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Southern Journal of Research

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Natural Sciences

A Study of Formal-Spatial-Morphology and Pattern Recognition; Computed on Evidence from Ecological Healing Environment fit for Hospital Architecture in Melbourne

Kamila Kasperska Adiunkt

Instytut Mauk Prawnych, , University Opole Poland, Lublin, Poland.

Abstract. Extensive evidence suggests that sunlight and fresh air are essential for healing and cure in healthcare settings. Daylight and environmental breeze are exceptionally beneficial and satisfactory UV rays along with adequate oxygen are fundamental for Healing Environment. This is an Evidence-Based design crafted accordingly as a subtractive solid where the complex matrix is achieved by applying pattern recognition of sun and wind movement hour by hour, then a building section is provided on 3D Max, to maximize the surface towards the sun in Melbourne. St Vincent's Hospital planning is analyzed on Climate Consultant Software by application of sunrays to sculpt the solid to incorporate a sunny plaza shaped according to sun movement and prevailing wind current every hour of each month. In this research hospital building massing and form is sculpted according to the sun and wind movement, and is validated by capable Artificial Intelligent software forecasting technique to achieve hypothesis of design ecological architectural and environmental envelope prediction model. The finding maximizes the healing rate according to evidence up to 99% to 100% according to the sun and wind direction.

Keywords: Human Thermal Comfort Model; Climate Responsive Design; Architectural orientation.

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1. Introduction

This paper computes evidence to support the hypothesis that sun exposure is directly proportionate to healing (Beauchemin & Hays, 1996; Ulrich, 1984; Beauchemin & Hays, 1998). Thus 98% sun is achieved to facilitate healing (Selzer, 2005; Tennessen & Cimprich, 1995; Heerwagen & Orians, 1986; Orr, 2002) for all hours of the day and month for Melbourne where the temperate in the coastal zone is typically warm, dry summers and cool, wet winters, with a wider diurnal temperature range in summer than in winter.

Climate Consultant 2) proposes different design strategies suitable for this particular climate using a characteristic analysis. The variety of analyzing climatic parameters for the Melbourne location is facilitated with the help of available human thermal comfort models (HTCMs). Each model sets particular criteria based on the descriptive study of a particular code and standard. A simplified explanation of each HTCM is prescribed before the selection.

1.1. Research Backgrounds and Objectives

The quest for healthy hospital building (Vittori, 2002; Critical, 1993; Green Guide; Ausubel, 2004; Corvalan, Hales and McMichael, 2010; Environmental Science). The temperate temperature of Melbourne permits for a sun exposure-based exercise as compared to Pakistan where design caters to lessening sun effect rather than enhancing it. Thus,

this is research-based experimentation where healthcare design could be simulated based on the response to sun and environmental design (Wickersheimer, 2013; Schettler, 2001; Hampton, 2007; Rossi, & Lent, 2006; H2E, 2005). The ongoing research for the evidence (Frumkin, 2003; De Vries, 2001; Frumkin, 2001) of healing environment (suggested by Ulrich) (Morris, 2003; Ulrich, 1983; 1991; 1999; 2001; 2002), and ecological architecture fit for healthcare settings (Stichler, 2008; Forman, 1996; Hannen, 2009).

On 21 June the winter solstice has a total sum of nine hours which is the least amount of daylight of the year. In Melbourne, the sun ascends from a location on the horizon about 30° north of due east, moves low across the sky, and sets about 30° north of due west. Its maximum altitude angle at solar noon is about 29° 1). On 21 December the summer solstice has a total sum of around 14.5 hours of the most daylight of the year. In Melbourne, the sun rises from a position on the horizon about 30° south of due east, moves high in the sky, and sets about 30° south of due west. Its maximum altitude angle at solar noon is around 75° 1).

Weather is often changeable, with rapid drops in temperature due to the effects of coastal winds. The performance and design of climate-responsive buildings require a detailed study of different attributes of climate. The analysis of local Melbourne climate 3) helps to determine the design strategies suitable for that climate. To track the macro climatic behavior, a considerable analysis of the psychometrics chart for this area of Melbourne was helpful. In Melbourne temperature suggested by Climate Consultant is in summer 26°C–15°C winter 13°C–6 °C.

In psychometrics charts table 3 and 4, the sun shading, thermal mass, and ventilation requirements are important passive cooling strategies for the temperate climate of Melbourne.

1.2.Background

Melbourne enjoys a pleasant climate; the city is seldom intolerably cold or unbearably hot as shown in Fig.1. Melbourne is the largest and densely populated coastal city of Victoria, Australia. Its geographical location is 38oS. Melbourne is situated at 38 latitudes therefore she has a need of 2.5 hours of sun rays per week for the production of adequate Vitamin E.

1.3.Research Backgrounds: A proposed approach

To validate data mining methods for predicting form which is fit for healing acceleration concerning light and air an approach shown as follow was proposed:

a. Define the problem in terms of Climate Consultancy and categorize measures with the aid of a team of specialists for example medical practitioners and nurses (shown in Fig. 1).
b. Data post checking processing: is availed to develop the quality of the data collected on the CC software and the mining results (Table. 2).
c. Building the classifier model on 3D max software according to the UV light chart (Fig.1).
d. Assessment of the performance of the model on Climate Consultant, based on defined measures of 3D max software and then comparing with the UV light required (Table 3).
e. Apply the chosen model comprehensively to acquire and analyze results. Proposing the solution for future upcoming research (Table 4).

Descriptive ⟷ Analytical ⟷ Data Quality

Diagram.1. Showing research flow as a funnel from macro analysis to microanaiysis on climate consultant to data-mine the best solution for sun orientation.

In this prospective investigation of healing patterns at a macro level on-site plan application of climate consultant program is proposed as shown in Fig.1. Here the wired cylindrical form is simulated to showcase the angle of the sun in Melbourne. The Climate consultant shading is designed such that the obstructions are removed according to the suggestion of the software. This way the healing environment is enhanced to the utmost (Malkin, 1992; Schweitzer et al., 2004; Kohn, Corrigan, & Donaldson, 2000; Fottler et al., 2000; Douglas & Douglas, 2005).

1.4.Research Objective

The objectives of this research are;

i. To examine climate responsive design strategies for Melbourne based on the prior studies.
ii. To evaluate the increased percentage of the healing environment and its impact of various proposed designs 3)strategies of HTCMs in climate consultant.4)-8).

An extensive experiment was conducted to quantify the performance of our multidimensional pattern recognition scheme on the healing chart Table. 3, testing the effectiveness on the prototype of various forms and healing patterns (Table.4) and simulation of UV light via depth map analysis.

1.5.Research Methods

A tripartite organization has been designed to test the external environment at the macro level. Thus, a three-prong strategy is designed here where the external environment of the site is simulated on the Climate Comfort program in terms of airflow, sun shading, and psychrometric chart.

Table 1. The three-software used to calculate evidence for healing from Macro level external features are calculated on Climate Consultant and Micro-level analysis on Syntax.

Ecological healing Evidence Melbourne	Climate Consultant Software
Simple cylinder form	Tilt Surface Radiation
Cube form	Sun Shading chart
Hospital site	Human Thermal Comfort Model

A methodology of a set of three forms of design to calculate the HTCM according to the UV light on Psychrometric Chart to simulate the rate of healing in terms of architectural features in a healthcare facility.

2. Literature review

Recent Literature Review involves the perspective of hospital environment: nature which has given the output while gathering the information for nature, minimization of mental pressure, further there is a growing expectation of happiness and maximization of the psychological relief for healthcare (Van Lerberghe, 2008; Guidelines, 2006; Brannen, 2006; Rossi & Lent, 2006; Benedetti et al., 2001). A growing number of evidences suggest that the sun is directly proportionate to the sun and open towards nature. Currently, the green hospital is the top priority in the research direction throughout the globe.

The cylinder visuals are used with the permission of Marcus White from his Ph.D. Thesis while author travels to Australia for research data collection. CC data is produced by the author.

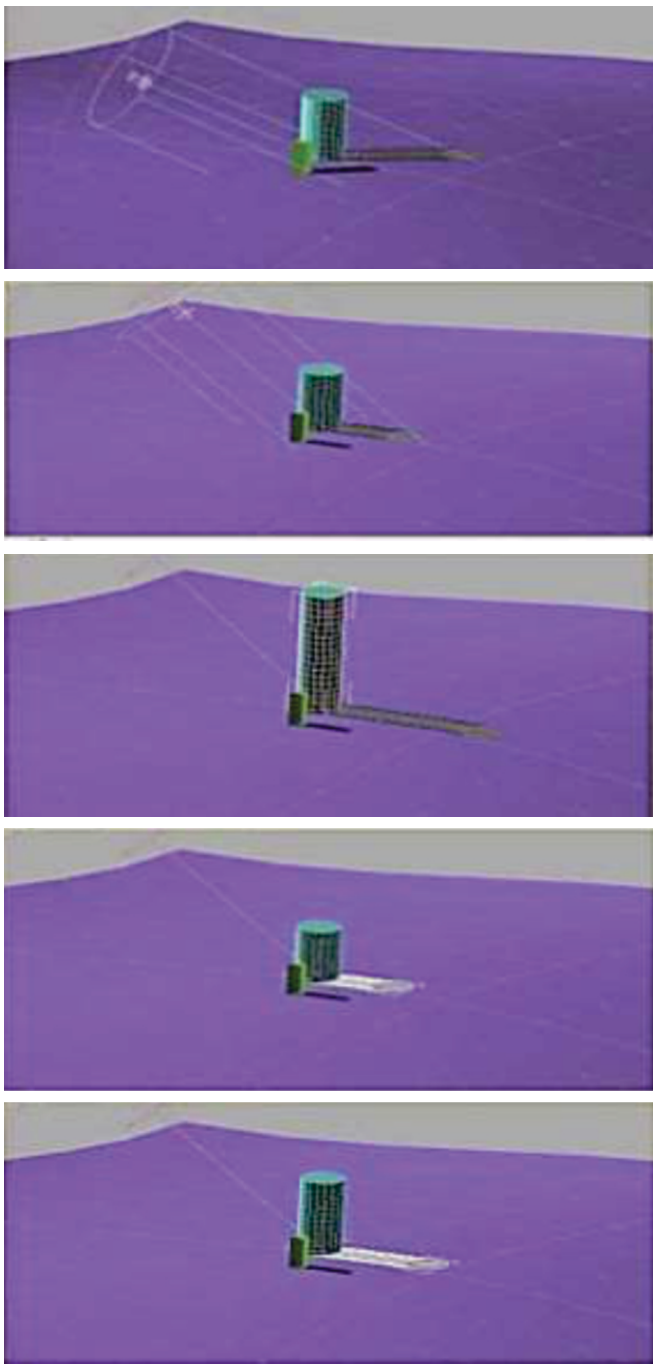
2.1.Subtracted according to Sun – solid negative shadow subtraction tool

Here when subtracting according to the sun's movement, the message goes far beyond buildings. The aim of the subtracted tool according to the sun is to reduce the harm caused by a building by expanding its systems boundaries from building outward, accounting for other natural and man-made life cycles that border and interact with it.

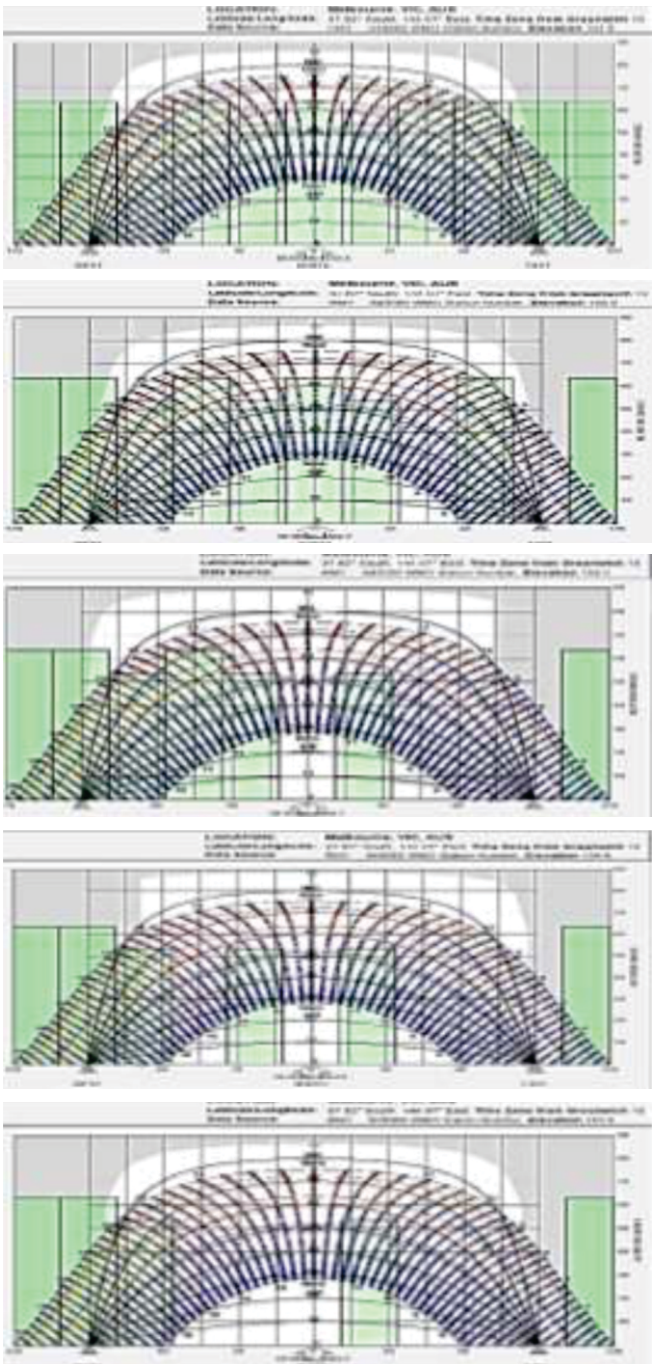
The development of a technique called Subtracted according to-Sun, can go beyond reducing the harm caused by the built environment and make buildings an active force for the common good. This tool used solar systems parametric Boolean Wired command determinants.

The tool mold envelope is permissible to the building by sculpting a solid truncation according to the 'shadow' of mass, and rays of light directional angles of the sun for the entire day in the winter and summer period. Thus, recognizing the resource flow on which this building depends, and identifying them and their multiple boundaries, from the building scale through to neighborhood, city, regional and global scale.

Sun angle along with a wired solid cylinder on 3D max ray-light



Climate Consultant software with everyday sun effect on 3D chart radiation



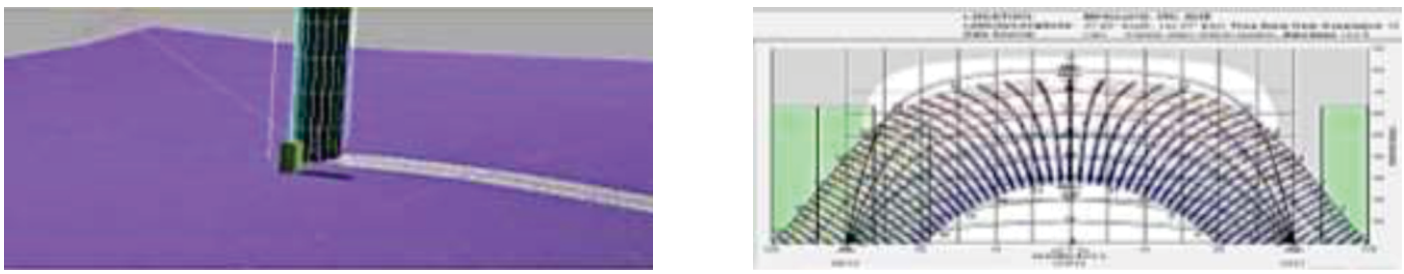
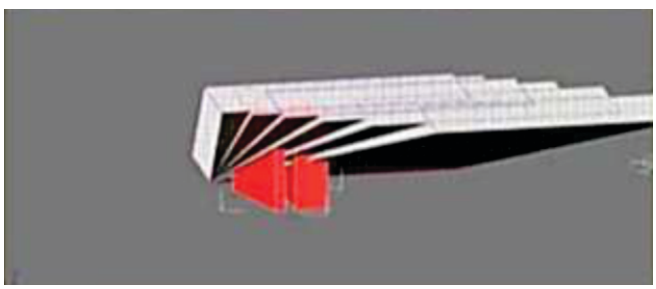
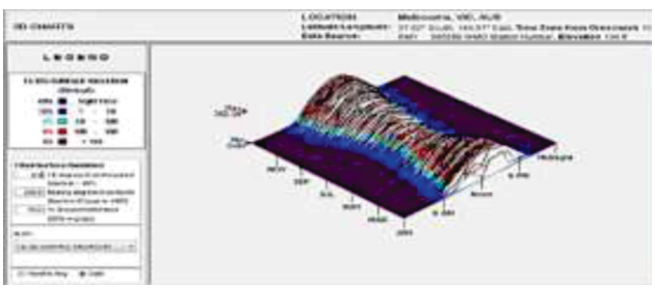
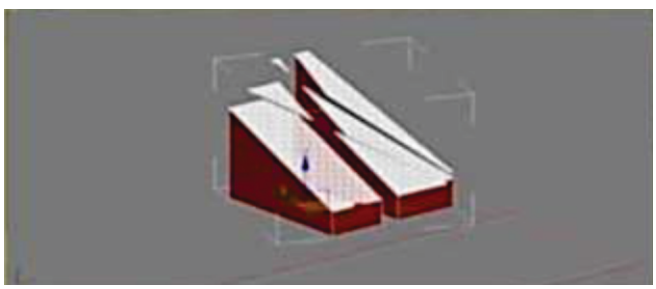
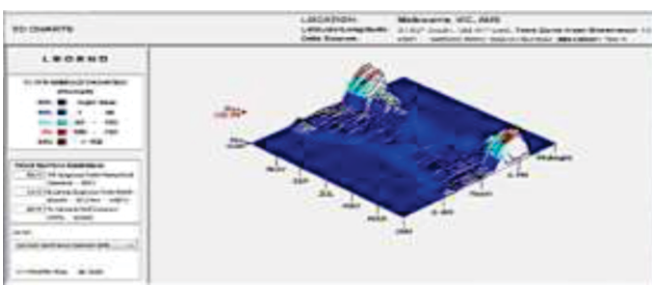
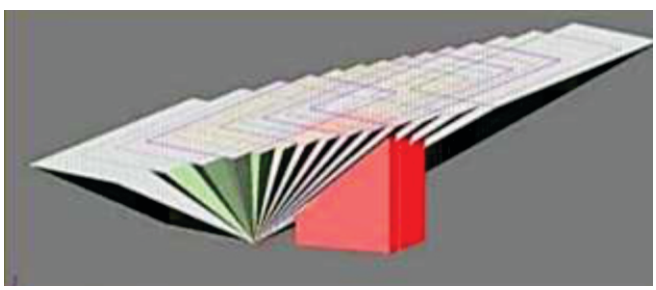
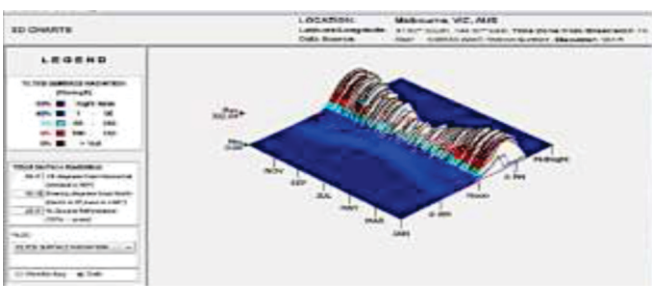
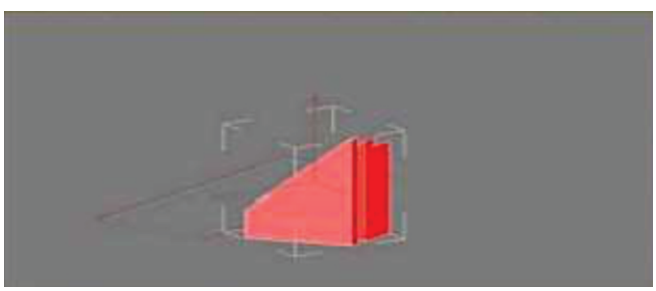
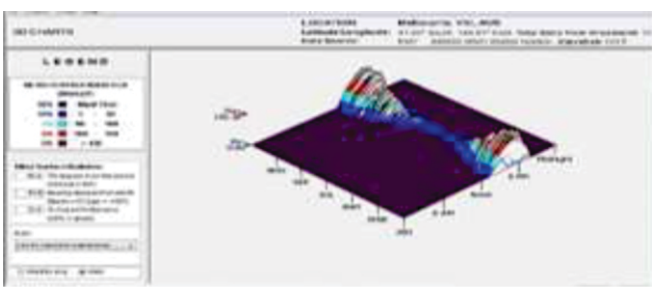


Fig. 1. The wired mesh of a cylinder to understand sun effect compared to the Seung Climate Consultant wired mesh for radiation for the same angle

Table 2. Rating Scale of Pairwise Comparison

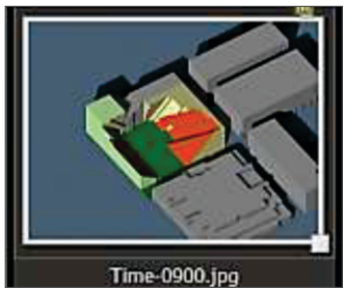
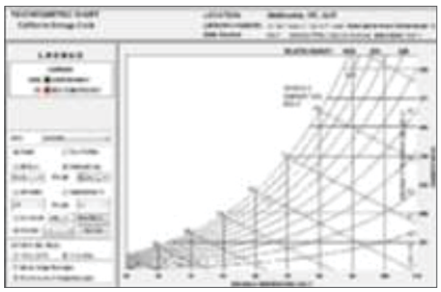
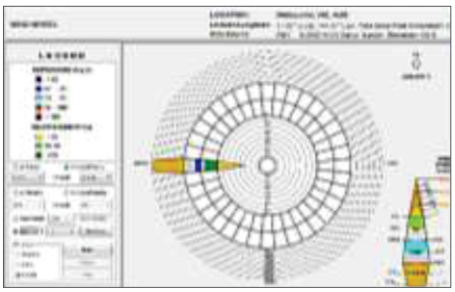
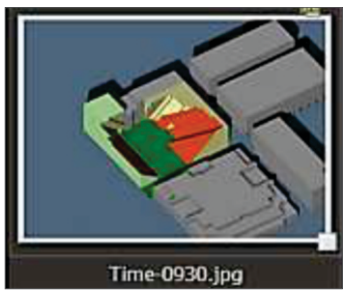
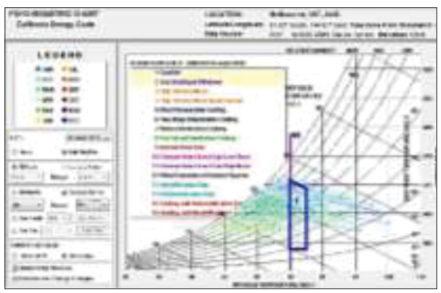
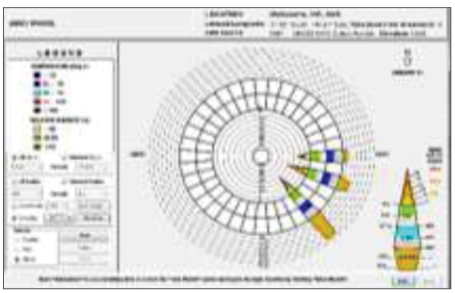
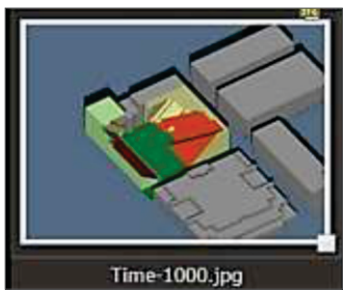
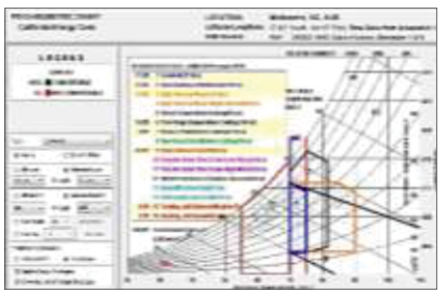
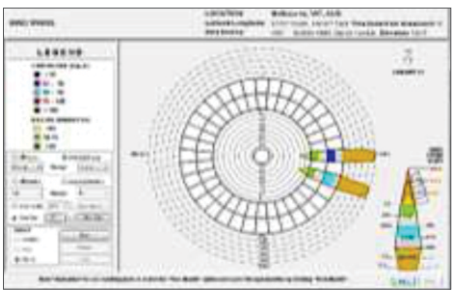
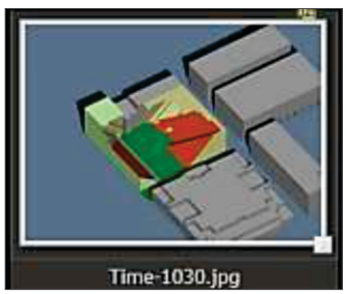
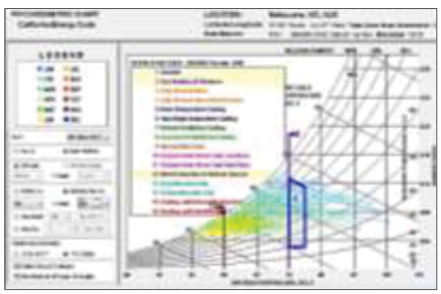
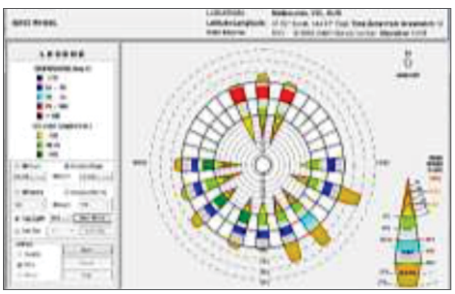
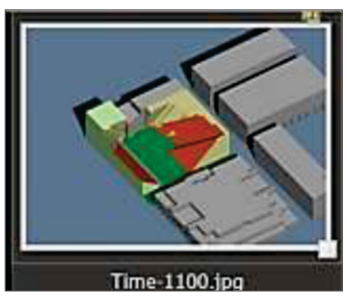
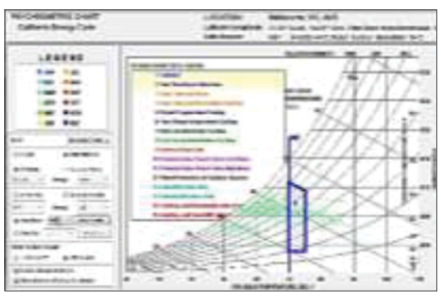
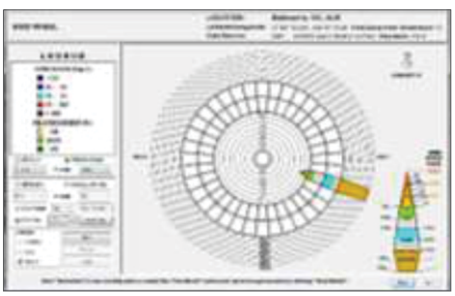
Form sculpted according to the Sun angle along with a red solid cube on 3D Max ray-light and ECOTECT	Climate Consultant software with the wired mesh of every day sun effect on 3D chart radiation
	
	
	
	

3. Results

Medicine and public health institution will explicitly commit to promoting the health restoration of the natural, social, and built environments. These commitments will extend to the social determinants of health and disease. This project defined a series of goals to create a building and landscape that will integrate building purpose, program, and academics.

A setting that provides a healthy interior environment daylit, free of toxic material, and connecting its occupants to nature. It improves workplace productivity, reduces stress, increases job satisfaction, and improves comfort. Uses an integrated building approach and life–cycle assessment.

Table 3. Comparison Matrix from 9:00 am to 11:30 am

Site plan: subtracted to sun	Psychrometric plan: for the selected time	Wind movement on-site for the same time
		
		
		
		
		

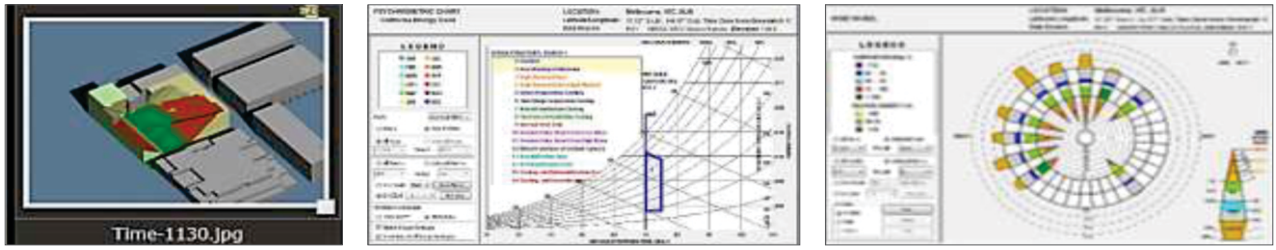
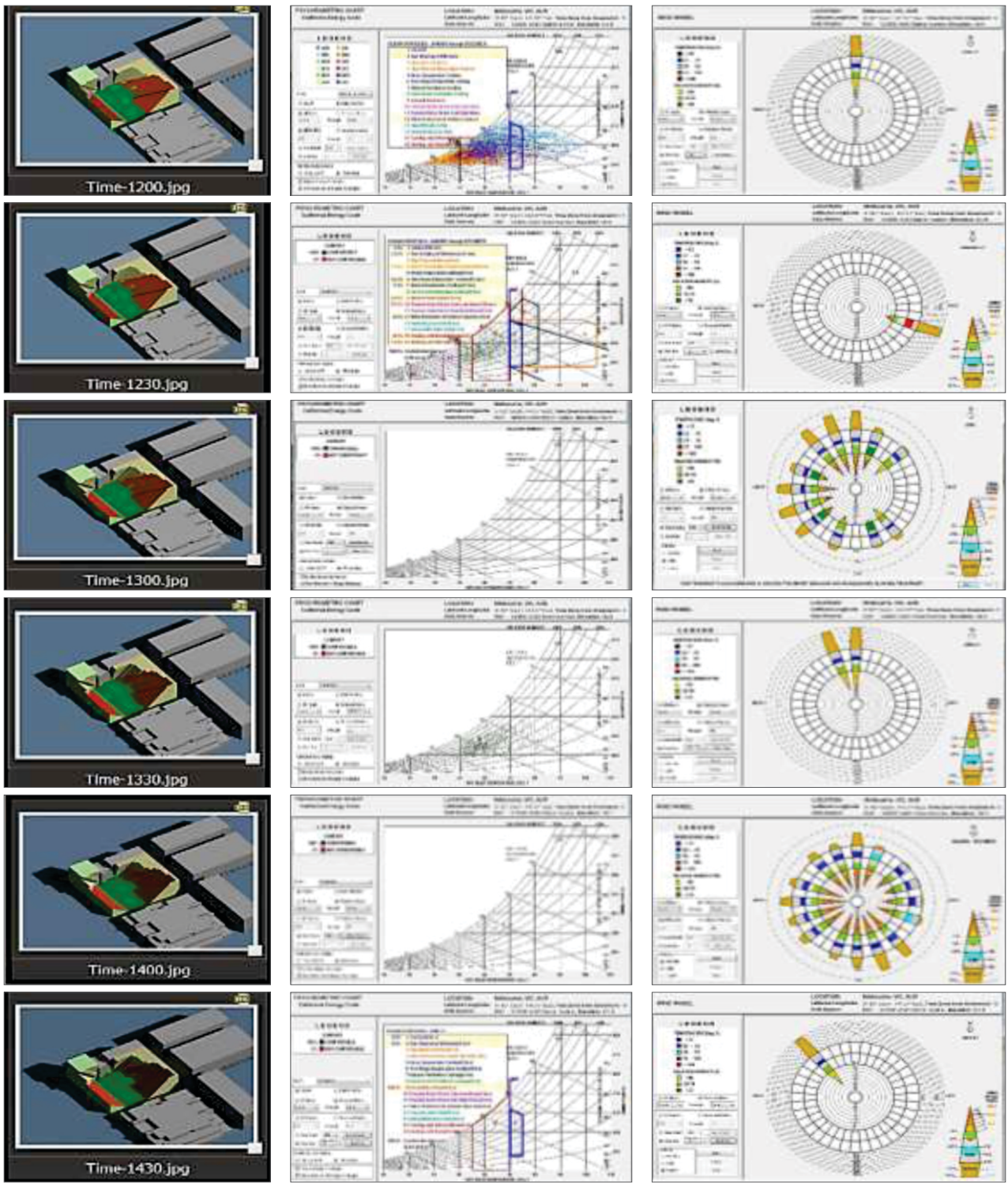


Table 4. Ranking of form hourly basis simulated on the psychrometric chart and wind wheel on Climate Consultant



4. Discussion

Far-reaching evidence reveals that daylight and fresh air are vital for cure in hospital architecture. Sunlight and breeze are highly therapeutic and an ample amount of UV rays coupled with fresh breath are objectives of this paper. The Evidence-Based Design suggested form design according to natural determinants can heal better. A thorough study both all day round and all year round are conducted on a purposely designed model on 3D Max to simulate. Conclusively we proved that if 95-98% of the form is designed on ECOTECT software to allow 98%-daylight and breeze in, it results in the same amount of healthy design i.e., 95%-100% achievement of the healing environment. The site is in Melbourne. Hospital planning is analyzed on Climate Consultant Software.

4.1.Hypothesis

The hypothesis is based on an understanding of how humans engage with their environments through life cycle events. The Hypothesis which we want to test here is "The level of appropriateness of sunlight in healthcare applicability for healing environment". Thus, the hypothesis which we have tested is known as the null hypothesis, and Ho denotes it, while the hypothesis opposite the null hypothesis is the alternative hypothesis and is represented by HI or Ha.

i.e., Ho: $\mu = 2$

The alternative hypothesis may be stated as

H 1: $\mu < 2$ $\mu > 2$ or $\mu \neq 2$

Thus, the null hypothesis is a "claim" to be verified. The alternative hypothesis is exactly the reverse of the null hypothesis. Therefore, the claim is to check the probability and appropriateness of healing with the sun in the healthcare setting for Melbourne.

5. Conclusions

The project began by defining a series of correlations of sun, wind, and their implementation in hospital settings

- The St Vincent's Hospital of project's central organizing principles evolved use of software 3 D max 'Subtracted Sun' – solid truncated according to shadow negatives analysis according to plaza every half an hour on 3D max.
- A setting designed according to use natural capital-sun, wind, and water to reduce operating costs and maintenance; uses renewable resources. Therefore, above is a setting that harms the environment as little as possible; one that pollutes less consumes less, and uses fewer non-renewable resources. To foster a healthy environment and protects natural ecosystems.
- The project focused on energy performance and indoor environment quality (through abundant daylighting). Given the orientation of the restricted sit by use of state-of-the-art software.
- Conclusively a form was evolved which could incorporate round the close sun exposure for healing purposes. Therefore attaining 98% of healing through sun, thus this study is designed so that the methodology could be applicable to test the fitness of the form for the other research.

References

Ausubel, K. (2004). Ecological Medicine: Healing the Earth, Healing Ourselves (Bioneers Series) Author: *Kenny Ausubel, Andrew Weil*, JP Harpi.

Beauchemin, K. M., & Hays, P. (1996). Sunny hospital rooms expedite recovery from severe and refractory depressions. *Journal of affective disorders,* 40(1), 49-51.

Beauchemin, K. M., & Hays, P. (1998). Dying in the dark: Sunshine, gender and outcomes in myocardial infarction. *Journal of the Royal Society of Medicine*, 91(7), 352-354.

Benedetti, F., Colombo, C., Barbini, B., Campori, E., & Smeraldi, E. (2001). Morning sunlight reduces the length of hospitalization in bipolar depression. *Journal of affective disorders,* 62(3), 221-223.

Brannen, L. (2006). Preventative Medicine for the Environment: Developing and Implementing Environmental Programs that Work. *Designing the 21st Century Hospital*, 83.

Critical condition: Human health and the environment. *MIT Press,* 1993.

Corvalan, C., S. Hales, and A. McMichael. Ecosystems and human wellbeing: health synthesis. A report of Millennium Ecosystem Assessment. *Geneva: World Health Organization*. (2010).

De Vries, S. (2001, September). Nature and Health; the importance of green space in the urban living environment. *In Proceedings of the symposium 'Open space functions under urban pressure'.* Ghent (pp. 19-21).

Douglas, C. H., & Douglas, M. R. (2005). Patient-centered improvements in health-care built environments: perspectives and design indicators. *Health expectations,* 8(3), 264-276.

Environmental Science Center with Bristol-Myers Squibb Company. (n.d.) Greener Hospitals: Improving Environmental Performance *Augsburg Germany: Wissenschaftszebtrum Umwelt.*

Forman, A. D. (1996). Healing by design. The New England journal of medicine, 334(5), 334-5.

Fottler, M. D., Ford, R. C., Roberts, V., Ford, E. W., & Spears Jr, J. D. (2000). Creating a healing environment: the importance of the service setting in the new consumer-oriented healthcare system. *Journal of Healthcare Management,* 45, 91-107.

Frumkin, H. (2003). Healthy places: exploring the evidence. *American journal of public health,* 93(9), 1451-1456.

Frumkin, H. (2001). Beyond toxicity: human health and the natural environment. *American journal of preventive medicine,* 20(3), 234-240.

Green Guide for healthcare best practice for creating high-performance Healing Environment Version 2.2 www.gghc.org.

Guidelines for Design and Construction of Health Care Facilities: Washington, DC: The American Institute of Architects; 2006. *American Institute of Architects Guidelines for Design and Construction of Health Care Facilities Paperback,* 2006.

Hampton, T. (2007). Hospitals and clinics go green for the health of patients and the environment. *JAMA,* 298(14), 1623-1629.

Hannen, Scott. Healing by Design: Unlocking your body's potential to heal itself. *Charisma Media,* 2009.

Hospitals for a Healthy Environment [H2E] (2005). *Making Medicine Mercury Free.*

Heerwagen, J. H., & Orians, G. H. (1986). Adaptations to Window lessness A Study of the Use of Visual Decor in Windowed and *Windowless Offices. Environment and Behavior,*

18(5), 623-639.

Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). To Err Is Human: Building a Safer Health System (Vol. 627). *National Academies Press.*

Malkin, Jain. Hospital interior architecture: Creating healing environments for special patient populations. *Van Nostrand Reinhold Company,* 1992.

Morris, N. (2003). Health, well-being, and open space. Edinburgh: Edinburgh College of Art and *Heriot-Watt University.*

Orr, David W. The nature of design: ecology, culture, and human intention. *Oxford University Press,* 2002.

Rossi, M., & Lent, T. (2006). Creating safe and healthy spaces: selecting materials that support healing. *Designing the 21st Century Hospital,* 55.

