analyzed the Solow growth model, whether it is reliable with the worldwide disparity in the standard of living or not. It is showed that an augmented Solow model including accretion of human and physical capital offers an outstanding picture of the cross-country data. The associations of the Solow model for conjunction in ethics of living, that, whether deprived nations incline to develop quicker than developed states have been analyzed in this study. It is concluded by results that Countries congregate at the same rate that augmented Solow model forecasts keeping population growth and capital accretion persistent. To analyses the augmented Solow, a proxy for human-capital accumulation is used as an entrains our cross-country analysis. The data is encompassed by real income, government and private consumption, investment and population, practically for the whole sphere except centrally premeditated economies. Annually data for the period1960-1985 has been used for estimation.

Outdoor assessments of physical and humanoid capital stocks route the growth secretarial deteriorations implicit by a Cobb Douglas cumulative production function was done. It has been resulted in this study that human capital appears unimportantly in describing per capita growth rates, but indicated a progressive role for human capital. At finest, though, registration ratios symbolize investment heights in human capital. It is explained in this study that literacy variable could be utilized as proxy of human capital but it has some crucial issues. Estimations of physical and human capital stocks to evaluate off-road indication on the factors of economic growth were utilized in this paper. It is approximated by a standard Cobb-Douglas production function. Results by this study showed some uncertainty on the customary part specified to human capital in the development procedure as an isolated element of production. Firstly, it is concluded that humanoid capital growth devours an insubstantial and adverse impact in describing each capita income evolution. This conclusion is forceful to a number of alternate descriptions and data sources. Positive role to the levels of human capital in growth accounting has been concluded. Consequences normally ensure that per capita income growth certainly hanged certainly on normal stages of humanoid capital.

Though the additional factors flop to significantly mark ratio of investment formerly one accounts for alterations in element accretion through nations.

The basic association, at the national level, between socio-economic factors and health resources in a developing country like Pakistan was examined by [12].The basic supposition is that auspicious socio-economic conditions, especially to influence resource division for improving the health status of any nation, modifications in gross domestic product per capita-GNPP, and education-E are predicted to play a significant role, the consequence on health strategies might be multidimensional. Data has been taken for analysis from Government of Pakistan (1994) for the time-period 1974-93.Urbanization is a significant factor of the accessibility of health employees and infrastructure. This indicates that education and GDP are intensely correlated. It is resulted that GDP is an important factor of non-development expenses on health and urbanization has an adverse and empirically substantial influence. The influence of education is amazingly destructive. The results displays that though the accessibility of health resources like doctors and nurses is rising in Pakistan, however their utilization and supply persist main issues.

[6] forecasted in his analysis that government expenses and taxation will have both short and long term impacts on growth. This prediction has been tested by using panes of yearly and period-averaged data for OECD countries through 1970-95.Endogenous growth model is strongly supported by conclusions and suggest that long-run Oscal impacts are not completely taken by these panel techniques. Contrasting earlier surveys, assessments are free from prejudices related with partial speciation of the government budget constraint. Data has been taken for twenty-two OECD countries from 1970. The Oscal data, which has been used in this study are collected from IMF, Government Financial Statistics Yearbook. Entirely Oscal variables are stated as fractions of GDP. By utilizing an OECD data set, it has concluded that, while enhancing a mixture of non-productive expenses and non-distortionary taxation, dynamic expenses increase the growth rate and distortionary taxes decrease it, as accordingly forecasts of the Barro ~1990 model.

[5] estimated restricted conjunction of OECD countries in health care expenses (HCE) per capita and gross domestic product (GDP). It grants assessment of the augmented Solow model recommended [6] to describe deviation in production and expenses each capita cross wise nations. Because of different savings rate, education, and population growth countries face different steady state growth paths. This study is an expansion of the MRW model by including health capital proxy by HCE to the improved Solow model. The concern of causation association amongst GDP and HCE is inspected. The experiential investigation is grounded on OECD states' data dated of 1970-1992. The consequences show that OECD countries congregate at 3.7% annually to their stable state level of income each capita. The consequences indicate that HCE has affirmative influence on the economic growth and the rate of conjunction. To analyze restricted merging of OECD nations in gross domestic product (GDP) and health maintenance expenses (HCE) each capita is the goal of this study.

The impacts of health humanoid capital on the growth ratio of each capita income in Sub-Saharan African and OECD states Kwabena were examined. To estimate progression ratio of each capita income which is dynamically and certainly affected by the store of investment and healthiness social capital, an developed Solow growth model, panel data and a dynamic panel evaluator have been applied in this study. Assessed results by examining the income growing equation with panel data of 21 Sub-Saharan African states of 20-year era and for 22 OECD nations of 35-year period shows that 22% and 30% of the evolution growth ratio of each capita income could be ascribed to health with positive influence in both samples. It is recommended by these results that addition in healthiness investments in Sub-Saharan African countries will raise economic growth shortly and permanently by becoming portion of the countries' shares of humanoid capital. As of a study perception, outcomes suggest that the stock of healthiness social capital and investment in it would be involved in growth calculations as additional estimators.

[10] analyzed the association among health and economic growth by following Barro (1991) and using, life expectancy and mortality degrees as factors of health although the Gross Domestic Product (GDP) is a sign for economic growth. The GDP and expenses on health data used have been taken from the Central Bank of Nigeria (CBN) of 1985-2009. It is concluded that the model is well-managed and the descriptive variables define around 87% deviation in GDP, which is the dependent and proxy variable for economic growth. Then tire expenses on health for the period 1985 to 2009 did not indicate a decent tendency and actually fund consumed on health capital schemes decline suddenly. This could be attained by enhancing the services of all channels of health sector, enhancing the assurance of health specialists and generate facilitating atmosphere for the manufacturers.

[1] has estimated the temporary associations amongst health expenditure and economic growth, as it has been become essential element in a number of current experimental studies. This study discovers this association at the

U.S. state-level. This study is an addition to literature by examining probable dynamic associations amongst health care expenses and financial evolution, estimated by gross state product in the southeast United States. Time series methodology has been used to take the empirical consequences, showing a weak, but progressive connection. Subsequently identifying unit roots in the data, cointegration in overall analysis was not identified, as a long run association appeared to be only for Georgia. The outcomes of the VAR examination are respectively restricted. Though the forms of the instinct functions confirm that there is appropriate positive association between positive particular health care expenses and economic growth. Gross state product (GSP) data for the period 1980-2004 has been taken from the U.S. Bureau of Economic Analysis (BEA) while State special health care expenses (PHCE) data for the same period were attained from the Center for Medicare and Medicaid Services (CMMS).its results were same as have examined by previous studies.

Theoretic and experiential literature both have a affirmative influence of human capital accretion as a kind of health on economic growth was assessed by [4].The obtained experiential proof is variegated for developed countries. Though, this study re-examines that whether health capital development increases GDP growth in developed states by employing anew experiential method of panel Granger-causality analysis. Thus, the assessment that health capital development raises long-run economic growth in the OECD zone is not supported by results. A comparatively new empirical procedure of dynamic panel Granger-causality assessments has been applied to inspect the impacts of health capital formation on long-term economic growth in this study. Just about 60% of the research depends on some portion of life expectancy rate and some select health care expenses (HCE) as a measurement. Data on per-capita health care expenses by a minimum five years, starting around 1970 are accessible from the OECD Health catalogue for 21 states. OECD data was not supported by any evidence, that whether capital development by health care expenses or the increase in life cycle anticipation Granger-cause per-capita GDP effect growth or not.

Analyses the impacts of health expenses on the Nigerian economic growth was estimated by [9]. Data on life probability at birth, fertility rate, capital and frequent expenses between 1985 and 2009 was taken for analysis. It is obviously perceived that the impacts of health expenses on the economic growth will be significant, if funds are cautiously used to the correct networks. It is recommended by this study is that more stress must be employed on the development of the excellence and kind of health to be delivered. This can only be possible to attain by enhancing the quality of health in all its sections. Henceforth, most important objective of any government should be provision of quality of health provision, along this economic development and poverty reduction of any country can be possible by providing maximum health facilities. Facility of clean water should also be the goal of any good government.

[9] struggled to inspect the impacts of health expenses on the Nigerian economic growth by estimating data on life expectation at birth, fertility rate, capital and persistent expenses among 1985 and 2009. It has been observed evidently that, moneys are cautiously used in the correct way; the impact of these expenses on the economic growth will be significant. It is recommended that more weight should be put on development of quality and forms of health to be given by enhancing the facilities in all channels of health sector. Data on GDP and health expense have been taken from the Central Bank of Nigeria (CBN) Statistical Bulletin, many issues. An encouraging on notation among human capital and economic growth of countries has been accepted by Economists. Therefore, with economic development and poverty reduction, health must be an essential objective of any government. Good government should have concentration on accessibility of clean water.

[10] planned to evaluate the influence of health expenditure on economic growth in Nigeria. Gross capital formation, total health expenses and the labor force output were assessed the major determinants of Economic growth in Nigeria by applying Multiple regression technique. By this study Life expectancy rate has adverse influence on growth. Time series data for the period of forty one (41) 1970– 2010 were attained from Central Bank of Nigeria (CBN) Statistical Bulletin (several issues) and African Statistical Year Books formed by the African Development Bank(several editions) is used in this study for analysis. The association amongst health expenditure and economic growth Grounded on a reformed neo classical Solow production function was estimated by a multiple regression technique. The model states Aggregate Real Output (Y) as a meaning of Capital Stock (K), Human Capital.

[8] concentrated on the influence of health programs on economic growth in Nigeria. Influence of health programs on human capital development in Nigeria was estimated by using subordinate data from Central Bank of Nigeria (CBN) statistical announcement for the period 1981 to 2012. To analyze the parameters of both models,

proposed by the study Ordinary Least Square technique was used, resulting in showing affirmative and substantial influence of health programs on human capital improvement in Nigeria. This result follows that with the a priori probability centered on economic theory by supposing that health programs have affirmative association and substantial effect on economic growth by the t-probability value 0.000 of health programs. This suggests that health programs have actual and positive influence on economic growth in Nigeria.

3. The Data:

Data by the Ministry of Finance issued the "Pakistan Economic Survey" and "Statistical Supplement" and other issues. These data cover the period from 1985 to 2015 each year. The time series includes the population, the actual gross domestic product, the actual total fixed capital formation, the real physical capital and the, HDI (human development Index) is used as human capital. Health expenses is seen as a representative of health capital, and trade concentration described by trade-to-GDP percentage is considered an open representative.

4. METHODOLOGY AND EMPIRICAL FINDINGS

Step I: Univariate Analysis

"A time series Y_t is static if its possibility distribution cannot variate within time," (Stock and Watson, 2004). As quoted by Dolado, Jenkinson and Sosvilla-Rivero (1990) Engle and Granger (1987) explain command of incorporation as, "A variable is $Y_t$said to be assimilated of order d [or y, ~ I (d)] if it has static, invertible, non-deterministic autoregressive moving average
(ARAMA) demonstration after diverting d times". Consequently, a time series is said to be stationary at level if it has no order of assimilation, whereas for a time sequence is static at first transformation if it has assimilated of orders one. Overall, if a time sequences has to be differenced d periods, at that time it takes an order of assimilation I (d) (Gujarati, 2004).