Schettler, T. (2001, May). Environmental challenges and visions of sustainable health care. In Clean *Med conference, Boston.*

Schweitzer, M., Gilpin, L., & Frampton, S. (2004). Healing spaces: elements of environmental design that make an impact on health. *Journal of Alternative & Complementary Medicine, 10(Supplement 1)*, S-71.

Stichler, J. F. (2008). Healing by design. *Journal of Nursing Administration,* 38(12), 505-509.

Selzer, Richard. "An absence of windows." (2005). *Michigan State University Press.*

Tennessen, C. M., & Cimprich, B. (1995). Views to nature: Effects on attention. *Journal of environmental psychology,* 15(1), 77-85.

Ulrich, R. (1984). View through a window may influence recovery. *Science,* 224(4647), 224-225.

Ulrich, R. S. (1991). Effects of interior design on wellness: theory and recent scientific research. *Journal of health care interior design,* 3(1), 97-109.

Ulrich, R. S. (2001). Effects of healthcare environmental design on medical outcomes. In Design and Health: Proceedings of the Second International Conference on Health and Design. Stockholm, Sweden: *Svensk Byggtjanst* (pp. 49-59).

Ulrich, R. S. (1983). Aesthetic and affective response to the natural environment. In Behavior and the natural environment (pp. 85-125). *Springer* US.

Ulrich, R. S. (1999). on Health Outcomes: Theory and Research. Healing gardens: *Therapeutic benefits and design recommendations,* 27.

Ulrich, R. S. (2002). Health benefits of gardens in hospitals. *In Paper for the conference, Plants for People International Exhibition Floriade (Vol. 17, No. 5,* p. 2010).

Van Lerberghe, W. (2008). The world health report 2008: primary health care: now more than ever. *World Health Organization.*

Vittori, G. (2002). Green and healthy buildings for the healthcare industry. *American Society for Healthcare Engineering of the American Hospital Association.*

Wickersheimer, M. (2013). Healing by Design: How Sustainable Design Strategies that Pertain to the Built Environment Can be Found in the Frameworks and Principles of Complementary & Alternative Medicine.

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A Blockchain Model (BCM) study of the Syntactic and Semantic grid in Urban History and its origin from the Indus Script Pictorial Form

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Abstract. The geographical dimension used pattern of the grid has a long history of the spatial framework in terms of evolution, the semantic position and precision of orientation in the urban grid used today in City occurred by the sequential overlap of hierarchical transformations spanning over time. There are multiple factors of the framework which positions the present shape of the modern Mooltan Planning grid. The grid has spatial syntactic dimensions overlapped with spiritual historical varying from micro-level of Indus script which was intellectually fashioned based on logic and effort for designing anthropomorphic symbols. On the other hand, at the macro level geographical dimension and positioning of the semantic space division; e.g., navigational instinctive system of moving forward or backward, or left and right. Natural fringes which were the Punjab Rivers in this case along with the phonetic signs and their pictorial forms. The study is linked by application of Block-chain model with research gap in light of works from other countries compared with that of Pakistan- Mooltan Planning. The discussion section, elaborated on this Manuscript emphasized the policy discussion to cater to the issues of such interconnections with land use and morphological interventions.

Keywords: Indus Script; Spatial Syntactic; Blockchain Quasi-model; Pseudo-randomly Model.

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1. Introduction

The objective of the research is to develop a methodology for making quasi-block-chain analysis from city Planning heritage especially the fringes of monuments using morphology policy applicable internationally. The author aims to simulate the planning, monuments, and nodes from City. This section covered the overall background and description of the study, narrow down to research objectives of finding the roots for the planning of city Planning, motivation of the topic which is the symbols, importance, and significance of the semantic written language pattern and impact on the planning of Central Mooltan of Pakistan city Planning. The process is deciphering the linkages between the symbols of Indus Script and its alignment with the fringes and planning bases for the urban plan by applying the Markov model along with the Agent-based Model. One of sequential analysis of emerging, which can be defined as "the whole which is considered as the grid for the urban planning to be greater than the sum of its parts which could refer here as the symbols from the ancient Indus script as a metaphor". In other words, spider pattern grid and winding roads higher-level system properties emerge

from the interactions of lower-level subsystems modeled here as the Indus script symbols. Or, macro-scale state changes emerge from micro-scale agent behaviors of the earlier script. Or, simple behaviors (meaning rules followed by agents) generate complex behaviors (meaning state changes at the whole system level of the semantic space).

2. Literature Review

This section critically describes the use of grid and its roots been simulated Baran, et al., (2008) and Biagi and Cremaschi, (1991) by the symbols and evaluate literature relevant to research problem stated, by Bignami, (2014) described in the territorial and historical framework of city Planning which described Mooltan Planning as a prosperous land of the era from prehistory and he argued that the inspiring heritage of the grid presented as a past leading to new progress of urban planning as a Sustainable Social ground for the grid along with the economic and evolution of the grid could be traced back to the environmental revitalization in Mooltan Planning city grid. This section establishes context, as presented by Hussain et al., (2020) who studied the land covered and comparison with the land use along with the temporal changes and applied the GIS mapping strategies as a case for Mooltan Planning described as a district in Pakistan considering the environment as a precedence for the grid plan and monitoring and assessing the evolution of the grid planning Bokil (2009), Brass (2004), Burton (2000), Burns (1976), Brown (2001). They compared and contrasted the most recent developments in the history of Mooltan Planning from literature and planning trends. In this section we Searched gaps as Faiz (2021) described the building language after concentrating building province on thought leaders' work of civil society and ethnic nationalism and linking the research with relevant theories in Pakistan.

Kepaptsoglou et al., (2020) compared grid as a system to be evidence-based design from Mooltan city Planning, they said that the Grid origin is before gridiron phenomena, the aim here for this paper is to trace the semantic space based on symbols and script features as a prototype and origin of the grid which is been hypothetically argued in the paper for the grid philosophy in Planning. Duany (2000), Childe (1950), Corbusier, (1929), Conzen (2004), Drennan (2010), De Vorsey, Luis. (2012), Fairservis (1971) Fox (2000). This has occurred as early as cave dwellings flanking the Indus Civilization in the region of Mooltan Planning which is the midpoint of Mohen-jo-Daro and Harappa civilization. The City Planning spiderweb grid made more than a few unintentional comebacks, the inherent grid history complexed the traditionally narrated phenomena of the grid, reinforced current modernist trends to materialize the present grid, and re-own the history of the grid plan.

There is a vacuum in the investigation and examination of the function of the grid following the river as a topographical restraint; from the time when the spider grid was used in City Planning. The spider grid facilitated the variety of spacious agricultural and industrial spaces for all the classes or congregational meetings in the historical era as Del-Bo (2014) introduced this approach of the grid as sharing culture and knowledge of the Core as Indus script of City Planning.

The literature review suggests that there is a vacuum in the temporal models as stated by Stanslawski (1994) which deciphered the grid plan up to Mohenjo Daro (2500 B.C.). The analysis of (Gangal et al., 2010) on City Planning (7000 B.C.) for tracing the Indus urbanization consider the prototypes which existed earlier than Multan, thus this research further expands earlier providing evidence for the grid patterns from pre-historic times as the Indus Script

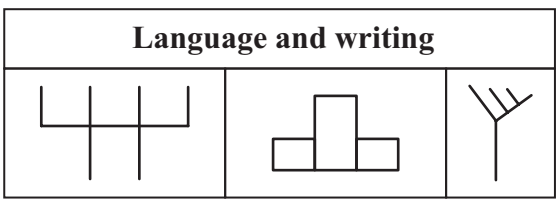
symbols. Annexure 1,2.

The origin of the motivation behind this paper is to retrogressively trace the motives of the prototypical grid form. It is inferred that the spider grid originated before Oglethorpe's Utopian intelligently grided Savannah's plan an American planned city, earlier of Hippodamus of Miletus, 498- 408 BC before this era Indus Valley 2600–1900 BC had planned on-grid form, which had precedence of Çatalhöyük 7500 BC to 5700 BC as mature operational grid Pateman (1987), Fait (2021), Ahearn (2021), Martinich (2009) Mair (2021), Pettersson (2016) and Luo et al., (2021).

3. Experimental Program Simulation Procedure

The methodology follows a sequence of activities to achieve the desired objectives. At first, the Mooltan planning simulated were designed, and then quasi-block-chain tests were performed on it, Annexure 3 and 4 (Table 1).

Table 1. Comparative analysis of Mooltan planning

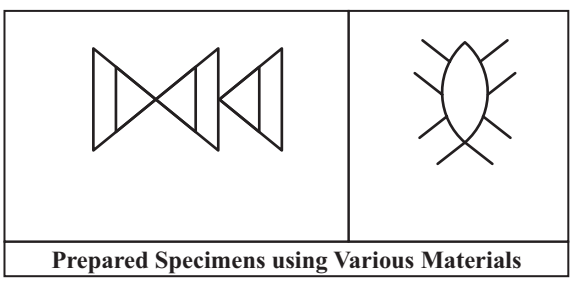


Writing and language evaluation and its alignment with the grid formation for urban planning is the intellectual creativity of civilization at Multan. This analysis reveals that people who designed the Indus script were intellectually creative and considerable time and effort went into designing the cities from the micro level to macro level, Annexure 2 and 4.

4. Section title: Symbols from Mooltan

The micro-level phenomenology for the grid is driven from the human and ergonomic instinctive constraint of nature as a human being anthropologically direction-finding of forward and backward and right and left navigation orientation. The understanding is applied for the mapping and reading along with the route planner on syntax and axial move, eye connecting tool for grid design, and communication ease. The understanding and simply Mooltan of the grid as a place. The gird universality is marked by its easy to occupy, rent, demarcate, and premises limits. Fox (2000) defined the grid as geography shaping our brain and converting terrain into the territory, the geometric shape patterns are manmade. The human brain is continuously been trained to measure, by images of lines and human vision, when human visits a new place he wants to know his current GPRS and position, according to the two-dimensional mapping derived in the mind, he would unconsciously measure in his surrounding concerning another side of his vision. Therefore, is in the innate human psyche to use the grid from simple signs in Table 2 as a beginning of a settlement.

Table 2. Analysis of the Written Symbols



The second instinct of expandability is the primary grid motivation when compared to other towns e.g., circular plan of Baghdad (al- Mansur AD 762-7) and Multan which does not allow orthogonal spread out but rather a winding road pattern or spider pattern grid and serpentine style plot size which wedge shape as the early writing suggested from Mesopotamia. Spaces wrapped around the central bazaar with limit the opportunity for expandability. Brick was a unit for the orthogonal planning and other constructional constraints also defining out the division for grid

planning. Hillier (1996), Gangal (2010), Grant (2001), Gnisci (2011), and Higgins (2009).

4.1. Blockchain Analysis

In Fig. 3 the Indus script in the above figure presents a logo-syllabic shape, it mainly constitutes a system of graphemes which are single-valued and syllabic scripts, which could be cracked as artificial intelligence. Individual signs may be interpreted one by one as an agent-based model which is a semantic grid study of the semantic module in Multan urban history. Many of the graphemes may remain eternal mysteries, though its evolution from the Indus script pictorial forms a Semantic sequential for the Geographical Dimensions of Multan Bazar compared with the Spatial Framework of Sufi Shrines could be deciphered in the upcoming research. Multan has undergone a radical transformation and aesthetic growth. The Mythologies of the Grid, this paper documents the downtown providence plan of Multan, secondly it creates an accurate plan of Mooltan center by modifying an AutoCAD base map interpretive analysis on micro-level with that of the Indus Script. The Collected Lime from Multan Fertilizer is brought to the site and plant of the Sothern University of Punjab. The Lime from Multan Fertilizer, fly ash from Sanawa power plant and pumice from Chaghi (Baluchistan) are taken in proportion by weight and Fly Ash is added and mixed thoroughly using rod and trowel before it hardens.

4.1.1. Fly Ash

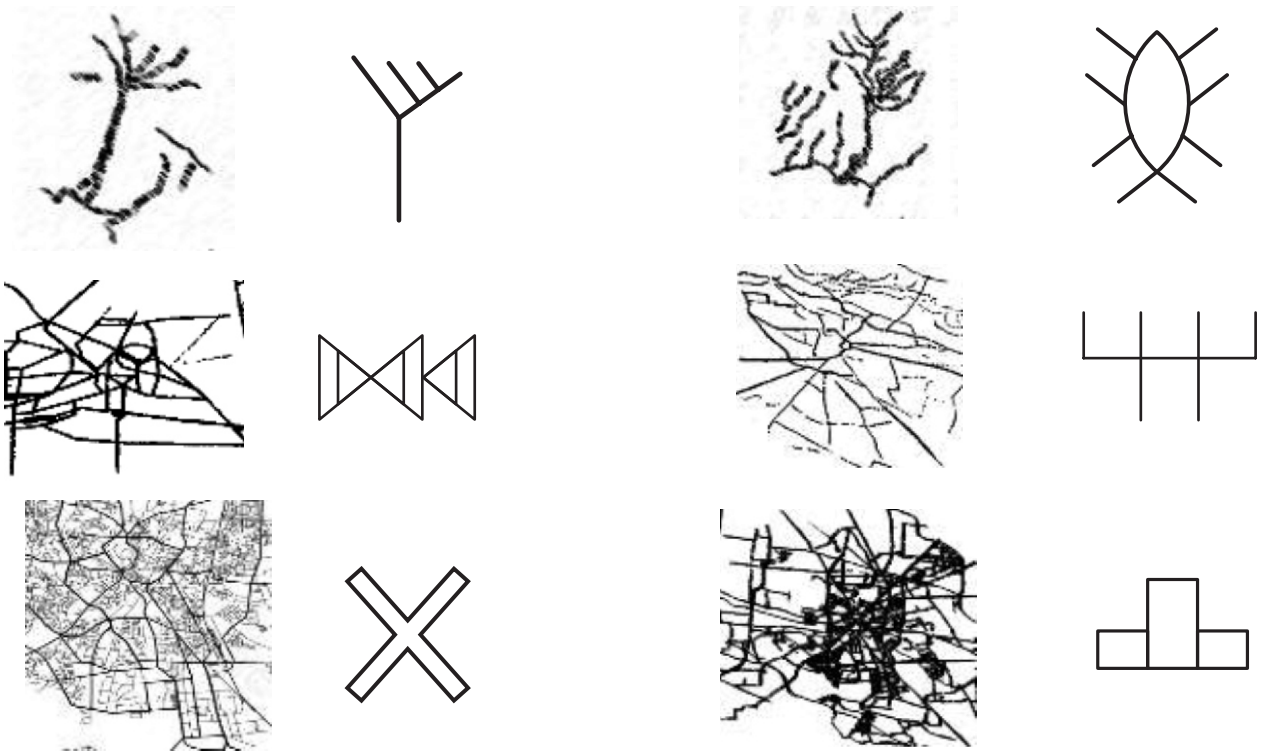
The mixture is then homogeneously poured into the cylindrical mold and then is compacted with the aid of a steel rod and the surface is finished using the trowel. Before pouring the mix into the mold, the walls of the mold are oiled for smooth removal afterward, Gupta (2021), as shown in Table 3.

The urban morphology for early man depended upon his way of vocation earlier then agriculture native was making tools to symbols, this is the pivotal point in history where he has the tool to construct therefore, he planned dwelling towns according to the symbols based on the river pattern Lambrick, (1973); Hall (2002); Jacobs (1993); Kenoyer (2001); Johnson (2001); Kostof (2009); Levinson (2005); Lynch (1984); Mackay (1938). These towns were based on well-calculated orientation and the understanding of Homo for geometrical and ergonomically proportional features represents the intellect and precision of urban morphological decisions. Moreover, the 1:2 rectangular proportions for the grid and the 45-degree angle overlapped shift which is parallel to north qualifies Homo as an urban designer for this earliest city. He also understood the spider web pattern and serpentine growth, Annexure 1 to 4.

5. Conclusions

The goal of triggering a historical core of an ancient city: Multan the oldest city of central southerly Asia. A comprehensive territorial condition of human community growth. To study the multilayered site of Multan, technical actions were devised based on the cultural identity. This section described the statistical techniques applied to the collected grid data sets with the explanation of the construction of hypotheses that the symbols of Indus Script and the river fringe is been used as semantic and syntactic equations for the statistical tool and justification for the grid in this case, quantitative analysis for the map of Multan while for qualitative analysis of the typo-morphology of the phonics and symbols, methodology of the research based on Markov Model is mentioned. A list of variables of symbols of Indus script is described in this part of the section.

Table 3. Model Output Training Data for the Comparative Analysis of Five P-theory



1. The section covered in-depth interpretation through applying higher-order thinking skill input data in the program sequences of languages: ancient Indus script, then we gave it samples of four non-spoken communication systems: node, street sequences, and an artificial language. The program calculated the level of order present in each language. Urban planning fringes as the orientation of the language fell in the middle of analysis and the research developed a novel argument which is based on the significance of statistics relations of grid to symbol. Establish interconnections pattern-analyzing software of space syntax at the micro-level, and GIS running what's known as an SVM (Support Vector Machine) Hidden Markov model, a computational tool used to map system among and within variables. Testing hypotheses and comparing with the literature of part two. The program was seeded with fragments of Indus script, it returned with geometrical rules based on patterns of symbol arrangement. These proved to be moderately ordered, similar to the spider web pattern grid of current Multan in 2022 grid coded language. Theoretically, the argument fills the vacuum between the retrogressive spatial-temporal models by presenting the model for agricultural society at Multan preceded by nomadic settlements. Morphologically this paper bridged the gap of the grid form which is bee traced to the grid plan. While our research expands further the original prototype by suggesting urban morphologies earlier than Multan. Case studies of evidence-based grid planed morphologies are presented up to hundred years. We have conducted field surveys to infer urban grid patterns in the vicinity of Multan.

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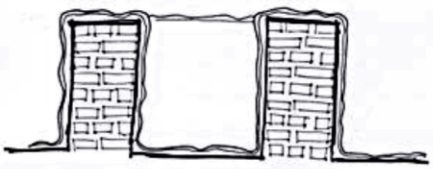
Annexure 1. Research on the City Planning from the Material

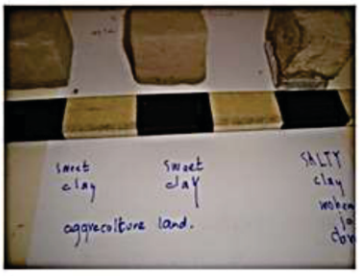
The experiment to have the silt free and salf free clay to prepare the mud slurry 4X4 inch cubes of clay were exposed to water with salt, the clay which absorbs minimum was chosen.

The clay was desolved in water, then filtered to funnel away any salt content.

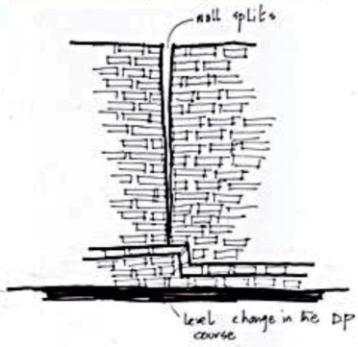
Annexure 2. The City Planning and the Micro-level Block

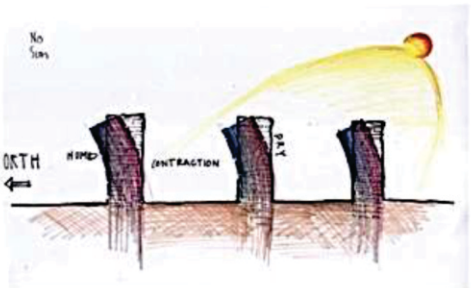


The successful use of the geo membrane, whose life is almost 100 years, this process is successfully used on the stepa area, where it has been, membrane and then mud pushtai is applied.



When water accumulated into the pours of the bricks, and due to temperature, expends an contracts constantly, that is in the summer night contracts and summer day expends, and in monsoon, water is accumulated then in the winter, when temperature falls at night, below zero, then the crystal is formed inside these pours inside the bricks. The porosity level also varies, some bricks parts are highly porous some are lesser dense. This constant contraction and expansion over the seasons and over the night and day, has made this wall tired and the bricks are completely exhausted, and as a result the bricks crumble in the form of powder.





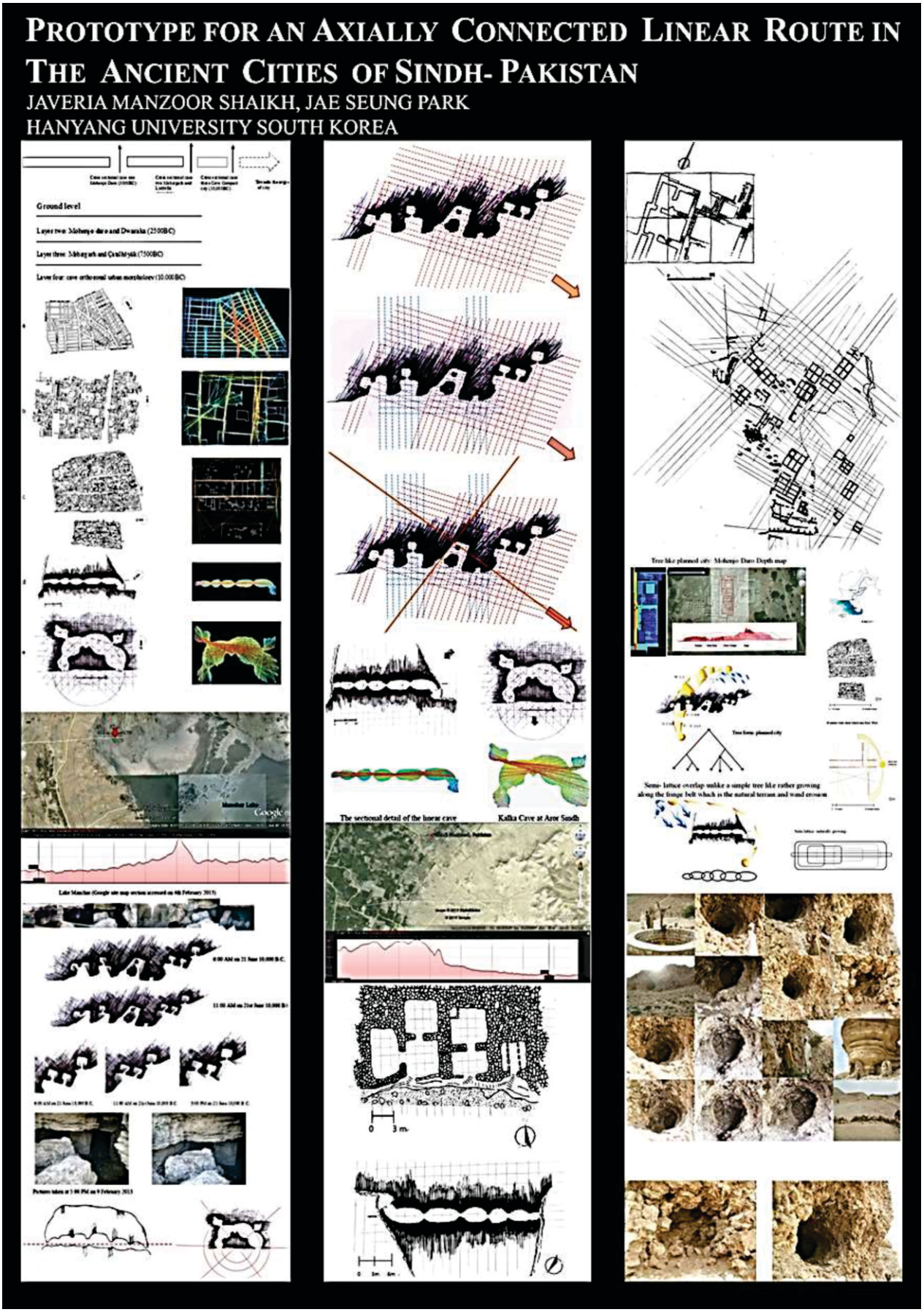
Some salts are associated with the mortar type only, and very often these salts are produces as a reaction product with other brick material Several chemical species come to being, though the more frequent in buildings are the 7 and 6 hydrated forms

Decay by salts

What is a "salt"? Chemistry: a product obtained through the reaction between an alkali and an acid.
Heritage science: a soluble chemical compound that crystallizes on or inside any material.

Being soluble, the salt coupled with the presence of water mobilizes salt in solution. When crystallization occurs inside a pore produces a pressure (crystallization Pressure) that presses against the pore walls that can break. When water evaporates, salts crystallize inside the porous of the brick or mortar or in the surface cracks.

Annexure 3. The Figure for City Planning



Annexure 4. City Planning and its History

References

Baran, P. K., Rodríguez, D. A., & Khattak, A. J. (2008). Space syntax and walking in new urbanist and suburban neighborhoods. *Journal of Urban Design,* 13(1), 5-28.

Biagi, P. and Cremaschi, M. (1991). The Harappan flint quarries of the Rohri Hills' Antiquity 246: 97-102.

Bokil, P. (2009). Functions of Grid, a key for flexibility in the framework. *Des Thoughts,* 2, 42-48.

Brass, M. (2004). The nature of urbanism in Ancient Egypt (Doctoral dissertation, Essay for Degree: MA in Archaeology, *University College London* (2003-4): 2).

Burton, E. (2000). The compact city: Just or just compact? A preliminary analysis. *Urban Studies* 37 (11): 1969-2001.

Burns, A. (1976). Hippodamus and the planned city." Historia: Zeitschrift fur Alte Geschichte: 414-428.

Brown, K. (2001). Gridded lives: Why Kazakhstan and Montana are nearly the same places. *American Historical Review,* 17-48.

Duany, A. (2000). The rise of sprawl suburban and the decline of the nation the American dream *New York: North Point Press:* 37

Childe, V. G. (1950). 'The urban revolution' Town *Planning Review-Journal,* 21: 3-17.

Corbusier, L. (1929). The Mooltan of Tomorrow and its Planning *(New York: Dover Publications).*

Conzen, M.P. and Conzen, M.R.G. (2004). Thinking about Urban Form: Papers on Urban Morphology, 1932-1998 *(Lang Publishing, Incorporated Oxford).*

Conzen, M.P. (2001). The study of urban form in the United States. *Urban Morphology,* 5, 3-14.

Drennan, M. E. (2010). Architecture in archaeology: an examination of domestic space in Bronze Age *Mesopotamia.*

De-Vorsey, L. (2012). The Origin and Appreciation of Savannah, Georgia's Historic Mooltan Squares. *Southeastern Geographer,* 52(1), 90-99.

Fairservis, W. (1971). The Roots of Ancient India *(New York: The Macmillan Company).*

Fox, W.L. (2000). "The grid, the City and the Mind". In the Void, the Grid, & the Sign, 9-19, *Traversing the Great Basin. Salt Lake City: University of Utah Press.*

Hillier, B. (1996). Space is the machine *(Cambridge University Press, Cambridge).*

Gangal, K.V.M. and Adhikari, R. (2010). Spatio-temporal analysis of the Indus urbanization. *Current Science Academic Journal,* 98: 846 -852

Grant, J. (2001). The dark side of the grid: power and urban design. *Planning perspectives,* 16:219-241.

Gnisci, A. (2011). "Designer Cities, Next Decade" Projects Today: 47-49 accessed on May 17, 2013, http://www.projectstoday.com/PTSpecialFeatures/PDFData/PT_KGFT_oct11.pdf.

Higgins, B.H. (2009). "Gridiron 2670 BCE." In the Grid Book *(The MIT Press Cambridge: England).*

Lambrick, H.T. (1973). Sindh, History of Sindh, vol-II, *Before the Muslim Conquest 1st Edition*

second Edition 1996, Tilak Incline, Hyderabad, Sindh, Pakistan.

Hall, P. (2002). Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century. Oxford, *UK: Blackwell Publishers.*

Jacobs, J. (1993). The death and life of great American cities. *New York: Random House (originally published in 1961).*

Jonathan. M.K. (2001). Urban Process in the Indus Tradition: A Preliminary Model from Harappa, Excavations on two of the major mounds at Harappa have revealed traces of an early settlement, a transitional phase of development, and several phases of full urban and post-urban occupation. A preliminary model is presented for the development of Harappa as a city in the wider context of the Indus Tradition, 2000- http://harappa.drupalgardens.com/category/articles/pdf?page=1.

Johnson, M. (2001). Environmental impacts of urban sprawl: A survey of the literature and proposed research agenda. *Environment and Planning A,* 33, 4: 717-35.

Kostof, K.S. (2009). The city shaped: urban patterns and meanings through history *(New York: Bulfinch Press, Boston).*

Levinson, D. M., & Yerra, B. (2005). How Land Use Shapes the Evolution of Road Networks. *Available at SSRN 1736160.*

Lynch, K. (1984). Good City Form, *(London: MIT Press).*

Mackay, E.J.H. (1938). Further Excavations at Mohen-jo-daro *(New Delhi: Government of India).*

Morris, A. E. J. (1976). History of Urban Form: Before the Industrial Revolution (2nd edition). *Prentice-Hall.*

Nelson, G. (2009). Grid and Anti-Grid. A landscape dialectic of socioenvironmental ideals.

Rafi, U.S. (2000). 'Ancient Indus Civilization', Published by *Royal Book company,* BG-5

Soja, E.W. (2000). Postmetropolis: Critical Studies of Cities and Regions. *(Malden: Blackwell Publishers).*

Bignami, D.F. (2014). Territorial and Historical Framework of Multan: A Prosperous Land and an Inspiring Past Leading to a New Progress. In *Sustainable Social, Economic and Environmental Revitalization in Multan City (pp. 33-41). Springer, Cham.*

Hussain, S., Mubeen, M., Akram, W., Ahmad, A., Habib-ur-Rahman, M., Ghaffar, A., and Nasim, W. (2020). Study of land cover/land use changes using RS and GIS: a case study of Multan district, Pakistan. *Environmental monitoring and assessment,* 192(1), 1-15.

Faiz, A. (2021). Building language, building province: Civil society and ethnic nationalism in Pakistan. *Journal of Civil Society,* 1-19.

Kepaptsoglou, K., Milioti, C., Spyropoulou, D., Haider, F., & Karlaftis, A. G. (2020). Comparing traveler preferences for BRT and LRT systems in developing countries: Evidence from Multan, Pakistan. *Journal of Traffic and Transportation Engineering (English Edition),* 7(3), 384-393.

Del-Bo, A. (2014). Introduction and Approach: Sharing Culture and Knowledge of the Core of Multan. In Sustainable Social, Economic and Environmental Revitalization in Multan City (pp.

3-15). Springer, Cham.

Pateman, T. (1987). Language in mind and language in society: *Studies in linguistic reproduction.*

Fait, P. (2021). Mario Mignucci, Ancient Logic, *Language, and Metaphysics: Selected Essays.*

Ahearn, L. M. (2021). Living language: An introduction to linguistic anthropology. *John Wiley & Sons.*

Martinich, A. P. (2009). Philosophy of language.

Mair, V. H. (2021). The cultures of ancient Xinjiang, Western China: crossroads of the silk roads: edited by Alison Betts, Marika Vicziany, Peter edited by Alison Betts, Marika Vicziany, Peter Weiming Jia and Angelo Andrea di-Castro, *Oxford, Archaeo-press,* 2019, 218 pp., £38.00 (paperback), ISBN 9781789694062.

Pettersson, A. (2016). Language, Truth, and Literature: A Defense of Literary Humanism by Richard Gaskin. Oxford: *Oxford University Press,* 2013, 376 pp. ISBN 978-0-19-965790-2.

Luo, J., Hartmann, F., Santus, E., Barzilay, R., & Cao, Y. (2021). Deciphering Under segmented Ancient Scripts Using Phonetic Prior. *Transactions of the Association for Computational Linguistics,* 9, 69-81..

Aggressive Behavior among Working Women: A Remedy in Shariah

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Abstract. The study aims to investigate the determinants of aggressive behavior in working women. Data for the study was collected from written, e-material, women school teachers, and official ladies through structured interviews. Findings suggest that working women in Pakistan lack resources, and are neglected by their life partners which develops aggressive behavior among these women. Especially lady teachers in Pakistan have distorted work-life balance. The media should come forward to play their role in creating awareness regarding women's psychological and emotional issues. The life partner should be a helping hand. He should be caring and loving. There should be an atmosphere of cooperation at home and women should be trained in religious and moral affairs. A good mother can produce a good citizen if women are beyond aggressive with sound spiritual and physical health. She can nurture her children as a positive and peaceful citizen.

Keywords: Aggressive Behavior; Working Women; Shariah Remedy; Psychological Problems; Islamic Solution.

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1. Introduction

Allah says that He created the Human with "His Two Hands" (Haider, 2002). In the present study term "aggressive behavior" refers to behaviors like a) complaining against workload at both places (b) grudges with colleagues, c) depression, anxiety, and tension due to partner's negligence d) behavior of boss e) single parent, f) no tolerance for criticism, g) unwilling to accept weak area h) health issue i) in-law's issues.

1.1. Problem Statement

The aggressive behavior of women is creating a huge disturbance in Pakistani society and the question is that are all women behaving aggressively or only working women are behaving aggressively in frequency than those of household women.

Objectives of Research

1.2. To highlight the interpretations of Verses and

- Hadith about aggression.
- To describe the aggressive behaviour in working women.

1.3. Research Questions

- What is aggression and aggressive behaviour?
- What are the Quranic and Shariah stances on Aggression?
- Is Aggression permissible on different occasions in the light of Shariah?
- What are the ways to control aggression as suggested by Islam?
- How does aggression affect human beings?
- What are the major causes of aggressive behaviour?
- What is a possible solution to minimize it according to Shariah.

2. Significance of the Research

It will critically analyze Aggression in the light of Shariah whether it is or it is not according to Shariah. The findings of the study have implications for working women in particular and for policymakers and readers in general to understand the reasons in the light of Shariah.

3. Research Tools

The data for the present study was obtained by conducting structured interviews with secondary school teachers as working women. The collected data about the presence of aggressive behavior in teachers as working women has been analyzed separately for married women, unmarried women, and single parents to find out the age and status-wise answer to each question.

3.1.Population

Female teachers of secondary private and public schools of Rawalpindi were considered as the population of this study.

3.2.Sample Data

Female teachers (75) from public and private secondary schools teaching 9th and 10th classes are a sample population from 20 schools of the Rawalpindi division.

4. Literature Review

Aggression can be caused by various triggers, from frustration due to blocked goals and lack of patience (William et al., 2009). Most of the work had been done on the aggressive behavior of students. Islamic researchers had done work on how to control anger according to Shariah. This study aims to fill the gap by identifying the causes of aggressive behavior of working women and using Shariah as a remedy. Data on Aggression and aggressive behavior has been gathered from Primary sources, Qur'an, Hadith, and scholar's views are also gathered from secondary sources such as different books of psychology, articles on aggression, and interviews from secondary school (RMS) (Glenn, 2007).

4.1.Aggression and aggressive Behaviour

Roland and Idsoe, (2001) defined that aggressive behavior involves conflict between individuals of equal levels (Roland and Idsoe, 2001). According to F. Gerard Moeller, (2001) aggressive behavior is known as wrong emotions that are part of antisocial behavior (Moeller, 2001). According to Ali (2016), there is a conflict of interests between individuals. Minton (2010) has studied the contribution of genetic, biological, temperamental, family, social, and cultural factors in causing aggressive behavior (Ali, 2016; Minton, 2010).

4.2.Aggression according to the Islamic perspective

Islamic teachings on humanity have been mentioned in Quran, Islam is what the Quran has instructed to do and how Muhammad has put them into practice (Philips, 1990). These sources are Primary sources of Shariah. In Al Qur'an (42:37):

وَالَّذِينَ يَجْتَنِبُونَ كَبَائِرَ الْإِثْمِ وَالْفَوَاحِشَ وَإِذَا مَا غَضِبُوا هُمْ يَغْفِرُونَ

"And those who avoid the major sins and immoralities, and when they are angry, they forgive" (quran.com42/37).

In sura Ale-Imran Allah SWT Himself describe the reason of being aggressive, Al-Quran (3:162)

أَفَمَنِ اتَّبَعَ رِضْوَانَ اللَّهِ كَمَن بَاءَ بِسَخَطٍ مِّنَ اللَّهِ وَمَأْوَاهُ جَهَنَّمُ ۚ وَبِئْسَ الْمَصِيرُ

"Is one who followeth the pleasure of Allah as one who hath earned condemnation from Allah, whose habitation is the Fire, a hapless journey's end" (quran.com/3:162).

4.3.Hadith of Holy Prophet Muhammad ﷺ

On the authority of Abu Hurayrah, "A man said to the Prophet, 'Give me advice', Do not get angry."

Through the teaching of the Holy Prophet Muhammad, we get the remedy of avoiding aggression which has a negative impact on human nature (Sahih Bukhari, Hadith 3).

The Prophet ﷺ said, "Anger comes from the devil, he should make wudu" (Jami at Tirmidhi 3452, Hadith 3452).

The Prophet of Allah said, "When one of you becomes angry while standing, he should sit down. If the anger leaves him, well and good; otherwise, he should lie down" (Bukhari, 1320, Hadith 12).

4.3.1.Effects of Aggression

Aggression is the temptation of Shaitan and also a root of all evils; it weakens the person's faith. Aggression is a natural feeling experienced by every normal person due to displeasure or unacceptable situation (Tariq, 2018). It is natural; aggression can have serious consequences for us as well as the people around us. In marital life over aggression leads to divorce, in some tribes it leads to murder, in sectarian societies it leads to target killing (Subramanian, 2017).

4.3.2.Why should we control our anger or aggression?

Because the aggression displeases Allah and pleases Shaitan when a person becomes angry, he has the choice to control his aggression by responding the way as Allah and Prophet Muhammad ﷺ recommended, or he could give away emotion and behave in a way that displeases Allah but delights shaitan.

4.3.3.Different ways to control aggression: According to Al Qur'an

The only way to manage your anger is to show restraint in your reaction towards the offender. He has mentioned this specifically in the Quran (3, 133-134) when He says:

الَّذِينَ يُنفِقُونَ فِي السَّرَّاءِ وَالضَّرَّاءِ وَالْكَاظِمِينَ الْغَيْظَ وَالْعَافِينَ عَنِ النَّاسِ ۗ وَاللَّهُ يُحِبُّ الْمُحْسِنِينَ

"Those who spend (in Allah's Cause) in prosperity and adversity, who repress anger, and who pardon men; verily, Allah loves Al-Muh'sinoon (the good-doers)" (quran.com/3/133-134).

4.3.2.Different ways to control aggression: According to Sunnah

The angry situation is a position of the devil, the devil is fire and in an aggressive position, a person is in a burning and firing situation so the Hadith is that the person should drink water in this situation.

a) Seeking Refuge with Allah From The shaitanMu Adh Bin Jabl narrated a hadith of the last prophet in these words that if someone is suffering from anger and behaving in an aggressive attitude, the person should read or say these words, and the anger will be finished. Hazrat Muadh bin Jabl asked, what are these words, then the last prophet Muhammad said, "Astagh fe rullah ha Rabbe min Kulle Zambinve Wa Atoobo Aleh" (Jami at Tirmidhi 3452, Hadith 3452).

b) Keeping Silent

Prophet Muhammad ﷺ said: If any of you becomes angry, let him keep silent (Saheeh al-Jaami', 693, 4027). The second remedy is to keep silent during the situation of anger. Silent is a great remedy to save you to face any negative feedback or interaction.