Hence it is essential to analyze the data for stationarity, or consistently to examine the command of integration for the apprehensive variables. The unit root test will apply on time series to check the stationarity

In this paper, at fore most step, we examine whether a time series is a stationary, a casual walk, a random walk with drift, or trend stationary. Here are altered methods that are accessible to assess the theory of stationarity of the data. Augmented Dickey and Fuller (1979, 1981) test has been applied to test the existence of unit root in a univariate time series. The idea behind this test is that lags of the dependent variable are added to the DF test. The ADF test is specified as follows;

$$\Delta y_t = \alpha + \beta_t + \rho y_{t-1} + \sum_{i=1}^{n} \lambda_i \, \Delta y_{t-i} + \varepsilon_t \qquad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

i=….1, 2…..n

In (12)ΔY_{t-1}" demonstrate the lagged value of regressed variable to interpret for the autocorrelation. Augmented dickey fuller ADF has been applied to analyze the stationarity of the concerned variables.

As it has been stated above that utmost of the time series are non-stationary or consistently their mean and variance differ by period. By differencing these variables could be transformed into stationary variables. If they are not transformed into stationary variables, the estimates are not effective and consistent. Augmented Dickey Fuller (ADF)has been employed to examine the stationarity of concerned variables.

Co-integration analysis:

(Johansen, 1988, 1991; and Johansen and Juselius, 1990) approach has been employed to assess the presence of synergistic integration in the essential series. Mutually they use the maximum Eigenvalue (λmax) and the trace (τ) test statistic to define the amount of co-integration vectors r. The null hypothesis of the test is that there is no common integral vector amongst the variables of equation (10). The results show that the non-cooperative null hypothesis was rejected in two tests at 1% significance level. Thus, there is a stout and steady long-run association amongst the variables in Eq. (10)

Considering that Johnson cointegration shows that there are multiple common integration vectors, the question is whether there are one or more common integration vectors in the underlying sequence that are better. The presence of many common merge vectors may shows that the system being examined is fixed in multiple directions and is therefore more established (Dickey et al., 1994).

Long-run parameter estimates:

The long-run factors assessed by employing the Johansen technique are standardized on the base of the GDP variable by set its assessed coefficient at -1. The factors and their corresponding standard errors are given in Table1.

Assessed long-run parameters

Equation	Coefficient	Std. Error
Yt	-1	
Kt	0.26*	0.03
Ht	0.39*	0.02
Et	0.14*	0.02
Ot	0.12*	0.08
Constant	-1.61*	0.17

Table 1 shows the consequences of the Augmented Dickey fuller tests of unit root. All the independent variables are converted into logarithmic arrangement before applying the unit root test. The data is converted into logarithmic form to decrease the influence of outliers and level the data set (Maddala, 1992). The results reveal that all the variables; Real GDP, Population, Human Capital, Trade openness, Real Physical capital, Health Expenditures and Real Gross Fixed Capital Formation are non-stationary at the level. The't' values were found to be lesser than the associated critical values at level which strongly accepted the null hypothesis of unit root or equivalently that the variables are non-stationary. The results also represent that all the variables are integrated of the order, I (1). Subsequently we have inveterate that all the variables included in estimated model are integrated of the similar order which is an essential state for the presence of long-term steadiness association amongst the variables, the Johansen co integration could be used to analyze cointegration or equally to see the long run association between the concerned variables.

Short-run ECM estimation:

Conferring by Engle and Granger (1987), common factors essentially have ECM demonstration. The main benefit of ECM is that it evades the false association amongst dependencies and independent variables, and creates usage of any short and long-term evidence. By using the Akaike (1969) FPE standard and the Caines, Keng and Sethi (1981) "gravity" (SGC) criteria, the corresponding lag length of respective variable and the sequence 3 entered in the ECM are selected.

The sign is the foremost differential operative, and Δ-tε is an error term. Regression corresponds to the one-year lag error correction term, and tEC06 <α is estimated. With the dynamic description of the model, short-term crescendos are affected by the aberration after the continuing association described by ECt-1. Note that the ECM model does not comprise intercept items. The cause is that the error correction ECt-1 at present contains its estimation.

Error Correction Specification

Growth Equation:

$$\Delta Y_t^r = -\sum_{i=1}^{2} \alpha_{1i} \Delta Y_{t-i}^r + \sum_{j=1}^{5} \alpha_{2j} \Delta K_{t-j}^r + \sum_{k=1}^{3} \alpha_{3k} \Delta H_{t-k}$$

$$+ \sum_{m=1}^{2} \alpha_{4m} \Delta E_{t-m} - \sum_{n=1}^{1} \alpha_{5n} \Delta O_{t-n} - \alpha_6 EC_{t-1} + \varepsilon_t$$

The observed results demonstrate that health expenses is a numerically substantial and consistent factors of growth. Thus, short-term growth is the growth of all three categories of capital. Though, openness variables have a significant but negative impact on short-term growth.

Open variables have a significant but negative influence on short-term growth. Several investigative and regulatory tests have been employed to examine the effectiveness of policy deductions collected from estimates of the ECM model.

Summary and Conclusion:

According to an economic model of earlier studies estimating the yearly economic data of Pakistan, this paper examines the probable cointegration of health expenses and GDP in the enhanced Solow growth model in the Cobb-Douglas functional form. It uses Johansen co-analysis, ECM methods and altered investigative tests. Prior to conducting a common test, the unit root test was executed by ADF and PP tests. The stated t-values as of the ADF

and PP tests show that the potential sequences appear to remain stationary in the first difference. Johnson's co-test approves the resilient and steady long-term association between the variables in the growth model.

Application of ECM technology to evade false regression phenomenon. The ECM model estimates that there is a short and long-run progressive and substantial relationship amongst health expenses and financial economic development. In addition, the short-term factors of the other two capitals (ie, material and human capital) have a substantial progressive impact on growth variables. In the long-term equilibrium adjustment, the error correction item ECT-1 was considered statistically significant. The instructions and diagnostic test results are satisfactory. Thus, the way in which health spending is included in health capital investment also increases the importance of human capital and physical capital in the growth model

Several diagnostic and measurement investigations have been smeared in order to square the rationality of the policy deductions, which are collected from the approximation of the ECM model.

Policy Recommendations:

- **It should help in policy debate.**
- **It should help in policy making.**
- **It should help in making growth model in country.**

Limitations and Recommendations:

In similar context, saving cause investment, and investment cause financial development in the country. Once economy moves on the higher level of financial development, the number of financial institutes starts increasing which in turn affect the behaviors related to consumption and cash holding of a society. In the existence of wider availability and accessibility of financial institutions, an economy moves on to, high technology status which further accelerate economic growth and development.

Economic growth coupled with financial sector development and innovation, an economy moves to the state of open society with business orientation rather than consumption orientation. All these are the multi-directional affects of transmission of saving into national economy.

Health capital has been added to Pakistan's Solow growth model. Secondly, its methodology is constructed on the covariance vector autoregressive (VAR) model introduced by Johansen (1988, 1991 and 1995). It has been considered crucially that multivariate modeling mechanism give a most important benefit in that multiple cointegration associations could be demonstrated in the system without the necessity to enact any standardization in the two-way Engle-Granger two-step cointegration process [15].

REFERENCES

[1]. Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics*, *34*(2), 143-173

[2]. Caines, P. E., Keng, C. W., &Sethi, S. P. (1981). Causality analysis and multivariate autoregressive modelling with an application to supermarket sales analysis. *Journal of Economic Dynamics and control*, *3*, 267-298.

[3]. Gyimah-Brempong, K., & Wilson, M. (2004). Health human capital and economic growth in Sub-Saharan African and OECD countries. *The Quarterly Review of Economics and Finance*, *44*(2), 296-320.

[4]. Hartwig, J. (2010). Is health capital formation good for long-term economic growth?–Panel Granger-causality evidence for OECD countries. *Journal of macroeconomics*, *32*(1), 314-325.

[5]. Heshmati, A. (2001). *On the causality between GDP and health care Expenditure in augmented Solow growth model* (No. 423). SSE/EFI Working Paper Series in Economics and Finance.

[6]. Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The quarterly journal of economics*, *107*(2), 407-437.

[7]. Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The quarterly journal of economics*, *107*(2), 407-437.

[8]. Nweze, N. P. (2015). THE IMPACT OF HEALTH PROGRAMMES ON ECONOMIC GROWTH IN NIGERIA. *GLOBAL JOURNAL OF APPLIED, MANAGEMENT AND SOCIAL SCIENCES*, *9*.

[9]. Ogundipe, M. A., & Lawal, N. A. (2011). Health expenditure and Nigerian economic growth. *Eur J Econ, Finance AdmSci*, *30*, 125-129.

[10]. Oni, L. B. (2014). Analysis of the growth impact of health expenditure in Nigeria. *IOSR Journal of Economics and Finance*, *3*(1), 77-84.

[11]. Rivera, B., &Currais, L. (1999). Income variation and health expenditure: evidence for OECD countries. *Review of Development Economics*, *3*(3), 258-267.

[12]. Siddiqui, R., Afridi, U., Haq, R., &Tirmazi, S. H. (1995). Determinants of Expenditure on Health in Pakistan . *The Pakistan development review*, *34*(4), 959-970.

[13]. Mohamed, A., Sahbi, F., Muhammad, S. and Frederic, T. (2014). The role of natural gas consumption and trade in Tunisia's output. Working Paper Series, IPAG Business School, 2014 – 057. Available at http://www.ipag.fr/fr/accueil/la-recherche/publications-WP.html.

[14]. Nasiru, I. and Usman, H.M. (2012). Health expenditure and economic growth nexus: An ARDL approach for the case of Nigeria. JORIND, 10(3): 95 – 100.

[15]. Imoughele, L.E. and Ismaila, M. (2013). Determinants of public health care expenditure in Nigeria: An error correct

[16]. Edame, G.E. (2014). Trends analysis of public expenditure on infrastructure and economic growth in Nigeria. International Journal of Asian Social Science, 4(4): 480-491.

[17]. Alhassan, A.L. and Fiador, V. (2014). Insurance-growth nexus in Ghana: An autoregressive distributed lag bounds cointegration approach. Review of Development Finance, http://dx.doi.org/10.1016/j.rdf.2014.05.003. Available online at www.sciencedirect.com.

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Peak Detection Image Processing Algorithm for Qualitative Analysis of Oil Palm Trees

Mubeena Pathan[1*], Barkatullah Qureshi[2], Pinial Khan Butt[3] and Ghulam Mujtaba[4]

[1,2,3]Information Technology Centre, Sindh Agriculture University Tandojam
[4]Faculty of Social Sciences, Sindh Agriculture University Tandojam

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ABSTRACT

Oil palm has tremendous potential for the economic development of the country, therefore it is imperative to have accurate and reliable information, especially concerning plant quality, phenology, and health and yield prediction. The most important limitations for decision making are the lack of data, cost effectiveness and timely processing of information. The innovation in technology, such as Remote Sensing (RS) has modernized the conventional methods and recognized as a modern agriculture crop information provider tool for worldwide oil palm stakeholders. The aim of this study is to design and implement peak detection image processing algorithm, as an approach to the qualitative analysis of oil palm trees, discriminate between the stressed and healthy oil palm trees identified through the aggregate value samples in visible, near infrared and shortwave infrared region for individual oil palm crowns. Subsequently detect the stressed and dead oil palms by analyzing the values in the near infrared and a shortwave infrared region. The algorithm applied on AISA Classic and AISA Eagle images and analyzed by the remote sensing image processing software Environmental Visualization of Images (ENVI 4.7) and Interactive Data Language (IDL 7.1). The results show that the algorithm can be functional for the better planning of oil palm plantation.