In another Hadith, we come to know that once the Prophet faced such kind of situation that his forehead became full of sweat due to some anger but he controlled himself by remaining silent and calm (Langrial and Shah, 2014).

c) Change in position

Here is another Hadith of the last prophet Muhammad Peace be upon him, which is also related to the defusion of anger. He said these words as a remedy in Arabic. "If you are standing and become angry, you should immediately sit down and if you are in a sitting position and have anger or aggressive attitude, you should immediately lie down and take a long breath (Imam Ahmad).

d) When you get angry, make wudu

The next Hadith is related to another effective remedy for aggressive behavior and that is ordered by the last Prophet Muhammad in these words, "If you have anger, you should perform ablution" (Abu Dawood).

e) Anger is a form of madness

The Last Prophet Muhammad peace be upon him said that Anger is a kind of madness so if anyone feels anger or aggressive behavior, he should express regret on it and if he does not feel any regret on his/her anger, then it is confirmed that the person is mad (Nahjul Balagha, 255).

f) The Strongest One

Abu Huraira reported: The Holy Prophet said ﷺ that the best wrestler is not the strong person but the strong person is that who controls his anger and does not be in aggressive mode (Ṣaḥīḥ al-Bukhārī 5763, Ṣaḥīḥ Muslim 2609).

g) Remembrance of hereafter life

Once a man came to Prophet Mohammad ﷺ and said that O Prophet of Allah Almighty, please teach me some words that can help me for leading a good life and please don't teach me so many tasks so that it will be difficult for me. The last prophet said that you should not be angry, you should control yourself and remain far from the position and behavior of aggressiveness (Ṣaḥīḥ al-Bukhāri, 572).

5. Data Analysis and Interpretation

In the study, data was collected about the presence of aggressive behavior, frequency of aggressive behavior among female secondary school teachers. The data is analyzed separately for married, unmarried and single-parent women, and some status-wise answers to each question are collected and analyzed.

5.1. Findings related to Aggressive Behaviour among Working Women

After analyzing the collected data, the following heads related to Aggressive behavior among working women are found.

5.2. Home and Family background

The majority of teachers have the opinion that the most important causes of aggressive behavior are negative parents' behavior and family background. It is further discussed in interviews and found that if the atmosphere of domestic matters is not peaceful and relieved, the attitude of working women will be aggressive and non-peaceful.

The domestic atmosphere is first related to the husband, if husband is not giving proper time and importance to the working woman and she is feeling

that she is not respected and loving her and disturbing the domestic matters due to extra engagements in official or educational life, then the attitude becomes irrelevant, non-cooperative and non-loving which ultimately generates aggressiveness among working females.

According to working women, it is their constraint to give proper time to their working environment so there is some mis-adjustment but husbands should cooperate with them and understand that they are contributing to their household financial matters so husbands should adjust with them.

5.3. Parents' behavior with the teacher as a slave

'Nuclear family' concept and implication is prevailing in our societies and the concept of joint family's system is vanishing. This trend is also generating many new horizons in family life especially related to parents and siblings' relationships (Sharma, 2013).

Collected data refers to that the parents of working women are behaving as they are slaves and do not give importance to their work or earning and expect to work more for them also side by side their official duties. Working women opined that the behavior of our parents is very demanding with us and they behave as we are just only for doing work and not human beings. They said that parents and families demand to complete their tasks along with the responsibilities of school and offices so this behavior is also a cause of aggression among us. Respondents said that unnecessary strict behavior of parents, harsh remarks, and direct complaining is also major causes of aggressive behavior

5.4. Behaviour of Authorities with Working Women

In the aggressive behavior of working women, the behavior of their authorities also has a major part. According to the data collected through the survey, there is a very high ratio response which indicated the strict, autocratic, and non-compensating dealing of authorities in the official environment. The respondents opinioned that discriminating behavior, the inability of understanding others problems, and degradation on minor mistakes by their bosses and authorities are also the causes for their aggressive behavior (Maqsood, 2016).

5.5. Too Much Work Load

The majority of respondents also have the view that too much workload is also a cause of their aggressive behaviors. They shared that lengthy official timings, extra workload, additional responsibilities, and out-of-office official responsibilities also put pressure on their nerves and they got aggressive. They expressed that, in a stressful atmosphere, it is impossible to maintain their mental condition and remain to relaxed without an aggressive attitude.

6. Solutions for Aggressive Behaviour

The respondents were asked about the solution to the aggressive behavior and their suggestions and views are as follows;

6.1. Good Incentives

Good incentives make employees work hard, and work on toe e.g., handsome amount of salary, children's education should be free.

6.2. Respect of teachers

From both sides students and parents should give them respect as they are not an ordinary commodity. Whether they are paying a high fee they need to give respect and follow Islamic teachings

6.3.Boss Attitude

The boss should understand his or her employee's emotions and treat them equally. There should be no discrimination, no favoritism. Head should not pressurize them with the deadline of tasks, she should not adopt insulting behavior.

6.4.Media Participation

A new aspect was invented during the research that media has also a crucial role in generating and promoting aggressive behavior among working women in Pakistan. Respondents viewed hat at different TV channels in Pakistan, maximum stories and messages are revolving around violence, abuse, propagation of western feminism and negative impression of In-Laws families. This continuous feeding also inclines them towards negative behavior or negative understanding towards society so they felt themselves in an aggressive attitude.

6.5.Religious and Moral Education

Being Muslims, the maximum respondents also opined that they have a less moral and religious education. They said that Islamic education puts them in a balanced life and inclines them towards a peaceful progressive life. They viewed that the educational system does not have Islamic or moral education as per its need so their attitude has been developed beyond a peaceful atmosphere so they behave aggressively unintentionally.

7.Conclusions

The conclusions of this research indicate that the external factor and negative behavior of others are the main causes of aggressive behavior among working women. The female teachers are teaching students but there is a very low level of tolerance in students and their parents. Working women are feeling aggressive due to the non-ethical behavior of authorities and families. It is also found that the frequency of aggressiveness among working women is more than 70 percent on account of unfair behavior of others towards them. It means they control themselves on about 30 percent of incidents and behavior but in about 70 percent of incidents and behaviors, they become aggressive.

Recommendations

Make Islamic teachings compulsory in our life and apply them in daily life and teach the students as well. On the other hand, women should be focused on the positive role. In the case of media, it can change its policies. Emphasize the importance of a good domestic environment, trust-based relationships, the head or boss's good behavior and positive attitude towards the employee, and regular moral and religious education to prevent and treat aggressive behavior with employees especially women. As per the conclusion of this research and experience gained through research, it can be recommended that Muslims should give priority to Islamic teachings to adopt Islamic ethics. As there is good tiding for tolerating each other, be patient, forgive others, and follow the Sunnah of Holy Prophet Muhammadﷺ. There is a dire need to change this capitalist approach that life is not to live but to love humanity.

References

Al-Quran 42: 37; https://quran.com/42/37; 3: 162; https://quran.com/3/162; 3, 133-134;

Bukhari, Al-adab al Mufrad 1319, book 57, Hadith 3; Al-adab al Mufrad 1320, Hadith 12; Saheeh al-Jaami', 693, 4027; Ṣaḥīḥ al-Bukhārī 5763, Ṣaḥīḥ Muslim 2609; Ṣaḥīḥ al-Bukhārī 572;

Ali, S. S. (2016). Modern challenges to Islamic law. *Cambridge University* Press p. 79.

Glenn, H. P. (2007). Legal Traditions of the World. Sustainable Diversity in Law. New York City;

Oxford: *Oxford University Press.* ISBN 978-0-19 920541-7.

Haider, N. (2000). Islamic Legal Reform: The Case of Pakistan and Family Law. Yale JL & Feminism, 12, 287. https://quran.com, https://www.quranexplorer.com/blog/Quran-the-Healer-of-Hearts/anger-management-in-the-quran.

Jami at Tirmidhi 3452, vol 6, book 45, Hadith 3452 (English).

Langrial, A, H & Shah, H. (2014). A Critical Review of Pakistani Muslim Family Laws Ordinance 1961 In the Light of Islamic Family Laws. *Gomal University Journal of Research,* 30(1).

Lindholm, Charles. (2008). Polygyny in Islamic law. Ethnology, 47, pages. 181-193.

Minton, Stephen James (2010). Students experiences of aggressive behavior and bully/victim problems in Irish schools. *Irish Educational Studies,* 29: 2, 131-152.

Maqsood, N. (2016). The Debate over Polygamy in the Context of Muslim Family Law Ordinance 1961. *Journal of Science international,* 28(4),1-2.

Moeller, T. G. (2001). Youth aggression and violence: A psychological approach. Mahwah, NJ. *Lawrence Erlbaum Associates.* Retrieved from http://www.questia.com/read/106225815/youth-aggression-andviolence-a-psychological-approach.

Philips, A. B. (1990). Polygamy in Islam. Riyadh, Saudi Arabia. *International Islamic Publishing house.*

Saheeh al-Jaami. https://quran.com/3/133-134.

Sharma, R. (2013). Muslim Personal Law. 10.1007/978-94-024-1267-3-854.

Sunan Ibn Majah, book 21, (in English).

Subramanian, N. (2017). Islamic Norms, Common Law, and Legal Reasoning: Muslim Personal Law and the Economic Consequences. *Islamic Law and Society,* 24. 254-286. 10.1163/15685195-00243P03.

Tariq, F. (2018). Comparative Study between Shariah Law and Muslim Personal Law of Pakistan. *Journal of International Law and Islamic Law,* Vol 13 (1).

Van Acker, R., Grant, S.H., & Henry, D. (1996). Teacher and student behavior as a function of risk for aggression. *Education and Treatment of Children,* 19, 316.

William I. Gardner & Courtney W. Moffatt. Aggressive Behaviour: *Definition, Assessment, Treatment,* (2009), Pages 91-100.

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Coping Strategies of Covid-19 among Survivors: A Case of Punjab, Pakistan

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Abstract. On January 30, 2020, the World Health Organization publicized the Pandemic outbreak, and it received emergency status worldwide. As of February 14, 2020, there were globally 49,053 laboratory-confirmed cases and 1,381 deaths. Corona Virus creates anomalous challenges for the world in all spheres of society. This uncertainty led us to think about providing quality life, health, and well-being to all individuals equally. In such crucial times, people tried to cope with pandemic outbreaks by using different CAM strategies. This paper aims to probe such CAM strategies that COVID-19 survivors across Punjab commonly use. For this purpose, a qualitative case study design is used to investigate various coping strategies among survivors. Furthermore, by using the non-probability sampling technique, the researcher conducts interviews and analyzes its results qualitatively.

Keywords: Coping Strategies; Covid-19; CAM Practices.

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1. Introduction

"Like science, emerging viruses have no host country, and they are spreading across the globe" this was the opening line of a book that helped the world set infectious diseases on the global health map (Morse, 1993). The volume of this book became a hallmark study to enhance the world's capacity to monitor and respond to emerging viruses more effectively. It helped the world in determining the emerging place of viruses and in reducing the risks of deaths in those places and their surroundings. Now global health has become the priority of the World Health Organization (WHO), which motivated it to build the agenda titled as Global Health Security.

Earlier Preventions regarding epidemics made the world able to deal with them more effectively and quickly. Scientific technologies shrink the spaces, and now information about such viruses is expanding rapidly and freely (Lakoff, 2017). This also helps the world detect those places where viruses first emerge and reduce the risks of deaths in such places and their surroundings. At the end of 2019, an epidemic virus known as novel Coronavirus associated with the family of SARS started emerging from the Chinese province Wuhan (WHO, 2020). It grew so abruptly that millions of cases were registered all over the world in just a few weeks. The virus started threatening people's lives as it gets transmitted from one person to another when they come in contact. This situation accelerated the governments to take serious actions against it by updating their medical system and adopting extraordinary measures in every field to break the spreading chain of this virus (CDC, 2019).

With the COVID-19 pandemic, humanity is confronting a thriving general danger for which no particular treatment has yet been likely settled. All through the planet, more than 46 million patients and 1.2 million deaths identified with COVID-19 had

happened before October 2020 (Johns Hopkins University, 2020). The COVID-19 pandemic correspondingly to past viral pandemic risks like Severe Acute Respiratory Syndrome (SARS), the Middle East respiratory syndrome (MERS), Ebola infection affliction, and swine influenza warrant the supposition that specialists will keep compromising clinical frameworks, social orders, and economies all through the planet (Pike Bogich Elwood Finnoff, & Daszak, 2014). Specific ways of life sway all things considered flourishing similarly as affect individuals to the degree that they can add to the spread and hostile outcomes of Communicable illnesses (Di Marco et al., 2020). Likewise, people and populations' nutrition and way of life can affect environmental sustainability and human health (Tilman & Clark, 2014). While the critical obsession during a pandemic, for example, SARS-CoV-2 is on causal portions for the illness, both the physical and mental thriving of people and everyone is moreover tremendous, particularly for those with risk factors (Zhou et al., 2019). Although lockdowns are a basic measure to ensure public health, several cross-sectional evaluations showed that they could bring several negative changes in lifestyles, including the lack of exercise, "irregular" eating plans, sleeping issues, and mental disorders including strain and depression (Constant, Conserve, Gallopel-Morvan, & Raude, 2020).

CAM practices by and large feature a broad, patient-focused way to deal with overseeing flourishing, clinical advantages, and well-being—reliably including psycho-emotional, supportive, social, and incredibly huge perspectives (Maizes, Rakel, & Niemiec, 2009). There is a fundamental belief in CAM practices, which has been utilized to deal with a variety of illnesses and is persistently used in clinical structures across the globe along with demonstrated Traditional Medicine Systems (TMS) (Abrams, 2012). The World Health Organization (WHO) underlines Traditional Medicine as a clinical legacy "to advance universal health by arranging traditional and complementary medical associations into clinical care and self-clinical thought" (WHO, 2019). Internationally, the Traditional Medicine system is mostly subsumed under Complementary and Alternative Medicine.

The complex interrelationships between the protected framework and a blend of way of life factors like exercise, stress decay, nutritional food, and placing energy in nature, positive inner mentalities, and well-being have previously been manifested (Kuo, 2015; Black & Slavich, 2016; Pace & Negi, 2009; Woods, 1999). Despite the difficulties faced by individuals across the globe due to prohibitive ways of life, for example, social distancing and quarantine measures. The general public and patients could use this time of constraint to develop fortitude through major preventive methods and self-care. Hence, CAM measures could be utilized to improve self-satisfaction in a remarkable circumstance, for example, the COVID-19 emergency that causes stress, fear, uneasiness, and despair among people and societies all through the planet (Alschuler et al., 2020).

Cautions are throughout dependably accommodated extremely huge monetary benefactors for taking central measures and are being changed at times as exhibited by the causing circumstance. Regardless, the effect of COVID-19 will firmly rely on the behavior of individuals, which like this, will depend upon their comprehension of COVID-19. The obligation of the overall people to these control measures is basic to winning the fight against COVID-19, which relies on their arrangement and practices. Like this, the present study was

orchestrated totally to investigate varying techniques utilized by survivors considering COVID-19.

2. Research Question

- What were the coping strategies (Complementary and Alternative Medicines) mostly used among COVID-19 Survivors?
- What are the policy suggestions to mitigate the effects of the virus on such a diverse population?

3. Methodology

The present study is an effort to understand social, cultural, and economic aspects of a pandemic on people's lives and how they cope with it. This research also focused on the need to give special care to the people affected by the virus by using different strategies to prevent others from becoming victims. This study briefly accounts for the difficulty people face during the spread of pandemics and their coping strategies. For digging out different coping strategies deeply, the researcher decides to use a qualitative study design and conduct a case study among survivors of different Punjab, Pakistan, to investigate various coping strategies of Covid-19. For this purpose, the researcher interview eight survivors by using a nonprobability sampling technique.

4. Results and Findings

This portion of the paper held a comprehensive discussion on a pre-determined research question, i.e., the popularity of CAM practices among survivors of Covid-19. For this purpose, telephonic interviews were conducted among survivors to know the usage of various CAM practices as their coping strategy against the virus. As Solomon and Adams (2015) argued, CAM practices are very helpful in lowering the effects of a pandemic on an individual's health. In recent years, significant studies have been conducted on CAM practices as an alternative treatment of COVID-19. Many countries adopt CAM practices along with the conventional approach of medicines to seek health quickly. From the above findings, we can draw a road map of our study that for a speedy recovery, respondents used several CAM practices as their coping strategies. Those strategies are divided into different themes and discussed in detail.

4.1. Positive Attitude to Life

Mental pressure has prompted a fundamentally and conditionally higher contamination rate with Covid and other occasional microorganisms. The emotional state may accordingly be a significant variable in the immune system. Various huge epidemiological examinations show the defensive impact of an uplifting outlook toward life in ongoing transferable sicknesses. Further investigations show that constant stress is related to unfavorable results in numerous ailments (Cohen, Tyrrell, & Smith, 1991).

As R1 Stated that:

"To minimize disease stress and keep my positivity level high, I used social media and watched movies often."

Similarly, R2 told us:

"To neutralize the mental stress and fear of disease, I started graphic designing for some organizations."

Positive mental wellbeing doesn't just appear to be pivotal for a few cardiovascular issues however for flexibility from a more extensive perspective (Boehm & Kubzansky, 2012). At the point when life gets significant and positive, it diminishes the danger factors for ongoing coronary illness and hypertension (Trudel-Fitzgerald, Boehm, Kivimaki, & Kubzansky, 2014) by decreasing undeniable degrees of stress chemicals. An uplifting outlook toward life can effectively affect endurance in sound and wipe out individuals (Chida, & Steptoe, 2008). Besides, an inspirational perspective on life is related to a lower

cardiovascular disease hazard and all-cause mortality (Rozanski, Bavishi, Kubzansky, & Cohen, 2019).

4.2.Spiritual Healing

Many studies show that spiritual healing has an immediate connection to an individual's prosperity. 'Convictions and practices are usually utilized in medication to adapt to disease and other upsetting life changes. The potential advantages [of profound beliefs] to emotional well-being and prosperity have physiological results that sway actual wellbeing, influence the danger of illness, and impact reaction to treatment (Koenig, 2012). As R 1 stated:

I was tested positive in the month of Ramadan, so fasting and regular prayers were normal, and it made me feel relaxed".

Similarly, R 2 Mentioned:

"I frequently recited Surah Yaseen and Surah Rahman to seek satisfaction."

In that capacity, spiritual consideration frames part of the human mind and is a basic segment of human consideration, wellbeing, and prosperity for families, patients, and medical care laborers. Moreover, Spiritual practices shown through sympathy and compassion reassure an individual and give genuinely necessary alleviation during increased pressure, misery, and anxiety (Roman, Mthembu, & Hoosen, 2020). Hence, faith in the consecrated or heavenly and the ensuing profound experience prompts positive mental conditions of harmony, mending, happiness, expectation, and delight.

4.3.Homeopathic Medication

Homeopathy is an individualized treatment arrangement; like this, there is no likelihood that one cure will fix all instances of a particular pathology (Boericke, 1990). Nonetheless, from the up to referenced side effects, both respiratory and foundational, proficient homeopathic doctors could utilize homeopathic super high diluted items in the beginning phases of pathology. As R 3 highlighted

"I used a few homeopathic syrups like influenza for cough and congestion."

Also, R 4 Stated that:

"I mostly rely on herbal and homeopathic cough syrups like Suduri and Sharbat Toot siyah."

Hence, Homeopathic treatment is dependable on the verifiable utilization of homeopathic interventions during pandemics. Presently, there is no accessible antibody and certain treatments for COVID-19, yet a few investigations are progressing to put the name of a protected and powerful conventional medication. Except for some specific traditional medications accessible, homeopathy gives an elective treatment to those COVID-19 patients with gentle to direct manifestations that are recuperating at home, most likely saving them from hospitalization (Lombardi, 2020).

4.4.Social Relationships

Connections are significant factors for wellbeing and endurance in various sicknesses (Shah SB, Barsky AJ, Vaillant G, Waldinger RJ, 2014). Disconnection and forlornness, sentiments that are probably going to result from isolation (ibid, 2014), which may, like this, apply huge negative effects on explicit physiological boundaries like safe capacities and are similarly hindering well-being (Campagne, 2019). As R4 mentioned:

"In such crucial times, I had full support from my family and friends, and their behavior gave me strength to fight with the virus."

R8 stated that:

After being tested positive, I had a strong relationship with my family members. We talk and

discuss daily matters by maintaining s safe distance from one another.

Especially in a circumstance of expanded instability like a pandemic, where social contacts have unfortunate underlying meanings, fortifying social connections (Brooks & Webster, 2020)— perhaps at the same time through outside and online administrations can be significant. As a rule, keeping up solid connections may prompt better target well-being status and view of wellbeing (Shah, Barsky, Vaillant, & Waldinger, 2014).

4.5.Nutritional Supplements

Nutritional supplements are at present examined not just as a distinct advantage for planetary wellbeing and the continuous current environment emergency, but also perceived as a possible source and repository for the rise of infections like Ebola, MERS, SARS (Nelson et al., 2015), and the improvement of multi-safe microscopic organisms because of production line cultivating and wild creature markets (ibid, 2015). During the COVID-19 pandemic, more seasoned grown-ups and patients with persistent illnesses became especially powerless and most in danger of nutritional imbalance. An enhanced nourishing status can have a scope of beneficial outcomes on the insusceptible framework (Alwarawrah, Kiernan, & MacIver, 2018). As R5 stated:

"After being tested positive, I also changed my diet and started consuming more citric fruits, Meat stock, and egg. Such food contains Vitamins A, C, D, and omega 6 in excess".

Similarly, R6 mentioned that:

When I tested positive and suffered from nutritional imbalance, I started taking citrus fruit juice twice a day with Omega 6 capsules to fulfill my nutritional requirements.

Nutritional Supplements can assume a significant part in the "singular weakness" to bacterial or viral contaminations and, whenever tainted, in the course and result of the irresistible infection. A dominatingly plant-based eating regimen, including, organic products, vegetables, nuts, and olive oil, may impact the defenselessness to irresistible illnesses; especially food varieties are containing conceivably antimicrobial, cell reinforcement, mitigating, and immunomodulatory phytochemicals, like severe substances, Vit C, mustard oils, spices and flavors, and homegrown teas (Gershwin, German, Keen, 1999).

4.6.Mind-Body Medicine (MBM)

Mind-Body Medicines depend on the understanding that collaborations between the cerebrum, brain, body, and conduct can be utilized to actuate wellbeing advancing pathways (Dusek and Benson, 2009). It remembers conduct approaches and methods for combination with work out, unwinding, contemplation, and stress-guideline intercessions (in the same place, 2009). A few CAM intercessions could be valuable in the field of pressure decrease in a pandemic, e.g., utilizing care, sympathy, yoga, and contemplation rehearse (Kuo, 2015; Black & Slavich, 2016; Pace & Negi, 2009).

As R6 stated that:

"During Quarantine at my home, I used to perform Yoga regularly to seek mental health along with my physical health."

In the same way, R7 said that:

I do breathe exercises regularly during quarantined at home.

Mind-Body Medicines (MBM) were used to improve mental boundaries, diminish individual and cell stress, aggravation, improve safe capacity, and involve epigenetic pathways, working with self-and

autoregulation and strength all in all (Stefano, Esch, & Kream, 2019).

5. Discussions

The point of this qualitative study was, to sum up, the accessible proof of CAM approaches with possible preventive as well as remedial pertinence to the current COVID-19 pandemic. Because of the accessible information, CAM could uphold adapting procedures that could accommodate managing the likely effect of public limitation measures forced by the pandemic on the wellbeing and prosperity of people and networks. The significance of CAM approaches in the COVID-19 pandemic depends for the most part on the accompanying four viewpoints:

1) CAM can effectively affect hazard factors through the way of life changes like eating regimen, stress decrease, work out, and different methods for self-care (Chan, Wong, & Tang, 2020; Gannotta et al., 2018).
2) CAM and particularly MBM mediations can positively affect pressure and mental boundaries in a pandemic circumstance, especially with regards to social disconnection, nervousness, and misery (Brooks & Webster, 2020),
3) CAM can reinforce the invulnerable framework on account of non-transferable and transferable infections (Baars & Zoen, 2019),
4) CAM may have antimicrobial impacts if there should arise an occurrence of focused dietary mediations (Alschuler et al., 2020).

The way that the referenced methodologies and their mechanisms of activity are not (yet) explicit for COVID-19 is certifiably not a persuading contention against the utilization of chosen CAM practices in this worldwide emergency. At the point when not much logical information on compelling and microorganism and infection explicit preventive or restorative decisions are accessible, considering CAM devices might be a shrewd reaction in our call for activity during this pandemic. Right now, no particular treatment for COVID-19 has been demonstrated to be compelling that has been tried. The first encouraging medications proof for COVID-19 was Hydroxychloroquine and Remdesevir, while overall research in this field is created with inconceivable earnestness (Zhang, Xie, & Hashimoto, 2020).

Likewise, demonstrated preventive methodologies are restricted to any contact that works with infection move (Kirby, 2020). Explicit populace bunches at specific danger are the old and patients experiencing COVID-19 with morbidities, for example, persistent sicknesses like hypertension, diabetes, lung infections, malignant growth, ailment, or immune system illnesses. These populace bunches need techniques to adapt to the current emergency (Zhou et al., 2020). There is no demonstrated or prescribed system for individuals in danger to diminish their defenselessness, or whenever tainted, improve course and result (Gasmi et al., 2020).

Furthermore, successful recovery estimates will be needed for COVID-19 serious consideration survivors. It is also critical to recognize explicit and vague measures just as their conceivable added substance commitments from the fields like Nutritional Supplements, homeopathic, Traditional Medicines, and Mind-body medicines. Another point ought to be to improve invulnerable capacities through adequate accessibility of fundamental micronutrients to fabricate safeguard and physiological ways of dealing with stress and increment regenerative capacities.

Complementary and Alternative Medicines (CAM) might be an approach to endeavor to postpone

infection replication on account of contamination, e.g., with the guide of chosen food varieties for which antiviral impacts have been shown tentatively effective. A few distinct supplements and nutrient mixtures and applications have been found to improve and clean mucosal surfaces, consequently meddling with viral replication on the mucosal surface and improving tissue homeostasis during viral replication (Neugebauer, Mickenhagen, Siefer, & Walger, 2005). For instance, nutrient C is especially significant in the digestion of invulnerable cells and, as a cancer prevention agent, gives security against blow-back to cells and tissues brought about by oxygen revolutionaries as a feature of the insusceptible safeguard. Regenerative cycles in building and keeping up connective tissue structures are also improved by nutrient C, an impact step by step lost in scurvy, the nutrient C inadequacy infection (Boretti & Banik, 2020). As recently talked about, a considerable lot of the CAM measures may have the best impact in avoiding and reinforcing ways of dealing with stress just as lessen hazard factors for extreme COVID-19 courses.

6.Policy Suggestion

Based on the above discussion, we can put the following policies to mitigate the effects of the virus on such a diverse population. These policies help control the present hype of the Covid-19 virus and can be fruitful in the future.

6.1.Mobility Restrictions

There is a rise in Covid-19 cases with the second wave, which is not a good sign. Hence, to minimize the affected ratio, the government should restrict movements of the general public by closing interconnected national and international borders for pandemics.

6.2.Closure of Hotspots of Virus

Instead of closing the whole country, the government should try to indicate the most affected areas with viruses and close them immediately. Closing of hotspots will prove helpful in lowering the affected ratio and minimizing the death toll of the virus.

6.3.Raising Awareness through Community Workers

We are all affected by the COVID-19 pandemic in every sphere of life. COVID-19 is an unprecedented health challenge for the whole world. Pakistan is one of those countries with diverse populations, and creating awareness in such a diverse population is not an easy task. To raise awareness equally among the general public, the government should engage volunteer Community workers who help people in their communities and surrounding communities.

6.4.Reducing fear

Pandemics usually create a sense of distress and fear among the general public. To reduce fear, the media should play their role and try not to highlight cases in prime-time news. Further, a variety of means can be adopted to minimize the public fear, like offering some interesting competitions and events that everyone can join from home.

6.5.Witch-hunting the Social Being

This paper concluded that the majority of the infected people avoided mal-treatment in the quarantines and corona treatment centers. Therefore, one should safely contend that instead of the witch hunt of the infected people and their viral contracts with their social circles, smart and effective means of geofencing should be done to confirm and limit the proliferation of viral disease through social transmission.

7. Conclusions

From the absolute first day, the world is dealing with issues to anticipate and administer pandemics. From the nineteenth century, numerous pandemics arose in metropolitan communities of the US and Europe, which delivered appalling outcomes for enormous scope. When plagues happen, they bring new difficulties for general wellbeing foundations and make challenges for them (Rosenberg, 1987). During the current COVID-19 pandemic, vigorous proof for successful avoidance and explicit treatment worldwide isn't yet accessible. There is no clinical proof of a CAM measure to forestall or treat Covid-19 contamination until this point in time. Furthermore, a move should now be made to decrease the possible adverse consequence of isolation and physical separation on human prosperity and diminish the dismalness and mortality of COVID-19 (Greenhalgh & Will, 2020).

CAM holds generous potential for building versatility and reinforcing protection assets through measures like changing life and diet, utilizing spices, improving mental and actual wellbeing, and lessening pressure. Specifically, the fields of homeopathy, herbal medication, and Aromatherapy ought to be subjects of additional logical consideration and clinical examination. It is known from generous preclinical and restricted clinical exploration that numerous botanicals have properties that ensure against respiratory infections. CAM offers an assortment of effectively achievable, available, proof-based preventive, and remedial alternatives for respiratory contaminations and reinforcing physical and mental flexibility, liable to likewise help in the counteraction and treatment of COVID-19.

An expanded and supporting utilization of the preventive and remedial capability of CAM, notwithstanding the improvement of immunization and explicit treatment techniques for COVID-19, appears to be conceivable and important. Albeit the number of writings on CAM themes is consistently expanding, this doesn't relate to an expansion in excellent proof. Especially, further clinical examination is required, including methodologically top-notch contemplates.

8. Limitations

Few limitations regarding the conduction of this research are given below:

- As the researcher collected data through telephonic interviews, survivors might mislead the researcher or be unable to respond accordingly. So, it will be better to collect data through surveys or face-to-face interviews.
- As a convenience sampling technique was used for this research and sample size was small, so findings may not be properly generalized to the whole population.
- Researcher suggested a need for a detailed landmark study on the usage of complementary and alternative medicines during COVID-19.

References

Abrams, D. I. (2012). Integrative medicine in America. *Glob Adv Health Med.* 1:10–2.

Adhikari, S., Meng, S., Wu, Y. et al. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infect Dis Poverty,* 9, 29.

Alschuler, L., Weil, A., Horwitz, R., Stamets, P., Chiasson, A.M., Crocker, R. et al. (2020). Integrative considerations during the COVID-19

pandemic. *Explore,* 16:354–6.

Alwarawrah, Y., Kiernan, K., MacIver, N.J. (2018). Changes in nutritional status impact immune cell metabolism and function. *Front Immunol*. 9:1055.

Attia, Y.A., Alagawany, M.M., Farag, M.R., Alkhatib, F.M., Khafaga, A.F., Abdel-Moneim, A et al. (2020). Phytogenic products and phytochemicals as a candidate strategy to improve tolerance to coronavirus. *Front Vet Sci*. 7:573159.

Baars, E.W., Zoen, E.B., Breitkreuz, T., Martin, D., Matthes, H., Von Schoen- Angerer, T., et al. (2019). The contribution of complementary and alternative medicine to reduce antibiotic use: a narrative review of health concepts, prevention, and treatment strategies. *Evidence-based complementary and alternative medicine. eCAM.* 2019:5365608.

Black, D.S., Slavich, G.M. (2016). Mindfulness meditation and the immune system: a systematic review of randomized controlled trials. *Ann N Y Acad Sci.* 1373:13–24.

Boehm, J.K., Kubzansky, L.D. (2012). The heart's content: the association between positive psychological well-being and cardiovascular health. *Psychol Bull*. 138: 655–91.

Boretti, A., Banik, B.K. (2020). Intravenous vitamin C for reduction of cytokines storm in acute respiratory distress syndrome. *PharmaNutrition.* 12:100190.

Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N. et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet,* 395:912–20.

Campagne, D.M. (2019). Stress and perceived social isolation (loneliness). *Arch Gerontol Geriatr.* 82:192–9.

Center of Disease Control (CDC): Healthcare Personnel Preparedness Checklist for 2019-nCoV. January 24, 2020 available at: https://www.cdc.gov/coronavirus/2019-ncov/downloads/hcp-preparedness-checklist.pdf.

Chan, K.W., Wong, V.T., Tang, S.C.W. (2020). COVID-19: an update on the epidemiological, clinical, preventive and therapeutic evidence and guidelines of integrative Chinese-western medicine for the management of 2019 novel coronavirus disease. *Am J Chin Med.* 48:737–62.

Chida, Y., Steptoe, A. (2008). Positive psychological well-being and mortality: a quantitative review of prospective observational studies. *Psychosom Med*. 70:741–56.

Cohen, S., Tyrrell, D.A., Smith, A.P. (1991). Psychological stress and susceptibility to the common cold. *N Engl J Med.* 325:606–12.

Constant, A., Conserve, D. F., Gallopel-Morvan, K., Raude, J. (2020). Socio-cognitive factors associated with lifestyle changes in response to the COVID-19 epidemic in the general population: results from a cross-sectional study in France. *Front Psychol.* 11:579460.

Di-Marco, M., Baker, M.L., Daszak, P., De-Barro, P., Eskew, E.A., Godde, C.M. et al. (2020). Opinion: sustainable development must account for pandemic risk. *Proc Natl Acad Sci USA.* 117:3888–92.

Dusek, J.A., Benson, H. (2009). Mind-body medicine: a model of the comparative clinical impact of the acute stress and relaxation responses. *Minn Med.*

92:47–50.

Gannotta, R., Malik, S., Chan, A.Y., Urgun, K., Hsu, F., Vadera, S. (2018). Integrative medicine as a vital component of patient care. *Cureus,* 10: e3098.

Gasmi, A., Noor, S., Tippairote, T., Dadar, M., Menzel, A., Bjorklund, G. (2020). Individual risk management strategy and potential therapeutic options for the COVID-19 pandemic. *Clin Immunol*. 215:108409.

Gershwin, M.E., German, J.B., Keen, C.L. (1999). Nutrition and Immunology: Principles and Practice. Berlin: *Springer Science & Business Media.*

Greenhalgh, T. (2020). Will COVID-19 be evidence-based medicine's nemesis? *PLoS Med*. 17: e1003266.

Harpan, H. (2020). Coronavirus disease 2019 (COVID-19): A literature review. *Journal of Infection and Public Health*, 671.

Henrich, N, & Holmes, B. (2010). Communicating During a Pandemic. *Health Promotion Practice,* 12(4), 610–619.

Hurlbut J. B. (2017). A science that knows no country: Pandemic *preparedness, global risk, sovereign science.*

Hurlbut, J. B. (2017). A science that knows no country: Pandemic preparedness, global risk, sovereign science. *Big Data & Society*, 4(2), 205395171774241.

Jones, C.S., Waters, L., Holland, O. (2010). Developing Pandemic Communication Strategies: *Preparation without Panic.*

Kakodkar, P., Kaka, N., Baig, M. (2020). A Comprehensive Literature Review on the Clinical Presentation, and Management of the Pandemic Coronavirus Disease 2019 (COVID-19). *Cureus* 12(4): e7560.

Katz, R., Vaught, A., Simmens, S. J. (2019). Local Decision Making for Implementing Social Distancing in Response to Outbreaks. *Public Health Reports*, 003335491881975.

Kirby, T. (2020). Australian Government releases face masks to protect against coronavirus. *Lancet Resp Med*. 8:239.

Kuo, M. (2015). How might contact with nature promote human health? Promising mechanisms and a possible central pathway. *Front Psychol.* 6:1093.

Li, Q., Guan, X., Wu, P., et al. (2020). Early transmission dynamics in Wuhan, china, of novel corona virus infected pneumonia. *N Engl. J Med.*

Maizes, V., Rakel, D., Niemiec, C. (2009). Integrative medicine and patient-centered care. *Explore,* 5:277–89.

Nelson, M.I., Viboud, C., Vincent, A.L., Culhane, M.R., Detmer, S.E., Wentworth, D.E. et al. (2015). Global migration of influenza A viruses in swine. *Nat Commun.* 6:6696.

Neugebauer, P., Mickenhagen, A., Siefer, O., Walger, M. (2005). A new approach to pharmacological effects on ciliary beat frequency in cell cultures–exemplary measurements under Pelargonium sidoides extract (EPs 7630). *Phytomedicine.* 12:46–51.

Pace, T.W., Negi, L.T., Adame, D.D., Cole, S.P., Sivilli, T.I., Brown, T.D. et al. (2009). Effect of compassion meditation on neuroendocrine,

innate immune and behavioral responses to psychosocial stress. *Psychoneuroendocrinology.* 34:87–98.

Pike, J., Bogich, T., Elwood, S., Finnoff, D.C., Daszak, P. (2014). Economic optimization of a global strategy to address the pandemic threat. *Proc Natl Acad Sci USA.* 111:18519–23.

Pirutinsky, S. (2020). COVID-19, Mental Health, and Religion Coping Among American Orthodox Jews. *Journal of Religion & Health,* 9-10.

Roman, N. V. (2020). Spiritual care - A deeper immunity' - A response to Covide-19 pandemic. *African Journal of Primary Health Care & Family Medicine, page*, 2.

Rozanski, A., Bavishi, C., Kubzansky, L.D., Cohen, R. (2019). Association of optimism with cardiovascular events and all-cause mortality: a systematic review and meta-analysis. *JAMA Netw Open. 2: e*1912200.

Shah, S.B., Barsky, A.J., Vaillant, G., Waldinger, R.J. (2014). Childhood environment as a predictor of perceived health status in late life. *Health Psychol Res*. 2: 1560.

Singla G. COVID-19 pandemic: a literature review https://www.ijrrjournal.com/IJRR_Vol.7_Issue.6_June2020/IJRR0040.pdf.

Stefano, G.B., Esch, T., Kream, R.M. (2019). Augmentation of whole-body metabolic status by mind-body training: synchronous integration of tissue- and organspecific mitochondrial function. *Med Sci Monitor Basic Res.* 25:8–14.

Tilman, D., Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, 515:518–22.

Trudel-Fitzgerald, C., Boehm, J.K., Kivimaki, M., Kubzansky, L.D. (2014). Taking the tension out of hypertension: a prospective study of psychological well-being and hypertension. *J Hypertens*. 32:1222–8.