KEYWORDS: oil palm; remote sensing; peak detection; algorithm; image processing

1. INTRODUCTION

Tropical rain forests represent some of the most biologically diverse, structurally complex ecosystems on earth. The identification of tree species is a key element in the definition of habitats of key fauna that use specific trees for food and shelter. Remote sensing is beginning to play a more active role in the efforts to detect, monitor and manage forests and individual tree. Monitoring individual tree health and stress from remotely sensed images is of concern for forest management. The art monitoring system aimed at tree species identification using airborne and the spaceborne sensors are potentially key tools for the development of sustainable development policies. Oil palm (*Elaeis guineensis Jacq*) is an inhabitant of the coastal swamplands, and freshwater rivers of central and West Africa. There are large-scale plantations of oil palm throughout the tropics, especially Malaysia and Indonesia, which are major producers. Demand for palm oil is raising and expected to climb further, particularly for the use of biodiesel; it is promoted as a form of renewable energy that greatly reduces next emission of carbon dioxide into the atmosphere, and decreases the impact of greenhouse effect [1]. The major threat to sustainable oil palm production is the *Ganoderma boninense* disease, which causes extensive damage to the oil palm. In this regards a technique developed [2] based on vegetation indices and red edge; however, the accuracy of the results achieved was not very high, being between 73% and 84%. Airborne hyperspectral remote sensing can be used as an efficient tool in monitoring the characteristics of oil palm plantation in order to predict and manage the oil palm production by using a new image processing techniques.

The innovation in technology, such as Remote Sensing (RS) and Geographic Information Systems (GIS), has modernized the conventional methods. Remote sensing is recognized as a modern agriculture crop information provider tool for worldwide oil palm stakeholders. One of the important characteristics of Hyperspectral sensors is the spectral resolution, which provides unique spectral signatures for trees and other natural and man-made objects. Spectral signatures show the amount of solar radiation absorbed, reflected, transmitted and emitted with different wavelengths as a distinctive curve. These phenomena allow the accurate classification of the oil palm plantation according to health and stress. A variety of remotely sensed data is available from a wide range of sensors and various platforms like multispectral and hyperspectral. Advances in sensor system technology, however, have effectively removed one of the most significant barriers of multispectral remote sensing, that is, the limitation of spectral dimensionality. Hyperspectral remote sensing has the potential to measure specific vegetation variables that are difficult to measure by traditional multispectral sensors. AISA-classic is one of the most significant sensors. The Airborne imaging spectrometer is extensively used for mapping applications and provides flexible operations under cloudy and variable skies.

One of the foremost requirements for the growth of oil palms is the nutrients. If there is a deficiency of any nutrient in the oil palm it can identify by leaf analysis [3]. For the examination of nutrients in oil palm [4] expressed that remote sensing data alone are inadequate for measurement, it also requires data analysis tools for laboratory observation, and,

***Corresponding Author:** Mubeena Pathan, Information Technology Centre, Sindh Agriculture University Tandojam
E-Mail: mubeena2009@gmail.com

finally, to identify the relationship between the laboratory data and sensor data. The focal intention of the study, which was carried out in Sungai Papan Estate, Kota Tinggi, and Johor, was to develop a model for quantifying nitrogen levels in oil palm leaves by using Landsat TM data. In this study a radiometric corrected Landsat-5 TM satellite image, digital map of the fertilizer trail plot and analysis data were used. ERDAS Imagine version 8.3.1 image processing software was used for atmospheric correction. Although the use of the remote sensing technique for the extraction of nutrients is faster and low cost, it is still only at an initial stage and necessitates a lot of work. The study, however, is more efficient and advanced if high-resolution hyperspectral images are used.

Fungal disease detection in perennial crops is a major issue in estate management and production. However, nowadays such diagnostics are long and difficult when only made from the observation of visual symptoms, and very expensive and damaging when based on a root or stem tissue chemical analysis. As an alternative, [5] developed a tool to evaluate the potential of hyperspectral reflectance data to detect the disease efficiently without the destruction of tissue. This study focuses on the calibration of a statistical model of discrimination between several stages of *Ganoderma attacks* on oil palm trees, based on field hyperspectral measurements on tree scale. A combination of preprocessing, partial least square regression and linear discriminate analysis is tested on about hundred samples to prove the efficiency of the canopy.

Spectrally continuous hyperspectral remote sensing data can provide information on forest biochemical contents, which are important for studying vegetation stress, nutrient cycling, productivity and species recognition, etc. Remote sensing measurements have the potential to provide a cost effective means to examine the complexity of forests and generalize findings from the plot scale. The introduction of hyperspectral sensors produces much more complex data and provides much enhanced abilities to extract useful information from the conventional data stream. However, it also demands more complex and sophisticated data analysis procedures if their full potential is to be achieved. Hyperspectral technology and imaging spectrometry technology are as being among the important leading research fields of remote sensing [6]. Research on processing, analysis and information extraction of hyperspectral data should be strengthened to determine more useful information, and make full use of the advantages and potential of hyperspectral remote sensing technology, and promote the development of new and vital technology [7, 8].

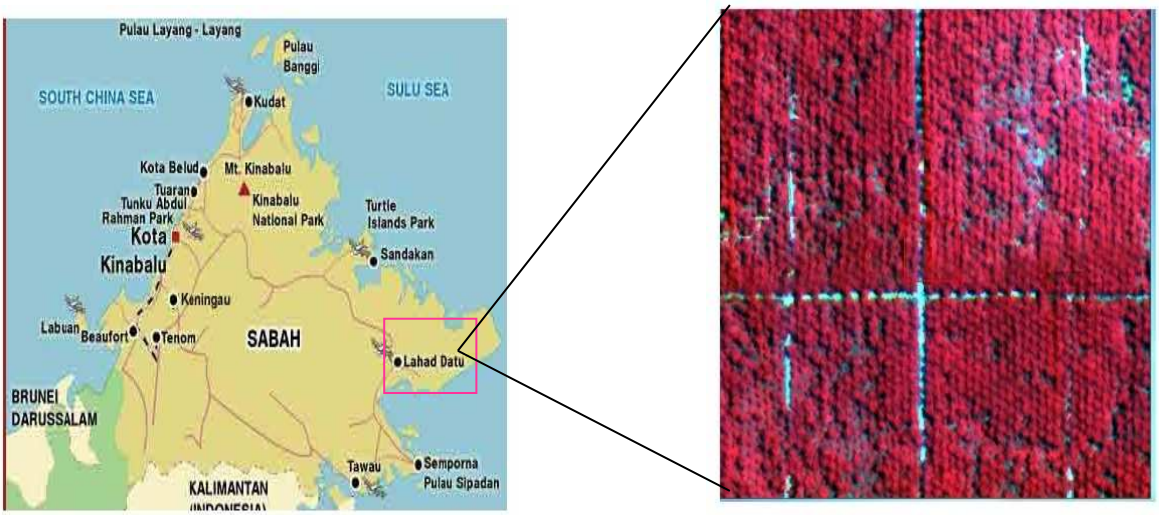
Digital image processing is an expanding area with applications regarding to our daily lives. Various tools and methods are used for image processing, data analysis and classification. Scientists and practitioners have made immense efforts to build up advanced approaches and techniques for improving accuracy [9]. Remote sensing software is exceedingly functional to manipulate geospatial data; therefore, image processing software offers a viable solution to access that data in an easy way and distribute new data to the extensive users. Several algorithms have been developed for diversifying functions in image processing, depending upon expert knowledge about the characteristic of interest in the data. Many image processing and analysis techniques have been developed to aid the interpretation of remote sensing images and to extract as much information as possible from the image. Remote sensing and Geographic information system (GIS) are very significant tools, that can provide crucial information to various fields such as Army, agriculture, environmental, transportation, medicine, industries, forestry and etc [10]. The aim of this study is to design and implement a practical and productive peak detection image processing algorithm, as an approach for the stress detection of oil palm trees. AISA Classic and AISA Eagle image have been analyzed by using ENVI and IDL. AISA systems have been chosen in the research because they are user friendly, easy to install and remove from any aircraft, and provide timely, accurate and reliable information.

2. MATERIAL AND METHOD

2.1. Study Areas and hyperspectral data

In this research two areas in Malaysia were selected as the study areas. The first study area is Lahad Datu, Tawau Division Sabah eastern Malaysia. Figure 1 shows the study area (Lahad Datu) and the hyperspectral airborne image used in the study. The image was acquired by using UPM-Advance Imaging Spectrometer for Application (AISA-Classic) sensor, which is light weight and can easily be installed in an aircraft such as the ShortSC7-SkyVan. The sensor is a very compact push broom system, with sensor head, a miniature GPS/INS data acquisition unit and caligeo post processing system. The sensor is capable of collecting data within a range of VIS/NIR 430-900 nm, up to 286 spectral channels and with a fine 1.8 nm spectral resolution. The spatial resolution of the data is 1m with 1000m flying altitude. The airborne image was acquired in May 2006, between 10 am and 2 pm over Lahad Datu Sabah. The map projection is Universal Transverse Mercator UTM zone 50 North, with a latitude of 5° 24’ 29.44” N and longitude 119°11’14.98” E, and datum World Geodetic System WGS-84. The hyperspectral image of the research area is a False Color Composite (FCC) image 1133x750x20 unsigned integer; band sequential (BSQ) with the default bands.

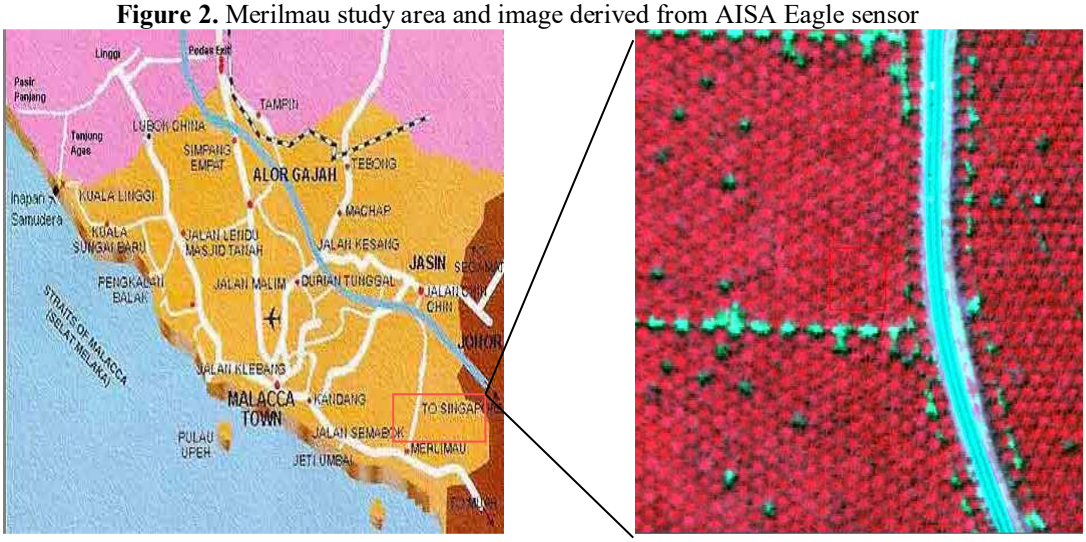
Figure 1. Lahad Datu study area and image derived from AISA Classic sensor



The second study area used in this research is Merilmau, a town in Melaka, Malaysia. Figure 2 indicates the second study area and the hyperspectral airborne image used in the study. The image was acquired performance, 244-channel hyperspectral imaging system known as AISA Eagle. It provides cost effective, end-to-end airborne collection capabilities that acquire research grade spectral imaging data for use in military, environment and commercial remote sensing programs. The sensor operates across the VIS/NIR portion of the spectrum (400-1000nm), resolving spectral difference as fine as 2-4 nm with 1000 pixels per scanning line. The map projection is Universal Transverse Mercator UTM zone 48 North, with a latitude of 2º 11' 51.72" N and longitude 102º26'17.71" E, and datum World Geodetic System WGS-84. The AISA Eagle image of research in that area is FCC image with 709x513x128 (samples, lines and bands) unsigned integer; band sequential (BSQ) with default bands.