Uchino, B.N., Cacioppo, J.T., Kiecolt-Glaser, J.K. (1996). The relationship between social support and physiological processes: a review with emphasis on underlying mechanisms and implications for health. *Psychol Bull.* 119:488–531.

University, J.H. Johns Hopkins University (2020). Available online at: https://coronavirus.jhu.edu/map.html.

Wemrell, M., Olsson, A., & Landgren, K. (2020). The Use of Complementary and Alternative Medicine (CAM) in Psychiatric Units in Sweden. *Issues in Mental Health.*

Woods, J.A., Davis, J.M., Smith, J.A., Nieman, D.C. (1999). Exercise and cellular innate immune function. *Med Sci Sports Exerc*. 31:57–66.

World Health Organization (WHO): Coronavirus disease (COVID-2019) advice for the public. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public.

Zhang, J., Xie, B., Hashimoto, K. (2020). Current status of potential therapeutic candidates for the COVID-19 crisis. *Brain Behavior Immunity,* 87:59– 73.

Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z. et al. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet,* 395:1054–62.

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Moderating Effect of Board Governance on the Relationship between Ownership Structure and Capital Structure

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Abstract. The current study explores the moderating effect of board governance on the relationship between ownership structure and capital structure. The study utilized Ordinary Least Square (OLS), Fixed Effect, and Random Effect models, however, Linear Regression; Correlated Panels Corrected Standard Errors (PCSEs) is used to resolve the issue of Autocorrelation and Heteroscedasticity. Firm size, the board size, return on equity, audit quality, and board meetings were control variables. The author used a panel of 60 non-financial sector firms listed in the Pakistan Stock Exchange (PSX) from 2014 – 2018. The results of the study revealed that managerial ownership is negatively and significantly associated with financial leverage while the association of institutional ownership, foreign ownership, and board independence are insignificant with financial leverage. The results demonstrate that the coefficient of board gender diversity is negatively associated with leverage, however statistically significant. The moderating influence of board independence, and board gender diversity is positive. The findings of the study explain that for sound corporate governance diversified ownership structure is very important. Thus, it is proposed that authorities should force the companies to contain well-diversified ownership structures. The shareholders who are destroying the firm long-term benefits for getting short-term benefits should be monitored carefully.

Keywords: Managerial and Institutional Ownership; Foreign Ownership; Board Independent; Board Gender Diversity; Financial Leverage.

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1. Introduction

Corporate governance (CG) is related to how the providers of the capital to companies assure themselves of receiving a return on their investment. A key role of board directors is to govern corporate strategy (Klarner et al, 2021). The countries that have applied sound CG normally have a strong growth of the corporate area and grip further capability in attracting funds to fuel the economy. Furthermore, the efficiency of governance not only enhances the performance of a firm but also increases the wealth of shareholder and decrease the cost of capital (Sheikh & Wang, 2012). Recent financial crises and corporate frauds in developing and developed economies across the globe have fortified the CG significance. CG issue bound to international business attention from virtual darkness after a series of the collapse of high-profile corporations, including Houston, Texas-based energy giant, Enron and WorldCom the telecom behemoth, shocked the business world with both the age and scale of their illegal and unethical dealings (Shleifer & Vishny, 2007).

Financing assets with either debt or equity is an important financial decision of a firm. However, managing capital structure is tricky which needs certain expertise of board and management Phung & Le (2019). Capital Structure (CS) is the blending of liability and capital. In developing countries like Pakistan, a firm's optimal CS is very essential. The main purpose of an ideal capital structure is to reduce chances of loss, cost of capital and maximize the profit for shareholders. Consequently, it is a very difficult job for the management of the organizations to make decisions about the investment pattern to maintain optimal capital structure (Bilal, 2016).

The empirical study mostly has been done in developed countries to analyze the effect of CG on financial leverage (Fosberg, 2004), while limited studies have been found in developing countries about CG and CS that have to distinguish institutional structures (Bokpin & Arko, 2009).

There are certain mechanisms of corporate governance and their effectiveness varies from country to country. These mechanisms may or may not improve the CS in a financial market. To testify which mechanism is important helpful in Pakistan's capital market. There is the influence of ownership structures like managerial shareholding, institutional ownership, and foreign ownership on capital structure along with moderating role of board governance such as Board Independence (BI) and Board Gender Diversity (BGD). Capital Structure choice is not only influenced by company attributes but also by the vision of managers, objectives along with needs, which are affected by managerial shareholding (Brailsford et al., 2002). Institutional ownership also acts as good monitors who actively perform their duties and maintain the CS optimally. CS theories entail that companies choose their leverage according to market frictions, for instance, agency cost and asymmetric information. In agency context, institutional owners devote themselves as an external disciplinary mechanism for administration, reducing the need for internal disciplinary mechanisms, for instance, debt. In the context of asymmetric information, institutional ownership reduces information asymmetry and decreases the unfavorable or wrong choice of costs of equity, serving to reduce the amount of debt necessary for signaling equilibrium, and to lesser the cost of equity related to debt (Michaely & Vincent, 2013).

There are mixed findings on the association of institutional ownership with FLEV for instance Abdoli et al. (2012) established a positive association of institutional ownership with capital structure in Tehran due to their easy access to distinguish sources of finance like bonds or credits. The same evidence was suggested by Abobaker and Elgiziry (2015). In contrast, some researchers were found an opposite association of institutional ownership with financial leverage such as Aljifri and Hussein (2012), exploring the significant opposite association of institutional ownership with leverage, this indicates firms with a large proportion of institutional owners may lead to less use of debt financing. Pecking order theory supports these results. The same results were found by the research of Cinko & Kasaboglu (2017) and Michaely & Vincent (2013). An increase in institutional ownership may cause low firm leverage by more expected to issue equity and fewer possibility to increase liability (Michaely & Vincent, 2012).

Put differently, independent or external directors are mainly concerned about their reputation in the labor market (Fama & Jensen, 1983), therefore, they restrict managerial opportunism, fire them from poor performance, protect minority shareholders and oppose certain types of investors who work in their

self-interest. Accordingly, this study hypothesized that independent directors moderates the association between OS and leverage.

Owing to mixed evidence on the association of CG mechanisms with leverage, this study seeks to improve and further explore underlying relationships. Academic work on the association of CG with financial leverage is scarce from the Pakistani perspective. Especially earlier researches have not ensured the moderating role of board governance between OS and financial leverage in the Pakistani context. The research explores how board characteristics restrict or support different kinds of investors to take debt or increase equity. Therefore, the results of the study may help academicians and policymakers to set optimal capital structure in the financial market of Pakistan.

2. Problem Statement

Independent directors are almost missing (Javid & Iqbal, 2010) and most of the firms are family-owned and they selected a less skillful board of directors based on their relations in the capital market of Pakistan. As a result, agency conflicts happen as the board decides on the support of only a specific group (Shah and Butt, 2009). Thus, it is believed that the proposed framework can reduce agency conflicts in the context of Pakistan.

The limited number of studies indicates the effect of corporate governance on the association between leverage and company has implemented a duality approach in exploring the associations among the three studies create: the association of firm value with leverage, the correlation between leverage and CG, and the association between CG and firm value (Lang'at, 2006; Musyoki, 2009; Ngaruiya, 2007). They have disregarded the moderating effect of corporate governance of these limited studies, as a result of failure to provide an empirical analysis of immediate affiliation of these three variables.

Secondly, the studies that have tried to analyze the three variables (for instance Byers et al. 2008) were conducted in developed countries and the conclusions in these studies may differ if the empirical analysis were replicated in the local environment. Therefore, there is a need to carry out experiential studies to analyze interrelationships between three variables.

In summing up, the research gaps of this subject are lack of local study that include concurrent analysis of the three variables; disregarding the moderating role of board governance in evaluating the association between financial leverage and OS as well as firm value and the fact that in dual studies of examining the relationships among the three-study build-up: the association between firm value and leverage or CG, conclusions are conflicting as well as unconvincing.

Especially, evidence in the context of Pakistan is either weak or non-existent, for instance, Abdoli et al. (2012) find a negative association of independent board with financial leverage. They suggested that Iranian outside directors do not increase the debt of the organization. In contrast, positive association between independent directors and financial leverage (Najjar & Hussainey, 2012). They argued that independent directors increase the debt level to enhance access to credit. Similar evidence was found by Sheikh and Wang (2012) in the context of Pakistan. In the context of board gender diversity, Alves et al. (2014), find that women on the board decrease short-term debt while increasing long-term debt of the organization. Similar outcomes were found by Emoni and Warden (2017). According to the researcher's best knowledge, there is no previous study in the Pakistani context on the relationship of

female directors with financial leverage. Conversely, in Pakistan Sheikh and Wang (2012) suggested a negative association between managerial ownership and debt ratio. Similar results were revealed by Hasan and But in 2009. In the context of institutional ownership, Abdoli et al. (2012) found a positive association between institutional investors and CS in Tehran due to their easy access to various sources of financing like bonds or loans. The same evidence was suggested by Abobaker and Elgiziry (2015). According to the author's best knowledge, there is no previous study found in Pakistan on the association between institutional shareholding and CS.

3. Research Questions

The research questions of the study are as under:

- Is there any effect of managerial ownership on capital structure in non-financial Pakistan firms?
- Is there any effect of institutional ownership on capital structure in non-financial Pakistan firms?
- Is there any effect of foreign ownership on capital structure in non-financial Pakistan firms?
- Is there any moderating effect of board independence on the relationship between ownership structure and capital structure?
- Is there any moderating effect of board gender diversity on the relationship between ownership structure and capital structure?

2. Research Objectives

The objectives of this study are:

- To assess the effect of managerial ownership on capital structure.
- To assess the effect of institutional ownership on capital structure.

  To assess the effect of foreign ownership on capital structure.
- To assess the moderating effect of board independence on the relationship between ownership structure and capital structure.
- To assess the moderating effect of board gender diversity on the relationship between ownership structure and capital structure.

5. Significance of the Study

According to the authors' best knowledge, studies, especially on the moderating effect of the corporate board on the relationship between the ownership structure and capital structure, are either scarce or non-existent. Thus, it is expected that this study will help policymakers and managers to make better decisions regarding the capital structure of the firm.

The study of the relation would augment our understanding about whether or not companies that are vulnerable to expropriation issue more debts to have more resources to use for personal benefits and how this explains company worth. Researchers may also desire to utilize the result of this study as a basis for further research on these unsolved issues of best capital structure.

The administration of the public quote companies would advantage from the study as they require making more knowledgeable financial decisions. Shareholders would also make use of the findings of this research to be able to make more well-versed decisions, as they will be aware of the corporate governance structure to anticipate before they invest in a company.

6. Literature Review

6.1 Underpinning Theories and capital structure

Modigliani and Miller's Irrelevance Theory, The Tradeoff Theory, Pecking Order Theory, The Agency Theory, and Stewardship Theory were used in this research Combination of liabilities and capital is

called capital structure (CS). It is utilized by firms to finance long-term operations. Foreign investors seem to avoid firms with concentrated ownership that either have high government or director ownership; however, accounting and market variables show significant impact on foreign investors' decisions CS is the blending of different securities that are utilized to fund an organization's resources (Brealey & Myers, 2003). Brealey and Myers (2003) also examined that a firm can provide different security utilizing various combinations but the greatest mixture is one that increases the market value. According to Akram and Ahmad (2010), the FLEV of an enterprise comprises liability and the owner's capital element utilized toward finance the enterprise.

6.2 Capital Structure Determinants

CS is determined through numerous elements. The objective of this segment is to observe earlier studies of CS determinants. Various researchers (e.g., Abor & Biekpe, 2009; Benkraiem & Gurau, 2013; Chadha & Sharma, 2015; Fareed et al., 2014; Kiong & Lean, 2011; Shubita & Alsawalhah, 2012; Uyar & Guzelyurt, 2015) have considered the association of company's attributes with firm leverage. Even so, outcomes are varied. Factors such as quality information, size of the firm, age of firm, asset structure, and profitability are affecting the capital structure. This section assesses and discusses the previous studies on the above-mentioned attributes.

The research conducted by Caneghem and Campenhout (2012) and Campenhout and Caneghem (2009) on quantity and quality of information on CS in Belgium pinpoint that the leverage of the organization will augment due to the high quantity and quality of information. The companies with high quality of information tend to depend more on debt, which is consistent with companies that contain a low cost of attaining external finance.

Furthermore, the study conducted by Kardan, Salehi and Abdollahi, (2016) of association between external finance and the financial reporting quality in Iran. The conclusion of the research indicates that the quality of financial reporting is positively associated with debt finance.

Firm size can be determined by obtaining total resources or total sales. TOT proposed a positive impact of firm size on FLEV. On the other hand, POT proposes the inverse impact of firm size on FLEV. According to Rajan and Zingales (1995), big companies give preference to equity financing as of "asymmetric information".

Previous studies (e.g. Boateng, 2004; Chadhs & Sharma, 2016; Saarani & Shahadan, 2013b) have exploited firm size in investigating the CS determinants. Though, there are different results on the association of firm size with FLEV. For example, (Saarani & Shahadan, 2013b) examined the determinants of CS of Malaysian organizations discovered firm size is an insignificant and negative association with total liability ratio and short term liability ratio, but positively associated with long term liability ratio. The studies of Gomez, Rivas, and Bolanos (2014) on CS determinants in Peru, the results found a positive and significant association of firm size with leverage. Similar results were found in other studies (Ogbulu & Emeni, 2012; Sheikh & Wang, 2011; Sherif & Elsayed, 2013; Zhang, 2010). Conversely, numerous researches of determinants of CS examined the negative association between firm size and CS (Alipour et al., 2015; Kariuki & Kamau, 2014; Masnoon & Saeed, 2014).

According to Ahmad and Wan Aris (2015), there is theoretical doubt about the definite association of a firm's age with FLEV. Various theories, for instance,

TOT assumed a positive association of firm age with leverage and POT assumed a negative association of firm age with financial leverage. In addition, the study of Forte et al., (2013) on Brazilian firms used the sample of 19,000 Brazilian companies for the year from (1994-2006) and the results show a negative association of firm age and FLEV. Similar results were found by Palacin-Sanchez and Ramirez-Herrera (2013). Furthermore, the studies that gave mixed conclusions between firm age and capital structure. Sarrani and Shahadan (2013b) observed the CS determinants in Malaysia. The study result indicates the opposite association of firm age with total liabilities and long-term liabilities however positively associated with short-term liability. Saarani and Shahadan (2013a) revealed a significant and inverse association of firm age with the long-term debt ratio.

On the other hand, POT suggests that tangibility is opposite correlated with leverage. POT explains that due to high tangible assets a company be likely to use low debt when they prefer internal financing instead of external financing since their final alternate. This theory is supported by numerous studies that found asset structure negatively associated with leverage (Bereźnicka, 2013; Masnoon and Saeed, 2014; Psillaki and Saarani and Shahadan, 2013b).

POT assumed inverse effect of profitability on leverage, wherever companies having high profitability less dependent on external financing. The company gives first preference to internal finance, next debt finance, and finally equity finance as the last option. Various current studies investigated the negative correlation between profitability and CS (Abeywardhana, 2015; Ahmad & Wan Aris, 2015; Gomez et al., 2014; Kariuki & Kamau, 2014; Masnoon & Saeed, 2014; Ramjee & Gwatidzo, 2012; Ukaegbu & Oino, 2014).

6.3. Corporate Governance and Capital Structure

The impact of corporate governance (CG) on firm capital structure (CS) is mostly studied in developed nations. It also defines that "Corporate Governance is associated with the firm's CS and financing decision" (Litov, 2005). Authors have noted that a positive association between board governance and stability efficiency is present (2021) Detthamrong, Chancharat, and Vithessonthi, (2017), examine non-financial organizations in Thailand from 2001-2014 highlight the association of CG with CS. The research finds CG features like board size, independent directors, audit committee size, women director, CEO duality, ownership concentration, and audit reputation do not influence firm CS. Earlier studies give various results about the association of board size with CS. According to Berger et al., (1997), there is a negative impact of board size on CS. In contrast, according to Jensen (1986), companies due to large board size have high firm capital structure as compared to those firms which have small board size and propose that companies due to larger board are more possible to utilize more debt level.

A good reputable auditor can play a vital role in decreasing the information risk of investors, and so decreasing company's cost of capital if financial statements give market participants such as shareholders, potential shareholders through information, and the data recorded in the financial statements would be accurate (Azizkhani et al., 2010). Authors suggest a positive association of audit reputation with firm capital structure.

The regression findings expose the presence of independent directors and variables of board committee are significantly associated with financial

leverage. Similar results were found by Kajanathan (2012). Moreover, According to Wellalage and Lock (2012), the negative association of managerial ownership with leverage demonstration that ownership concentration encourages managers to lower the levels of gearing but the impact is not significant. Lastly, this study recognized that excluding board composition and board committees, other CG variables are insignificantly influenced by the leverage choices. Similar results were found by Somathilake & Udahakumara (2015).

According to Nyakundi (2016), the results explain the negative association of board size with leverage, the negative association between independent directors' leverage. There is a positive association between Government ownership and financial leverage.

According to Hafeez (2017), a strong relationship between CG practices with financial leverage of listed companies in Egypt from 2007 to 2016. Experimental outcomes show that there is a significant association between different internal and external corporate governance practices with firm leverage in Egyptian companies. The internal CG attributes are characterized by the board size, institutional investors, concentration of ownership, and government ownership, while external CG variables external auditor.

6.4 Moderating Effect of Board Governance

Corporate Governance Variables include Managerial Ownership, Institutional Ownership, and Foreign Ownership. The association between OS and CS is explained by board governance, the moderating variable in the relationship between ownership structure and CS. This would establish a link by moderating OS between, so indicating a relationship that otherwise would not be visible. According to Modigliani and Miller (1958), the association between OS and CS cannot be assumed, but the relationship is moderated and is formalized through a basic sequence between variables in an economic sense. In another word, to observe the direct association of CS with ownership structure is not possible, but in reality, the worth of the company is associated with the impact of CG on CS. Through the CG dimension under control, the actual correlation between leverage and ownership structure could be observed using an economic model (Corbetta, 1992).

The effects of independent directors and ownership have not been completely investigated (Brown et al., 2011). The impact of ownership and independent board on leverage may not be fully explored without the observation of moderating effect.

Therefore, investigating with moderating effect of independent directors on the association of OS with CS, the research expects to fill up this gap. Furthermore, previous studies inspected the only direct effect of OS and independent directors on CS. On the other hand, the study of Hsu, Wang, and Hsu (2012) indicates the specific moderating role of independent directors on the association between OS and CS has not been experienced.

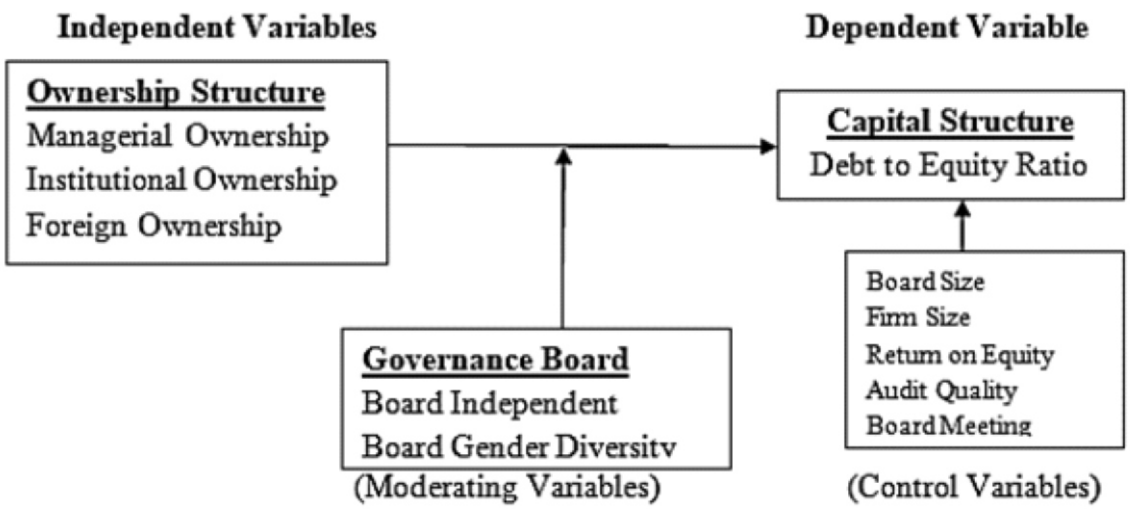
Furthermore, the conclusion of earlier studies is mixed and demonstrates that further research is required to examine the indirect effect of independent directors lying on the association of OS with CS. Thus, this study observes moderating effect of independent directors on the relationship between OS and capital structure. Finally, in a dynamic environment, the moderating influence of independent directors is likely to make stronger the association between OS and CS. We argue that a dynamic model enhanced the impact of leverage on this association of OS with independent directors.

The study explores the moderating impact of a female director on the association of OS with leverage. Earlier studies only examine the direct correlation of OS with capital structure (Abdurrouf, 2011; Manaseer et al., 2012). Two types of diversity are visible and non-visible. The visible diversity consists of gender, age, race, and ethnicity whereas the non-visible diversity contains knowledge, education, values, perception, and features of personality (Kilduff & Mehra, 2000). Majority of diversity studies and their impact upon performance concentrate on the demographic type of diversity.

Additionally, the study needs to observe the moderating role of board governance (board independence, board gender diversity) on the relationship between OS and CS and firm worth in Pakistan. On this topic, a lot of research has been conducted in advanced countries, but in Pakistan and other developing economies smaller attention has been given to investigating the said relationship.

7. Research Framework and Hypotheses

The research framework looks for the relationship of corporate governance attributes for instance managerial shareholding, institutional shareholders, and foreign investors with capital structure. Independent variables are managerial shareholders, institutional shareholders, foreign investors, and capital structure is the dependent variable. There is an eminence discussion in academic literature to solve the agency issues. According to Core et al. (1999), sound corporate governance can decrease shareholders' and managers' conflicts of interest. Scholars have considered board attributes and efficient ownership structure as the dimensions of sound corporate governance. According to Sun and Cahan (2009), that boards of directors play a vital role in aligning CG with CS decisions as well as connecting the interest of shareholders with managers. Thus, board governance (board independent and board gender diversity) is explained as moderating variable of the study.



7.1 Managerial Ownership

"Managerial ownership includes the shares owned by CEO, directors, their spouse, and children". Managers are probably less to use further perquisites or invest business assets below the cost of capital in case they have company shares. Agency problems alleviate through managerial shareholding as of alignment of benefits between principal and agent

(Jensen & Meckling, 1976).

In literature, on this phenomenon, there are diverse empirical shreds of evidence found. There is no significant association between CEO and managerial ownership and debt ratio (Wiwattanakantang, 1999). On the other hand, negative correlation between CEO holdings with leverage (Fosberg, 2004). The study argued that CEO will have a preference for his private benefits instead of shareholders' interest. According to Bokpin and Arco (2009), the significant positive influence of managerial shareholders with capital structure in Ghanaian listed companies. Thus, authors hypothesize that:

H1: A positive association between managerial shareholding and debt to equity ratio.

7.2 Institutional Shareholders

Institutional owners provide the facility to increase long-term finance at a profitable rate in a firm. Firstly, institutional shareholders are ready to give loans to a firm than whose board they enjoy an influence because these institutional shareholders themselves act as a source of long-term liability. Secondly, for a firm's strategic decisions, institutional shareholders provide an effective monitoring role. Institutional shareholders decrease managerial opportunism and also reduce the firm's agency costs. This provides confidence to the lenders resulting in favorable conditions of taking loans by the company and the general public. Thus, it is hypothesized that:

H2: Companies having high institutional shareholders are more likely to have high leverage.

7.3 Foreign Ownership

Typically, research sustains the opposite impact of foreign investors on leverage. The negative association of foreign ownership with all measures of leverage remains (Li et al., 2009). They explained that higher foreign ownership in firms would contain more varied finance channels to access funds as compared to others due to their repute and relationship. Similar results were found by Huang et al. (2011) in Chinese firms.

According to Al-Najjar and Taylor (2008), foreign investors can better access the information and have a better capability of understanding the information on firm performance. As a result, the manager's overinvestment problem and agency cost between principal and agent controlled by foreign owners.

Thus, foreign investment and leverage may provide alternates in controlling managerial self-benefits (Moon, 2001). Therefore, it is broadly decided that companies having large foreign investments have a tendency to employ low debt.

H3 Companies with high foreign ownership are probable to have lower leverage.

7.4 Board Independent

Studies also discovered that a large no. of independent directors can facilitate in decreasing agency conflicts. Through this argument, Bebchuk, et al. (2002) argue about independent directors have more power to restrict the CEOs from rent-seeking. The current research of Buigut et al. (2015) on UK public limited firms, founds a significant association of decrease in CEO overcompensation with a ratio of independent directors. Furthermore, independent directors efficiently and effectively observe the opportunistic behavior of managers and associate their remuneration efficiently with their performance (Chee-Wooi & Chwee-Ming, 2010; van Essen et al., 2015).

From agency theory, this study suggests that independent directors can restrict managers as well as majority shareholders from rent extraction. These

directors reduce the self-interested behavior of different shareholders and managers to align their interests with that of the firm. Thus, it is believed that independent non-executive directors can influence managers, institutional investors, and foreign investors to maintain an optimal level of capital structure. Owing to the lack of this evidence especially in the perspective of Pakistan, the following hypotheses are developed to fill the information gap in scholar's literature:

H4: Board independence significantly moderates the association between ownership structure and capital structure.

H4a: Board independence significantly moderates the association between managerial ownership and capital structure.

H4b: Board independence significantly moderates the association between institutional ownership and capital structure.

H4c: Board independence significantly moderates the association between foreign ownership and capital structure.

7.5 Board Gender Diversity

A diverse board has people of different environments and different information, know-how, expertise and is probably to make better involvement in decision making procedure and monitoring role, consequently which would encompass large impact on firm financial decision as well as firm performance. Our argument in favor of the moderating effect of board diversity provides support to agency theory and is based on a cost-effective basis. Theoretically, healthy varied governance structures will make sure better safeguard shareholders' interest through efficient and effective monitoring of CEO behavior and other executives through the people of diverse environments and skills. In this viewpoint, the impact of female directorship through better monitoring role of female directors will cause companies to be economically wealthy guiding to larger productivity and thus generate worth to the investors. This proposed to facilitate the influence of board gender diversity will positively strengthen the connection between governance structure and firm financial decisions. Therefore, the following hypothesis is established to test the moderating effect of board gender diversity:

H5: Board gender diversity significantly moderates the association between ownership structure and capital structure.

H5a: Board gender diversity significantly moderates the association between managerial ownership and capital structure.

H5b: Board gender diversity significantly moderates the association between institutional ownership and capital structure.

H5c: Board gender diversity significantly moderates the association between foreign ownership and capital structure.

8. Research Methodology

8.1 Measurement of Variables

The study makes use of accounting measures in measuring leverage. The following variables are measures of some prior studies as shown in the table below.

Variable	Measurement	Sources of measurement
Dependent Variable		
Capital structure	Total Debt to Total Equity	(Nyakundi, 2014)
Independent Variables		
Managerial Ownership	The proportion of equity owned by managers	Hasan & Butt (2009); Naseem et al. (2017)
Institutional Ownership	The proportion of equity owned by institutional ownership	(Blume & Keim, 2012)
Foreign Ownership	The proportion of equity owned by foreign ownership	Sueyoshi et al. (2010); (Bircan, 2011)
Moderating Variables		
Board Independent	The ratio of independent directors on the board	Sanda et al., (2010); Sheikh & Wang (2012);
Board Gender Diversity	The ratio of women directors on the board	Ekadah & Mboya (2012); Alabede (2016)
Control Variables		
Firm Size	Natural log of total assets	Sheikh & Wang (2012); Hasan & Butt (2009)
Board size	Total members of the board	Shukeri (2012); Garba &Abubakar (2014):
Return on Equity (ROE)	Total income divided by shareholders equity	
Audit Quality	Dummy variable 1 used if audit from 4 larger firms and 0 used for other.	Al-Matari (2017)
Board Meeting	Frequency of board meetings	Bashir & Asad (2018)

8.2 Sampling

This study will collect data from secondary resources like annual reports of firms. Data obtained from the annual reports were statement of profit and loss account, balance sheet, cash flow statement and a statement of change in owner's equity, ownership structure includes managerial shareholding, institutional shareholders, foreign investors, information about board governance. The data of sixty top-performing non-financial firms will be collected from 2014-2018 to fulfill the aims of the study.

8.3 Statistical Test

The statistical models of the study are Pooled OLS (Ordinary Least Square), Random and Fixed Effect Models. To eradicate the problem of Autocorrelation and Heteroscedasticity in panel data, this study also utilized PSCEs to attain definite results.

8.4 Operational Model

$$CS=\beta0+\beta1MANG+\beta2INST+\beta3FOR+\beta4BIND+\beta5BD+\beta6MANGBIND+\beta7INSTBIND+\beta8FORBIND+\beta9MANGBGD+\beta10INSTBGD+\beta11ORBGD+\beta12FSIZE+\beta13BSIZE+\beta14ROE+\beta15AQ+\beta16BM+\varepsilon$$

Whereas

CS = Capital Structure

MANG = Managerial Ownership

INST = Institutional Ownership

FOR = Foreign Ownership

BIND = Board Independent

BGD = Board Gender Diversity

MANGBIND = Interaction of Managerial

ownership with Board Independent

INSTBIND = Interaction of Institutional ownership wit Board independence

FORBIND = Interaction of Foreign ownership with Board Independence

MANGBGD = Interaction of Managerial ownership with Board Gender Diversity

INSTBGD = Interaction of Institutional ownership with Board Gender Diversity

FORBGD = Interaction of Foreign ownership with Board Gender Diversity

BSIZE = Board Size

FSIZE = Firm Size

ROE = Return on Equity

AQ = Audit Quality

BM = Board Meeting

9. Data Analysis and Findings

The descriptive statistics has been exemplified in the table indicates the highest scores, lowest scores, average mean values, and standard deviation values of dependent, independent, moderating, and control variables from 2014-2018. The data regarding the total 300 observations of each variable are obtained from the listed companies in Karachi Stock Exchange intended for five years. Descriptive statistics are under given in the Table 1.

Table 2 indicates the results of Ordinary Least Square (OLS). According to the results of the OLS Regression Model, the value of R-square is 0.16. It shows that 16% of deviation in FLEV is explicated through the independent or explanatory variables under the postulation of the OLS Model.

The result shows that Managerial Ownership is statistically significant and negatively associated with financial leverage (β=-0.0134, P=0.03). The association of Institutional Ownership with FLEV is insignificant. The Coefficient of Foreign Ownership is insignificant (β=-0.256, p=0.67).

In the case of board independence, the association between board independence and FLEV is statistically not significant (β=-0.065, P=0.57). The Coefficient of Board Gender Diversity is negatively associated with leverage but significant (β=-0.010, P=0.000).

MANGBIND is the interaction of managerial ownership with independent directors. The coefficient is positively associated with FLEV but statistically insignificant (β=0.399, p=0.7). INSTBIND indicates the interaction of institutional investors with independent directors. The beta coefficient is positively related to FLEV and significant (β=0.239, p=0.3). FORBIND is the interaction of foreign investors with independent directors. The positive association of beta coefficient with LEV but insignificant.

In the case of interaction between MANGBGD, there is a negative association of coefficient with FLEV and statistically significant. While in the case of INSTBGD and FORBGD, positive association with FLEV.

Furthermore, in the case of Control variables Coefficient of Board Size have positively associated with FLEV and is statistically significant (β=0.16, p=0.02). The coefficient of Firm Size and ROE is negatively related to FLEV and significant. The coefficient of Audit Quality is positively associated with FLEV but not significant (β=0.468, p=0.14) while Board Meeting is positively associated with FLEV and statistically significant β=0.125, p=0.09).

Table 1. Regression Analysis

Variable	N	Mean	Std. Dev.	Min	Max
LEVERAGE	300	1.364	2.011	-6.562	16.034
MANG	300	0.281	2.889	0	50
INST	300	0.172	0.215	0	0.99
FOR	300	0.106	0.201	0	0.97
BIND	300	0.773	1.186	0	8
BGD	300	0.54	0.827	0	3
BSIZE	300	8.49	1.736	6	15
LnFSIZE	300	17.763	2.019	14.804	24.68
ROE	300	0.171	0.248	-1.398	1.791
AQ	300	0.83	0.376	0	1
BM	300	5.47	1.624	2	13

Table 2. Ordinary Least Square Regression Model

LEVERAGE	Coef.	P-Value
MANG	-0.013	0.03
INST	-0.163	0.78
FOR	-0.256	0.67
BIND	-0.065	0.57
BGD	-0.010	0.00
MANGBIND	0.399	0.7
INSTBIND	0.256	0.05
FORBIND	0.239	0.3
MANGBGD	6.435	0.02
INSTBGD	0.078	0.64
FORBGD	0.05	0.73
BSIZE	0.16	0.02
FSIZE	-0.000	0.04
ROE	-0.015	0.00
AQ	0.468	0.14
BM	0.125	0.09
R-squared=0.1567 Adj R-squared=0.109 Prob>F = 0		

Table 3 presents the outcomes of the random effect model. The overall value of R-square is 0.08 which shows that 8% variation independent variable (Leverage) has been explicated through the variation in independent or explanatory variables and the rest of the 92% disparity independent variable (Leverage) due to other factors.

The results show that most variables have a negative association with financial leverage. It is found that independent variables like Managerial Ownership, Institutional Ownership, and Foreign Ownership are negatively associated with financial leverage *(β=-0.328, p=0.63 β=-0.836, p=0.14, β=-0.373, p=0.58)*. In the case of board independence, the coefficient of board independent is negatively related to financial leverage *(β=-0.157, p=0.36)*. The coefficient of board gender diversity is statistically not significant

and has negatively associated with leverage *(β=-0.281, p=0.36)*.

In the case of interaction between MANGBIND, INSTBIND, and FORBIND the coefficient of these variables is positively correlated with leverage and insignificant *(β=0.325, p=0.86, β=0.195, p=0.15, β=0.216, p=0.3)*. Coefficient of MANGBGD, INSTBGD AND FORBGD are negatively related with leverage and statistically not significant respectively *(β= -0.019, p=0.51, β= -.0144, p=0.36, β= -0.151, p=0.29)*. However, the coefficient of board size has positively associated with leverage but is statistically insignificant *(β=0.103, p=0.29)*. The association between Firm Size and leverage is insignificant *(β=0.000, p=0.27)*. The coefficient of ROE is negatively associated with leverage but significant *(β= -0.011, p=0.01)*. The coefficient of Audit Quality and Board Meeting is positively associated with leverage and statistically insignificant respectively *(β=0.415, p=0.33 β=0.544, p=0.58)*. Breusch and Pagan Lagrangian multiplier test for random effects is used to compare the OLS and Random Effect Model. Random Effect Model is better than Pooled OLS Model because the Prob > chibar2 = 0.0000.

Table 3. Random Effect Model

LEVERAGE	Coef.	P-Value
MANG	-0.328	0.63
INST	-0.836	0.14
FOR	-0.373	0.58
BIND	-0.157	0.36
BGD	-0.281	0.36
MANGBIND	0.325	0.86
INSTBIND	0.195	0.15
FORBIND	0.216	0.3
MANGBGD	-0.019	0.51
INSTBGD	-0.144	0.36
FORBGD	-0.151	0.29
BSIZE	0.103	0.29
FSIZE	-0.000	0.27
ROE	-0.011	0.01
AQ	0.415	0.33
BM	0.058	0.41
R-sq: within = 0.0949 between = 0.0431 overall = 0.0787		

Table 4 shows the outcomes of the fixed effect model of regression analysis. According to the results of this model positive association between Managerial shareholding and FLEV but insignificant *(β=0.365, p=0.733)*. Institutional Ownership negatively correlated with FLEV and its coefficient is statistically significant *(β=-0.013, p=0.05)*.

The association of foreign ownership with LEV is insignificant *(-0.173, p=0.828)*. The association between board independence and LEV is negatively insignificant *(β=-0.23, p=0.475)*. The coefficient of Board Gender Diversity is positively associated with FLEV but statistically not significant *(β= 0.238, p=0.548)*.

In the case of interaction between MANGBIND, INSTBIND, and FORBIND, the coefficient of these variables is positively associated with FLEV and statistically insignificant *(β=0.974, p=0.815 β=0.184,*

p=0.238 β=0.288, p=0.277). The coefficient of MANGBGD is positively associated with FLEV and insignificant *(β=0.551, p=0.877)*. The relationship of INSTBGD and FORBGD with FLEV is insignificant *(β=-0.246, p=0.172 β=-0.197, p=0.218)*.

For Control Variables, the coefficient of board size is positively correlated with FLEV but insignificant *(β=0.027, p=0.846)*. The association of firm size with FLEV is insignificant *(β=0.000, p=0.774)*. The coefficient of ROE is negatively associated with leverage but statistically significant *(β= -0.011, p=0.02)*. Audit Quality and Board Meeting are positively correlated with FLEV and insignificant respectively *(β=0.371, p=0.542 0.032, p=0.699)*.

Hausman test is evaluated to choose between Random Effect and Fixed Effect models which model is better for analysis purpose either random effect model or fixed-effect model. The fixed effect model is better than the random effect model because the probability of the fixed effect model is less than 0.05.

There is an issue of autocorrelation in the data, p-value < 0.05. Therefore, to eliminate the issue of autocorrelation Wooldridge test has been used to evaluate the autocorrelation in the results. There is an issue of Heteroscedasticity in the data. Therefore, to use the Linear Regression, correlated panels corrected standard errors (PCSEs) to remove the problem of Heteroscedasticity in the fixed effect regression model.

Table 5 shows the result of Linear Regression, correlated panels corrected standard errors (PCSEs). The model is used to solve the issue of autocorrelation in data. According to table 4.5, the value of R-squared is 0.1477. It signifies that independent or explanatory variables have 0.15% capability to explicate deviation of the dependent variable and the remaining 85% is influenced by other elements or factors which are not discussed in this research. Thus, the outcomes of this model indicate that the corporate governance attributes explicate a 15% variation in FLEV of companies listed in PSX. The finding indicates that the measures of corporate governance insignificantly affect the decisions of CS of the listed firm in PSX. The results of the study pinpoint that the coefficient of managerial ownership is negatively associated with FLEV but statistically significant *(β= -1.345, p=0.000)*. The result of the study follows the agency theory proposing that the alignment of interest between managers and shareholders is eliminated due to augmentation of managerial shareholding in a firm and to mitigate the agency conflicts by decreasing the role of debt as an instrument. In addition to this, the results show that higher leverage is a smaller amount of attractiveness to managers as it forced high risk to managers as compared to public investors. The study of Fosberg (2004) is consistent with the finding of a negative association of managerial shareholding with FLEV.

Institutional ownership and foreign ownership are negatively and insignificant associated with FLEV. The outcome of the study indicates that the association of independent directors is negative with FLEV is insignificant *(β=-0.074, p=0.26)*. The results advocate that the ratio of independent directors on the board is low in non-financial Pakistani firms listed in PSX. The outcome proposes that a board with low independent directors cannot examine the board actively. Furthermore, the findings of the study show that due to the low ratio of independent directors on the board, the firm cannot take more loans from financial institutions. Furthermore, the conclusion of the study shows that the low existence of independent directors on the

board decreases the firm creditability which makes it possible for the company to borrow more loans on positive terms and conditions to gain the tax shield advantage. The results demonstrate that the coefficient of board gender diversity is negatively associated with FLEV, however significant and strong *(β=-0.991, p=0.000)*. The finding shows that female director leads to less debt financing and focus on firm internal financing. Moreover, the ratio of female directors is less in the non-financial firm's list in PSX

Table 4. Fixed Effect Model

LEVERAGE	Coef.	P-Value
MANG	0.365	0.733
INST	-0.013	0.054
FOR	-0.173	0.828
BIND	-0.23	0.475
BGD	0.238	0.548
MANGBIND	0.974	0.815
INSTBIND	0.184	0.238
FORBIND	0.288	0.227
MANGBGD	0.551	0.877
INSTBGD	-0.246	0.172
FORBGD	-0.197	0.218
BSIZE	0.027	0.846
FSIZE	0.000	0.774
ROE	-0.011	0.024
AQ	0.371	0.542
BM	0.032	0.699
Prob > F = 0.0489		

Table 5. Linear Regress, correlated panels corrected standard errors (PCSEs)

LEVERAGE	Coef.	P-Value
MANG	-1.345	0
INST	-0.175	0.74
FOR	-0.193	0.779
BIND	-0.074	0.263
BGD	-0.991	0.000
MANGBIND	0.209	0.517
INSTBIND	0.242	0.005
FORBIND	0.226	0.116
MANGBGD	-6.231	0.000
INSTBGD	0.072	0.595
FORBGD	0.052	0.78
BSIZE	0.185	0.012
LnSIZE	-0.065	0.007
ROE	-1.478	0.002
AQ	0.414	0.005
BM	0.135	0.162
R-squared = 0.1477 Prob > chi2 = 0.0000		

The MANGBIND indicates the interaction between managerial ownership and board independence. The moderating influence of board independence between managerial shareholding and FLEV is positive *(β= 0.209, p=0.517)*. The results indicate that due to a limited number of independent directors the

association between managerial shareholding and FLEV is not effective. Generally, the findings proposed that there should be a need to increase the appearance and contribution of independent directors in the firms listed in PSX. Thus, the conflict of interest between managers and shareholders can be aligned by increasing the number of independent directors on the board.

The INSTBIND indicates the interaction of institutional investors with board independence. The results of this moderating effect are positive and significant *(β= 0.242, p=0.005)* which explains that institutional shareholders force the managerial shareholders and foreign investors to take more loans. The FORBIND shows the interaction of foreign ownership with board independence. The outcome of the study explains that the moderating effect of board independence is positive and insignificant *(β=0.226, p=0.116)*.

The MANGBGD is the interaction of managerial shareholding with board gender diversity. The moderating effect of BGD is a negative and significant association between managerial ownership and leverage *(β=-6.231, p=0.000)*. It means female directors concentrate on the firm internal source of financing than debt financing and considerable control on leverage.

In the case of INSTBGD and FORBGD positive and insignificant moderating role of BGD on the relationship of institutional ownership with FLEV and foreign ownership with FLEV respectively *(β=0.072, p=0.595, β=0.052, p=0.78)*. The results indicate that owing to a limited number of female directors on the board the relationship between institutional shareholders and FLEV as well as the association between foreign investors and FLEV is ineffective. In general, the finding suggested that there should be a need to augment the presence and contribution of female directors in the companies listed on PSX.

In the case of control variables, the result of board size shows that the coefficient is positively associated with FLEV and statistically significant *(β=0.185, p=0.01)*. The findings explain that companies with large board sizes have high debt financing. The study concluded that a large board size can examine the administration in a better way and can make better decisions. This is similar to the result of Adam and Mehran (2003). Firm Size is measured by the natural log of assets. The coefficient of firm size is negatively associated with FLEV and statistically significant *(β= -0.065, p=0.007)*. The result shows that larger firms use less debt financing as compared to smaller firms that utilize more debt financing.

The coefficient of Return of Equity is negatively related to FLEV and significant *(β= -0.015, p=0.002)*. The results explain that the firms with high profitability less depend on external financing like debt financing.

The coefficient of Audit Quality is positively associated with company financial leverage and statistically significant *(β=0.414, p=0.005)*. This result shows that mostly listed firms in PSX conducted their audit through the top four international audited firms. The result indicates that firms have high FLEV when they employ the top four international audited firms (i.e., KPMG, Deloitte,PricewaterhouseCoopers, and Ernst & Young) for conducting audits as compared to other firms which do not utilize the services of big four international audit firms.

The coefficient of Board Meeting is positively associated with FLEV *(β=0.135, p=0.162)*.

10. Conclusions

The negative association of managerial shareholding with financial leverage (FLEV) leads to low debt financing; however, the association is significant. The negative association of institutional shareholders and foreign investors with FLEV indicates that companies with a small proportion of institutional and foreign shareholders bear a lower debt level.

The negative relationship of independent directors with FLEV show that board with more independent directors take fewer loans on positive conditions due to better control and effective monitoring. The negative association of board gender diversity with FLEV demonstrates that the ratio of fewer women directors to more debt finance and the more proportion of female executives guides to low debt financing.

The INSTBIND positively and significantly moderate. The results explain that institutional shareholders put pressure on managerial and foreign shareholders to use more debt finance to enhance firms worth and decrease the problem of free cash flow.

The MANGBGD is the interaction of managerial ownership with board gender diversity. The moderating effect of BGD is a negative and significant association between managerial shareholding and FLEV. It means female directors concentrate on the firm internal source of financing than debt financing and considerable control on FLEV.

The positive moderating role of female directors on the relationship between institutional and foreign investors indicate that owing to the limited number of female directors in the firm lead to low debt finance and a large percentage of women directors utilize more debt level.

The positive association of board size with FLEV explains that companies with large board sizes have high debt financing than small firms. The negative association of company size with FLEV shows that larger firms decrease debt financing as compared to smaller firms that utilize more debt levels. The negative association of Return on Equity (ROE) with FLEV indicates that firms with high profitability led to low debt levels and vice versa.

The positive correlation of Audit Quality (AQ) with FLEV shows that those firms which are audited by four big international auditing companies lead to increase debt levels as compared to those firms which cannot conduct their audit by the top four international auditing firms. In Pakistan, 83% of companies that are listed in PSX conduct their audit by big four international companies. The positive association of board meetings with FLEV demonstrates that companies with a large number of board meetings bear more debt levels.

11. Limitation of the Study

This study attempted to present a logical and better observation of the moderating role of board governance on the relationship between ownership structure financial leverage. The restrictions of the study are:

- The sample size is small in this study.
- The research is restricted to non-financial companies in Pakistan. As a result, the conclusion of the research may perhaps be generalized to companies like those that were included in this study.
- The present research employs just a few corporate governance variables.
- The other limitation of this study is that the endogeneity problem has not been considered which can also affect our results.

12. Future Recommendations

The research presents critical views on the current stage of this educational text and recommends logical opinions to direct future studies. In the context of Pakistan, there is a need to further research for getting in the detailed body of knowledge regarding the CG attributes along with different other moderators. In this study, only a few CG variables and incomplete ownership structure were discussed. Further governance attributes such as CEO compensation, board remuneration, firm age, board composition, etc. may be included in future studies.

The other OS like family ownership, state ownership, ownership concentration may be included in future studies. In addition to this, the research can be more investigated to other Asian economies to disclose the applicability of the existing model to other capital markets to other Asian nations. Additionally, within the context of Pakistan sector-wise analysis is possible.

In this study, the only non-financial sector has been discussed. The financial sector is an essential part of our country. This sector may be included in future studies. SME is also vital for our country. In our research, SMEs could not be included in our study it should be studied in the future by the researchers. In this study, Pooled OLS model has been used to test the hypotheses. However, for cross-sectional and time-series observations panel data analysis may perhaps give a more realistic behavioral model. PCSEs model is used to overcome the autocorrelation and heteroscedasticity issue. Therefore, to reduce the potential biases the prospect research should examine the model of this study with a wide range of panel data techniques. To remove the endogeneity issue 2SLS and GMM models are used for future study.

13. Policy Implications of the Study

There are numerous critical implications of the research particularly for policymakers, theorists, academia, researchers, and regulatory bodies. Thus, the study has been separated into two parts theoretical and practical implications. A theoretical and practical implication of the research is discussed in this section. It has been recognized that the firms and shareholders both depend on the corporate governance system. Agency theory postulates that the association of shareholders with managers may be subject to inefficiencies, due to discrepancy of interest, which guide to information asymmetric. In this perspective, the stream of information is affected which in turn raises the asymmetric information, and so, decreases disclosure and transparency practices.

Numerous earlier researches who examine agency problems typically used various characteristics of CG like board ownership structure, board remuneration, characteristics of the audit committee to overcome these conflicts within the organization. Agency theory viewpoint, higher managerial shareholding can facilitate business to reduce agency costs. From the agency theory viewpoint, institutional investors give as a peripheral corrective mechanism intended for management, reducing the requirement for inner disciplinary mechanisms, for instance, debt. In the context of asymmetric information, institutional shareholders reduce information asymmetry and decline adverse or incorrect selection of costs of equity. POT predicted that the firms with a higher proportion of independent directors have more reliance on debt finance than internal finance.

Moreover, Agency theory is supported board diversity. The addition of women directors on the board gets better the financial decisions of the company. Accordingly, there is a need for the entry of women on board, to access the investment and

boost overall board independence. Better forms of financing are available for a business as women are more likely to ask questions as compared to males. Due to gender diversity, it is likely for companies to perform better as compared to competitors and promotes a better understanding of the market.

Agency theory also supports the moderating influence of female directors and it is based on the economic cause. From a theoretical viewpoint, sound diversified CG structures will make sure better protection for shareholders' interest through useful monitoring of the behavior of the CEO and other decision-makers by people of different backgrounds and knowledge. The SECP was designed and implemented an amended Code of CG in 2012 in Pakistan to build up the governance structures in firms for the improvement and accountability of the capital market. The corporate governance systems can be improved by a revised Code of CG equal to the standards of developed economies.

The evidence shows that in developing nation's corporate structure, business culture, and legal systems vary from developed nations and sudden improvement cannot be made in the capital market, but gradually alteration is compulsory in the corporate systems.

In addition to this, the results explain that for sound CG diversified OS is very important. The agency conflict cannot align with a single and concentrated ownership. Thus, it is proposed that authorities should force the companies to contain well-diversified ownership structures. The shareholders who are destroying the firm long-term benefits for getting short-term benefits should be monitored carefully. Furthermore, the policymakers, managers, shareholders, practitioner, regulatory bodies and the general public gets understanding and awareness

References

Abdoli, M., Lashkary, M., & Dehghani, M. (2012). Corporate governance and its effect on the corporate financial leverage. *Journal of Basic and Applied Scientific Research*, 2(9), 8552-8560.

Abeywardhana, D. K. (2015). Y (2015). Capital structure and profitability, an empirical analysis of SMEs in the UK. *Journal of Emerging Economics, Finance and banking,* 4(2).

Abor, J., & Biekpe, N. (2009). How do we explain the capital structure of SMEs in sub-Saharan Africa? Evidence from Ghana. *Journal of Economic Studies*, 36(1), 83-97.

Ahmad, N., & Wan Aris, Y. B. (2015). Investigating of Shariah compliant companies Capital Structure determinants. *International Business Management,* 9(3), 200-207.

Akram, B. & Ahmad, A. (2010). Entrenchment effect and audit quality in family business of Pakistan. *7th International Conference on Enterprise Systems, Accounting and Logistics,* Rhodes Island, Greece.

Alabede, J. O. (2016). Effect of board diversity on corporate governance structure and operating performance: Evidence from the UK listed firms. *Asian Journal of Accounting and Governance,* 7, 67-80.

Ali Shah, S. Z., Butt, S. A., & Hassan, A. (2009). Corporate governance and earnings management an empirical evidence form Pakistani listed companies. *European Journal of Scientific Research,* 26(4), 624-638.

Alipour, M., Seddigh, M. F. M., & Derakhshan, H. *International Journal of Law and Management,* 57(1) (2015) 53-83.

Al-Manaseer, M. F. A., Al-Hindawi, R. M., Al-Dahiyat, M. A., & Sartawi, I. I. (2012). The impact of corporate governance on the performance of Jordanian banks. *European Journal of Scientific Research,* 67(3), 349-359.

Al-Matari, E. M., Al-Matari, Y. A., & Saif, S. A. (2017). Ownership structure, audit quality and firm performance moderating and direct-effect models: An empirical study. *Corporate Board: Role, Duties and Composition,* 13(1), 28-35.

Al-Matari, E. M., Al-Swidi, A. K., Fadzil, F. H., & Al-Matari, Y. A. (2012). The impact of board characteristics on firm performance: Evidence from nonfinancial listed companies in Kuwaiti Stock Exchange. *International Journal of Accounting and Financial Reporting,* 2(2), 310-332.

Al-Najjar, B., & Taylor, P. (2008). The relationship between capital structure and ownership structure: New evidence from Jordanian panel data. *Managerial Finance,* 34(12) (2008) 919-933.

Azizkhani, M., Monroe, G. S., & Shailer, G. (2010). The value of Big 4 audits in Australia. *Accounting & Finance,* 50(4), 743-766.

Bajaher, M., Habbash, M., & Alborr, A. (2021). Board governance, ownership structure and foreign investment in the Saudi capital market. *Journal of Financial Reporting and Accounting.*

Bashir, A., & Asad, M. (2018). Moderating effect of leverage on the relationship between board size, board meetings and performance: A study on textile sector of Pakistan. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS),* 39(1), 19-29.

Bebchuk, L. A., Fried, J. M., & Walker, D. I. Managerial Power and Rent Extraction in the Design of Executive Compensation' (2002). *University of Chicago Law Review,* 69, 751-846.

Benkraiem, R., & Gurau, C. (2013). How do corporate characteristics affect capital structure decisions of French SMEs? *International Journal of Entrepreneurial Behavior & Research,* 19(2), 149–164.

Bereźnicka, J. K. (2013). Corporate Performance Interpretation and Measuring Problems. *Universal Journal of Accounting and Finance,* 1(1), 19–28.

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The journal of finance,* 52(4), 1411-1438.

Bilal, M. (2016). Determinants of the Capital Structure of the Cement Industry From *Pakistan. GRIN Verlag*.

Bircan, T., & Hooghe, M. (2011). Immigration, diversity and crime: an analysis of Belgian national crime statistics, 2001-6. *European Journal of Criminology,* 8(3), 198-212.

Blume, M. E., & Keim, D. B. (2012). Institutional investors and stock market liquidity: trends and relationships. *Jacobs Levy Equity Management Center for Quantitative Financial Research Paper.*

Boateng, A. (2004). Determinants of capital structure: Evidence from international joint ventures in Ghana. *International Journal of Social Economics,* 31(1/2), 56-66.

Bokpin, G. A., & Arko, A. C. (2009). Ownership structure, corporate governance and capital structure decisions of firms: Empirical evidence from Ghana. *Studies in Economics and Finance,* 26(4), 246-256.

Borokhovich, K. A., Parrino, R., & Trapani, T. (1996). Outside directors and CEO selection. *Journal of Financial and Quantitative Analysis,* 31(3), 337-355.

Brailsford, T. J., Oliver, B. R., & Pua, S. L. (2002). *Accounting & Finance,* 42(1), 1-26.

Brealey, R. A., Myers, S. C., Sandri, S., & Bigelli, M. (2003). *Principi di finanza aziendale. Milano: McGraw-Hill.*

Brown, K. W., Ryan, R. M., Loverich, T. M., Biegel, G. M., & West, A. M. Reply to Grossman (2011).

Buigut, S., Ettarh, R., & Amendah, D. D. (2015). Catastrophic health expenditure and its determinants in Kenya slum communities. *International journal for equity in health,* 14(1), 1-12.

Bulathsinhalage, S., & Pathirawasam, C. (2017). The effect of corporate governance on firms' capital structure of listed companies in Sri Lanka. *Journal of Competitiveness,* 9(2).

Butt, S. A., & Hasan, A. (2009). Impact of ownership structure and corporate governance on capital structure of Pakistani listed companies. *International Journal of Business & Management*, 4(2).

Byers, T. E., Wolf, H. J., Bauer, K. R., Bolick-Aldrich, S., Chen, V. W., Finch, J. L., ... & Yin, X. (2008). The impact of socioeconomic status on survival after cancer in the United States: findings from the National Program of Cancer Registries Patterns of Care Study. *Cancer: Interdisciplinary International Journal of the American Cancer Society,* 113(3), 582-591.

Van Caneghem, T., & Van Campenhout, G. (2012). Quantity and quality of information and SME financial structure. *Small Business Economics,* 39(2), 341-358.

Chang, Y. K., Chou, R. K., & Huang, T. H. (2014). Corporate governance and the dynamics of capital structure: New evidence. *Journal of Banking & Finance,* 48, 374-385.

Chee-Wooi, H., & Chwee-Ming, T. (2010). The monitoring role of independent directors in CEO pay–performance relationship: The case of Malaysian government linked companies. *Macroeconomics and Finance in Emerging Market Economies,* 3(2), 245-259.

Claessens, S., & Fan, J. P. (2002). Corporate governance in Asia: A survey. *International Review of finance,* 3(2), 71-103.

Corbetta, L., Pesiri, P., Ferro, G., & Mander, A. (1992). Improvement of fog and exercise-induced bronchoconstriction after local and subcutaneous immunotherapy in mite asthma. *Allergologia et immunopathologia*, 20(2), 61-66.

Core, J. E. (1999). Holthausen. RW, Larcker, DF, 1999. Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics*, 51(3), 371-406.

Detthamrong, U., Chancharat, N., & Vithessonthi, C. (2017). Corporate governance, capital structure and firm performance: Evidence from Thailand. *Research in International Business and Finance,* 42, 689-709.

Ekadah, J. W., & Kiweu, J. M. (2012). Effect of

board gender diversity on the performance of commercial banks in Kenya.

Fama, E. F., & Jensen, M. C. (1983). Agency problems and residual claims. *The journal of law and Economics,* 26(2), 327-349.

Fareed, Z., Aziz, S., Naz, S., Shahzad, F., Arshad, M., & Amen, U. (2014). Testing the relationship between profitability and capital structure of Textile industry of Pakistan. *World Applied Sciences Journal,* 29(5), 605-609.

Forte, D., Barros, L. A., & Nakamura, W. T. (2013). Determinants of the capital structure of small and medium sized Brazilian enterprises. *BAR-Brazilian Administration Review,* 10, 347-369.

Fosberg, R. H. (2004). Agency problems and debt financing: leadership structure effects. Corporate Governance: *The international journal of business in society,* 4(1) (2004), 31-38.

Garba, A. S., Kabir, S., & Nalado, A. M. (2014). An assessment of students' entrepreneurial intentions in tertiary institution: A case of Kano State Polytechnic, Nigeria. *International Journal of Asian Social Science,* 4(3), 434-443.

Gomez, G., Rivas, A. M., & Bolaños, E. R. L. (2014). The determinants of capital structure in Peru. *Academia Revista Latinoamericana de Administración,* 27(3), 341–354.

Hafeez, H., Zeshan, M., Tahir, M. A., Jahan, N., & Naveed, S. (2017). Health care disparities among lesbian, gay, bisexual, and transgender youth: a literature review. *Cureus,* 9(4).

Harris, M., & Raviv, A. (2008). The Review of Financial Studies. *The Review of Financial Studies,* 6, 473-506.

Huang, B. Y., Lin, C. M., & Huang, C. M. (2011). The influences of ownership structure: Evidence from China. *The Journal of Developing Areas,* 209-227.

Hussainey, K., & Aljifri, K. Journal of Applied Accounting Research. *Journal of Applied Accounting Research*, 13(2), 145-160.

Hussainey, K., & Al-Najjar, B. (2012). Understanding the determinants of RiskMetrics/ISS Ratings of the quality of UK companies' corporate governance practice. *Canadian Journal of Administrative Sciences/Revue canadienne des sciences de l'administration,* 29(4), 366-377.

Javid, A. Y., & Iqbal, R. (2010). Corporate governance in Pakistan: Corporate valuation, ownership and financing. *Working Papers & Research Reports,* 2010.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics,* 3(4), 305-360.

Kajananthan, R., & Achchuthan, S. (2013). Liquidity and capital structure.

Kardan, B., Salehi, M., & Abdollahi, R. (2016). The relationship between the outside financing and the quality of financial reporting: evidence from Iran. Journal of *Asia Business Studies,* 10(1), 20-40.

Kariuki, S. N., & Kamau, C. G. (2014). Determinants of corporate capital structure among private manufacturing firms in Kenya: A survey of food and beverage manufacturing firms. *International Journal of Academic Research in Accounting, Finance and Management Sciences,* 4(3), 49–62.

Khan, K., Nemati, A. R., & Iftikhar, M. (2011).

Impact of corporate governance on firm performance: Evidence from the tobacco industry of Pakistan. *International Research Journal of Finance and Economics,* 61(7), 14-31.

Kilduff, M., Angelmar, R., & Mehra, A. (2000). Top management-team diversity and firm performance: Examining the role of cognitions. *Organization science,* 11(1), 21-34.

Kiong, I. W. T., & Lean, H. H. *Asean Academy of Management Journal of Accounting and Finance,* 7(2) (2011) 137–156.

Klarner, P., Yoshikawa, T., & Hitt, M. A. (2021). A capability-based view of boards: A new conceptual framework for board governance. *Academy of Management Perspectives,* 35(1), 123-141.

Lang'at, R. (2006). Corporate Governance Structures and Performance in Firms Quoted in the Nairobi Stock Exchange (Doctoral dissertation).

Li, X., Xing, Y., Jiang, Y., Ding, Y., & Li, W. (2009). Antimicrobial activities of ZnO powder-coated PVC film to inactivate food pathogens. *International journal of food science & technology,* 44(11), 2161-2168.

Litov, L. P. (2005). Corporate governance and financing policy: *New evidence. Unpublished working paper.*

Masnoon, M., & Rauf, M. (2013). Impact of corporate governance on capital structure-a study of KSE listed firms. *Global Management Journal for Academic & Corporate Studies,* 3(1), 94-110.

Masnoon, M., & Saeed, A. (2014). Capital Structure Determinants of KSE Listed Automobile Companies. Masnoon & Saeed (2014)" Capital Structure Determinants of KSE Listed Automobile Companies" *European Scientific Journal, May edition,* 10(13), 451-461.

Michaely, R., & Vincent, C. (2012). Do institutional investors influence capital structure decisions. *Johnson School Research Paper Series.*

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American economic review,* 48(3), 261-297.

Moon, D. (2001). Essays on ownership structure and corporate policies. *City University of New York.*

Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of financial economics,* 13(2), 187-221.

Naseem, M. A., Zhang, H., & Malik, F. (2017). Capital structure and corporate governance. *The Journal of Developing Areas,* 51(1), 33-47.

Ngaruiya, J. (2007). Unpublished MBA. *Research Project, UoN.*

Nyakundi, K. M. (2016). Relationship Between Capital Structure and Corporate Governance of Companies Listed at the Nairobi Securities Exchange. *(Doctoral dissertation, University of Nairobi).*

Ogbulu, O. M., & Emeni, F. K. (2012). Capital structure and firm value: Empirical evidence from Nigeria. *International Journal of Business and Social Science,* 3(19), 252-261.

Palacín-Sánchez, M. J., Ramírez-Herrera, L. M., & Di Pietro, F. (2013). Capital structure of SMEs in Spanish regions. S*mall Business Economics,* 41(2), 503-519.

Paligorova, T., Xu, Z. J. (2012). Corp. Finance, 18, 701–716.

Phung, D. N., & Le, T. P. V. (2013). Foreign Ownership, Capital Structure and Firm Performance: Empirical Evidence from Vietnamese Listed Firms. *IUP Journal of Corporate Governance,* 12(2).

Ponnu, C. H., & Ramthandin, S. (2008). Governance and performance: Publicly listed companies in Malaysia. *Journal of Business Systems, Governance and Ethics,* 3(1), 35-53.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *The journal of Finance*, 50(5), 1421-1460.

Ramjee, A., & Gwatidzo, T. (2012). Dynamics in capital structure determinants in South Africa. *Meditari Accountancy Research,* 20(1), 52-67.

Saarani, A. N., & Shahadan, F. (2013). The comparison of capital structure determinants between Small and Medium Enterprises (SMEs) and large firms in Malaysia. *International Journal of Economics and Finance Studies,* 5(1), 22-32.

Saarani, A. N., & Shahadan, F. (2013). The determinant of capital structure of SMEs in Malaysia: evidence from enterprise 50 (E50) SMEs. *Asian Social Science,* 9(6), 64.

Safiullah, M. (2021). Stability efficiency in Islamic banks: Does board governance matter? *Journal of Behavioral and Experimental Finance*, 29, 100442.

Sanda, A. U., Mikailu, A. S., & Garba, T. (2010). Corporate governance mechanisms and firms' financial performance in Nigeria. Afro-Asian *Journal of Finance and Accounting,* 2(1), 22-39.

Sangeetha, M., & Sivathaasan, N. (2013). Factors determining capital structure: a case study of listed companies in Sri Lanka. *Research Journal of Finance and Accounting,* 4(6), 236-247.

Sheikh, N. A., & Wang, Z. (2011). Determinants of capital structure: An empirical study *of firms in manufacturing industry of Pakistan. Managerial finance,* 37(2), 117–133.

Sheikh, N. A., & Wang, Z. (2012). Effects of corporate governance on capital structure: empirical evidence from Pakistan. Corporate Governance: *The international journal of business in society.*

Sherif, M., & Elsayed, M. (2013). *School of Management and Languages,* 44(1), 1–27.

Shleifer, A., & Vishny, R. W. (2008). 5. Management Buyouts as a Response to Market Pressure (pp. 87-102). *University of Chicago Press.*

Shubita, M. F., & Alsawalhah, J. M. (2012). The relationship between capital structure and profitability. International Journal of Business and Social Science, 3(16), 104–112.

Shukeri, S. N., Shin, O. W., & Shaari, M. S. (2012). Does board of director's characteristics affect firm performance? Evidence from Malaysian public listed companies. *International business research,* 5(9), 120.

Sueyoshi, T., Goto, M., & Ueno, T. (2010). Performance analysis of US coal-fired power plants by measuring three DEA efficiencies. *Energy policy,* 38(4), 1675-1688.

Sun, J., & Cahan, S. (2009). The effect of compensation committee quality on the association between CEO cash compensation

and accounting performance. Corporate Governance: *An International Review,* 17(2), 193-207.

Suto, M. (2003). Capital structure and investment behaviour of Malaysian firms in the 1990s: A study of corporate governance before the crisis. *Corporate Governance: An International Review,* 11(1), 25-39.

Ukaegbu, B., & Oino, I. (2014). The determinants of capital structure: A comparison of financial and non-financial firms in a regulated developing country - Nigeria. *African Journal of Economic and Management Studies,* 5(3), 341–368.

Uyar, A., & Guzelyurt, M. K. (2015). Impact of firm characteristics on capital structure choice of Turkish SMEs. *Managerial Finance,* 41(3), 286–300.

Van Essen, M., Otten, J., & Carberry, E. J. (2015). Assessing managerial power theory: A meta-analytic approach to understanding the determinants of CEO compensation. *Journal of management,* 41(1), 164-202.

Wellalage, N. H., & Locke, S. (2011). Agency costs, ownership structure and corporate governance mechanisms: A case study in New Zealand unlisted small companies. *International Research Journal of Finance and Economics,* 78, 178-192.

Wiwattanakantang, Y. (1999). An empirical study on the determinants of the capital structure of Thai firms. *Pacific-Basin Finance Journal,* 7(3-4), 371-403.

Zhang, Y. (2010). The product category effects on capital structure: evidence from the SMEs of British manufacturing industry. *International Journal of Business and Management,* 5(8), 86.

Impact of Working Capital Management on Corporate Performance. A Case-study of Automobile, Chemical, Food, and Pharmaceutical sector of Pakistan

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Abstract. There is no hidden secret that working capital management policies do impact profitability but to what extent this is still a debatable issue. The capital structure theories suggest that apart from the firm size, the sensitivity of working capital management policies varies among different business sectors. The present study aims to investigate variation in working capital policies of the Automobile, Chemical, Food, and Pharmaceutical sectors of Pakistan. Firm performance is measured through Return on Assets and Shareholders wealth is measured through Return on Equity. We find that the chemical sector aggressively manages working capital with the mean value of the Net Trade Cycle is 21 days. The results also suggest that aggressive working capital policy does not show any association with a firm's profitability while the opposite does harm a firm's performance.

Keywords: Capital Management; Corporate Performance; Automobile; Pakistan's Economy.

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1. Introduction

The present study emphasizes to study the working capital practices of the Automobile, Chemical, Food, and pharmaceutical sectors of the economy and its contribution to the profitability of the same as well. Working capital management proved to be an important area of corporate finance in the last decades especially its importance recognized in the era of economic downturn 2007-08. Because of its growing importance in the world of corporate finance, the CFO Magazine publishes reports on working capital management performance in many countries.

Investment in working capital always remains one of the important decisions that was taken by the financial manager. Several theories help managers to resolve this puzzle successfully. This decision is important as it has a direct impact on firm value. Haq et al. (2011) concluded that a firm's profitability is affected by the working capital policy adopted by the financial manager. Working capital in the simplest way can be defined as the ability of the company to meet its day-to-day operations (Charitou, Elfani, & Lois, 2010). The efficient management of working capital ensures not only the continuity in the operation of the business but also ensures to pay short-term debt and upcoming operational expenses. It consists of the management of inventories, accounts receivables, accounts payable, and cash.

Numerous theories evolved to understand the relation between working capital and firm performance. One school of thought argued that investment in working capital has a positive impact on firm performance. This is because this will allow firms to increase sales as well as get discounts under early payments. Excess investment in stock also gives shelter against

price fluctuations, reduces order cost, and the possibility of reduced sale due to stock out situation. On the other hand, overinvestment in stock increases financing costs. So eventually high-interest cost leads to bankruptcy.

Corporate managers have three ways to deal with working capital namely Conservative, aggressive and moderate policy of working capital management. Each one has a unique effect on a firm's profitability, liquidity, and risk. In the conservative approach, the firm makes excess investment in the current asset so this approach is less risky and less profitable as well. In an aggressive approach, the firm made less investment in the current asset. This approach increases the profitability and as well as risk as well. Moderate approaches manage the way between these two sides of the coin. In this approach, the firm tries to manage a permanent portion of the current portion with long-term funds while the rest of the portion of current assets with short-term financing.

It is important to note that working capital policies vary from organization to organization keeping in view the nature of business. For instance, manufacturing industries have to maintain spare parts and equipment resultantly heavy investment in the current assets. While services need not make heavy investments in current assets. In this context, it is implied that working capital policy significantly impacts shareholders' value.

Financing constraints of an organization change the optimum level of working capital and its possible association with the profitability of the organization. This is not supported by the seminal work of Modigliani and Miller in which they claim that in a perfect capital market, firms are independent with financing and investment decisions regarding their Asif, M. et al.value. After that extensive literature on capital market imperfection evolved. Researchers concluded that market imperfection increases the cost of external financing as compared to internally generated funds. Fazzari et al. (1988) argue that the number of financial factors like availability of retained earnings, access to the capital market, and cost of financing put the effect of firm's investment in working capital. Fazzari and Petersen (1993) concluded that investment in working capital is more sensitive to financial constraints. To our knowledge, our paper is the first one to analyze the impact of financing constraints on this relationship. Based on findings we concluded that managers put concentration on other areas of finance to increase shareholder's value as working capital has the least impact on a firm's profitability. To the best of our knowledge, this is the first attempt to take the four diverse economic sectors simultaneously to analyze the possible impact of working capital management on a firm's profitability.

2. Literature Review

Nadiri (1969) was among the pioneers who firstly study the role of working capital management on the profitability of the organizations. After that researchers evolve a number of approaches by using Nadiri's model.

There is extensive literature available on working capital approaches about risk and return of the same (Pinches, 1991; Brigham and Ehrhardt, 2004; Gitman, 2005 and Moyer et al., 2005). Aggressive working capital policies associated with minimum investment in current assets. Resultantly characterized with high risk and high return characteristics. Conservative working capital policies are associated with huge investment in current assets as compared to aggressive policies hence, characteristics with low

return and low risk (Van Horne and Wachowicz, 2004).

Jose, Lancaster, and Stevens (1996) suggest that the cash conversion cycle is the most appropriate measure of working capital management. CCC measures the period between cash paid for acquiring inputs and cash received from regular sales (Knauer & Wohrmann, 2013). CCC is the period acquiring the inputs and then the collection of cash from the sale of goods (Charitou et al., 2010; Deloof, 2003); Afza and Nazir (2009) claim that shorter the CCC leads to an increase in the profitability of the company.

Researchers claims that there is an inverted U-shaped relationship exists between firm performance and working capital management that means an optimal level of investment in current asset differ between firms according to the level of financial constraints they face. This U-shaped relationship exists because working capital is linked with profitability positively at the minimum level of working capital and inversely associated with the high level of working capital requirement. Modigliani and Miller (1958) claim that companies' availability of external finance is not a problem especially in a frictionless world; hence investment does not depend on the availability of internal funds. In an imperfect market, external funds prove to be costly as compared to internal resources. Fazzari et al., (1988) claim that firms' placement of funds in current assets depends upon various financial factors like availability of internal finance, cost of external funds, and access to the financial market.

Filbeck and Krueger (2005) study the working capital management policies of 32 non-financial industries of the US to analyze the impact of the same on the profitability of the organization. They concluded that working capital policies significantly differ among industries over time. These policies also change from time to time among firms.

Shin and Soenen (1998) collect the data of 58,985 firms from 1975 to 1994 to empirically test the possible association between net trade cycle and profitability of sample firms. They conclude that there exists a strong association between net trade cycle and profitability and suggested in order the increase profitability firm should reduce the net trade cycle. Rehan and Nasir (2007) analyze the possible association between working capital and profitability by using the data of 94 Pakistani firms. They use CCC as a working capital measure to measure the impact of the same on firms profitably. They concluded that CCC is negatively associated with profitably.

Ghosh and Maji (2003) empirically test the working capital management performance of the comment industry by using the data of 1992-1993 and 2001-2002. They calculated the indices instead of traditional working capital measures to analyze the efficiency of targeted firms. They found Indian Cement industry performance not satisfactory during the studied period. Gill et al. (2010) analyzed the impact of working capital management on a firm's profitability. They collect the data of 88 US firms from the period 2005 to 2007. They used a generalized least square regression model and concluded that there is a significant relationship between CCC and profitability. Mohammad (2011) analyzed the relationship between profitability and working capital management in Iranian firms by using the data from 2001 to 2006. The cash conversion cycle is used as a measure of working capital efficiency. He concluded that the average collection period is inversely associated with

profitability and inventory Turnover days were found significantly associated with profitability. They suggested that the firm should decrease the CCC to increase the firm profitability.

Mona (2012) studied the working capital policies (conservative, Aggressive) of Jordanian firms from the period 2001 to 2009. Conservative working capital policy, as a relatively large investment in current assets, measuring current assets to total assets. He found by using a regressive method that conservative working capital policy is positively associated with profitability and the value of the firm. Aggressive working capital policy on the other land is negatively associated with firm profitability and value.

Mosa et al., (2012) investigate the working capital management and profitability relationship of food companies of Tehran by collecting the data from 2006 to 2011. They take debt rate and log sales as control variables and conclude that debt payment period. Inventory turnover and CCC are negatively associated with profitability. So, the manager should behave accordingly to enhance firms' value.

3. Methodology

3.1.Sample

This study uses data of non-financial firms listed on the Pakistan Stock Exchange. A firm must meet the following acceptance criteria in order to be a part of the study i.e. (Tables 1 & 2).

- The firm does not discontinue its business in any way during the study period.
- The firm should never delist during the study period.
- The firm has complete data of study period.

The data of sample firms were collected from their respective income statement and balance sheet. Finally, as per selection criteria 41 KSE listed firms were selected which comprises 11 firms from the Automobile sector, 7 firms from the pharmaceutical sector, 15 firms from the chemical sector, and 8 firms from the food sector. We take financial statements of sample firms from their respective websites and data regarding the market price of shares collected from daily quotations of KSE.

Table 3 describe descriptive statistics of 41 sample firms of the Automobile, Chemical, food, and Pharmaceutical sector of Pakistan for the period from 2010 to 2015. In part A of the table, we present Industry-wise descriptive statistics. Results show that the cash conversion cycle of the chemical sector is about 14 days while the mean value of the cash conversion cycle of the automobile, food, and pharmaceutical sectors is 37 days, 35 days, and 61 days respectively. The net trade cycle of the chemical sector is 21 days which is the lowest as compared to other sectors. The net trade cycle of the automobile, food, and pharmaceutical sectors are 57 days, 30 days, and 76 days respectively. In the automobile sector, there is a difference between the net trade cycle and cash conversion cycle. Results show that the net trade cycle of the automobile sector is about 20 days more as compared to the Cash conversion cycle. Other sectors have almost the same net trade cycle and cash conversion cycle. Hence based on descriptive results we conclude that the chemical sector manages its working capital more efficiently as compared to other sectors of study. The average return on assets of sample firms is 12.48 % and the mean value of return on equity is 27.22%. The average net trade cycle of studied firms is 42 days and the average cash conversion cycle is 32 days.

3.2. Variables of Study

3.2.1. Dependent Variables

To quantify the role of working capital management on corporate profitability, we used Return on Equity (ROE), and Return on Asset (ROA) as dependent variables. Following Shin and Soenen, 1998; Afza and Nazir, 2008; Nazir and Afza, 2009; Reheman et al., 2010 in their seminal work used ROE as a measure of corporate profitability. It depicts how efficiently shareholders' investment is used to generate profit. On the other hand, there are several researchers like Jose et al., (1996); Wang, (2002); Garcia-Teruel & Martinez-Solano (2007) used return on asset (ROA) as a proxy to measure a firm's profitability.

3.2.2. Independent Variable

Net Trade Cycle (NTC) and Cash Conversion Cycle (CCC) were used as a variable to judge the working capital management efficiency of the sample firms. CCC is a widely used proxy to measure working capital management (Deloof, 2003; Gill et al., 2010). It measures the time span between cash outflow in order to acquire the resources and then eventually cash inflow by way of sales. Following Shin and Soenen NTC is an efficient proxy to measure the working capital management. So, we used both widely used working capital management proxies to testify the impact of both on profitability.