The images exhibit outside the visible range of electromagnetic spectrum; therefore, the vegetation is displayed in red color, urban areas in cyan and soil in light brown color. All other shades are based on leaf structure, moisture content and the health of the plant. After image acquisition the data was preprocessed to remove all distortion, artifacts and noise. After preprocessing, the feature extraction technique is used to detect the main regions of interest from the AISA image. In this phase the image is organized into distinguished components and training areas according to their feature characteristics. The main purpose is to sort out the pixels in an image into different land cover classes and analyze the image according to reflectance absorption in the visible band, near infrared band (NIR) and Shortwave infrared (SWR) region.

Figure 2. Merilmau study area and image derived from AISA Eagle sensor



2.2. Peak detection image processing algorithm

For qualitative analysis the algorithm largely depends upon the previously conducted FBE studies. Using SCC as a reference point, analysis was carried along the NIR and SWR of the electromagnetic spectrometer. Traditionally, researchers have focused on the Foliar Biochemical Estimation (FBE) and with the use of finer spectrographic have been able to identify the spectral signatures that define the stress levels in vegetation using the near infrared regions (NIR) of the electromagnetic spectrometer.

The growth status of vegetation can be identified by the indication of chemical concentration of different nutrients in the crop. The common factor to estimate crop yield is to monitor real time changing detection in chemical concentration. Since Hyperspectral sensors measured in contiguous, narrow band spectral analysis therefore the reflectance and absorption features related to specific crops can be detected from the spectral profile. Spectral analysis techniques provide versatile methods for the different applications including agriculture, forestry and vegetation. It can compare the absorption and reflectance features present in the spectrum. On the basis of an in-depth study concerning the health of the oil palm trees [11] expressed that image spectral reflectance signatures indicate the physical characteristics of the oil palm. The most imperative characteristics of vegetation are the absorption of light in the visible part of the spectrum and strapping reflectance at the wavelength above 700nm.The red edge phenomenon specifies the rapid amendment in the reflectance of chlorophyll and reveals the status of vegetation in near infrared range [12].

Peak detection image processing algorithm has been developed to monitor the health and stress status of individual oil palms. In this regards discriminate between the stressed and healthy oil palm trees identified through the aggregate value samples in the visible, near infrared and shortwave infrared region for individual oil palm crowns. Subsequently detect the stressed oil palms, which have been categorized into three classes (S1, S2, and S3) according to their stress condition. The slightly stressed oil palms have been categorizes as S1, moderately stressed as S2, and severely stressed as S3. Finally identify individual dead oil palms by analyzing the values in the visible, near infrared and shortwave infrared region. The healthy oil palm trees have higher reflectance between 700-900 nm because of the higher concentration of chlorophyll in the fronds and NIR is greater than SWR.

$$Healthy\ Tree\ = Visble\ > NIR\ and\ SWR$$

$$Dead\ Tree\ = Visible\ < NIR\ and\ SWR$$

$$Stressed\ Tree\ = Visible\ more\ > NIR\ and\ SWR$$

However, the stressed trees seem to have a lower level of chlorophyll and mineral deficiency, which leads to a decrease in the spectral reflectance of the leaves in the range of 450-500, and NIR, is less than SWR. This reflectance increases with the varying levels of stress in the vegetation. Dead oil palm trees have the lowest spectral reflectance due to the lowest moisture control in the NIR portion of the electromagnetic spectrum. Referenced studies show that in comparison to the healthy trees where SWR is less than NIR, in the dead trees it inverse, as shown in Figure 3 and Figure 4 respectively.

Figure 3. Indicates the Visible Higher than Near Infrared and Shortwave Infrared Region in Healthy Tree Spectral Signature

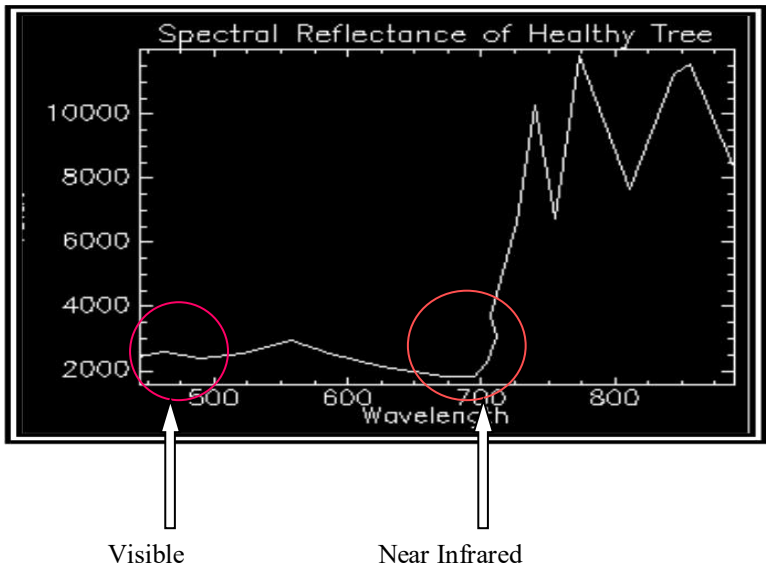
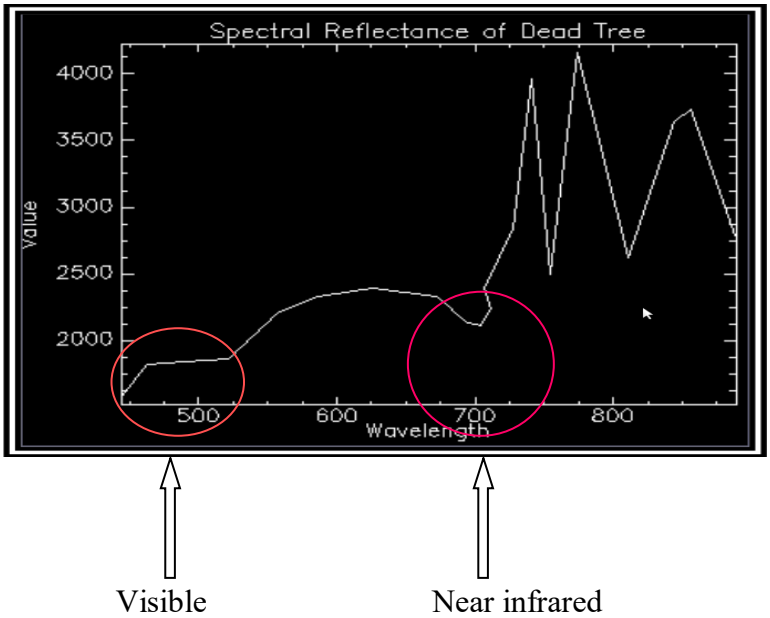


Figure 4. Indicates the Visible lower than Near Infrared and Shortwave Infrared Region in Dead Tree Spectral Signature



The assessment of the stress levels of a tree is measured against the predefined levels of visible and NIR readings on a spectrograph. Presently, these levels are taken as a symbolic value for programming purposes only in order to be able to demonstrate the application's capability for identifying the different stress levels of the trees. When analyzing the spectral properties of a plantation, the reflectance of water bodies is significant in the identification of dead trees within the region having high vegetation indices reflection. A tree, while having a highly reflective canopy will typically overshadow the reflectance of the soil water, whereas the region of a dead tree will continue to display a high value for soil water reflectance shortwave infrared SWR in the spectrograph. The difference between the healthy and stress levels in the visible and near infrared region can be observed Figure 6.

Figure 5. Indicates stressed oil palm tree level in Visible and NIR region

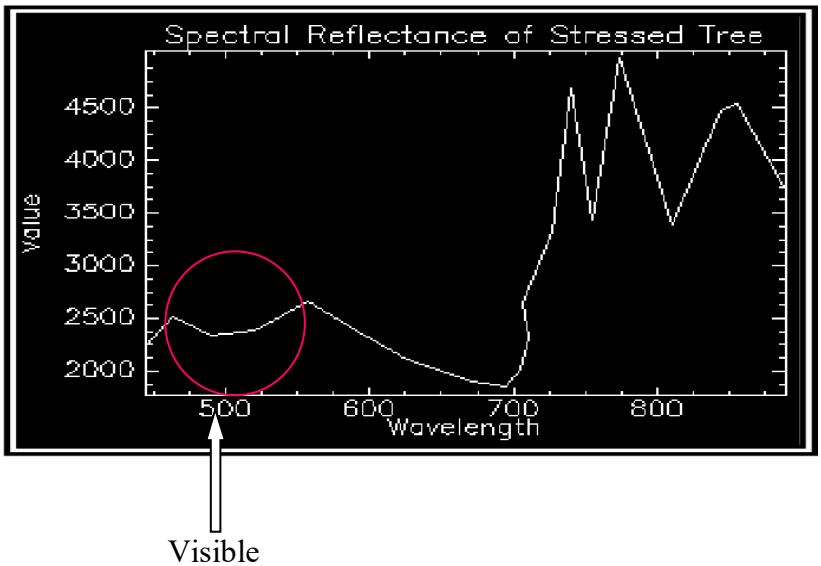


Figure 6. Aggregate values indicates oil palm health

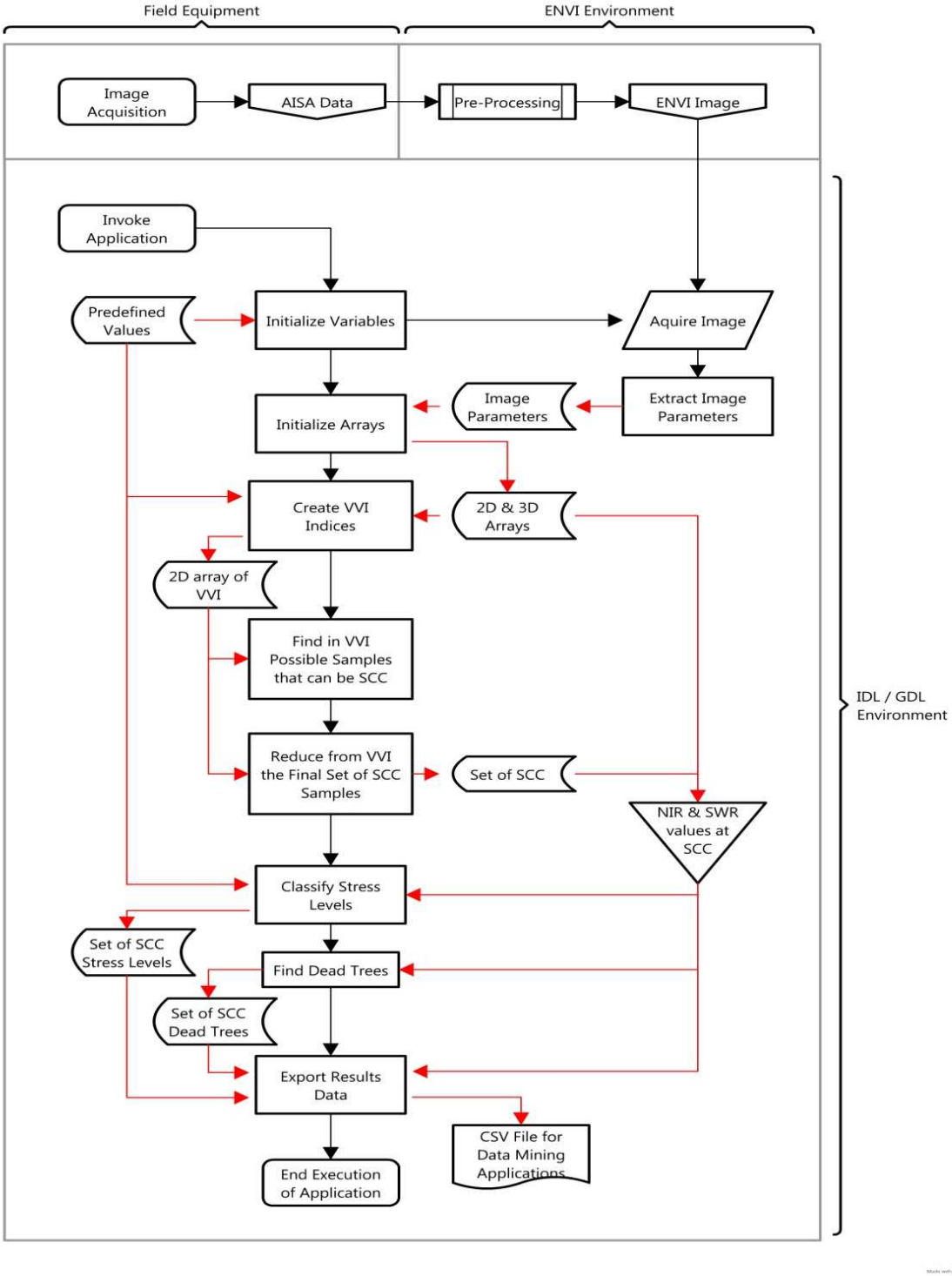
0	0	1	0	0	0	0	0	0	1	0	0	0	0
0	1	2	2	1	1	0	0	2	3	3	2	1	0
0	2	6	6	6	2	0	0	3	8	8	7	3	0
1	3	7	8	7	3	1	1	4	8	9	8	4	0
1	3	6	3	7	2	0	1	4	8	6	8	3	0
0	2	3	3	2	1	0	0	3	4	4	3	1	0
0	0	1	1	0	0	0	0	0	1	1	0	0	0

Figure 7. Major Steps Involve in peak detection image processing algorithm

```
  Initialize variables for individual tree SCC, healthy tree H,
  Slightly stressed S1, moderately Stressed2 S2, severely Stressed S3
  and dead tree D.
begin
        Initialize Arrays
        Find VVI possible samples that can be SCC
if SCC located  then
        Identified and count as an individual tree.
else
        Non vegetated Area.
        begin
        Set threshold values for H,
        Set threshold values for S1,
        Set threshold values for S2,
        Set threshold values for S3
        Set threshold values for D.
        Identified and count H, S1, S2, S3, and D.
        end
        Compute and Export results in CSV format.
end
end
```

The major steps involved in the algorithm are described in Figure 7 and further explained in flowchart illustrated in Figure 8. The black arrows represent the flow of the code while the red arrows indicate the memory variables set recalled in the different sections of the application.

Figure 8. Flowchart describe peak detection image processing algorithm; the black arrows represent the flow of code while the red arrows indicate memory variables Set recalled in the different Sections of the application



In order to automate the process, the algorithm is implemented in the IDL code, which analyzes the AISA Classic and ASA Eagle image, and demonstrates the calculated results. The peak detection algorithm software application developed imports the ENVI data into IDL variables and delivers (converting the sample indices according to IDL standards) and outputs the result in text and comma Separated Values (CSV) format, which can be utilized by any data mining application for further analysis in future.

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3. RESULTS AND DISCUSSION

The AISA Classic and AISA Eagle images have been examined according to parameters are set according to these regions of interest and applied in the IDL source code. The whole AISA Classic image is very large, consists of 1,133 Samples, 750 lines and occupies approximately 85 ha.The AISA Eagle image comprises 709 samples, 401 lines and occupies 36 ha area. First the seven spatial subsets of the AISA Classic image (ACSS1-ACSS7) as shown in Figure 9 and Figure 10, were taken and analyzed using the peak detection image processing algorithm in IDL. Finally, the whole AISA Classic image analyzed.

Figure 9. Gray scale AISA Classic image indicates the randomly selected spatial subsets

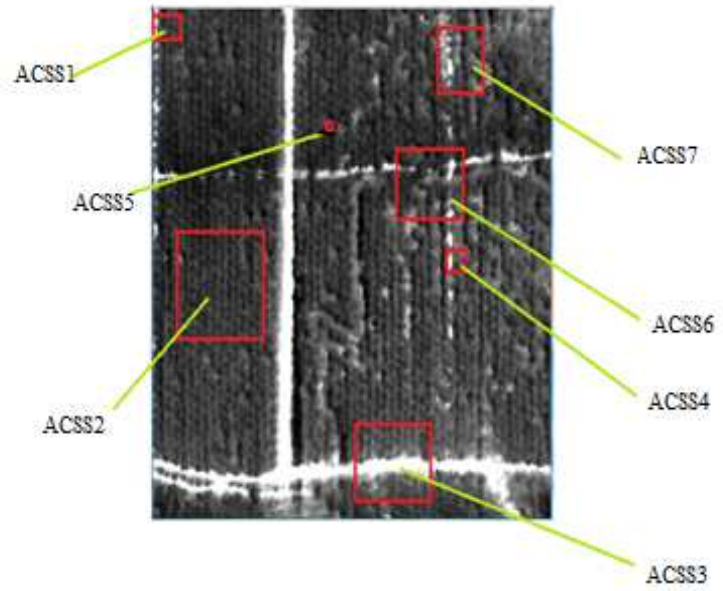
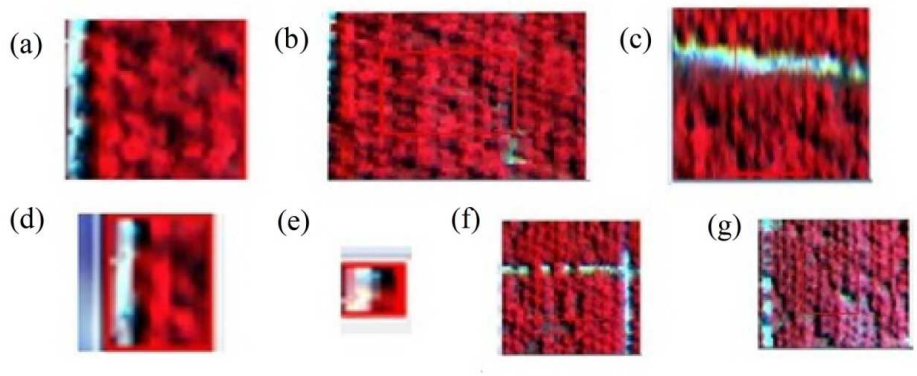


Figure 10. AISA Classic image selected spatial subsets (a) ACSS1, (b) ACSS2, (c) ACSS3, (d) ACSS4, (e) ACSS5, (f) ACSS6, (g) ACSS7



Similarly the seven spatial subsets of the AISA Eagle image (AESS1-AESS7) as shown in Figure 11 and Figure 12, were taken and analyzed using the peak detection image processing algorithm in IDL. Finally, the whole AISA Eagle image analyzed.

Figure 11. Gray scale AISA Eagle image indicates the randomly selected spatial subsets

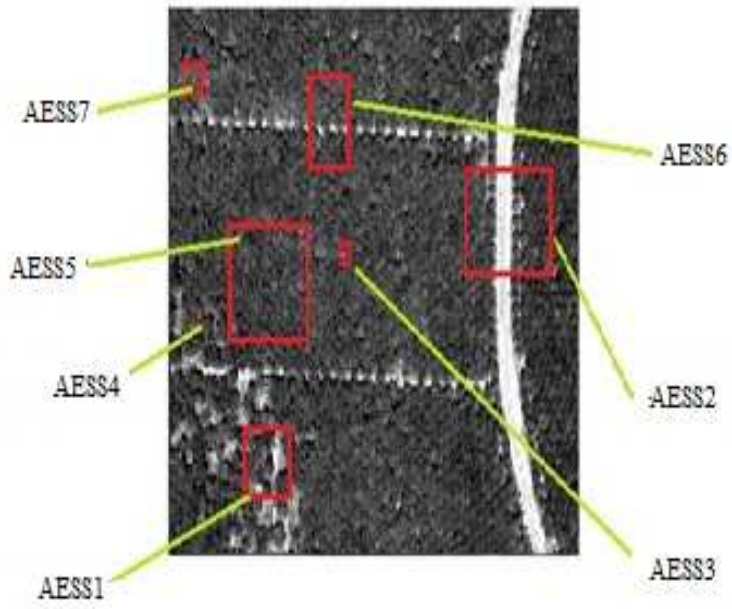
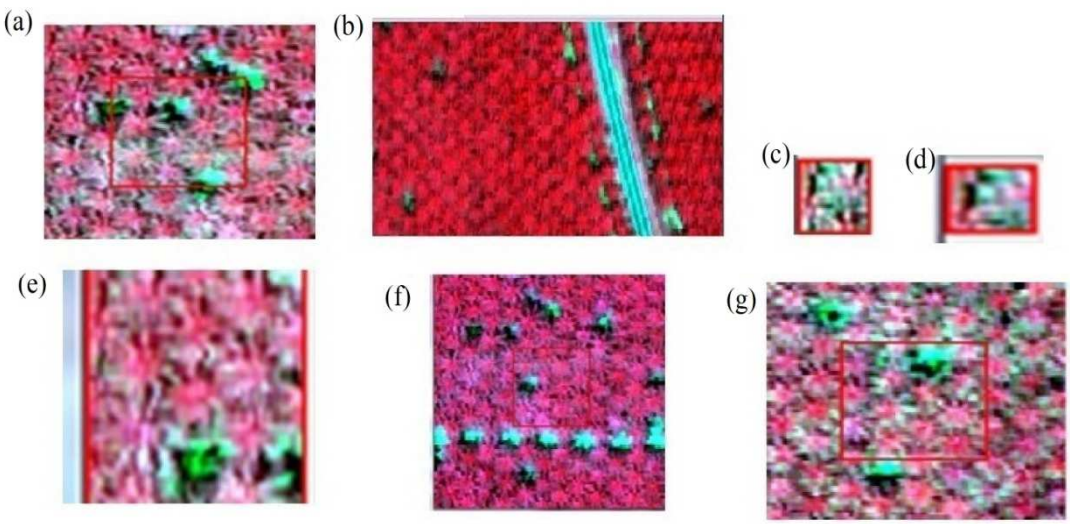


Figure 12. AISA Eagle image selected spatial subsets (a) AESS1, (b) AESS2, (c) AESS3, (d) AESS4, (e) AESS5, (f) AESS6, (g) AESS7



In the qualitative analysis of the oil palm trees; the health and stress status of each oil palm was analyzed. The individual oil palm tree (TC) in AISA Classic image and AISA Eagle is located according to the peak detection at the X-coordinate at X-axis as X-cord and Y-coordinate at Y-axis as Y-cord. The Health Status (HS) is categorized into different classes, which indicates a dead tree as “D”, a healthy tree as “H”, and a slightly stressed oil palm as “S1” moderately stressed as “S2” and severely stressed as “S3”.