Following previous literature Firm size, liquidity, firm's financial leverage, and growth opportunities were used as control variables in the present study (Table 4).

Table 1. Variables and their measurements

Variables of Study		
Variables	**Symbol**	**Desciption**
Dependent Variales		
Return on Asset	ROA	Ratio of Net Income to Total Assets
Return on Equity	ROE	Ratio of Net Income to Shareholder's Equity
Independent Variables		
Cash Conversion Cycl	CCC	Days A/R +Days Inventory-Days A/P
		A/R /Sales *365+ Inventory/CGS*365 - A/P/CGS*365
Net Trade Cycle	NTC	(Accounts Receivables / Sales)* 365 + (Inventories / Sales) *365 -
		(Accounts Payalbe /Sales)* 365
Control Variables		
Firm Size	FS	Natural Logrithm of Total Assets
Financial Leverage	LEV	Debt/ Total Assets
Liquidity	LIQ	Current Assets / Current Liabilities
Growth Opportunities	GRO	Current Sale - Previous Sale/ Previous Sale

Table 2. Descriptive Statistics

Industry wise Descriptive Statistics						
Industries	**Firms**	**-**	**NTC**	**CCC**	**ROA**	**ROE**
Automobile	11	Mean	57.6365	37.031	0.1216	0.213
		Std.dev	60.702	62.8732	0.101	0.1302
Chemical	15	Mean	21.5551	14.019	0.1135	0.20428
		Std.dev	57.3644	75.3261	0.1377	0.288
Food	8	Mean	30.81	35.3261	0.1627	0.5589
		Std.dev	77.479	81.2728	0.111	0.5753
Pharma	7	Mean	76.119	61.937	0.11	0.1833
		Std.dev	25.03	40.451	0.747	0.098
Panel C: Statistics on Variables						
			N	Mean		Std.dev
Firm Characteristics						
Firm Size			246	9.7966		0.6318
Financial Leverage			246	0.27		0.362
Growth Opportunities			246	0.7637		0.9322
Liquidity			246	2.0033		1.6922
Firm performance Variables						
Return on Assets			246	0.1248		0.1151
Return on Equity			246	0.2722		0.3461
Main Explanatory Variables						
Net Trade Cycle			246	42.7654		61.8967
Cash Conversion Cycle			246	32.5891		70.2299

Table 3. Correlation Matrix

-	ROE	ROA	CCC	NTC	FS	LIQ	LEV	GRO
ROE	1							
ROA	.669** (.000)	1						
CCC	-.385** (.000)	-.220** (.001)	1					
NTC	-.425** (.000)	-.195** (.002)	.789** (.000)	1				
FS	.094 (.142)	.019 (.0763)	-.483** (.000)	-.427** (.000)	1			
LIQ	-.131* (.039)	.197** (.002)	.291** (.000)	.332** (.000)	-.232** (.000)	1		
LEV	-.195** (.002)	-.310** (.000)	.017 (.794)	.073** (.256)	.175** (.006)	-.397**	1	
GRO	.244** (.000)	.195** (.002)	-.032 (.620)	.008 (.890)	.081 (.205)	-.050	-.038 (.594)	1

** Correlation is significant at the 0.01 level (2-tailed); *correlation is significant at the 0.05 level (2-tailed)

3.3. Correlation Analysis

Table 5 presents the correlation results among studied variables. Correlation measures that how variables are associated with each other. Results show cash conversion cycles are highly negatively correlated with return on equity and return on assets. Net Trade Cycle too negatively correlated with return on equity and return on equity. Firm size and Growth opportunities are positively associated with return on equity and return on assets. Liquidity and a Firm's financial leverage are negatively associated with return on assets and return on equity.

3.4.Models

OLS is a widely accepted technique used by the majority of researchers to empirically test the impact of working capital management policies on firms' profitability and shareholders' wealth maximization. (See for example; Deloof, 2003; Afza and Nazir (2009); and Lazaridis and Tryfonidis (2006). To analyze the impact of firm working capital policies on its profitability, we used the following model by

$$ROAit = \beta0+\beta1CCCit+\beta2FSQit+\beta3LEVit+\beta4LIQit+\beta5GROit+ei \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$ROAit = \beta0+\beta1NTCit+\beta2FSQit+\beta3LEVit+\beta4LIQit+\beta5GROit+ei \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$ROEit = \beta0+\beta1CCCit+\beta2FSQit+\beta3LEVit+\beta4LIQit+\beta5GROit+ei \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

$$ROEit = \beta0+\beta1NTCit+\beta2FSQit+\beta3LEVit+\beta4LIQit+\beta5GROit+ei \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where ROA represents Return on Asset, ROE represents Return on Equity, CCC represents Cash Conversion Cycle, NTC represents Net Trade Cycle, FS represents Firm Size, LEV represents firm's financial leverage, LIQ represents Liquidity, and GRO represents Growth Opportunities.

Table 4. Regression results on Return on assets as dependent variable and Net Trade Cycle as an independent variable along with control variables

Return on Asset	Panel Data Analysis				
	Full Sample	Automobile	Chemical	Food	Pharma
Net Trade Cycle	-0.001	0.000	0.000	-0.001	-0.001
p-value	0.000	0.079	0.457	0.003	0.17
Firm Size	-0.006	0.018	0.003	-0.028	0.079
p-value	0.616	0.575	0.902	0.211	0.013
Financial Leverage	-0.076	-0.044	-0.038	-0.128	-0.094
p-value	0.000	0.693	0.204	0.017	0.032
Growth Opportunities	0.024	-0.033	0.066	0.01	0.007
p-value	0.001	0.18	0.000	0.306	0.443
Liquidity	0.014	0.01	0.051	0.017	-0.009
p-value	0.003	0.131	0.000	0.494	0.477
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
R-square	0.208	0.138	0.372	0.61	0.346
N	246	66	90	48	42

Table 5. Regression results on Return on assets as independent variables while Cash conversion cycle used as an independent variable along with control variable

Return on Asset	Panel Data Analysis				
	Full Sample	Automobile	Chemical	Food	Pharma
Cash Conversion Cycle	0.000	-0.001	0.000	0.000	0.000
p-value	0.000	0.063	0.081	0.175	0.693
Firm Size	-0.010	0.008	-0.005	-0.012	0.099
p-value	0.403	0.817	0.797	0.597	0.02
Financial Leverages	-0.067	0.02	-0.034	-0.201	-0.118
p-value	0.001	0.871	0.239	0.000	0.019
Growth Opportunities	0.024	-0.031	0.06	0.011	0.009
p-value	0.001	0.216	0.001	0.291	0.387
Liquidity	0.013	0.014	0.051	-0.013	-0.014
p-value	0.003	0.071	0.000	0.593	0.367
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
R-square	0.205	0.147	0.391	0.538	0.313
N	246	66	90	48	42

Table 6. Regression results on return on equity as a dependent variable while NTC taken as independent variable along with control variable

Return on Equity	Panel Data Analysis				
	Full Sample	Automobile	Chemical	Food	Pharma
Net Trade Cycle	-0.003	-0.001	-0.001	-0.004	-0.001
p-value	0.000	0.005	0.094	0	0.033
Firm Size	-0.053	0.023	0.018	-0.205	0.033
p-value	0.111	0.581	0.706	0.069	0.43
Financial Leverage	-0.225	0.057	-0.161	-0.313	-106
p-value	0.000	0.685	0.018	0.228	0.075
Growth Opportunities	0.087	0.013	0.161	0.041	0.014
p-value	0.000	0.681	0	0.375	0.301
Liquidity	-0.017	-0.001	0.030	-0.181	-0.019
p-value	0.176	0.943	0.206	0.142	0.304
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
R-square	0.298	0.187	0.296	0.644	0.283
N	246	66	90	48	42

4. Results and Discussion

This section describes the regression results to conclude the findings. We analyze the impact of working capital policies in two perspectives (I) impact on firm performance and II impacts on shareholder's return. with two measures of profitability Return on Asset and Return on Equity. Working capital management to measure with two proxies i.e., Net trade cycle and Cash conversion cycle. Firm size, financial leverage, liquidity, and growth opportunities were used as control variables to conclude the findings.

4.1. Working Capital Policies and Firm's Performance

Table 5 and 6 presents the regression results, in

which net trade cycle and cash conversion cycle are used respectively as working capital management proxies to analyze the possible impact of the same on a firm's performance. Firstly, we conclude the findings by taking variable data as a whole and after that industry-wise analysis is conducted. Results show that the net trade cycle has a negative impact on a firm's profitability but this impact is insignificant. We can predict that by squeezing the net trade cycle firm can increase their profitability. While in industry-wise analysis all the sectors have not on one page. In Food and Pharma sector, the net trade cycle is insignificantly negatively associated with a firm's performance and the automobile and chemical sector net trade cycle found irrelevant regarding the firm's performance point of view. A firm's size and financial leverage are too negatively associated with corporate profitability. As the firms grow and insert more debt into their capital structure, firm performance will move downward. These findings quite match with the second equation in which the cash conversion cycle is used as a working capital management proxy. As per findings, the cash conversion cycle was found to be irrelevant regarding the firm's performance. Whatever policy regarding managing the cash conversion cycle adopted by the organization, has not any impact on the firm's profitability. In industry-wise analysis, cash conversion cycle too found irrelevant except automobile sector in which CCC found insignificant negative relationship with firm's performance. These findings quite mismatch with earlier conclusions made by different researchers. (Ben Ukaegbu, 2014; Kieschnice et al. 2013) concluded in his study that the cash conversion cycle put a negative impact on profitability. They argued that to increase investment in working capital, firms need additional financing that ultimately has a certain cost and increases the probability of bankruptcy as well. Hence lowering the profitability of the organizations. Control variables too, interact differently on a firm's profitability as per findings. A firm's size, financial leverage is found to be negatively associated while liquidity and growth opportunities were found to be positively associated with the firm's earnings.

4.2. Working capital policies and shareholders wealth maximization

Tables 6 and 7 presents the regression results, in which working capital management proxies are used to analyze the possible impact of the same on shareholders' wealth maximization. Findings are concluded in different steps as at first take data of entire variable as a whole to see the impact and then industry-wise results compiled to further narrow down our conclusions. It has been found that working capital policies act differently on shareholders' wealth maximization as compared to its impact on a firm's performance. Results show that the net trade cycle has a negative impact on a firm's profitability but this impact is very minimal. A financial manager can improve shareholders' earnings after designing a carefully working capital management policy. Cash conversion cycle to have the same direction as net trade cycle has regarding the impact on return on equity. In industry-wise analysis too result is not much surprising as sector-wise too both working capital management proxies are negatively associated with shareholders' wealth maximization. Literature too proves that the cash conversion cycle is negatively associated with profitability (Deloof (2003), Wang (2002), Lazaridis and Try fonidis (2006), Gil et al (2010) in their studies prove a negative relationship of cash conversion cycle towards profitability. Firm size, financial leverage, and liquidity are negatively associated with return on equity. Surprisingly,

liquidity is negatively associated with return on equity but the same was not the case regarding a firm's performance as liquidity positively linked with the firm's return on assets. Growth opportunities as earlier findings negatively associated with shareholders' wealth maximization.

Table 7. Regression results on Return on equity as a dependent variable and CCC is the main independent variable along with control variables

Return on Equity	Panel Data Analysis				
	Full Sample	Automobile	Chemical	Food	Pharma
Cash Conversion Cycle	-0.002	-0.001	-0.001	-0.003	0.001
p-value	0.000	0	0.002	0.015	0.249
Firm Size	-0.057	-0.009	0.001	-0.108	0.099
p-value	0.114	0.825	0.985	0.367	0.095
Financial Leverages	-0.197	0.257	-0.137	-0.675	-0.177
p-value	0.001	0.088	0.029	0.011	0.012
Growth Opportunities	0.084	0.015	0.133	0.066	0.017
p-value	0.000	0.615	0.001	0.226	0.231
Liquidity	-0.023	0.011	0.033	-0.33	-0.035
p-value	0.084	0.235	0.148	0.011	0.115
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
R-square	0.251	0.279	0.351	0.562	0.215
N	246	66	90	48	42

5. Conclusion

The present study aims to study the role of working capital policies in the perspective of a firm's performance and shareholder's return by keeping studying different industrial sectors namely the automobile sector, chemical sector, food sector, and pharmaceutical sector of Pakistan. Sample data of 41 firms from four different industrial sectors have been collected for the period of six years ranging from 2010 to 2015. Working capital policies are measured through two proxies i.e., Net Trade Cycle and Cash Conversion Cycle. The impact of working capital policies can be analyzed in two perspectives i.e., regarding firm performance and shareholder's wealth maximization. Firm size, liquidity, financial leverage, and growth opportunities are taken as control variables. It has been found that working capital policies impact differently on a firm's performance and shareholder's wealth maximization. Results suggested that working capital policies have no impact on a firm's performance as a whole and in industry-wise analysis too. This means firm's performance is irrelevant with the policies of working capital adopted by the management. On the other hand, working capital policies are negatively associated with return on equity. There is an inverse relationship between working capital and shareholder's return. Lower the trade cycle and cash conversion cycle higher will be the return to the shareholders. Firm size, financial leverage, and liquidity too have an inverse relationship with return on equity. Overall results are not matched with earlier findings of different researchers. This may be because of the inconsistent and volatile economic

conditions of the country. There may be a need to further explore the reasons in future research.

References

Afza, T., & Nazir, M. S. (2007). Working Capital Management Practices of Firms: Empirical Evidence from Pakistan. 9th South Asian Management Forum (SAMF) held on February 24-25. *North-South University, Dhaka*, Bangladesh, 334-343.

Brigham, E.F. and Ehrhardt, M.C. (2004). Financial Management: Theory and Practice. 11th Edition, *South-Western College Publishing, New York*.

Charitou, M. S., & Lois, P. (2010). The effect of working capital management. *Journal of Business and Economics research*, 8(12), 63-68.

Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Journal of Business Finance and Accounting,* 30, (3/4), 573–587.

Filbeck, G., Krueger, T. (2005). Industry related differences in working capital management. *Mid-American Journal of Business*, 20 (2), 11–18.

Fazzari, S.M., Hubbard, R. G., & Petersen, B. C. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, 1,141–195.

Fazzari, S.M., Petersen, B.C. (1993). Working capital and fixed investment: new evidence on financing constraints. *RAND J. Econ.*, 24, 328–342.

Ghosh, S. K. and Maji, S. G. (2004). Working Capital Management Efficiency: A Study on the Indian Cement Industry. *Management Accountant*, Vol. 39, No. 5, pp. 363-372.

Gill, A., Bigger, N., Mathur, N. (2010). The relationship between working capital management and profitability: evidence from the United States. *Business and Economics Journal,* 2, 1–9.

Gill, A., Bigger, N., Mathur, N. (2010). The relationship between working capital management and profitability: evidence from the United States. *Business and Economics Journal*, 2, 1–9.

Gitman, L. A. (2005). Principles of Managerial Finance. 11th Edition, *Addison Wesley Publishers, New York*.

Haq, I., Sohail, M., Zaman, K., Alam, Z. (2011). The relationship between working capital management and profitability: a case study of cement industry in Pakistan. *Mediterranean Journal of Social Sciences,* 2 (2), 365–372.

Jose, M.L., Lancaster, C. and Stevens, J. L. (1996). Corporate Returns and Cash Conversion Cycle, *Journal of Economics and Finance*, Vol. 20, No. 1, pp. 33-46.

García-Teruel, P.J., Martínez-Solano, P. (2007). Effects of working capital management on SME profitability. *Int. J. Manag. Finance*. 3 (2), 164–177.

Knauer, T., & Wöhrmann, A. (2013). Working capital management and firm profitability. *Journal of Management Control*, 24(1), 77-87.

Kieschnick, R., Laplante, M., Moussawi, R., (2013). Working capital management and shareholders' wealth. *Rev. Finance*, 17, 1827–1852.

Lazaridis, I., Tryfonidis, D. (2006). Relationship between working capital management and profitability of listed companies on the Athens Stock Exchange. *J. Financial Management Anal.,* 19 (1), 26–35.

Miller, M. H., & Modigliani, F. (1961). Dividend Policy, Growth, and The Valuation of Shares. The Journal of Business, XXXIV (4), 411-433.

Mohammad, A. (2011). Working capital management and corporate profitability: Evidence from Iran. *World Applied Sciences Journal,* 12 (7), 1093–1099.

Moyer, R. C., McGuigan, J. R. and Kretlow, W. J. (2005). Contemporary Financial Management. 10th Edition, *South-Western College Publishing, New York.*

Pinches, G. E. (1992). Essentials of Financial Management. 4th Edition, *HarperCollins College Publishers, New York.*

Mona, A. (2012). The impact of working capital management policies on firm's profitability and value: the case of Jordan. *International Research Journal of Finance and Economics,* (85), 147–153.

Mosa, A., Iraj, S.A., Maryam, G. (2012). Studying the relationship between working capital management and profitability at Tehranstock exchange: a case study of food industry. *Research Journal of Applied Sciences, Engineering and Technology,* 4 (13), 1868–1874.

Raheman, A., Nasr, M. (2007). Working capital management and profitability – case of Pakistani firms. *International Review of Business Research Papers,* 3 (1), 279–300.

Raheman, A., Nasr, M. (2007). Working capital management and profitability – case of Pakistani firms. *Int. Rev. Bus. Res. Pap.,* 3 (1), 279–300.

Shin, H. H., Soenen, L. (1998). Efficiency of working capital management and corporate profitability. *Financial Practice and Education,* 8, 37–45.

Van-Horne, J. C., Wachowicz, J. M. (2004). Fundamental of Financial Management. 12th Ed. *Prentice Hall, New York.*

Wang, Y. J. (2002). Liquidity management, operating performance, and corporate value: evidence from Japan and Taiwan. *J. Multinatl. Finance. Manag.,* 12 (2),159–169.

Comparative Evaluation of Different Cooking Techniques for Biochemical, Physico-chemical and Sensorial Quality of Various Brands of Chicken Meat

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Abstract. The study aims to evaluate the effect of traditional cooking methods (simple boiling, pan-frying, grilling and steam roasting) on physicochemical and sensory attributes of the Desi, Aseel and commercial Broiler chicken meat. The results declared no variation in the pH, drip loss and expressible moisture contents of the raw meats. However, cooking resulted in significantly highest ash and protein, while significantly lowest moisture in the meat samples. Moreover, pan-frying produced remarkably highest TBA and TMAN values, while grilling resulted in the highest TVBN values. To conclude, simple boiling and steam roasting were the most effective treatments concerning meat spoilage and cooking yields. On the contrary, pan-fried and grilled broiler meat revealed the highest sensory acceptance. In addition, Broiler meat exhibited the highest fat contents while Aseel and Desi chicken meats expressed the highest protein contents. The findings of the study imply the right selection of cooking method and chicken breed to obtain better quality of meat products.

Keywords: Chicken meat; Broiler; Desi; Aseel, Cooking methods, Meat spoilage.

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1. Introduction

Globally, underdeveloped and developing regions are facing meager to severe protein-energy malnutrition challenges due to poor access to sufficient and wholesome protein-rich diets. The dietary intake of protein from all sources i.e., 17g per capita per day among the impoverished population groups is below the standard requirement for proteins i.e., 27g / per capita per day (PPA 2020). The poultry sector is considered as a potential source for bridging the gaps for protein-energy deficiency due to its lesser fat, high nutritional value, better growth rates, low pricing with profit-maximizing potential, better feed conversion ratios and consumer preference. Earlier data also reveals that of the total meat consumption in Pakistan approx. 40 – 45% belongs to chicken meat (Mukhtar et al, 2012; Sohaib & Jamil 2017) with Pakistan being ranked 11th in the globe regarding poultry meat production with an annual broiler meat production is 1.02 billion and annual growth rate is 8 – 10%. As broiler is attributed to carry antibiotics, observes higher mortality rates and greater sensitivity, consumers preference of consuming broiler meat is comparatively declining. A significant shift has been noticed from broiler to indigenous chicken i.e., Desi and Aseel (Aslam et al, 2020) as their meat contains less fat and higher

omega 3 fats and is considered free of antibiotics and additives (Sirri et al, 2011).

Meat is considered a naturally enriched source of nutrients such as minerals (Fe, Mg, & K), vitamins (B1, B2 & B6), and digestible proteins. However, the processing of meat via cooking techniques holds an influential impact on the quality attributes of meat (Lee et al, 2005). Nutritional and physicochemical quality of meat is dependent on multiple factors such as processing methods, cooking techniques, genetics, feed intake and farming practices (Lofgren 2005). Dietary intake of chicken meat helps to ameliorate various health maladies including cancer, cardiovascular health disorders. Chicken meat is reported to contain meager magnitudes of collagen proteins, unsaturated lipids and higher levels of health benefiting essential fats i.e., linoleic acid and alpha-linolenic acid, vitamins (thiamin, pantothenic acid and vitamin B6) and inorganic elements (zinc, iron and magnesium) (Godfray et al, 2018).

The processing of meat is attributed to elevating the nutritional significance of meat and meat-based products. Cooking is recognized as an effective technique to ensure nutritional quality, microbiological safety, palatability and digestibility of meat (Roccato et al, 2015). Earlier literature reveals the utilization of numerous cooking methods such as boiling, grilling, microwaving, frying and steaming to improve the nutritional quality of meat (Kim et al, 2013). Thermal processing of meat and meat products improves the nutritional, textural and digestive properties via protein denaturation (Mancinelli et al, 2021); (Pathera et al, 2017). Cooking / thermal processing of meat consequently generates oxidation products e.g., volatile organic compounds, ketones, free acids and aldehydes. Earlier studies have reported the use of various cooking methods including microwave cooking, frying, roasting, superheated steaming, deep frying and grilling to improve the nutritional and physicochemical attributes of meat and ready to serve meat products (Asmaa & Tajul 2017; Pathera et al, 2017; Chansataporn et al, 2019). Keeping in view of the consumer preferences present study was investigated for comparative assessment of efficacy of different cooking methods (i.e., boiling, grilling, pan frying and steam roasting) on the meat quality of Broiler, Desi and Aseel chicken.

2. Material and Methods

2.1. Experimental birds

A total of 180 male chickens i.e., commercial broilers (Cobb), Desi and Aseel (indigenous chicken) were procured from the local poultry market of Faisalabad (60 birds per breed). The birds were acclimatized for 3-days with enough water and feed. Subsequently, the birds were feed deprived for 8-hours and were sacrificed following the Halal standards as mentioned in Pakistan Halal Standards (PS3733:2013). The carcass, head and shanks were eviscerated and the meat was separated for further processing. Afterward, the meat of experimental birds was processed via four different cooking methods including boiling, pan-frying, grilling and steam roasting. The physicochemical and organoleptic quality of cooked chicken breast meat was examined in the Laboratory of Meat Science and Technology, National Institute of Food Science and Technology, University of Agriculture of Faisalabad.

2.2. Treatment plan

Meat samples of Cobb, Desi and Aseel chicken were processed using the following protocols as mentioned in Table 1.

Table 1. Cooking treatments with respect to Broiler, Desi and Aseel chickens

Treatments	Breeds	Cooking Temperature (°C)	Cooking Time (min)
Simple boiling (T0)	Broiler	100	10
	Desi	100	40
	Aseel	100	40
Pan frying (T1)	Broiler	60	15
	Desi	60	30
	Aseel	60	30
Grilling (T2)	Broiler	62	15
	Desi	62	30
	Aseel	62	30
Steam roasting (T3)	Broiler	100	15
	Desi	100	45
	Aseel	100	45

(n=3)

2.3.Raw Meat Analysis

2.3.1.Physicochemical Analysis of Meat

Raw and processed meat samples of chicken meats were subjected to the determination of the pH, drip loss and water holding capacity. The pH of meat samples was estimated by following the method documented by Pingen et al, (2016) using the pH meter (InoLab, pH 7110, Germany) after calibration. Drip loss (DL) of meat samples of Broiler, Desi and Aseel chickens was examined according to the protocols documented by Pingen et al, (2016). Wherein, the meat samples were hung in the refrigerator for a day and drip loss was calculated using the following formula given below:

Drip loss (%) = (Initial wt. of sample - Wt. of sample after 24 h)/Initial weight of sample ×100

Likewise, water holding capacity (WHC) was calculated using the method of Karunanayaka et al, (2016) wherein, about 2 g of each meat sample was compressed with 196 N force for 15 minutes. WHC was calculated using the following formula:

WHC (%) = (Initial weight - Weight after compression)/Initial weight ×100

2.3.2. Nutritional Composition

Proximate analysis i.e., ash, crude protein, crude fat and moisture contents of raw and processed chicken meat of Broiler, Desi and Aseel chicken breeds were analyzed under the protocols as documented by AOAC (2006).

2.3.3.Physicochemical Analysis

Total Volatile Basic Nitrogen (TVBN) Determination: The total volatile basic nitrogen (TVBN) of cooked chicken meat was determined using the method of Goulas & Kontominas (2005). 10 g of each sample was mixed into 100 mL of clean distilled water and filtered. Afterward, 5 mL (1 %) magnesium oxide (MgO) was added in 5 mL of the filtrate and distillation was performed against 20 mL (2 %) boric acid aqueous solution containing 0.1 g methyl red solution. Subsequently, titration was performed against 0.1 N hydrochloric acid (HCl) till the completion of titration showing a pink-colored endpoint. The total volatile basic nitrogen (TVBN) in mg / 100 g of cooked chicken meat was estimated using the formula:

$$\%\, mg\ TVBN = (V \times C \times 14 \times 100)/10$$

2.3.4. Thiobarbituric Acid (TBA) determination

Thiobarbituric acid (TBA) content of meat samples were estimated according to Buege & Aust (1978). Accurately measured 5 g of each meat sample was amalgamated in 20 mL of thiobarbituric acid (TBA) solution (i.e., 15% trichloroacetic acid, 0.375% thiobarbituric acid and 0.25 mol / 1 HCl). The mixture was heated for 10 min in boiling water in a water bath, cooled and centrifuged for 20 min at 3600 rpm at room temperature. Subsequently, sample

absorbances were recorded at 532 nm. Thiobarbituric acid (TBA) was calculated as mg/kg sample by using the formula mentioned below: mg TBA = Absorbance × 5.58

2.3.5. Trimethylamine Nitrogen (TMAN) estimation

Trimethylamine's nitrogen (TMAN) of cooked chicken meat was determined as reported by Malle & Tao (1987). About 10 g of each meat sample was poured in 10 mL of distilled water. Thereafter, the mixture of 3 mL of distilled water, 2 g MgO, 10 mL (20 %) formaldehyde (HCHO) and 1 drop of silicone (i.e., anti-foaming agent) was poured in the distilled water already containing the sample. Distillation was performed and subsequently titrated against 0.05 N HCl. The trimethylamine (TMAN) contents in mg/100g of each chicken meat sample were estimated using the following formula:

% mg TMAN = V × C × 14

2.3.6. Reducing sugars analysis

Reducing sugars of processed chicken meat were investigated adopting the method of Jayasena et al, (2015). About 1 g of each meat sample was extracted for sugars using 5 mL (80%) ethanol (50°C). The extracts were centrifuged at 5000 rpm for 20 min at 4°C and the supernatant was filtered in 10 mL test tubes. Accurately measured 2 mL extracted sample was mixed with 3 mL dinitrosalicylic solution (i.e., 0.5 g dinitrosalicylic acid, 150 g Rochelle salt and 8.0 g NaOH in 500 mL distilled water) in the test tube. Each sample was later heated at 90°C for 10 min in the water bath and cooled for 5 min. The absorbance of the samples was recorded at 550 nm using a spectrophotometer (Model #) using the following formula;

Reducing sugar (%) = 6.25 × A/B

A = Absorbance

B = Volume of filtrate

2.3.7. Cooking loss

Cooking loss of Broiler, Desi and Aseel chicken meat samples were determined as per the method of Khan et al, (2014). Each cooked chicken meat sample was measured for its weight prior and post-processing. The cooking losses of the samples were calculated as given below:

Cooking loss (%) = (Initial weight - Final weight)/Initial weight ×100

2.3.8. Instrumental colour

The instrumental color analysis of the Broiler, Desi and Aseel chicken breeds was conducted using Color Analyzer - Chromameter (X-Rite Model SP60; Grand Rapids, MI) as a measure of lightness (L*), redness (a*) and yellowness (b*), as per the method of Ye et al, (2015).

2.3.9. Sensory evaluation

Sensory properties of processed versions of chicken meat were analyzed using the 9 - point hedonic scale (ranging from 1 - very dislike to 9 - like very much) for appearance, flavor, tenderness, juiciness and overall acceptability by selected sensory experts at NIFSAT per the methods as laid followed by Yang et al, (2016).

2.3.10. Statistical Analysis

Data on the processing of Cobb broiler, Desi, and Aseel chicken meat and physicochemical properties were recorded in triplicates and presented in mean ± S.D. The data was statistically analyzed using the Statistix (Version 8.1, USA) software. The level of significance was computed using the least significant differences (LSD) test.

3. Results and discussion

3.1.pH

The results for the pH of the Desi, Aseel and Broiler chicken raw meat have been presented in Fig. 1. The data portrayed non-significant ($p<0.05$) outcomes for the mean values of the pH of the raw meats of the Desi, Aseel and Broiler chicken. The highest pH value for the raw meat was observed in Aseel i.e., 6.3 while the least pH value was observed in broiler i.e., 6.14. The low pH of the raw meat of the Aseel might be attributed to the greater extent of bonding among proteins of Aseel when compared with the proteins of the broiler raw meat. Earlier studies by Haruna et al, (2016) and England et al, (2016) have shown slightly lower mean values for the pH i.e., 5.4 – 5.8 when compared with the present study. The slightly lower mean values of the pH could be attributed to greater extents of the rigor mortis, composition of the meat muscles and the ability of the meat to release water during respiration.

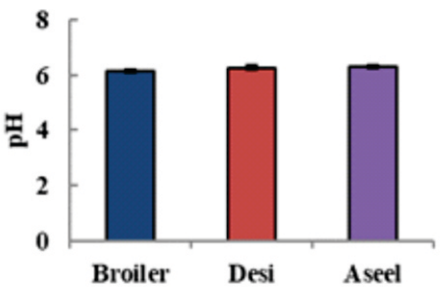

Fig. 1. pH of raw meat obtained from Broiler, Desi and Aseel chicken (n=3)

3.2.Expressible Moisture

The data obtained from the present study elucidated the non-significant ($p<0.05$) effect of cooking methods on the expressible moisture of the Desi, Aseel and Broiler meat (Fig. 2). The highest expressible moisture was noticed for Broiler meat i.e., 31.57% while the lowest was observed for Aseel i.e., 31.28. Expressible moisture is considered as a pivotal quality parameter that is reliant on the ability of the myosin and actin – the myofibrillar proteins to hold maximum magnitudes of water. However, elevated levels of expressible moisture are associated with the unfolding of the structures of proteins which leads to denaturation of the sarcoplasmic proteins (Dai et al, 2013). Protein denaturation, rigor mortis and pH variations are linked with elevated levels of the expressible moisture in meat (Van Laack 1999). Our results for expressible moisture are in close corroboration with the previous studies wherein Zakaria et al, (2017) and Saenmahayak et al, (2010) reported similar extents of expressible moisture in raw meat i.e., 34 – 35% on addition of 40 – 80 ppm organic complexed-Zn in meat.

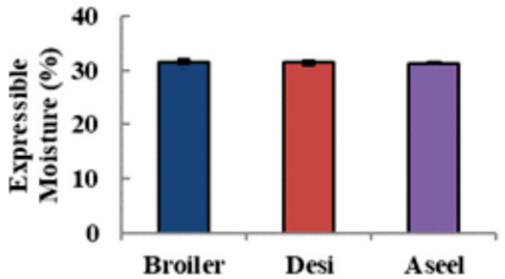

Fig. 2. Expressible moisture (%) of raw meat obtained from Broiler, Desi and Aseel chicken (n=3)

3.3.Drip Loss

Findings on the drip loss of raw meat of Desi, Aseel and Broiler chicken have been documented in Fig. 3. The reported findings portrayed non-significant ($p<0.05$) outcomes for the mean values of drip loss for Desi, Aseel and Broiler chicken. The highest drip losses were seen in Desi chicken meat i.e., 2.34% while the minimum drip losses were observed in Aseel chicken meat i.e., 2.26%. The lower drip losses in raw meat of raw meats noticed in the present study could be associated with the higher water holding capacity (WHC) of raw meat of Desi and Aseel when compared to the raw meat composition of broiler. Slightly higher drip losses i.e., 10 – 11% were observed in earlier studies conducted by del Puerto et

al, (2016). The greater contrary in mean values in the drip losses of meat could be attributed to the lower water holding capacity of the broiler meat.

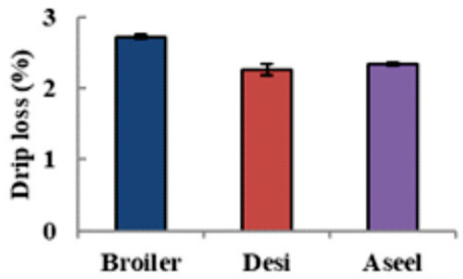

Fig. 3. Drip loss (%) of raw meat obtained from Broiler, Desi and Aseel chicken (n=3)

3.4.Effect of Cooking on Proximate Composition of Meat

The current study examined the proximate contents of three different varieties of chickens (Table 2). Raw Broiler meat revealed the significantly highest ($p<0.05$) fat content (1.8%), contrary to the Desi (1.33%) and Aseel (1.27) meat samples. Furthermore, cooked Aseel chicken showed the highest ($p<0.05$) protein (26.3%) followed by Desi (25.9%) and Broiler chicken meat samples (22%). Similarly, the highest ($p<0.05$) fat content was revealed by cooked Broiler chicken (1.56%). Among cooking methods, grilled meat had the highest ($p<0.05$) protein (27.2%) and ash (1.8%), pan-fried chicken samples demonstrated the highest ($p<0.05$) fat (2.4%), while simple boiling and steam roasting revealed the highest ($p<0.05$) moisture contents (65 and 64.9%, respectively). The current results were consistent with the findings of (Tengilimoglu-Metin et al, 2017; Tengilimoglu-Metin & Kizil 2017) who experienced similar effects of cooking on meat samples. Cooking led to the escape of water from the extracellular matrix coupled with structural alteration, ultimately reducing the moisture while increasing the average protein and ash of the samples (Pathare & Roskilly 2016).

3.4.Total Volatile Basic Nitrogen (TVBN)

The results regarding the Total Volatile Basic Nitrogen (TVBN) of cooked chicken meat samples revealed significant ($p<0.05$) effects with respect to cooking treatments and chicken breeds (Table III). The grilling of chicken samples revealed the highest ($p<0.05$) TVBN values (3.1 mg%), followed by steam roasting (2.9 mg%), pan-frying (2.6 mg%) and simple boiling (2.1 mg%) of samples. Moreover, Aseel and Desi chicken revealed the highest TVBN values (3.1 and 2.7 mg%) as compared to the broiler chicken (2.2 mg%). In another study, Khulal et al, (2016) evaluated the TVBN of freshly stored (day 1 and 3) chicken meat and reported 5.7 and 11.39 mg/100g TVBN, respectively. The differences in the current and cited results were attributed to different treatments, breeds and experimental conditions. TVBN constitutes volatile compounds including ammonia, di and trimethylamine that are formed on the onset of proteolysis in meats (Kanatt 2020). These compounds are transformed into smaller units such as free amino acids that go through oxidative deamination, decarboxylation, and desulfurization, thus producing gases like H2S, NH3 and CO2 (Lee et al, 2019). During the storage of meat, microbial and enzymatic actions contribute to the increased production of TVBN and ammonia due to proteolysis and amino acid deamination. Therefore, TVBN is generally recognized as an indicator of meat spoilage (Choe et al, 2019). According to Kozačinski et al, (2012), the refrigerated chicken meat spoiled at the ammonia level of 9 mg/g. Likewise, Kahraman et al, (2015) suggested a safe limit of 40 mg N/100 g TVBN of fresh chicken meat.

Table 2. Proximate composition of raw and cooked Broiler, Desi and Aseel chicken meat

		Protein (%)	Fat (%)	Ash (%)	Moisture (%)
Raw meat					
Breeds	Broiler	21.28±0.74	1.80±0.21 ^{a}	0.89±0.04	72.25±0.3
	Desi	21.46±0.63	1.33±0.14 ^{b}	0.96±0.03	71.91±0.12
	Aseel	21.35±0.66	1.27±0.18 ^{b}	0.94±0.05	71.86±0.29
Cooked meat					
Simple boiling	Broiler	23.98±0.16	0.93±0.05 ^{g}	1.53±0.04	65.06±0.14
	Desi	24.78±0.32	0.83±0.05 ^{h}	1.55±0.04	64.99±0.13
	Aseel	25.48±0.65	0.78±0.04 ^{h}	1.57±0.03	65.07±0.35
Pan Frying	Broiler	26.04±0.12	2.57±0.07 ^{a}	1.61±0.05	63.86±0.35
	Desi	26.18±0.21	2.29±0.05 ^{b}	1.66±0.03	63.56±0.38
	Aseel	26.81±0.36	2.19±0.05 ^{c}	1.65±0.03	63.94±0.96
Grilling	Broiler	26.4±0.4	1.83±0.05 ^{d}	1.85±0.03	61.27±0.63
	Desi	27.32±0.37	1.46±0.06 ^{e}	1.82±0.04	61.18±0.58
	Aseel	27.8±0.36	1.33±0.06 ^{f}	1.8±0.05	61.08±0.45
Steam Roasting	Broiler	24.08±0.58	0.92±0.03 ^{g}	1.56±0.04	65.21±0.33
	Desi	25.12±0.61	0.8±0.02 ^{h}	1.62±0.04	64.88±0.39
	Aseel	25.23±0.26	0.77±0.03 ^{h}	1.59±0.04	64.78±0.32
Chicken breeds	Broiler	25.13±1.19 ^{c}	1.56±0.72 ^{a}	1.64±0.14	63.85±1.68
	Desi	25.85±1.09 ^{b}	1.35±0.64 ^{b}	1.66±0.11	63.65±1.64
	Aseel	26.33±1.15 ^{a}	1.27±0.61 ^{c}	1.65±0.1	63.72±1.72
Cooking treatments	Simple boiling	24.75±0.75 ^{c}	0.85±0.07 ^{c}	1.55±0.03 ^{c}	65.04±0.2 ^{a}
	Pan Frying	26.34±0.41 ^{b}	2.35±0.18 ^{a}	1.64±0.04 ^{b}	63.79±0.57 ^{b}
	Grilling	27.17±0.7 ^{a}	1.54±0.23 ^{b}	1.82±0.04 ^{a}	61.18±0.49 ^{c}
	Steam Roasting	24.81±0.7 ^{c}	0.83±0.07 ^{c}	1.59±0.04 ^{c}	64.96±0.36 ^{a}

Mean±SD; means that have different letters as superscript in a column are statistically significant ($p<0.05$, n=3)

3.6. Thiobarbituric Acid (TBA)

Thiobarbituric Acid (TBA) of cooked chicken meat samples differed significantly ($p<0.05$) as per the different cooking treatments and chicken breeds (Table III). The present study confirmed the highest TBA concentration in pan-fried broiler meat (3.3 mg MDA/kg). In another study, Pathera et al, (2016) investigated the TBA content of cooked chicken nuggets during refrigerated storage and reported 0.79 and 2.6 mg MDA/kg lipid oxidation of oven-cooked chicken nuggets at day 0 and 20, respectively. Likewise, Kanatt (2020) reported 0.64 and 0.34 mg MDA/kg TBARS of fresh fish and chicken, which increased to 2.89 and 1.25 mg MDA/kg respectively after 3 days of storage. TBA is an indicator of lipid oxidation in meat. It takes account of malonaldehyde (MDA) and is determined by estimating thiobarbituric acid reactive substances (TBARS), secondary products of lipid oxidation (Choe et al, 2011). An acceptable limit of TBARS in fresh meat is 1 mg MDA/kg (Raeisi et al, 2019). However, stored meat products with <3 mg MDA/kg TBARS can also be considered safe concerning oxidative changes (Al-Kahtani et al, 1996).

3.7. Trimethylamine Nitrogen (TMAN)

The pan-fried Broiler meat samples exhibited significantly ($p<0.05$) highest Total Volatile Basic Nitrogen (TVBN) value (1.2 mg N/100g) (Table 3). Among cooking methods, pan-frying resulted in the highest ($p<0.05$) TMAN values. On the other hand,

no remarkable differences were observed in the TMAN values within Broiler, Desi and Aseel chicken breeds. The current findings were similar to the study of Goulas & Kontominas (2005), who evaluated the quality of salted and smoked chub mackerel and reported 1% TMAN values. TMAN represents the degree of breakdown of proteins and non-protein nitrogen compounds (Zhao et al, 2019). It is formed from the microbial and enzymatic amino acid decarboxylation, thus reflects the extent of meat spoilage (Raeisi et al, 2019). Among the nitrogenous components, urea and trimethylamine oxide (TMAO) are broken down into volatile ammonia-based compounds by microbial action. Kahraman et al, (2015) reported an acceptable level of 10 mg TMAN for fresh poultry meat that can serve to be a fine detector of biogenic amines due to its volatile nature.

3.8. Reducing Sugar

The current study investigated no effect of cooking on the reducing sugar contents of Broiler, Desi and Aseel chicken varieties (Table III). Likewise, Tengilimoglu-Metin & Kizil (2017) explored the glucose and fructose contents of 0.15 mg/g and 0.16 mg/g in raw chicken meat, respectively and found no effect of cooking on reducing sugar levels in meat. However, Gibis & Weiss (2010) and Liao et al, (2009) found that the glucose level significantly decreased during frying. Reducing sugars tend to contribute to the Maillard reaction with free amino acids and creatinine, thus leading to the formation of heterocyclic amines in meat at temperatures above 150°C (Haskaraca et al, 2014). However, these Maillard reactions play an important role in the aroma and flavor of meat (Ali et al, 2019). In other raw meats like beef, the average reducing sugar content has been reported to be 0.42% (Piao et al, 2019).

3.9. Cooking Loss

Cook losses of different varieties i.e., Desi, Aseel and Broiler chicken were evaluated and have been mentioned in Table III. The data presented in this study reported significant ($p<0.05$) findings for mean values of cook losses for Desi, Aseel and Broiler chicken. The highest cooking losses were seen in broiler chicken meat processed with grilling process i.e., 33.4% while the lowest cook losses were showed by Aseel cooked by steam roasting i.e., 26.02%. The lower cook losses in cooked meats in this study could be attributed to variation in the cooking conditions and cooking temperature and time of the cooking. Earlier research by Saenmahayak (2007) and Saenmahayak et al, (2010) have reported slightly lower cook losses in broiler meat on cooking that ranged between 26 – 30%. Hence, this study reveals close corroboration in cook losses for the meat of the Desi, Aseel and Broiler chicken meat as has been earlier depicted by the previous scientists. Cook loss is a chief indicator of processing yield. Therefore, the right selection of cooking methods is important in limiting the losses of nutrients and water (Mena et al, 2020), as well as proteins and lipids (Del Pulgar et al, 2012). Higher temperatures enable denaturation of proteins that induces changes in structure, thereby causing the sarcoplasmic fluid to expel from muscle fibers (Khan et al, 2014).

Table 3. Physicochemical evaluation of cooked Broiler, Desi and Aseel chicken meat

Cooked meat analysis		TVBN (mg %)	TBA (mg MDA/kg)	TMAN (mg N/100g)	Reducing sugar (%)	Cooking loss (%)
Simple boiling	Broiler	1.64±0.04 ^{h}	2.3±0.05 ^{de}	1.05±0.02 ^{bc}	1.31±0.11	30.73±1.01 ^{bc}
	Desi	2.52±0.02 ^{e}	2.11±0.04 ^{fg}	1.05±0.08 ^{bcd}	1.12±0.07	28.13±0.98 ^{ef}
	Aseel	2.13±0.03 ^{g}	2.23±0.13 ^{e}	1.1±0.01 ^{b}	0.95±0.07	29.34±1.01 ^{cde}
Pan Frying	Broiler	1.66±0.03 ^{h}	3.3±0.04 ^{a}	1.19±0.02 ^{a}	1.14±0.13	32.32±1.02 ^{ab}
	Desi	3.21±0.02 ^{c}	2.9±0.07 ^{b}	1.08±0.04 ^{b}	1.11±0.08	32.03±1.01 ^{ab}
	Aseel	2.8±0.02 ^{d}	2.84±0.09 ^{b}	1.05±0.02 ^{bc}	0.93±0.33	29.96±1.01 ^{cd}
Grilling	Broiler	3.23±0.02 ^{c}	3.24±0.05 ^{a}	0.98±0.07 ^{de}	0.99±0.09	33.41±1.01 ^{a}
	Desi	2.23±0.02 ^{f}	2.42±0.07 ^{cd}	0.99±0.06 ^{cde}	1.11±0.02	27.96±1.01 ^{ef}
	Aseel	3.77±0.02 ^{a}	2.47±0.04 ^{c}	1.06±0.03 ^{b}	1.16±0.07	28.66±1.54 ^{def}
Steam Roasting	Broiler	2.24±0.02 ^{f}	2.31±0.03 ^{de}	0.97±0.01 ^{e}	1.12±0.09	28.22±1.02 ^{def}
	Desi	2.8±0.02 ^{d}	2.06±0.08 ^{g}	1.05±0.02 ^{bc}	1.16±0.07	27.21±1 ^{fg}
	Aseel	3.52±0.03 ^{b}	2.2±0.12 ^{ef}	1.1±0.03 ^{b}	1.13±0.02	26.02±1.01 ^{g}
Chicken breed	Broiler	2.19±0.67 ^{c}	2.79±0.5 ^{a}	1.05±0.1	1.14±0.15	31.17±2.99 ^{a}
	Desi	2.69±0.38 ^{b}	2.37±0.35 ^{c}	1.04±0.06	1.12±0.06	28.83±2.14 ^{b}
	Aseel	3.06±0.67 ^{a}	2.44±0.28 ^{b}	1.08±0.03	1.04±0.18	28.5±1.86 ^{b}
Cooking treatments	Simple boiling	2.1±0.38 ^{d}	2.21±0.11 ^{c}	1.07±0.05 ^{b}	1.13±0.17	29.4±2.1 ^{b}
	Pan Frying	2.56±0.7 ^{c}	3.01±0.22 ^{a}	1.11±0.07 ^{a}	1.06±0.21	31.44±2.75 ^{a}
	Grilling	3.08±0.68 ^{a}	2.71±0.4 ^{b}	1.01±0.06 ^{c}	1.08±0.09	30.01±3.61 ^{b}
	Steam Roasting	2.86±0.56 ^{b}	2.19±0.13 ^{c}	1.04±0.06 ^{bc}	1.14±0.06	27.15±2.09 ^{c}

Mean±SD; means that have different letters as superscript in a column are statistically significant (p<0.05, n=3)

Table 4. Instrumental color values of cooked Broiler, Desi and Aseel chicken meat

Cooked meat analysis		*L**	*a**	*b**
Simple boiling	Broiler	62.34±1.05 ^{b}	1.81±0.33 ^{d}	4.42±0.63 ^{e}
	Desi	55.47±1.12 ^{e}	3.49±0.56 ^{bc}	13.72±1.13 ^{b}
	Aseel	52.34±1.32 ^{f}	3.64±0.91 ^{b}	11.58±0.54 ^{c}
Pan Frying	Broiler	60.48±0.64 ^{c}	3.52±0.52 ^{bc}	21.56±0.63 ^{a}
	Desi	39.7±1.18 ^{h}	3.63±0.65 ^{b}	9.44±0.72 ^{d}
	Aseel	46.69±0.93 ^{g}	3.53±0.51 ^{bc}	13.61±0.86 ^{b}
Grilling	Broiler	56.15±0.64 ^{de}	5.46±0.52 ^{a}	21.92±1.05 ^{a}
	Desi	33.44±1.1 ^{j}	3.22±0.69 ^{bc}	3.33±0.61 ^{e}
	Aseel	35.57±1.47 ^{i}	1.8±0.41 ^{d}	4.12±0.96 ^{e}
Steam Roasting	Broiler	66.26±1 ^{a}	2.56±0.6 ^{cd}	14.57±0.96 ^{b}
	Desi	57.83±1.01 ^{de}	4.04±0.09 ^{b}	14.14±0.71 ^{b}
	Aseel	55.74±1.1 ^{e}	3.85±0.7 ^{b}	10.6±1.14 ^{cd}
Chicken breed	Broiler	61.31±3.87 ^{a}	3.34±1.49	15.62±7.45 ^{a}
	Desi	46.61±10.82 ^{c}	3.6±0.56	10.16±4.6 ^{b}
	Aseel	47.59±8.06 ^{b}	3.2±1.02	9.98±3.79 ^{b}
Cooking treatments	Simple boiling	56.72±4.54 ^{b}	2.98±1.04	9.91±4.27 ^{c}
	Pan Frying	48.96±9.19 ^{c}	3.56±0.49	14.87±5.37 ^{a}
	Grilling	41.72±10.9 ^{d}	3.49±1.66	9.79±9.13 ^{c}
	Steam Roasting	59.95±4.9 ^{a}	3.48±0.84	13.1±2.06 ^{b}

Mean±SD; means that have different letters as superscript in a column are statistically significant (p<0.05, n=3)

3.10.Instrumental Colour

The instrumental color of Desi, Aseel and Broiler chicken meat was investigated (Table 4). The findings of the instrumental color (L*, a* and b* values) exhibited a significant (p<0.05) impact of the cooking methods on the Desi, Aseel and Broiler chicken meat

Meat color is a fundamental element for consumer acceptance. It varies according to the chicken breeds as it is dependent on fatty acid profile, pH, myoglobin content and browning induced by cooking (Holman et al, 2018).

The results for the instrumental color varied as; L* values 33 – 66, a* values 1.8 – 4.1 while the b* values varied between 3 – 14 for Desi, Aseel and Broiler against all types of cooking methods. Our results for instrumental color parameters have been in close corroboration with the earlier studies by Zakaria et al, (2017), Aksu et al, (2011) and Álvarez et al, (2019) wherein the L* values ranged between 51 – 52, a* values between 1 – 11 and b* values ranged between 12 – 15. The variation in the color values could be attributed to the drip losses, caramelization and Maillard reactions during the cooking process. However, the addition of oils during the cooking process may also elevate the yellowness of the meat.

3.11.Sensory Evaluation

The effect of different cooking treatments on the sensory parameters of Desi, Aseel and Broiler processed chicken meat was assessed. The findings of the present study elucidated the significant ($p<0.05$) effect of different cooking methods on organoleptic scores for color, flavor, and other parameters of Desi, Aseel and Broiler cooked meat (Table 5). Best flavor and tenderness among the meat varieties were observed among cooking methods and different varieties of chicken the broiler meat with pan-frying and grilling elucidated the better overall acceptability score i.e., 8.7. The better tenderness and flavor of the meat have been a key indicator of the good meat quality.

Table 5. Sensory evaluation of cooked meat obtained from Broiler, Desi and Aseel Chicken

Cooking treatment	Breed	Appearance	Flavor	Tenderness	Juiciness	Overall acceptability
Simple boiling	Broiler	7.27±0.25 c	7.08±0.03 c	6.37±0.48 c	8.33±0.44 a	7.63±0.44 b
Pan Frying	Broiler	7.96±0.22 b	8.69±0.33 a	8.74±0.26 a	6.82±0.52 c	8.53±0.32 a
Grilling	Broiler	8.7±0.27 a	8.7±0.27 a	8.8±0.18 a	6.55±0.36 c	8.83±0.14 a
Steam Roasting	Broiler	6.59±0.42 d	7.82±0.13 b	7.11±0.09 b	7.7±0.36 ab	7.1±0.07 b
Simple boiling	Desi	6.06±0.11 e	4.92±0.06 de	4.82±0.11 e	7.52±0.46 b	6.35±0.51 c
Pan Frying	Desi	4.95±0.07 f	3.05±0.04 g	3.43±0.5 g	5.68±0.51 d	4.66±0.27 ef
Grilling	Desi	4.3±0.51 g	3.62±0.24 f	3.44±0.45 g	3.85±0.66 e	4.35±0.47 f
Steam Roasting	Desi	6.1±0.09 e	5.06±0.04 d	5.4±0.52 d	5.14±0.25 d	5.02±0.21 e
Simple boiling	Aseel	6.04±0.03 e	4.65±0.38 e	4.14±0.11 f	7.1±0.1 bc	5.75±0.33 d
Pan Frying	Aseel	3.99±0.02 gh	3.53±0.14 f	3.41±0.17 g	3.81±0.22 e	3.57±0.37 g
Grilling	Aseel	3.88±0.1 h	3.09±0.1 g	3.31±0.46 g	2.87±0.08 f	3.25±0.21 g
Steam Roasting	Aseel	5.82±0.21 e	5.19±0.17 d	5.73±0.27 d	6.44±0.45 c	5.65±0.15 d

Mean±SD; means that have different letters as superscript in a column are statistically significant ($p<0.05$, n=3)

The flavor of the meat is enhanced upon cooking with pan-frying when compared with the other techniques of cooking the chicken meat. Likewise, the broiler showed better tenderness and flavor because it is known to contain low molecular weight proteins. While, among various cooking methods and different varieties of chicken the broiler meat with pan-frying exhibited the better overall acceptability score i.e., 8.53. Earlier, previous studies by Ba et al, (2012) and Breslin (2013) revealed better sensory scores for flavor and overall acceptability for the broiler-cooked meat. The variation in the cooked meat of different varieties could be attributed to various chemical processes taking place inside the meat during cooking i.e., vitamin breakdown, Maillard reactions, oxidation of lipid and lipolysis (Ba et al, 2012). Conclusively, based on the data of present research the broiler meat among all other varieties of chicken meat processed with pan-frying and grilling could be considered the best fit for humans which reduces the time of the cooking.

4. Conclusions

The current study aimed at evaluating the nutritional profile and physicochemical quality of the Broiler, Desi and Aseel chicken meats using the four commonly used cooking methods. Simple boiling and steam roasting proved to be the best techniques in terms of processing quality. However, pan-frying and grilling secured the highest sensory acceptance. The current findings will be advantageous for the meat processing industries to help them earn profits by selecting the suitable cooking method as well as the right kind of chicken breed to limit the yield losses and attain the highest processing quality keeping in view the physicochemical and nutritional profile of the chicken breeds.

References

Aksu, T., Aksu, M. I., Yoruk, M. A., & Karaoglu, M. (2011). Effects of organically-complexed minerals on meat quality in chickens. *British poultry science*, 52(5), 558-563.

Al-Kahtani, H.A., Abu-Tarboush, H.M., Bajaber, A.S., Atia, M., Abou-Arab, A.A., El-Mojaddidi, M.A. (1996). Chemical changes after irradiation and post-irradiation storage in tilapia and Spanish mackerel. *Journal of food science,* 61(4), 729-733.

Ali, M., Lee, S. Y., Park, J. Y., Jung, S., Jo, C., & Nam, K. C. (2019). Comparison of functional compounds and micronutrients of chicken breast meat by breeds. *Food science of animal resources,* 39(4), 632.

Álvarez, C., Morán, L., Keenan, D. F., Mullen, A. M., & Delgado-Pando, G. (2019). Mechanical and biochemical methods for rigor measurement: Relationship with eating quality. *Journal of Food Quality,* 1-10.

AOAC. (2006). Association of Official Analytical Chemists. *AOAC Press, Philadelphia, USA*.

Aslam, H. B., Alarcon, P., Yaqub, T., Iqbal, M., & Häsler, B. (2020). A Value Chain Approach to Characterize the Chicken Sub-sector in Pakistan. *Frontiers in veterinary science,* 7, 361.

Asmaa, A. A., & Tajul, A. Y. (2017). Influence of superheated steam and deep-frying cooking on the proximate, fatty acids, and amino acids composition of chicken sausage. *International Food Research Journal*, 24(3), 1308.

Ba, H. V., Hwang, I. H., Jeong, D., & Touseef, A. (2012). *In Latest research into quality control.*

Buege, J. A., & Aust, S. D. (1978). Microsomal lipid peroxidation. *In Methods in enzymology,* 52, pp. 302-310.

Chansataporn, W., Prathumars, P., Nopharatana, M., Siriwattanayotin, S., & Tangduangdee, C. (2019). Kinetics of Maillard reaction in a chicken meat model system using a multiresponses modeling approach. *International Journal of Chemical Kinetics,* 51(1), 14-27.

Choi, Y. S., Choi, J. H., Kim, H. Y., Kim, H. W., Lee, M. A., Chung, H. J., & Kim, C. J. (2011). Effect of lotus (Nelumbo nucifera) leaf powder on the quality characteristics of chicken patties in refrigerated storage. *Food Science of Animal Resources,* 31(1), 9-18.

Choe, J., Kim, G. W., & Kim, H. Y. (2019). Effects of green tea leaf, lotus leaf, and kimchi powders on quality characteristics of chicken liver sausages. *Journal of animal science and technology,* 61(1), 28.

Del-Puerto, M., Olivero, R., Terevinto, A., Saadoun, A., & Cabrera, M. C. (2016). Dietary organic and inorganic selenium on liver glycogen and lactate, pHu, color and drip loss of chicken pectoralis and gastrocnemius muscles. *Open Journal of Animal Sciences,* 6(1), 59-67.

Del-Pulgar, J. S., Gázquez, A., & Ruiz-Carrascal, J. (2012). Physico-chemical, textural and structural characteristics of sous-vide cooked pork cheeks as affected by vacuum, cooking temperature, and cooking time. *Meat Science*, 90(3), 828-835.

England, E. M., Matarneh, S. K., Oliver, E. M., Apaoblaza, A., Scheffler, T. L., Shi, H., & Gerrard, D. E. (2016). Excess glycogen does not resolve high ultimate pH of oxidative muscle. Meat science, 114, 95-102.

Gibis, M., & Weiss, J. (2010). Inhibitory effect of marinades with hibiscus extract on formation of heterocyclic aromatic amines and sensory quality of fried beef patties. *Meat science*, 85(4), 735-742.

Godfray, H.C.J., Aveyard, P., Garnett, T., Hall, J.W., Key, T.J., Lorimer, J. (2018). Meat consumption, health, and the environment. *Science,* 361(6399).

Goulas, A. E., & Kontominas, M. G. (2005). Effect of salting and smoking-method on the keeping quality of chub mackerel (Scomber japonicus): biochemical and sensory attributes. *Food chemistry,* 93(3), 511-520.

Haruna, M. H., Olusola, O. O., Olugbemi, T. S., Ayo, T. S., & Umar, U. A. (2016). Effect of rigor state and curing temperature on the processed yield and physicochemical properties of broiler meat. *Journal of Animal Production Research*, 28: 25-32.

Haskaraca, G., Demirok, E., Kolsarıcı, N., Öz, F., & Özsaraç, N. (2014). Effect of green tea extract and microwave pre-cooking on the formation of heterocyclic aromatic amines in fried chicken meat products. *Food research International,* 63, 373-381.

Holman, B.W., Collins, D., Kilgannon, A.K., Hopkins, D.L. (2018). The science of red meat and its importance to New South Wales. *Meat Science,* 135:42-45.

Jayasena, D. D., Jung, S., Kim, H. J., Yong, H. I., Nam, K. C., & Jo, C. (2015). Taste-active compound levels in Korean native chicken

meat: The effects of bird age and the cooking process. *Poultry science,* 94(8), 1964-1972.

Kahraman, T., Issa, G., Bingol, E. B., Kahraman, B. B., & Dumen, E. (2015). Effect of rosemary essential oil and modified-atmosphere packaging (MAP) on meat quality and survival of pathogens in poultry fillets. *Brazilian Journal of Microbiology,* 46, 591-599.

Kanatt, S.R. (2020). Development of active/intelligent food packaging film containing Amaranthus leaf extract for shelf-life extension of chicken/fish during chilled storage. *Food Packaging and Shelf Life,* 24, 100506.

Karunanayaka, D. S., Jayasena, D. D., & Jo, C. (2016). Prevalence of pale, soft, and exudative (PSE) condition in chicken meat used for commercial meat processing and its effect on roasted chicken breast. *Journal of animal science and technology*, 58(1), 1-8.

Khan, M. A., Ali, S., Abid, M., Ahmad, H., Zhang, L., Tume, R. K., & Zhou, G. (2014). Enhanced texture, yield and safety of a ready-to-eat salted duck meat product using a high pressure-heat process. Innovative *Food Science & Emerging Technologies*, 21, 50-57.

Khan, M. A., Ali, S., Abid, M., Ahmad, H., Zhang, L., Tume, R. K., & Zhou, G. (2014). Enhanced texture, yield and safety of a ready-to-eat salted duck meat product using a high pressure-heat process. *Innovative Food Science & Emerging Technologies,* 21, 50-57.

Khulal, U., Zhao, J., Hu, W., & Chen, Q. (2016). Nondestructive quantifying total volatile basic nitrogen (TVB-N) content in chicken using hyperspectral imaging (HSI) technique combined with different data dimension reduction algorithms. *Food Chemistry,* 197, 1191-1199.

Kim, H. W., Hwang, K. E., Song, D. H., Lee, S. Y., Choi, M. S., Lim, Y. B., ... & Kim, C. J. (2013). Effects of dietary fiber extracts from brewer's spent grain on quality characteristics of chicken patties cooked in convective oven. *Food Science of Animal Resources,* 33(1), 45-52.

Kozačinski, L., Fleck, Ž. C., Kozačinski, Z., Filipović, I., Mitak, M., Bratulić, M., & Mikuš, T. (2012). Evaluation of shelf life of pre-packed cut poultry meat. *Veterinarski arhiv*, 82(1), 47-58.

Lee, C. H., Ha, J. S., Jeong, J. Y., Lee, E. S., Choi, J. H., Choi, Y. S., & Kim, C. J. (2005). Effects of cooking method on physicochemical characteristics and qualities of hamburger patties. *Food Science of Animal Resources*, 25(2), 149-155.

Lee, K., Park, H., Baek, S., Han, S., Kim, D., Chung, S., ... & Seo, J. (2019). Colorimetric array freshness indicator and digital color processing for monitoring the freshness of packaged chicken breast. *Food Packaging and Shelf Life,* 22, 100408.

Liao, G., Xu, X., & Zhou, G. (2009). Effects of cooked temperatures and addition of antioxidants on formation of heterocyclic aromatic amines in pork floss. *Journal of food processing and preservation*, 33(2), 159-175.

Lofgren, P. A. (2005). Meat, poultry and meat *products. Elsevier,* pp: 230-237.

Malle, P., & Tao, S. H. (1987). Rapid quantitative

determination of trimethylamine using steam distillation. *Journal of Food Protection,* 50(9), 756-760.

Mancinelli, A. C., Silletti, E., Mattioli, S., Dal Bosco, A., Sebastiani, B., Menchetti, L., ... & Castellini, C. (2021). Fatty acid profile, oxidative status, and content of volatile organic compounds in raw and cooked meat of different chicken strains. *Poultry science,* 100(2), 1273-1282.

Mena, B., Fang, Z., Ashman, H., Hutchings, S., Ha, M., Shand, P. J., & Warner, R. D. (2020). Influence of cooking method, fat content and food additives on physicochemical and nutritional properties of beef meatballs fortified with sugarcane fibre. International *Journal of Food Science & Technology,* 55(6), 2381-2390.

Mukhtar, N., Khan, S. H., & Khan, R. N. A. (2012). Structural profile and emerging constraints of developing poultry meat industry in Pakistan. *World's Poultry Science Journal,* 68(4), 749-757.

Pathare, P. B., & Roskilly, A. P. (2016). Quality and energy evaluation in meat cooking. *Food Engineering Reviews,* 8(4), 435-447.

Pathera, A. K., Riar, C. S., Yadav, S., & Sharma, D. P. (2017). Effect of dietary fiber enrichment and different cooking methods on quality of chicken nuggets. *Korean journal for food science of animal resources,* 37(3), 410.

Pathera, A. K., Riar, C. S., Yadav, S., & Singh, P. K. (2016). Effect of cooking methods on lipid oxidation, microbiological and sensory quality of chicken nuggets under refrigerated storage. *Cogent Food & Agriculture,* 2(1), 1232472.

Piao, M. Y., Lee, H. J., Yong, H. I., Beak, S. H., Kim, H. J., Jo, C., ... & Baik, M. (2019). Comparison of reducing sugar content, sensory traits, and fatty acids and volatile compound profiles of the longissimus thoracis among Korean cattle, Holsteins, and Angus steers. *Asian-Australasian journal of animal sciences,* 32(1), 126.

Pingen, S., Sudhaus, N., Becker, A., Krischek, C., & Klein, G. (2016). High pressure as an alternative processing step for ham production. *Meat science,* 118, 22-27.

Raeisi, M., Hashemi, M., Afshari, A., Tabarraei, A., Aminzare, M., & Jannat, B. (2019). Cinnamon and rosemary essential oils incorporated into alginate coating improve chemical and sensorial quality of chicken meat. *Available at SSRN* 3627606.

Roccato, A., Uyttendaele, M., Cibin, V., Barrucci, F., Cappa, V., Zavagnin, P., ... & Ricci, A. (2015). Survival of Salmonella Typhimurium in poultry-based meat preparations during grilling, frying and baking. *International journal of food microbiology*, 197, 1-8.

Saenmahayak, B., Bilgili, S. F., Hess, J. B., & Singh, M. (2010). Live and processing performance of broiler chickens fed diets supplemented with complexed zinc. *Journal of Applied Poultry Research*, 19(4), 334-340.

Sirri, F., Castellini, C., Bianchi, M., Petracci, M., Meluzzi, A., & Franchini, A. (2011). Effect of fast-, medium-and slow-growing strains on meat quality of chickens reared under the organic farming method. *Animal,* 5(2), 312-319.

Sohaib, M., & Jamil, F. (2017). An insight of meat

industry in Pakistan with special reference to halal meat: a comprehensive review. *Korean journal for food science of animal resources,* 37(3), 329.

Tengilimoglu-Metin, M. M., Hamzalioglu, A., Gokmen, V., & Kizil, M. (2017). Inhibitory effect of hawthorn extract on heterocyclic aromatic amine formation in beef and chicken breast meat. *Food research international*, 99, 586-595.

Tengilimoglu-Metin, M. M., & Kizil, M. (2017). Reducing effect of artichoke extract on heterocyclic aromatic amine formation in beef and chicken breast meat. *Meat science,* 134, 68-75.

Van Laack, R. L. (1999). The role of proteins in water-holding capacity of meat. In Quality attributes of muscle foods (pp. 309-318). *Springer, Boston,* MA.

Yang, H., Khan, M. A., Han, M., Yu, X., Bai, X., Xu, X., & Zhou, G. (2016). Optimization of textural properties of reduced-fat and reduced-salt emulsion-type sausages treated with high pressure using a response surface methodology. *Innovative Food Science & Emerging Technologies,* 33, 162-169.

Ye, K., Feng, Y., Wang, K., Bai, Y., Xu, X., & Zhou, G. (2015). Effect of High Hydrostatic Pressure Combined with Moderate Heat to Inactivate Pressure-Resistant Bacteria in Water-Boiled Salted Duck. *Journal of food science,* 80(6), M1336-M1342.

Zakaria, H. A., Jalal, M., Al-Titi, H. H., & Souad, A. (2017). Effect of sources and levels of dietary zinc on the performance, carcass traits and blood parameters of broilers. *Brazilian Journal of Poultry Science*, 19, 519-526.

Zhao, C. C., Benjakul, S., & Eun, J. B. (2019). Changes in protein compositions and textural properties of the muscle of skate fermented at 10° C. *International Journal of Food Properties,* 22(1), 173-185.

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Code-Switching between Lasi and Urdu among Teachers at Secondary Level High School in Bela

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Abstract. Code-switching is a natural and inevitable linguistic phenomenon of bilingual or multilingual classrooms in Pakistan. The term code-switching is broadly used and discussed in linguistics. Code-switching allows people to switch from one language to another. Teachers switch codes in language classrooms in different situations for various reasons. The study aims to investigate the reasons for code-switching between Urdu and Lasi by high school teachers in Bela. Code-Switching is a most beneficial process in a way of teaching and learning. Teachers switch between codes in the classroom for different reasons. The main objective of this small study is to find out the reasons and the purposes of code-switching by teachers in the secondary level classroom in Bela. Different types of Code-Switching have been used by teachers, like Inter-sentential, Intra-sentential, Tag-switching, and Intra word. This research applies qualitative and descriptive research designs. The data of this study have been collected through observation and recording teacher's lectures to find out Code-Switching between Lasi (L1) and Urdu (L2). The markedness model of Myers Scotten (2002) has been used to analyze the use and effective role of code-switching in a classroom setting. The results reveal that teachers use the above-mentioned types of code-switching in the classroom as they believe that it works better to learn/acquire things in a classroom. Students learn more in L1 than L2. It is also found that the medium of classroom lecture is Urdu, however, students perform well in L1. The finds reveal that teachers switch from Lasi to Urdu for the ease of students. However, they teach in both codes so they may learn in both.

Keywords: Code-Switching; Classroom; Bilingual and Multilingual.

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1. Introduction and Background

Carol Myers-Scotton (1977) identified switching as the process in which use two or more varieties of languages in same interaction". Code-switching is a process in which two different languages are used in a single idea. Code-Switching is a process in which two speakers change their code from one language to another language. According to Lin (2008), the code-switching process is used by a speaker from one grammatical system to another system. Code-switching for curriculum access is to facilitate learning and understanding.

Code-Switching refers to the "use of two or more languages in the same conversation, usually within the same conversational turn, or even within the same sentence of that turn." Code-Switching in the shifting by a speaker from language A to language B (Scotton, 1988). Bilinguals can speech fluently when

they follow constraints, and they will not fluent if a bilingual will not switch grammatically (Brice& Bricee, 2000). Sometimes speakers change and mix their codes, this process according to Auer (1998), is known as the Code-Switching process in which sometimes speaker use one word of another language in a conversation or single discourse and utterance that phenomenon is called code-mixing.

Code-Switching occurs mostly in bilingual communities. Speakers of more than one language are known for their ability to code-switch or mix their language during their communication. As Aranoff and Miller (2001) indicate, many linguists have stressed the point that switching between languages is a communicative option available to a bilingual member of a speech community, just as switching between styles or dialects is an option for the monolingual speaker. The use of complete sentences, phrases borrow words from another language this process is known as the code-switching process (Brice & Brice, 2000). Urdu and Hindi share an Indo-Aryan base, but Urdu is associated with the Nastaliq script style of Persian calligraphy and reads right-to-left, whereas Hindi resembles Sanskrit and reads left-to-right. The language started developing from Persian and Arabic contacts during the invasions of the Indian subcontinent by Persian and Turkish forces from the 11th century and onwards. Urdu developed more decisively during the Delhi Sultanate (1206–1526) and the Mughal Empire (1526–1858). Modern Urdu is the national language of Pakistan, and it is widely spoken everywhere.

Skiba (1997) argues that Code-Switching is not language as it supplements speech. Where it is used due to an incapability of expression, Code-Switching provides stability in speech rather than presenting interference in language. The socio-linguistic benefits have also been identified as a means of communicating commonality, or association to a particular social group, whereby Code-Switching should be viewed from the standpoint of providing a linguistic advantage rather than an obstruction to communication. Code-Switching allows a speaker to convey feelings and other affecting using a method available to those who are bilingual and again serves to advantage the speaker, much like bolding or underlining in a text document to emphasize points. Language is used for communication, interaction in different societies. In Pakistan, many people are known as multilingual speakers (Rasul, 2016). Ehsan & Aziz, 2014; Dar, 2008) defined that nowadays English has become important for every person, in different courses like Certificates, Diploma and language improvement programs, etc. People mostly applied the process of code-switching in their speeches and switch from one language to another. According to Stern, (1992) the practice of alternately using two languages at the same time is known as Code-Switching. Language is the communication ability; it expresses our thought emotions. Language is an authority on our concepts and identity.

Multilingual speakers who can understand and they have linguistic competence to know several languages and in the same discourse" (ibid). Code-switching is particular to bilinguals and multi-lingual only as monolinguals cannot switch code because they have no other language to switch. According to Gulzar (2010) Harrub et al, (2003), a person who knows only one language is monolingual. The process of Code-Switching is also used to mark solidarity (Hughes et al, 2006). Many teachers do Code-Switching for different purposes such as social management purposes Barandagh (Dar et al, 2014; Ahmad, 2019). Code-Switching is a process of interchange between two languages; it is used in an unchanged setting within the same discourse.

Everyone can use different varieties of languages. It shows different concepts and contexts of speakers. Use two languages that share the same grammatical structure (Ahmed, 2019; Ayeomoni, 2006; Schendle & Wright, 2011).

David (2008) argues that Code-Switching is constructed that the alternate used two languages at the same speech. Eppler (1994) has explained that Code-Switching is processed which occurs when bilingual speakers, which use more than one language in a single discourse at the clause level. According to Lin (2013), Code-Switching increases the cognitive process when a speaker expresses in L2, and they try to translate in their L1. Speaker learns more vocabulary from this phenomenon. Borlongan (2009) pointed out that in a classroom the process of Code-Switching is to be used by side by the teacher and the student. There are different aspects of the study of code-switching in bilingualism. Li (2008) further explained code-mixing that is a combination of two different languages. It is pathological behavior.

Code mixing shows a language contact situation, the process of code-mixing. Code-Switching and interference do take place. Code mixing and Intra sentential switching both are the same but inter-sentential is known as the Code-Switching process. Language contact sometimes occurs when there is an increased social interaction between natives who live in the neighborhood and have conventionally spoken different languages. However, more often it is initiated by the spread of languages of power and prestige (Tabaro, 2013). Faltis (1989). Borlongan, (2009) agreed upon the same idea that in a classroom the process of Code-Switching should be used by the teacher as well as students. Code-switching is "as the Juxtaposition within the same speech exchange of passage of belonging to two different grammatical systems or subsystems (Gumperz, 1982).

Inter-sentential switching is a type of Code-Switching where the switching occurs between sentences; a conversation starts in one language, and it shifts/moves to another code in the very next sentence. This type of code-switching can be used at a clause or a sentence level; commonly termed as inter-sentential Code-Switching. It requires an advanced level of bilingual proficiency as it often entails the production of full clauses in each language. More examples of inter-sentential code-switching (Milroy, 1995) have been discussed in the analysis.

Intra- Sentential code-switching is concerned with the language alternation that occurs within a word or a clause boundary, sometimes it includes mixing within word boundaries. Code-Switching occurs within a word. There are some examples of intra-word sentential Code-Switching that can be seen in the analysis (Poplack, 1980). Tag code-switching refers to a small kind of language or a word which may contain a word or a group of words that are used at the end of another language called tag Code-Switching (Poplack, 1980). The examples have been discussed in the analysis of the study.

Code-Switching is one of the important terms discussed in the field of sociolinguistics. Sociolinguistics is the study of language and society. Many experts/linguists have studied language structure and how language functions are used in communication. The term Code-Switching is used in the sociolinguistics field (Rasul, 2016). In linguistics, the term "Code" first comes into use in the field of sociolinguistics. 'Code' means language and there are several codes that are used in the world, every code has its own rules and regulations (Tabouret-Keller, 1995).

This process transfers information from one source to another (Skiba, 1997). Having started the research problem, this study has the following objectives:

2. Research Problem

In Bela, teachers switch codes due to students having less proficiency in L2 and being unable to understand L2 properly. This is one of the major problems of this study. The Code-Switching process is used all over the world and is mainly used in Pakistan where people switch codes in different situations. The same process is mostly used in Bela School.

Code-Switching in the process of alternating between two or more languages (codes), this phenomenon is mostly applied in Bela schools. Teachers switch from one code to another (Lasi-Urdu and vice versa). Students at the primary and secondary level have less or zero L2 proficiency that is why teachers apply the Code-Switching process for better teaching and learning. Teachers, as well as students, feel easy and comfortable in switching from one code to another during teaching and learning. This phenomenon helps in those situations when two or more communicators share their ideas, and they change their codes with each other from one language to another language.

This is an important study in the field of linguistics. This study investigates different types of Code-Switching in different situations in a classroom setting of Government School at Bela, depending upon various situations, like public communication, especially in schools. Most of the teachers do Code-Switching in a situation where students feel difficulty in the second language; they cannot understand the concepts of the teachers and sometimes they feel difficulty in learning lexicons. This phenomenon is not just limited to schools but also colleges and universities. "Every teacher should use Code-Switching in a classroom when students feel difficulty" (Lin, 2008).

In Bela schools where students have less proficiency in a second language (Urdu), which is why teachers keep on switching between Urdu to Lasi and vice versa in their classrooms. This phenomenon has a strong position in those schools/places where students do not get a second language properly. According to different opinions, Code-Switching is a process of interchanging between two languages during communication and interchange of two languages by bilingual speakers. Code-Switching has also come into the teaching process like in different classes and this process is used by teachers and as well as by students, it occurs equally in the education system (Sert, 2005). Code-Switching learning is a good opportunity for speakers and listeners.

Lasi language is a dialect of the Sindhi language (Azam, 2018; Asadullah, 2018; Ali, 2019). Lasi is used not only in district Lasbela but also in some districts of Sindh province. In Lasbela, the majority of the people are Lasi, and it also has other speakers like Baloch, Brahvi, Punjabi, Sindhi, and Pashtun. Bela is one of the towns (tehsil) of Lasbela having bilinguals and multilingual. The process of Code-Switching has been observed in a bilingual or multilingual society. In Bela primary schools' teachers use Code-Switching and code-mixing processes in their classrooms so that their lecturer may be understood by every student. These processes

are important in bilingual and multilingual communities (Anwar, 2009).