The AISA Classic image spatial subsets (ACSS) results are described in Table 1. In the ACSS1, 34 healthy oil palm trees and one dead oil palm tree were detected. No stressed oil palm trees were detected in the spatial subset image. In the ACSS2, there are 179 healthy oil palm trees out of 186. Three oil palms were detected in the slightly stressed category; however, no oil palm was detected in the S2 or S3 condition. Four oil palms were identified as dead in the image. In the ACSS3, there are 97 healthy trees and one dead oil palm tree. However, no stressed oil palms were detected in the S1, S2 or S3 condition. In the ACSS4, no healthy oil palm trees were identified. In addition, one oil palm is in the slightly stressed condition S1, five are in the moderately stressed condition S2, and one dead oil palm tree was detected. The ACSS5 indicates that only one dead oil palm tree was detected in the image. The ACSS6 reveals that there are 113 healthy, two slightly stressed S1 condition and seven dead oil palm trees in this image. However, no moderately stressed S2 and severely stressed S3 oil palm trees were detected. The qualitative analysis of ACSS7 reveals that there are 232 healthy, three slightly stressed S1 condition and nine dead oil palm trees in this image. However, there were no moderately stressed S2 or severely stressed S3 oil palm trees detected. Finally, the whole AISA classic image analyzed, there are 1125 healthy, 547 dead oil palms detected in the AISA Classic image. Furthermore, there were 598 oil palms in the slightly stressed S1 condition, 27 in the moderately stressed S2 condition and 19 in the severely stressed S3 condition found in the image.

Table 1. AISA Classic image spatial subsets qualitative analysis

ACSS	TA(ha)	TT	HT	ST			DT
				S1	S2	S3	
ACSS1	0.250	35	34	0	0	0	1
ACSS2	0.201	186	179	3	0	0	4
ACSS3	0.683	98	97	0	0	0	1
ACSS4	0.062	7	0	1	5	0	1
ACSS5	0.014	1	0	0	0	0	1
ACSS6	1.020	122	113	2	0	0	7
ACSS7	1.353	244	232	3	0	0	9
ACI	84.975	2286	1125	598	27	19	547

ACSSI =AISA Classic image subset, ACI= AISA Classic full image, TA = Total area in hectares, TT= Total number of trees, HT=Healthy trees, ST= Stressed trees, S1= Slightly stressed trees, S2= Moderately stressed trees, S3= severely stressed trees, DT=Dead trees

Table 2. AISA Eagle image spatial subsets qualitative analysis

AESSI	TA(ha)	TT	HT	ST			DT
				S1	S2	S3	
AESS1	1.000	173	139	20	12	0	2
AESS2	3.534	589	537	2	2	6	42
AESS3	0.040	1	0	1	0	0	0
AESS4	0.022	1	1	0	0	0	0
AESS5	0.250	30	29	1	0	0	0
AESS6	2.250	365	289	38	23	8	7
AESS7	1.020	140	137	2	0	1	0
AEI	36.371	5439	5287	69	38	45	288

AESSI =AISA Eagle image subset, AEI= AISA Eagle full image, TA = Total area in hectares, TT= Total number of trees, HT=Healthy trees, ST= Stressed trees, S1= slightly stressed trees, S2 = Moderately stressed trees, S3= severely stressed trees, DT=Dead trees

The AISA eagle image was resized into seven different spatial subsets (AESS) and the results analyzed for the validation of the algorithm. Finally, the whole AISA Eagle image was analyzed, the result depicted in Table 2. The AESS1 shows that there are 139 healthy, 20 slightly stressed S1 condition, 12 moderately stressed condition S2 and two dead oil palm trees in this image. No severely stressed S3 oil palm trees were detected. The AESS2 indicates that there are 537

healthy, two slightly stressed S1 condition, two moderately stressed S2, six severely stressed S3 and 42 dead oil palms. The AESS3 indicates that there is only one healthy oil palm in the image. Zero stressed or dead oil palm was found in the image. The AESS4 indicates that there is only one healthy oil palm in the image. No stressed or dead oil palm was found in the image. The AESS5 indicates that there are 29 healthy and one slightly stressed S1 oil palm in the image. No moderately stressed S2 severely stressed S3or dead oil palms were found in the image. The AESS6 indicates that 289 healthy, 38 slightly stressed S1, 23 moderately stressed S2, eight severely stressed S3 and seven dead oil palms were found in the image. AESS7 indicates that there is 140 healthy, two slightly stressed S1 and one severely stressed S3 oil palms. No moderately stressed S2 or dead oil palms were found. The whole AISA Eagle image shows that 5,287 healthy, 69 slightly stressed S1, 38 moderately stressed S2, 45 severely stressed S3 and 288 dead oil palms were found in the image.

4. CONCLUSIONS

The main notion behind the study was to propose an easily handled tool, for the qualitative analysis of hyperspectral data regarding individual oil palm trees, over the two study sites of Malaysia Lahad Datu and the Merilmau. Oil palm qualitative analysis is a laborious and complicated task; the proposed peak detection image processing algorithm solves this problem successfully. It is the simplest way to analyze individual oil palm trees by using image processing software ENVI and IDL. The results reported in CSV format were further analyzed using a data mining application in future.

REFERENCES

1. Kamaruzaman, J.; Mubeena, P. Mapping of individual oil palm trees using airborne hyperspectral sensing: an overview. *Journal of Applied Physics Research* **2009**, 1, 15-30.
2. Shafri, H.Z.M.; Hamdan, N. Hyperspectral imagery for mapping disease infection in oil palm plantation using vegetation indices and red edge techniques. *American Journal of Applied Sciences* **2009**, 6, 1031-1035.
3. Turner, P.D. *Oil palm diseases and disorders*. Oxford University Press, Kuala Lumpur, 1981; 280p
4. Nor Azleen, A.R; Wahid, B.O.; Tarmizi, A.M; Basri, W. Remote sensing for oil palm foliar nitrogen. *Malaysian Palm Oil Board Information Series*, 2003, TT NO 177.
5. Camille, C.D.L.; Jean, M.R.; Simon, B.; Fabrice, D.; Mathieu, L.; Nurul, A.S.; Doni, A. R.; Jean, P.C. Evaluation of oil-palm fungal disease infestation with canopy hyperspectral reflectance data. *Sensors*, **2010**, 10, 734-747..
6 Jiang, X.; Tang, L.; Wang, C.Y.; Wang, C. Spectral characteristics and feature selection of hyperspectral Remote sensing data. *International Journal of Remote Sensing*, **2004**, 25, 51–59.
7. Mazer, S.A.; Martin, M.; Lee. M.; Solomon, J.E. Image processing software for imaging spectrometry data analysis. *Journal of Remote Sensing of Environment*, **1988**, 24, 201–211.
8. Kruse, F.A.; Lefkoff, A.B.; Boardman, J.W.; Heidebrecht, K.B.; Shapiro, A.T.; Barloon, P.J. The spectral image processing system (SIPS) – Interactive visualization and analysis of imaging spectrometer data. American institute of Physics Conference Proceeding 1993, 283, 192-201.
9. Gong, P.; Howarth, P.J. Frequency-based contextual classification and gray-level vector reduction for land-use identification. *Journal of Photogrammetric Engineering and Remote Sensing*, **1992**, 58,423–437.
10 Mubeena, P.; Kamaruzaman, J.; Alias, M.S.; Razali, Y; Barkatullah, Q. Implication of image processing algorithm in remote sensing and GIS applications. *Journal of Theoretical and Applied Information Technology*, **2011**, 33, 034-041.
11. Kamaruzaman, J. Sustainable Management of a Matured Oil Palm Plantation in UPM Campus, Malaysia Using Airborne Remote Sensing. *Journal of Sustainable Development*, **2009**, 2, 195-200.
12. Curran, P.J. Remote sensing of foliar chemistry. *Journal of Remote Sensing of Environment*, **1989**, 30, 69-76.

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Pakistan Stock Exchange and Its Relationship with Emerging Countries Stock Markets

Syed Arshad Ali Shah[1], Muhammad Nisar Khan[2], Ikram Ullah[3], Muhammad Taimur Khan[4], Mohammad Daud Ali[5]

[1]Lecturer (Finance), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan
[2]Lecturer (Finance), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan
[3]MBA (Scholar), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan
[4]Lecturer (Management Sciences), Department of Management Sciences, Bacha KhanUniversity, Charsadda
[5]Lecturer (Management Sciences), University of Haripur

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ABSTRACT

Pakistan stock exchange has seen many ups and downs since the last period. The local investors are feeling themselves much insecure in local investment. The reasons behind are political instability, severe power crises and terrorism which compelled the local investors to go across boarder and need to explore the multiple option of investment in international securities to minimize the investment risk. Aims of the study to analyze short and long terms relationship between Pakistan stock exchange and its four emerging countries stock markets namely India, China, Turkey and Sri-Lanka. The study has utilized monthly data of stock indices for the period ranging from 1st January 2008 to 31st December 2016.We used Augmented Dickey-Fuller test to check the unit root or stationarity. ADF augmented dickey fuller test exhibits that all the data are at level so we run directly regression. From the consequences of the regression analysis it is found that there is no relationship between Pakistan stock exchange and other four emerging countries stock markets such as India stock market, china stock market, turkey stock market and Sri-Lanka stock market.
KEY WORDS: PSX-100 Index, India stock market, china stock market, turkey stock market and Sri-Lanka stock market.

INTRODUCTION

The stock exchange is known as the market in which shares of publicly held companies are issued and traded either through exchanges or over-the-counter (OTC) markets. It is also known as the equity market, the stock exchange is one of the most vital components of a free-market economy, as it provides companies with access to capital in exchange for giving investors a share of ownership in the company. The stock market makes it possible to grow small initial sums of money into large ones, and to become wealthy without taking the risk of starting a business.
According to Bodie and Marcus, (2007) that the investors hold a diversified security to get a suitable return, and get opportunity to reduce risk. Therefore, investors normally wants to select such types of security which are not correlated. For these purpose investors go outside their national borders and tend to invest in other countries stocks markets. By this geographic diversification investors are able to capture high rate of return offered by new emerging markets. This diversification increased significance of international capital markets.
For two main purpose investors tend to invest in other countries markets. First of all, due to worldwide liberalization during 1980-1990 developed countries reduced capital flow were followed by developing countries.
Yang and Bessler, (2003) studied that due to globalization and communication network among the countries are very significant for both, the institutional and individual investors to invest in stock market of other countries. The investors want to hold one's security and to invest other countries actually resulting the flow of capital across countries and especially to developing markets from developed markets.
Increase in communication and flow of capital of investors it will directly moving towards more economically integrated world. For success of economic integration, the world integrated financial countries are the most important factor. Countries want to provide desirable sources for sustainable growth of the economy and to get advantage from their emerging countries stock market. Commercial incorporation agrees stockholders to get stable growth and profits (Aksoy & zeytunlu, 2011)

***Corresponding Author:** Syed Arshad Ali Shah, Lecturer (Finance), Department of Management Sciences, Bacha Khan University, Charsadda, Pakistan. Email: arshadbadshah@hotmail.com

Ergun, (2013) explored in his research that the relationship between Pakistan and Turkey have long and good due to economic and supporting corporation between the countries in sectors such as energy, transport, communications, infrastructure, textiles, automobiles, agriculture, industry, food processing, dairy development, information technology, oil and gas. When the Prime Minister of Pakistan visited Istanbul in 2013 the corporation between the countries established stronger push and after that the Turkish Prime Minister visit to Pakistan in December. Both prime ministers of the state agreed to their mutual relationship for greater mutual gains. And were signed three important memorandum of understanding between the Karachi Industrial Department and Turkey Cooperation Agency, Pakistan Railways and Turkish Logistics Organization, Pakistan Standard Quality Control Authority and Turkish Standards Institution,

According to Aazim, (2012) main emerging countries of Pakistan are China, India, US, Malaysia, Japan and Singapore. Pakistan trade with these countries is relatively high and also the data of stock indices are easily available for the selected time period. Pakistan trade with emerging countries stock markets and its volume in 2010 was with European Union it was 13.6%with China it was 14.5% with UAE it was 8.5% with US it was 7.6% with Singapore it was 3.2% with Saudi Arabia it was 6.7% with India it was 5.3% with Kuwait it was 4.7% with Afghanistan it was 2.9% with Japan it was 2.7% with Iran it was 3.5% with Malaysia it was 5.1%.

DG Trade, (2012) studied in his research that emerging countries like Saudi Arabia, Afghanistan, Iran and Kuwait are not included in the study because the data of stock indices are not available for selected time period. This study is conducted to find out short and long-term relationship of Pakistan stock Exchange and its relationship with emerging countries stock markets. The problem which are facing that what type of relationship occur among selected stock market and what is the effect of other stock market on Pakistan stock exchange. Many researchers found this relationship but this research is slightly different from other researches due to using different emerging countries stock markets with Pakistan stock exchange. Secondly, whereas most studies have used daily and weekly data of those countries stock markets, while this study used monthly stock market indices values for each of these selected countries. Because the information flows rapidly and markets react to the information exposed in values of other stock markets very quickly. The objectives of the study to investigate the relationship among Pakistan stock exchange and selected emerging countries stock markets i.e. India, Turkey, China and Srilanka.

- To investigate the relationship between Pakistan stock exchange and National stock exchange India.
- To investigate the relationship between Pakistan stock exchange and Istanbul stock exchange Turkey.
- To investigate the relationship between Pakistan stock exchange and Shenzhen stock exchange China.
- To investigate the relationship between Pakistan stock exchange and Colombo stock exchange Srilanka.

LITERATURE REVIEW

As discussed above, investigation of stock markets correlation is very essential performance so stockholders become aware of the stock markets. Where they reduce their risk and where they have chances of diversification. Following is brief literature review of the past studies conducted on area of the research.

Hassan and Naka, (1996) studied that Germany, Japan, UK and US stock market, to check the relationship among stock indices for long and short periods. Through the daily data for the period 1984-1991 and there was not significant evidence supporting the long and short-term relationship among the equity indices? It was also found in the study that in the post short term in 1987 all other stock exchanges were operating by the US stock market. But in all the long-held positions in all the periods led to all other stock markets.

Yang and Bessler, (2003) Studied the correlation of stocks exchange in Australia, Japan, UK, France, US, Hong Kong, Germany, Switzerland, and Canada using daily closing prices of stock indices for the period of June 1997 June 1999 provided proof of correlation and said that in America a consistent long-term impact in other stock markets.

Muckley, Lucey and Agarwal (2003) investigated the integration of the European stock markets and identified Frankfurt as the major market values. He has also determined that in year 1997-98 rose to the integration of the European stock markets.

The process of investigating the relationship between Equity Australia and Hong Kong, Taiwan, Singapore, America, Britain, Korea and Japan market value for Rock (1999) period 1974-1995 and using Johansen and Juselius, Granger Carany and Australia and others Zero correlation between markets

Irakle and Genduj, (2001) determined that after the Asian crisis, the relationship among G7 and Turkey Stock Exchange and Egypt, Morocco, Israel and Jordan, has been investigated, but no relations have been found with MENA countries. In addition, determine the implicit relationship between the G-7 and Turkey Stock Exchange.

Glezakos and Mylonakis, (2009) studied for the period of February 2009 during the financial crisis, before the investigation of interdependence among stock exchanges in Romania, Bulgaria, Croatia, Greece, Turkey and

Germany during the financial crisis. To check stationarity Dickie-fuller and Philips person test were used, and Granger was used to control the causation test. They found that these markets are loosely linked during the normal period of business and have been mutually correlated during the economic downturn.
According to Maghyereh, (2003) the market in Turkey, Jordan, Morocco and Egypt developed in 1997-2002.He also studied and found that there is the level of incorporation in the stock market of Morocco, Egypt, Jordan, that there is less and Turkey.
Kucukcolak, (2008) examined the level of market incorporation with Turkey stock exchange and European Union, the stock market indices of France, Britain, Greece and Germany for the period of daily data 2001-2005. The use of Engle-Granger's equation has shown, in the long term, the Turkish market value is not correlated with France, Britain and Germany, is correlated with the Greek stock market.
Ergun, (2010) discussed that EU markets under the condition of the Turkish region the use of Turkey stock market for the period of 1988-2010. The Dynamic Relationship examined the effect of instability, CGARCH, an agreement after establishing strong relations among the stock market between the EU, Turkey and NASDAQ Turkey throughout the sample period, the Istanbul Stock Exchange exited the instability of NASDAQ.
Atyeh and Rashad (2012) examined the integration between the financial markets of the Arab countries using the Johansen approach the indices for the period from January to December and establishment of integration between the countries of the European Union and Arab market. When the index is dependent variable the financial markets of the Arab countries, but when the EU is dependent variable, there is the integration among the EU and the financial markets with Arab countries.
Nath and Verma, (2003) describe in his research they used daily data of capital market indices from Nov 1994 to Jan 2002 to investigate the stock market of three interdependence countries market of India, Taiwan and Singapore stock markets. They examine that the number of indices levels is not stable and also pointed out that no co-integration between the index and both for the entire period is not a long-term balance.
Karim, (2007) explained the integration of stock market of Malaysia and major trading partners using weekly data for the period of July 1998-2007. The VECM approach and co-integration has established a strong integration between Johansen and Johansen by using evidence of Juselius among Malaysia stocks exchange there were no possibilities for its main trading partners and therefore international diversification.
Lamba, (2005) determined in his research a large sample for short and long-term relationship among in December 2003 Pakistan, Sri Lanka and Indian markets have been examined in South East Asian markets developed for the period of July 1997. His study has shown that the Indian market is influenced by the United States, Britain and Japan. In addition, he clarified that this effect has been taking place on the United States after September 11, 2001 terrorist attacks.
Saleem and Hassan, (2008) studied the long-term relationship among the developed world stock market and Karachi stock market using the multivariate correlation analysis he used weekly stock market data from 2000-2001.They included multivariate co-integration apply Johansen and Juselius's analysis. Studies have shown that a long-term relationship between these markets and the markets are not integrated. Together with their analysis co-integrated Germany, Canada, US, UK, Italy and Australia have shown that the stock markets are not co-integrated with Karachi stock markets.
Azeem and Ahmed Yasser, (2009) in his research he used monthly data from 1999 -2009 four major shares of the South Asian people for the markets including the Bangladesh Stock Exchange, Srilanka Stock exchange, Pakistan Stock Exchange and India Stock Exchange. It has been successful and South Asian stock correlation analysis and vector error correction models are very rare among market.Since last 48 months, the Pakistan stock exchange 100-index continued greatly unstable. During that period three most extreme financial crises were seen. Pakistan stock exchange PSX 100-index was crashed in 2005 firstly. Collapse was observed in the quarter of 2006 secondly. The most serious was observed from May 2008 to Jan 2009 thirdly. More than 9 thousand points of PSX 100 index was fallen in this period. In Jan 2013 again a major crash was observed which was the second largest crash in Pakistan history more than 500 points of PSX 100-index was fallen due to that crash (Economic Survey of Pakistan (2008-09 & 2012-2013).

Research Hypotheses

- H_0: There is no significant relationship among Pakistan Stock Exchange and other selected emerging countries stock markets.
- H_1: There is significant relationship among Pakistan Stock Exchange and other selected emerging countries stock markets.

Sub Hypotheses

- H_0: There is no significant relationship between Pakistan Stock Exchange and National stock exchange India.
- H_1: There is a significant relationship between among Pakistan Stock Exchange and National stock exchange India.
- H_0: There is no significant relationship between Pakistan Stock Exchange and Istanbul stock exchange Turkey.
- H_1: There is a significant relationship between Pakistan Stock Exchange and Istanbul stock exchange Turkey.
- H_0: There is no significant relationship between Pakistan Stock Exchange and Shenzhen stock exchange China.
- H_1: There is significant relationship between Pakistan Stock Exchange and Shenzhen stock exchange China.
- H_0: There is no significant relationship between Pakistan Stock Exchange and Colombo stock exchange Srilanka.
- H_1: There is significant relationship between Pakistan Stock Exchange and Colombo stock exchange Srilanka.

DATA COLLECTION RESEARCH METHODOLOGY

Type of research

This research is exploratory. Most of the work of others researcher has been briefly discussed and hypothesis is developed.

Sample size

In this study the sample size taken ranged from Jan 2008 to Dec 2016. The monthly data of stock indices are used for all the variables.

Sources of data

The data is secondary in nature and is collected from different sources. Google search engine and official sites of Pakistan stock exchange and yahoo finance.

Data collection

The data is collected from several areas. The index price have been collected from the Pakistan stock exchange. The closing prices of the stock returns are taken and their log returns are calculated. The log returns are calculated by the formula in excel.

$$RT = \ln (P1/Po)$$

RT = represents the return

P1 = represents the closing price on the given day

Po = represents the closing price on the day previous to P1

RESEARCH METHODOLOGY

To investigate short term and long-term relationship between Pakistan stock exchange and its relationship with emerging countries stock markets, different time series econometric techniques are used. This study used Unit Root Tests for data stationarity and Regression analysis to check the relationship among the stock exchange of Pakistan and emerging countries stock markets.

This study used monthly closing value of stock indices of Pakistan stock exchange and other four emerging countries stock markets including, India, China, turkey and Srilanka. The study includes five variables including Pakistan, India, China, Srilanka, Turkey stock indices.

Augmented Dickey Fuller Test

As it is the assumption of regression analysis that there should be no trend in the data. We first checked the stationarity of data, there are different tests to check the Stationarity. We used ADF (augmented dickey fuller test).

If the whole variables become stationary at level we will directly go for regression. If some of these variables become stationary at level and some on first difference then we use ARDL (Auto Regressive Distributed Lag) to check log-run relationship of our variables. If entire variables become stationary at 1st difference we use co-integration to check log-run relationship of our variables.

Regression Model

PSX= α+β (India National stock exchange, China Shenzhen stock exchange, Turkey Istanbul stock exchange and Srilanka Colombo stock exchange) + error term

Dependent variable

Pakistan stock exchange

PSX 100 index used as a proxy for the stock exchange of Pakistan.

Independent variables

Indian stock exchange

National stock exchange NSE used as a proxy for the stock exchange of India.

China stock exchange

Shenzhen stock exchange used as a proxy for China.

Turkey stock exchange

Istanbul stock exchange ISE used as a proxy for the stock exchange of turkey.

Srilanka stock exchange

Colombo stock exchange used as a proxy for Srilanka.

RESULTS AND DISCUSSION

As we have taken four stock markets such as India stock market, china stock market, turkey stock market and Sri-Lanka stock market and checked the relationship with Pakistan stock exchange. The monthly data are collected for these four variables which is time series in nature so we should have to check the stationarity of the data, for this purpose we used the Augmented Dickey –Fuller (ADF) test to check the stationarity of our data. For ADF test there is a null hypothesis Ho that there is a unit root. The results of ADF test is given below:

Table 1

Variables	ADF Test value	Order of Integration
Pakistan Stock Market	-8.982335	I (0)
India Stock Market	-8.817425	I (0)
China Stock Market	-9.319610	I (0)
Turkey Stock Market	-7.900811	I (0)
Srilanka Stock market	-8.204207	I (0)

ADF augmented dickey fuller test exhibits that all the data are at level therefore we go directly for regression.

Regression Analysis

Table 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005140	0.031968	0.160789	0.8726
NSE	0.388873	0.467407	0.831981	0.3073
CSE	0.353749	0.344736	1.026142	0.4074
ISE	-0.165815	0.487144	-0.340382	0.4785
SSE	0.370563	0.520980	0.711282	0.7343

R-squared	0.029854	Mean dependent var	0.008590
Adjusted R-squared	-0.008190	S.D. dependent var	0.324026
S.E. of regression	0.325350	Akaike info criterion	0.637772
Sum squared resid	10.79697	Schwarz criterion	0.762671
Log likelihood	-29.12080	Hannan-Quinn criter.	0.688404
F-statistic	0.784716	Durbin-Watson stat	2.920182
Prob (F-statistic)	0.537683		

Interpretation of regression analysis

From the above regression analysis the results exhibits that the p-value of India stock market, china stock market, turkey stock market and Sri-Lanka stock market are 0.4074, 0.3073, 0.7343 and 0.4785 respectively. We concluded from these values that there is no significant relationship of Pakistan stock market with other four emerging

countries stock market because the p-value is greater than the critical value 0.05.Our result show that H_O is accepted and alternative hypothesis H_1 rejected due to no relationship between Pakistan stock exchange and other four emerging countries stock markets. There is no relationship between the stock exchange of Pakistan and its other emerging countries stock markets because Pakistan stock exchange is inefficient and therefore don't represent the effect of other international capital markets although it is receptive to national events like ups and down in Pakistan stock exchange, natural disasters (Earth quake and flood) and artificial disasters (Terrorism, War against Terror) and represents the effects of these events. These result are consistent to Anjum Shezad (2014), Muhammad Ihsan Ullah Khan (2012) and Tazeem Anwar (2016).

Conclusion

In this research the relationship between Pakistan stock market and other four emerging countries stock markets such as India stock market, china stock market, turkey stock market and Sri-Lanka stock market. This is obvious from this study that there is no significant relationship between Pakistan stock exchange and other four emerging countries market such as India stock market, china stock market, turkey stock market and Sri-Lanka stock market. We collected the monthly data for all the five variables which is time series. Before going to analysis we first check the unit root for Pakistan stock exchange and other four emerging countries stock markets such as India stock market, china stock market, turkey stock market and Sri-Lanka stock market for which the null hypothesis is that there is a unit root. We used Augmented Dickey-Fuller test to check the unit root or stationarity. ADF augmented dickey fuller test exhibits that all the data are at level so we run directly regression. From the consequences of the regression analysis it is found that there is no relationship between Pakistan stock market and other four emerging countries market such as India stock market, china stock market, turkey stock market and Sri-Lanka stock market. These result are consistent to Anjum Shezad (2014), Muhammad Ihsan Ullah Khan (2012) and Tazeem Anwar1 (2016).

Recommendation

This study analyzed relationship between Pakistan stock exchange and its only four emerging countries stock markets such as India, China, Turkey and Srilanka stock markets. However other major emerging countries of Pakistan like Afghanistan, UAE, Saudi Arabia, Kuwait and Iran are not included because of unavailability of data for the selected period so further research on the area can be carry out by taking these countries into account.

Limitation

However, the limitation of the study must be included in this this research. My analysis is based on some limitation. The limitation are given below.

The first limitation is that we consider only four emerging countries stock markets.

Second refer to the fact that the research is only on the basis of Pakistan which is the developing country because in the literature some researchers study these relationship on the basis of developed countries therefore their results were different from me.

Lastly some of the journals are chargeable. In chapter 2, conducted the literature review by reading on the journal that done by other researchers on the topic which is similar to our research. For some of the important journal which is directly discussing their finding relation among the countries. I only found its paragraphs of abstract but not in full journals, I am required to pay for it prior to access to the whole journal. Students may not afford to pay for it. These all limitations are due to short period of time.

This study is conducted in a limited span of time and to check the relationship. After studying the previous researches on co-relation of Pakistan stock exchange with four emerging countries stock markets especially in my selected sample there is little work being available in which these markets are studied together. Therefore, it can be emerging topic for further research to analyze co-relation in these markets.

REFERENCES

Adrian, T., & Erkko, E. (2010). Funding Liquidity Risk and the Cross-Section of Stock Returns. *Federal Reserve Bank of New York Staff Reports*, *(464).*

Aghababaei, H. R., Ataei, S., & Azizkhani, H. (2013). Effects of credit Risk indicators on shareholders' value of commercial banks in IRAN. *International Research Journal of Applied and Basic Sciences*, *6*(8), *1143–1149. Retrieved from www.irjabs.com*

Akram, N. (2014). The Effect of Liquidity on Stock Returns: An Evidence from Pakistan. *IOSR Journal of Business and Management*, *16*(2), *66–69. https://doi.org/10.9790/487X-16216669*

Arif, A., Abrar, A., & Afzal, M. (2012). Credit Risk and Shareholders' Value in a Developing Economy: Evidence from Pakistani Banking System. *Journal of Economics and Behavioral Studies*, *4(2), 87–95*.

Balasemi, N., & Veiseh, S. M. (2015). Relationship between liquidity and stock returns considering company' s life cycle: The case study of Tehran stock exchange listed companies, *31*, *85–91*.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2007). Liquidity and expected returns: Lessons from emerging markets. *Review of Financial Studies*, *20(6), 1783–1831. https://doi.org/10.1093/rfs/hhm030*

Bond, S. A., & Chang, Q. (2013). Liquidity Risk and Stock Returns: A Return Decomposition Approach*, 1–44*.

Co, C., & Petrasek, L. (2014). Liquidity risk in stock returns: An event-study perspective. *Journal of Banking and Finance*, *45(1), 72 83 .https://doi.org/10.1016/j.jbankfin.2013.09.020*

Chekili, S., & Abaoub, N. (2013). Impact of Liquidity on Stocks Returns: Application on the Tunis Stock Exchange, *3(3), 23–32*.

Iqbal, S., Nasir, S., Iqbal, N., & Zia, M. (2015). Impact of liquidity risk on firm specific factors: A case of islamic banks of Pakistan, *9*(11), 256–260.

Kang, C., & Kang, H. (2009). The Effect of Credit Risk on Stock Returns. *Journal of Economic Research*, *14, 49–67*.

Li, B., Sun, Q., & Wang, C. (2011). Liquidity, Liquidity Risk and Stock Returns: Evidence from Japan. *European Financial Management*. *https://doi.org/10.1111/j.1468-036X.2011.00629*.x

Liang, S. X., & Wei, J. K. C. (2012). Liquidity risk and stock returns around the world. *Journal of Banking and Finance*, *36(12), 3274–3288. https://doi.org/10.1016/j.jbankfin.2012.07.021*

Moradi, N. (2015). The Relationship between Liquidity Risk and Stock Returns Case Study: Oil Companies in Tehran Stock Exchange, *3*.

Nielsen, C. Y. (2015). Hidden in the factors? The effect of credit risk on the cross-section of equity returns $, *46(October).*

Ogilo, F. (2012). The Impact of Credit Risk Management on Financial Performance of Commercial Banks in Kenya. *DBA Africa Management Review*, *3(1), 22–37*.

Resti, A., & Sironi, A. (2007). *Risk Management and Shareholders' Value in Banking*. *Wiley FinanceRetrievedfromhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:No+Title#0*

Salehi, M., Talebnia, G., & Ghorbani, B. (2011). A study of the relationship between liquidity and stock returns of companies listed in Tehran Stock Exchange. *World Applied Sciences Journal*, *12(9), 1403–1408. Retrieved from http://www.idosi.org/wasj/wasj12(9)/6.pdf*

Steiger, F. (2010). The Impact of Credit Risk and Implied Volatility on Stock Returns, *(May). Retrieved from http://arxiv.org/abs/1005.5538*

Tripathy, T., & Ahluwalia, E. (2015). Day Long Effect of Liquidity on Stock Return: An Empirical Investigation in a Day of Political and Economic Importance in India. *International Journal of Economics and Finance*, *7(10), 204–214*. https://doi.org/10.5539/ijef.v7n10p204

Vovchak, V. (2012). Liquidity and Liquidity Risk in the Cross-Section of Stock Returns. *Papers.Ssrn. Com*, *1–27. https://doi.org/10.2139/ssrn.2078295*

Watanabe, A., & Watanabe, M. (2008). Time-varying liquidity risk and the cross section of stock returns. *Review of Financial Studies*, *21(6), 2449–2486. https://doi.org/10.1093/rfs/hhm0542015*

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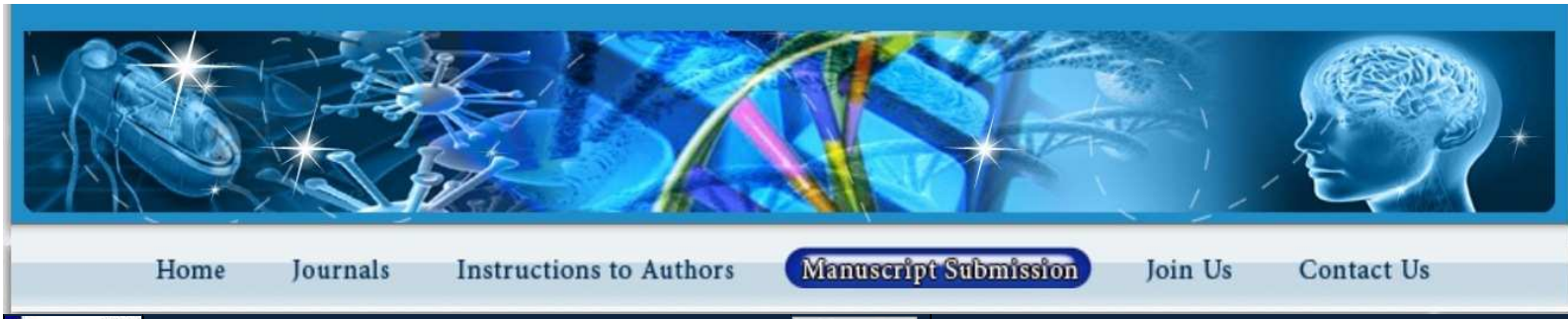

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