The Code-switching process is an alternative process between two languages such as Lasi to English or English to Lasi. For example, I want to go there but huth ilahi rush aa (I want to go there but there is a lot of rush). In this example, we see the process of code-switching between Lasi and English; the sentence starts with English and ends at Lasi. This study attempts to analyze code-switching among teachers at Bela High School.

3. Objectives of the study

This study aims to investigate whether Code-Switching occurs or not in the mentioned Schools in Bela, Lasbela. The study looks to describe the process of code-switching and its types among the teachers at Bela High School. It also attempts to investigate the reasons for code-switching among the teachers at Bela High School.

4. Research Methodology

The research methodology part is the backbone of research; it explains the process/procedure of research. The current research is qualitative (Creswell, 2014). It uses descriptive and exploratory research designs. This study is qualitative research in nature because it explores the process of code-switching and its reasons. Researchers observed the data to check which code is suitable for teachers to teach students. Teachers believe that learners are better motivated if they are commented in their language, a language which is close to their hearts and minds (Ahmed, 2009). However, although code-switching helps students understand concepts better and freely express themselves, the practice has also to a certain extent impacted negatively on students' performance, both in the classroom and in the public examinations (Stern, 1992)..

Data collection is one of the processes that are designed by the researchers for the purpose to collect data regarding the current study. Researchers observed code-switching from different classes of High School in Bela. This study focused on the environment of the classroom and activities of their languages and problems of classroom. Another main thing was to identify participants' emotions, feelings, and different opinions regarding a particular research method. The main advantage of this study through observation was that many things of teachers' and students' activities were noticed in the classroom. Researchers got positive points of view about Code-Switching. Classroom activities, observations, and recording from different teachers and the way of teaching and motivation through this phenomenon. This skill has successful development in a way of learning. Researchers and participants both have direct and personal contact, and the observer must have the ability and should be well in observation (Rasul, 2016). A good observer must have this ability and researchers develop successful skills to know everything of participants.

This research study is focused on the high school level in Bela, Lasbela. In Bela, all teachers in primary secondary, and high schools are bilinguals and multilingual, and most students are Lasi and Balochi speakers. The medium of instruction in such schools is Urdu, as prescribed by the provincial government. However, teachers and students use Lasi no matter it is their L1 or L2. When teachers shifted their code from Urdu to Lasi then all students picked up everything easily. We visited some schools, mainly the High School, and found that there were 20 to 25 students in each class. Bela schools' teachers are not fully able to in every difficult situation. By this process students learn new things and students can pick up each idea easily from difficult things,

getting new information from various subjects. There were 9 teachers of various classes, and they did Code-Switching in various subjects. Teachers were motivated and cooperative during the classes and students pick up everything easily in the classroom from their teachers teach in Urdu, but they depend on this more helpful phenomenon and make them easy.

The Markedness Model developed by Scotton (2002) is one of the complete theories of code-switching motivations. It posits that language users are rational and choose to speak a language that marks their rights and obligations, relative to other speakers in the conversation and its setting. When there is difficulty in communication for L2, the speaker tries to practice code-switching to explore possible language choices. Many sociolinguists, however, object to the Markedness Model's postulation that language-choice is entirely rational. This model has been applied to validate and analyze the data so that we may come up with results; reasons for switching from one code to another.

5. Results and Discussion

In intra-sentential Code-Switching, the shift is seen in the middle of a sentence as were seen by David, M. K. (2003) & David, M. K., & Dumanig, F. P. (2008).

Teacher (A1) used this process, she said to students apni English ki book kholo unit no 3 "Our world and pollution" teacher told to the students that if they have any problem regarding this topic then they can ask, first she wrote words meaning on the blackboard, one student asked the teacher in Lasi language

Students: Bajii Fertility jo matlab? (What is the meaning of Fertility). The first teacher replied in Urdu "

A1: ok, Iska mtlab hai zarratya zarkhezi bhi ae theek, samajh aya?

A1: Pollute ka mtlab hai jese ke fectry waghera ke dhohen, iye bhi mahol'k aloodo ta kan mtlab khrab karte hain.

And further, she told them in Lasi language to clarify its meanings and many other words in which they felt difficulty.

A1: Yahan aplo bohat sari examples milengi, hanrh aven soche bunadayo hinah joon misaaliyon, sab bataoge

The use of L1 has become a significant area of research for many years. She used the Code-Switching process Urdu to Lasi, after that she used tag Code-Switching in her lecture and she used both, Code-Switching and tag Code-Switching at the same time unconsciously. Teachers should have such types of teaching ways in which students feel at ease and they make their concept clear. If students feel complexity in any subject so they can ask again and again without hesitation.

In English subject, (A1) teacher mixed two codes From Urdu to Lasi and Lasi to Urdu, and she also used the tag Code-Switching in her lecture, which is mentioned below.

A1: Aven sab kitabion kado, jaldi Karen
A1: Tahira toon uthi budae ke Fertility kia hoti hai?
Student 1: zameen ki zarkhezi.
A1: Very good, Thank you, Biyo kair
A: wese budanrh sabneenk ghurge sahi hai na
In another sentence, the teacher said (Jese har class main kio na koi bacha position holder hota hai han na?)

In the above examples, you have noticed that the teacher used Urdu sentence and at the end of the sentence she used "hao na" it means "right", "isn't it" which is the piece of other language and used at the end of language (Lasi).

In inter-sentential Code-Switching the shift is seen at the clause or sentence level boundaries

In 9th (B) class, teacher (f) read the English subject "Discipline" One student asked that,

F: Acha kal hum ne kia parha tha acha moon jeki definition likhaai wi wo bari bari batao english main phir isko translate karo,

Studen: We wish to act together in the society, jb hum koi ak kaam sath karte hain use hum discipline kehte hain, jiyah ghar kam

F: Good ye bi sahi hai, safia toon budae.

Student: Miss likhan ya budayan

One student asked Miss penalized aur unforeseen meaning cho a.

First, she replied in Urdu Language and then in Lasi language to clarify the difficult concept. Sometimes teacher answered in the Urdu language, but she noticed that still, students did not get the sentence in English then teacher switch code in Urdu to Lasi language, and the teacher asked the whole class that

In Islamic study, teacher, in class 7th, she told the students that apni book kholo, panjhi book kholyo sahi a na (open your books right) first she said in Urdu then she switched code in Lasi language,

R2: Acha aven students ghor si bude jaon sahi a, and then she starts reading, after a while, she said kaleemullah ka matlab kia hai ata hay kisi ko? For a while, whole class was silent then teacher said kaleemullah ju matlb aeAllah pak seen mukhatib us se baat karna sahi haina, (kaleemullah means to talk to Allah pak, is it ok)

In this class, the teacher used both inter-sentential and tag Code-Switching. In the above examples, inter-sentential Code-Switching is occurring more than others that have been used by other teachers in other subjects.

In the 10th (A) class, a teacher (S) taught social studies the "Parliament" chapter in which she did not switch code from Urdu to Lasi. She used the code-mixing process from Urdu to English and English to Urdu. Her teaching method was different from other teachers; she used code mixing many times from Urdu to English such as,

(S): unhon ne ek parliament bnain quami majlis our parliament ek mujlis ki ehmyat rakhti hai(They made a parliament and it has as much importance as the assembly has. In this class, students didn't use this process, just the teacher used it.

Switching is occurring in various situations because everyone has different teaching methods. In this study, researchers noticed all types of activities in 30 minutes in the total period. Observer observed all types of activities in a classroom that what method she has applied in her class.

It depends on the teaching method. This process is beneficial for students, by this process, those students who are unable to speak L2, have different opinions regarding this phenomenon in which some people say that this process is not beneficial because this is not used in exams and most subjects are in English, not in their mother tongues.

Teacher (S) said to students, ye tab select hoten hain jab awam inko laati hai ya phir inko reject kr deti hai students matlb mustarid sahi hai.
The teacher had applied code-mixing in Urdu and English languages, not in Lasi. She rarely used this process in a classroom.
Some other examples which are used in social studies class by the teacher(S) are:

Ye policy hai

Government ki waja se

Vote dye gae

Jamhooryat jese Democracy our baki dosri politics

matlab siyasat

In the SST class teacher used code mixing 6 times in 30 minutes class. The teacher used 70 sentences in the overall class.

Islamic Studies was taught in class 9th and 10th, "Ibadat" During class teacher used various intra words like copiyon, penclyon, and other words used as intra word sentential Code-Switching which are discussed below.

The morpheme is a meaningful smallest grammatical unit of language, and it cannot be further divided, for example in, come–in, these units of language.

The morpheme is a short segment of language which cannot be divided further.

For example, the book to books at the end of this word we used (s) which is a plural form of word book, the same examples are mentioned below in Lasi and Urdu language:

Teacher R used intra word sentential, like:

N2: Aven panjhiyon kitabion kholyo our kapiyon bhijo pochongiwo batana our likhna sahi.

N2: Pencilyon our pen hatham karyon

English, Urdu and Lasi Intra words

Singular/ Plural	**intra word Singular /Plural**	
Pen/	pens	Pen*ion*
Pencil	pencils	Pencil*ion*
Shop/	Shops	Shop*ion*
Copy/	Copies	Cop*ion*

English, Urdu and Lasi Intra words

Singular/ Plural	**intra word Singular /Plural**	
Pen/	pens	Pen*ion*
Pencil	pencils	Pencil*ion*
Shop/	Shops	Shop*ion*
Copy/	Copies	Cop*ion*

Shahida et al.The following table represents the Code-Switching by different teachers in various subjects (Table 1).

5.1.Findings

This study has similarities almost with the previous views and ideas, but very few differences have been observed.

In the present study teachers code-switch from one language to another language, (Urdu to Lasi) and they use many times Code-Switching in their mother tongue is compared to the second language.

Researchers noticed that the previous studies had similarities with the present study but very little difference.

In both studies, teachers were motivated and cooperative with the students as they do not force students to use a second language only, but they were allowed to use the first language.

Table 1. Code-Switching by different teachers individually

Lesson	Topic	Code-Switching	Code mixing
English	Our world and Pollution	20	5
English	Discipline	15	0
Science	Matter	2213 13	555 5 5
Islamic Studies	Akhrat	15	6
English	Quid-e-Azam	14	0
Soci Social studie	Parliament	6 00 0	H10 6 6
Islamic Studies	Hazrat Moosa	14 14 14	Ddd 5 5
IslIii Science	Classification of animals	10	0 00 0
Islamic Studies	Ibadat	18	5
Total		117	32

Table 2. Findings of types of Code-Switching

1. Types of Code-Switching	Reasons of Code-Switching
In inter-sentential Code-Switching, the language switch is done at sentence boundaries—words or phrases at the beginning or end of a sentence. This type is seen most often in fluent bilingual speakers. For example: Bachon apni kitaben kholo, aven sab jaldi karyo. 2. In intra-sentential Code-Switching, the shift is done in the middle of a sentence, without, hesitations, disruption to indicate a shift. Class blkul khamosh, shor makryo Tag- switching 3. This is the switching of either a single word or a tag phrase (or both) from one language to another. Har cheez clear thi wai han na?	Students are unable to understand L2 properly; Code-Switching helps those who Have less proficiency in L2, Teachers applied this phenomenon from one language to another language: Another reason is that teachers know their students in a class, so teachers think that they do not properly understand all things in one language, so they change their code from one to another language. Teachers have noticed this process is so comfortable and any difficult concept, it makes very easy. Sometimes teachers do code switch unconsciously and clarify all things because they already know this phenomenon works better and play important role in classroom learning. Code-Switching allows speaks to convey attitude, anger, and other emotional expressions shown from a conversation.

The Code-Switching phenomenon is a good activity in class when the teacher and students do code-switch in different situations and students feel complex, Borlongan (2009) agreed upon the same idea that in a classroom the process of Code-Switching should be used by the teacher as well as Students.

6. Conclusion

Code-Switching (CS) process is a beneficial, helpful, and very good process which is used among bilingual and multilingual community members, this phenomenon does not occur in one or two languages, but every language is involved in this phenomenon, many people are from Urdu medium they cannot understand the complete concept of the teacher. We are not sure that every person prefers this phenomenon because many students of English medium will not agree that teachers do code switch target to in their mother tongue because they can understand everything in the second language. Many students feel difficulty when teachers do not switch one language to another language, sometimes teachers, and students both feel difficulty in pronunciations, and they

pronounce incorrectly this process is known as markedness. Students feel more difficulties in English subjects, so many Urdu medium students face many problems when classroom teachers do not code-switch in their lecture and conversation. This phenomenon can help, and they easily understand every difficult concept. People do switch codes and alternate in words, phrase clauses, and sentences. It occurs in different situations and people can speak multi-languages at the same time. This process also developed different ideas and it helps increase vocabulary in two or more languages. It could be very helpful and solve students' problems which they usually face in the classroom. Different authors and writers talked in favor of this phenomenon and also suggested that the teachers don't force the students to use the target language and pressurize but allow using L1 in a classroom when they don't understand concepts and ideas in L2.

The Code-Switching process has many advantages in learning, this is applied and used by bilingual and multilingual, which can transfer and change their code easily from one language to another language. This process can help both, the teachers and their students in different ways. It has many positive aspects.

In Pakistan most of the people are Bilingual and multilingual, they can easily switch from one to another language. Urdu speakers switch code from Urdu to English, Baloch speakers switch code from Balochi to English and Lasi speakers do code-switch from Lasi to Urdu or Lasi to English so on, so it means that every language has such types of quality that Bilingual alternatively changes their codes.

From the school, we observed that at a low-level students' High level both were able to pick up the ideas from Code-Switching. Therefore, Code-Switching should be used with low and high-level students. In Bela, I have noticed different schools in which teachers practice this process for better guidance in the classroom to convey their ideas, and somehow, they were seen successful by Code-Switching. Therefore, teachers should appreciate their students to do Code-Switching when they face difficulties during class.

The Code-Switching process has different kinds which are used in daily basis conversation. The observation and recording techniques were used to collect data from different teachers. Observer also noticed all activities of the teachers which were the subject of this research. The code-mixing process was also used in science subjects and social studies. The Code-Switching process is a beneficial process for those who are unable to understand the concept of a second language.

7. Contribution

Code-Switching is the best way to change ideas from one language to another language, so in this case when someone who unable to understand the concept of other languages, in this situation they can apply the Code-Switching phenomenon. Code-Switching is a beneficial process that helps and clear difficult ideas.

Many scholars have written in favor of this phenomenon (Code-Switching) because it is important in society, it expresses culture and social context among people. It is an interchange of two codes and mixing of two different languages and makes easier several confusions. It is used on certain occasions.

Li (2008), says when students feel difficulty during the class so in that situation teacher would handle

and can switch from L1 to solve the student's problem and the second is that teacher uses L1 to give grammar instruction in classroom tasks, etc. Code-Switching has both advantages and disadvantages, if it is a literature class code interchange is beneficial, if it is a language class then it could be beneficial because in literature there is more flexibility of ideas but the language has much complexity.

Many teachers force students to use a second language and they are not allowed to use the first language in a classroom, so such type of restriction develops negative effects on students' mind and their studies. Teachers should motivate students in a friendly manner, so such type of behavior can encourage the students' mentality and students can easily share anything without hesitation. Mejia (1998) mentioned that Code-Switching is a dual-language process in which the speaker uses two languages at the same time, and the speaker can understand both languages.

This process is used by different teachers in high school Bela, they applied in various subjects. This process has a positive role among teachers because they know better than how much this phenomenon would be better and beneficial in a classroom. Teachers, as observed by the researchers of this study, use two languages, Urdu to Lasi and Lasi to Urdu for the sake of making students' concepts clear in English subject, according to Stern (1992) the practice of using two languages at the same time is known as Code-Switching. Last but not least, this study contributes to the existing literature on sociolinguistics and mainly on code-switching along with contribution to the literature on the Lasi language.

References

Ahmad, B. H. (2019). Teachers' Code-Switching in Classroom Instructions for Low English Proficient Learners. *English Language Teaching,* 49-55.

Ayeomoni, M. O. (2006). Code-switching and code-mixing: the style of language use in childhood in Yoruba speech community. *Nordic journal of African studies, 90–99.*

Anwar, B. (2009). Urdu-English Code-Switching: The use of Urdu phrases and clauses in Pakistani English (A non-native variety). International Rasul. *Journal of Language Studies,* 3(4).

Borlongan, A. M. (2009). Tagalog-English code-switching in English language classes: Frequency and forms. *TESOL journal,* 1, 28-42.

Brice, A., & Brice, R. (2000). Language in the classroom: comparisons of four bilingual environments. *Retrieved October 2,* 2005.

Dar, M. F., Akhtar, H., & Khalid, H. (2014). Code-switching in Pakistani English language classrooms: perceptions of English language teachers. *Journal of Social Sciences and Interdisciplinary Research, 2(2),* 16-26.

Ehsan, A., & Aziz, S. A. (2014). Code-mixing in Urdu news of a private Pakistani channel: A case study. *Academic research International,* 160.

Eppler, E. (1994). Code-switching in Emigranto. *Vienna English working papers,* 75.

Gulzar, M. A. (2010). Code-switching: Awareness about its utility in bilingual classrooms. *Bulletin of Education and Research,* 32(2), 23-44.

Gumperz, J. J. (1982). Discourse strategies. vol. 1. Cambridge: *Cambridge University Press.*

Hughes, C. E., Shaunessy, E. S., Brice, A. R., Ratliff, M. A., & McHatton, P. A. (2006). Code-Switching among bilingual and limited

English proficient students: Possible indicators of giftedness. *Journal for the Education of the Gifted*, 30(1), 7-28.

Harrub, B., Thompson, B., & Miller, D. (2003). The origin of language and communication. *Journal of Creation,* 17(3), 93-101.

Li, D. (2008). Understanding mixed code and classroom code-switching: Myths and realities. *New Horizons in Education,* 56(3), 75-87.

David, M. K. (2003). Role and functions of code-switching in Malaysian courtrooms. *Multilingual,* 22(1), 5-20.

David, M. K., & Dumanig, F. P. (2008). Nativization of English in Malaysia and the Philippines as seen in English dailies. *Philippine Journal of Linguistics*, 39(1), 1-1.

Milroy, J. (1995). One speaker, two languages: Cross-disciplinary perspectives on code-switching. Cambridge: *Cambridge University Press.*

Poplack, S. (1980). Sometimes I'll start a sentence in Spanish terminoenespanol: toward a typology of code-switching. *Linguistics*, 18(7-8), 581-618.

Rasul, S. (2006). Language hybridization in Pakistan as a socio-cultural phenomenon: An analysis of code-mixed linguistic patterns. (Doctoral dissertation, *NATIONAL UNIVERSITY OF MODERN LANGUAGES ISLAMABAD).*

Rasul, S. (2016). Code-Switching of English in Pakistani Urdu Classrooms: Bilingual Practices and Challenges. *Kashmir Journal of Language Research,* 19(1).

Scotton, C. M., & Ury, W. (1977). Bilingual strategies: The social functions of code-switching. *International Journal of the sociology of language,* 1977(13), 5-20.

Scotton, C. M. (1988). Codeswitching as indexical of social negotiations. *Codeswitching: Anthropological and sociolinguistic perspectives*. 86-151.

Sert, O. (2005). The Functions of Code-Switching in ELT Classrooms. *Online Submission*, 11(8).

Schendl, H., & Wright, L. (Eds.). (2011). "Code-switching in early English (Vol. 76)": *Walter de Gruyter.*

Skiba, R. (1997). Code-Switching as a countenance of language interference. *The internet TESL journal,* 3(10), 1-6.

Stern, H. H. (1992). Issues and options in language teaching: Cambridge. *Cambridge University Press.*

Tabaro, C. (2013). Code-switching in Rwanda: A case study of Kigali City secondary schools. *Southeast Asia: A Multidisciplinary Journal*, 13, 14-26.

Tabouret-Keller, A. (1995). Conclusion: code-switching research as a theoretical challenge. *One speaker, two languages*. 344-355.

Magnetic Separation Studies of a Lateritic Nickel Ore

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Abstract. Hydrogen reduction and thermal treatment experiments were carried out in the laboratory using a transition zone lateritic nickel ore. The products of the pyrometallurgical operations were subjected to magnetic separation. The ore and samples produced after the thermal processing (reduction and thermal treatment) were characterized by X-ray diffractometry (XRD), thermogravimetric analysis (TG), scanning electronic microscopy (SEM), and energy dispersive spectrometry (EDS). The qualitative identification of the main mineral transformations was performed and the influence of these thermal transformations in the magnetic properties of the sample was studied. When the reduction experiments were performed at 800 ° C, with a magnetic flux of 97.5 ± 10.6 mT, the nickel content increased by up to 33 % (recovery of ≈ 75 %) in the magnetic fraction. During the formation of magnetite in the reduction experiments, carried out at 400°C, the sample became very magnetic and, consequently, the unit operation of magnetic separation was not selective. It was possible to remove magnesium from all samples, regardless of the thermal treatment or reduction temperature used. The contents of this element were adjusted to the characteristic values of a limonitic ore.

Keywords: Laterite Nickel Ore; Magnetic Separation; Reduction by Hydrogen; Thermal Treatment.

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1. Introduction

The most important primary sources of nickel-metal are sulfide (30 - 40%) and laterite ores (60 - 70 %). Despite the greater abundance of laterite ores, most nickel production (60%) comes from the processing of sulfide sources (Norgate and Jahanshahi, 2011). The largest production of nickel from sulfide sources can be attributed to the higher concentration of nickel in this mineral in comparison with the laterite ores and the technological challenges associated with the processing of the latter (Zevgolis et al., 2010; Kaya and Topkaya, 2011). However, as the world demands increase with a parallel decrease of the sulfide deposits, the role of the laterite sources is expected to grow significantly in a near future. Some estimates indicate it as the main source of this element within a few years (Zhai et al., 2010). Laterite deposits are formed by severe tropical weathering of other minerals, forming in general different types of lateritic nickel sources. These ores show profiles with different compositions varying from the surface to the bottom, in such a way that normally, more weathered minerals are found closer to the surface, becoming less weathered as deeper layers are reached. As a result, layers situated at different

depths are classified according to the mineralogical distribution found across the deposit and the most important are (i) limonitic, (ii) saprolitic, and (iii) transition layers where the percentage of nickel is not greater than 2.5% (Mudd, 2010). The different composition between limonitic and saprolitic ores renders the extractive process necessary to produce nickel from one of them unsuitable when applied to the other. Currently, there is no industrial hybrid process capable of efficiently extracting nickel that can be applied to either ore indistinctively (Zhu et al., 2012). Despite the lack of such a hybrid unique process, some established routes are commonly used for the different types (Oxley and Barcza, 2013). For most existing processes, minerals from the transition layer are not used as raw materials, i.e., they are normally discharged in waste dumps and, therefore, a considerable amount of nickel is lost. It is worth noting that very often nickel content in this layer of the deposit is larger than that in the limonitic ore (Mudd, 2010). The non-conformity of ores from the transition layer to the extractive processes is normally caused by the higher content of Mg when compared to limonitic ore; and by the lower content of Ni and higher content of Fe, when compared to saprolitic ore (Oxley and Barcza, 2013).

To achieve a better profit from laterite ores, several studies using classical pyrometallurgical procedures such as reduction, dehydration, drying, and calcination, followed by unitary ore dressing operations (milling and magnetic separation) have been carried out by different research groups (Sheng-Li et al., 2010; Crundwell et al., 2011; Burkin, 1987; Wang et al., 2017; Oxley et al., 2016; Zhu et al., 2004). Many reports can be found in the literature dealing with thermal treatment and reduction of these ores to improve the global yield of the Caron Process, (Ashok et al., 2019; Zhu et al., 2019). Increase nickel extraction in subsequent acid leaching steps (Li et al., 2020; Liu et al., 2010; Rao et al., 2013; Guo-Lin et al., 2014) and identify chemical transformations that take place in the ore during thermal treatment precluding a unique processing route from being proposed.

Here we point out some studies showing that it is possible to concentrate nickel in the magnetic phase after the ore is subjected to reduction and magnetic separation (Ribeiro et al., 2021; Li et al., 2012). It is important to emphasize that many of these studies were carried out with ores with low nickel content, to make it an economic mineral deposit. The present work shows the results obtained when pyrometallurgical processes of thermal decomposition and reduction with hydrogen followed by magnetic separation were applied to a lateritic ore from the transition zone (Kin et al., 2010; Zhu et al., 2012; Reddy et al., 1995; Ma et al., 1995).

2. Methodology

A sample of lateritic nickel ore from Brazil was wet sieved and the experiments were carried out with the granulometric fraction in the range between 212 μm < φ < 500 μm. After sieving, the sample was oven-dried at 105°C for 48 h and labeled as "LG".

2.1. Thermal treatment and Reduction with Hydrogen

Approximately 20 g of sample LG was subjected to thermal decomposition at 400°C and 800°C, in a tubular oven under nitrogen (99.9990 % pure) atmosphere at a flow rate of 100 mL/min for 3 h. Reduction with hydrogen (99.9990 % pure) as the reducing agent was carried out under the same conditions. Samples obtained by both procedures were labeled as shown in Table 1.

Table 1. Classification of the samples obtained in the thermal and reduction procedures

Label	Experimental Condition
TLG4	Nitrogen, 400 °C
TLG8	Nitrogen, 800 °C
RLG4	Hydrogen, 400 °C
RLG8	Hydrogen, 800 °C

2.2. Chemical Analysis

The main chemical elements present in the samples were determined by inducted coupled plasma emission spectrometry using a Varian ICP-AES model 725.

2.3. Thermogravimetric Analysis (TG)

TG curves were obtained in a Mettler Toled TG equipment, model Star System. High purity nitrogen (99.9990 %) was purged at 60 mL/min and the samples were heated at 10 °C/min between 100 °C and 850 °C.

2.4. X-Ray Diffractometry

X-ray diffractograms were obtained in a Shimadzu X-ray equipment model XRD-6100, provided with a Cu tube (45kV and 40mA) and scanning speed of 1°/min. Diffractogram analyses were carried out by comparison with standard cards from a library (ICDD – International Committee of Diffraction Data) supported by the software XRD-6100/7000 version 7.00.

2.5. Scanning Electron Microscopy (SEM) and Energy Dispersive Spectrometry (EDS)

Samples were embossed with polyester resin and, after wet sanding, were polished with diamond paste (φ = 1 μm). Metallization was carried out using graphite carbon. Subsequently, SEM-EDS images of the samples were obtained using a TESCAN equipment model VEGA 3 LMH coupled with an Oxford INCA x-act EDS equipment model 51-ADD0007.

2.6. Magnetic Separation

An INBRAS magnetic separator model WHC-01B was used in this step. Two densities of magnetic flow were applied, namely 52 mT ± 7.0 and 97.5 mT ± 10.6. The magnetic flow was monitored during the whole experiment using a previously calibrated gaussmeter.

2.7. Thermodynamic Data

The software HSC Chemistry 6.0 was used to determine all of the thermodynamic data.

3. Results

Chemical analysis for sample LG (Table 2) is compatible with ores from transition zone (Fe: 25 – 40 %, Ni: 1.5 – 1.8 %, Mg: 3 – 9 %) (Burkin, 1987). It must be pointed out that this type of ore is not used as raw material in either of the two main processing routes to obtain nickel from lateritic ores, namely, the RKEF (Rotary Kiln Electric Furnace) and the HPAL (High-Pressure Acid Leaching). Thus, this fraction from the deposit almost always becomes a residue during the mining process steps and/or lateritic ore dressing.

Table 2. Nickel, iron and magnesium in LG

Sample	Ni (%)	Fe (%)	Mg (%)
LG	1.25 ±0.06	25.8 ±1.0	2.79 ±0.25

The relevant mineral phases found in the sample X-ray diffractogram (Fig. 1) are: goethite (01-073-6522); nickeliferous goethite (00-014-0556); hematite (00-033-0664); quartz (00-046-1045), chlorites (00-022-0712; 00-060-0322), eskolaite (00-038-1479) and pleonaste (00-011-0009). The baseline in the diffractogram also shows the presence of some amorphous material, a common feature for lateritic ores, since they possess a considerable amount of intemperized minerals (Oliveira et al., 2019).

MEV-EDS images (Fig. 2) from some minerals

identified in the diffractogram show that the sample is quite heterogeneous. The images also indicate that, except for those minerals assigned to the chlorite group, nickel is not concentrated in any other mineral phase.

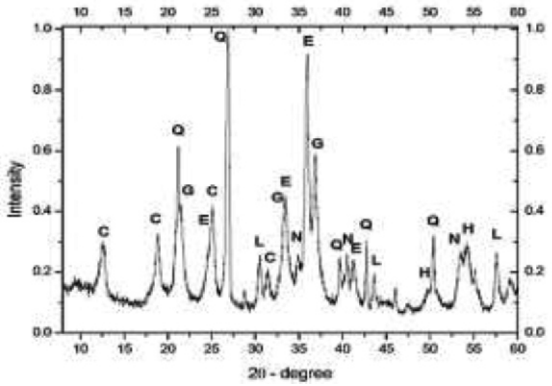

Fig. 1. X-ray diffractogram for LG: (C) chlorites; (Q) quartz; (E) eskolaite; (L) pleonaste; (N) nickelifeous goethite; (G) goethite; (H) hematite

TG and DTG curves for sample LG obtained in an inert atmosphere (Fig. 3) present four events of mass loss, identified as A, B, C, and D. Event A with 0.31 % mass loss is assigned to the release of water adsorbed in the ore and, even after drying for 48h at 100°C, the results show that the sample continues to lose water gradually. This same behavior has been reported by other researchers and it is indicative of the low crystallinity of the mineral (c.f. Fig. 1) (Liu et al., 2010; Zevgolis et al., 2010; O'Connor et al., 2006; Li et al., 2009; Mathew et al., 2007; Landers and Gilkes, 2007; Liu et al., 2013; Yang et al., 2013; Pickles et al., 2014; Pickles et al., 2015; Liu et al., 2013). The second event can be assigned to dihydroxylation of goethite according to the following equation:

$$2FeO.OH \rightarrow Fe_2O_3 + H_2O \quad (1)$$

Some values found in the literature for the decomposition temperature of goethite (385 °C and 337 °C) are considerably higher than those found in this work (267 °C). It is worth pointing out that lower values of decomposition temperature, such as those found in the present study, are associated with goethites with low crystallinity (Liu et al., 2010; Zhu et al., 2012; Reddy et al., 1995; O'Connor et al., 2006; Rhamdhani et al., 2009; Samouhos et al., 2012). A 3.71 % mass loss corresponds to 36.62% goethite in the sample, indicating that out of 25.8% of iron present, only 2.77% are not in the form of goethite. Event C is attributed to the thermal decomposition of chlorites, resulting in 3.88 % of mass loss. It starts at 425°C with a maximum rate of 567°C and ends at 700°C (Li et al., 2009). Identification of the minerals belonging to the chlorite group, present in the ore, was not carried out in this study, nevertheless, the TG/DTG curves show that this decomposition takes place over a wide range of temperature ($\Delta T \approx 275$ °C), suggesting the presence of more than one specific mineral. Moreover, diffraction peaks identified in the XRD analysis as a mineral from the chlorite group (c.f. Fig. 1), are quite large, confirming the low crystallinity of these minerals. Just as the serpentine, an ultrabasic rock, which gives origin to the lateritic deposit of nickel when it is weathered (Burkin, 1987), chlorites belong to the phyllosilicate group, whereby some Si atoms are replaced by Al atoms while some Mg atoms are substituted by Al, Fe, and Ni atoms. Therefore, serpentine was used as a model phyllosilicate for the chlorites thermal decomposition reaction, which can be represented by the following chemical equation (Krsak et al., 2005):

$$\underset{serpentine}{\frac{Mg_2Si_2O_5(OH)_4}{}} \rightarrow \underset{forsterite}{\frac{Mg_2SiO_4}{}} + \underset{enstatite}{\frac{MgSiO_3}{}} + 2H_2O$$

$$\Delta G^o = -185.9T + 120550 \text{ (J/mol)} \quad (2)$$

ΔGo values for the above reaction show that, in the standard state, the thermal decomposition of serpentine will be spontaneous above 375 °C (648K). The experimental value found (event C) is quite close to this theoretical value and the temperature range found for the thermal decomposition is similar to the

values found in the literature (Rao et al., 2013; Kekkonen et al., 2011; Hrsak et al., 2005). Dlugogorski et al. (2014) report that the values for the thermal decomposition of serpentine depend on the decomposition method studied (isothermic or non-isothermic) and display values ranging from 400 to 820°C (Dlugogorski et al., 2014). Finally, the fourth event of mass loss, between 650°C and 850°C, is due to the release of hydroxyl groups remaining in the crystalline structure of the minerals of chlorite group as well as non-stoichiometric hydroxyl groups present in these minerals (Dlugogorski et al., 2014; Yang et al., 2013; Liu et al., 2013; Oliveira et al., 2019).

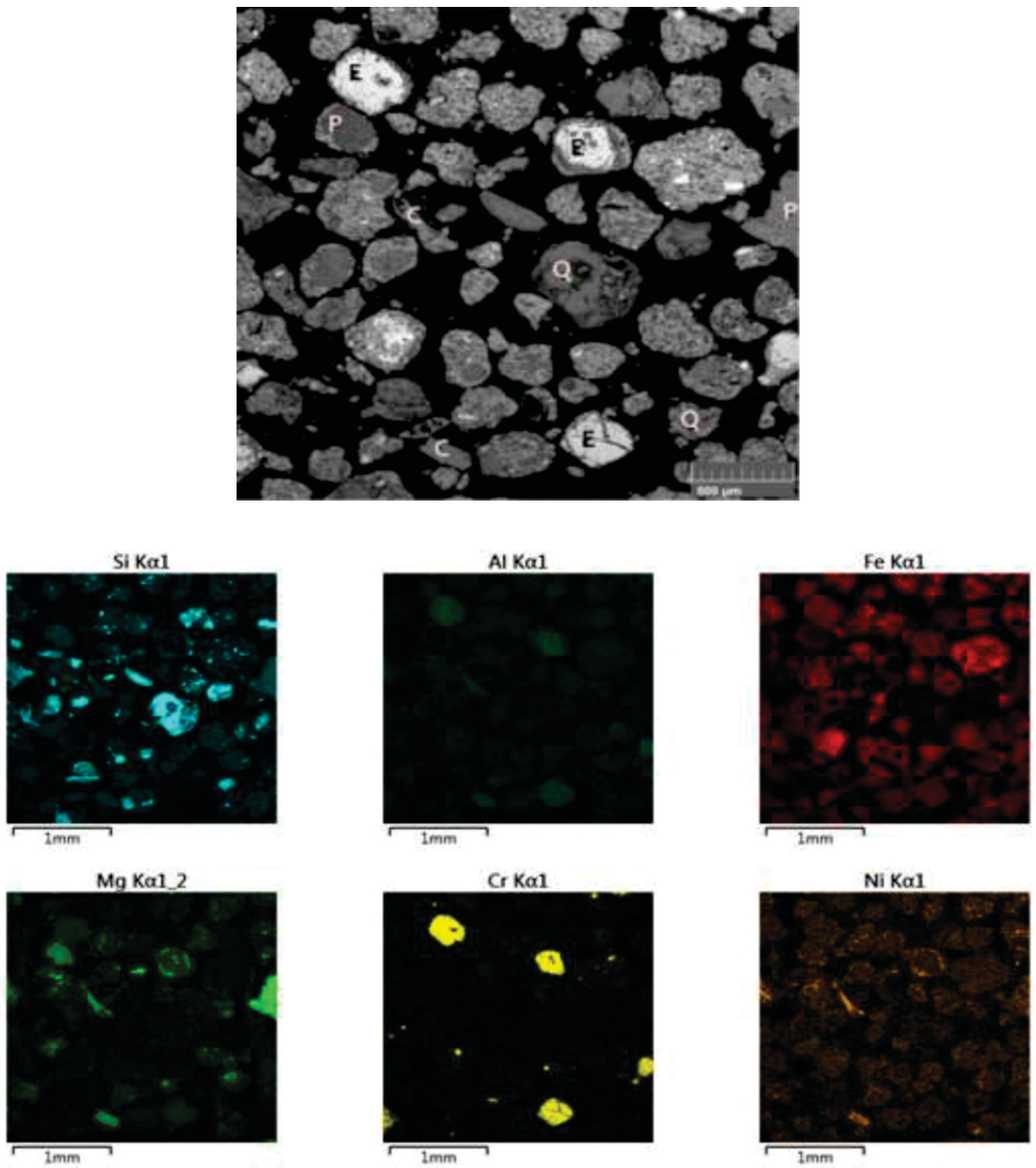

Fig. 2. MEV-EDS images for sample LG. (C) chlorites; (Q) quartz; (E) eskolaite; (L) pleonaste; (N) nickeliferous goethite; (G) goethite; (H) hematite

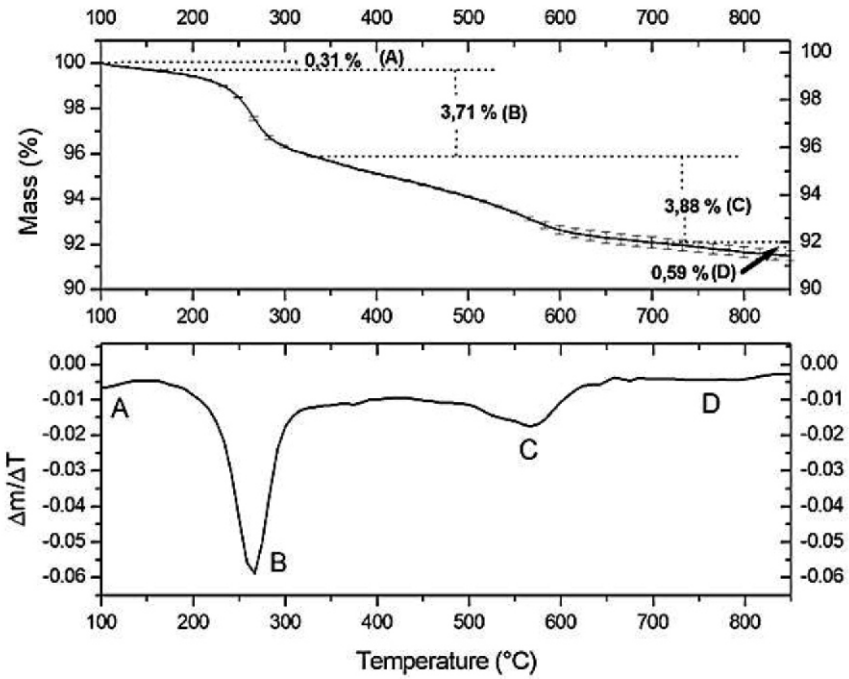

Fig. 3. TGA/DTG curves for sample LG (N2 – 60mL/min; 10°C/min)

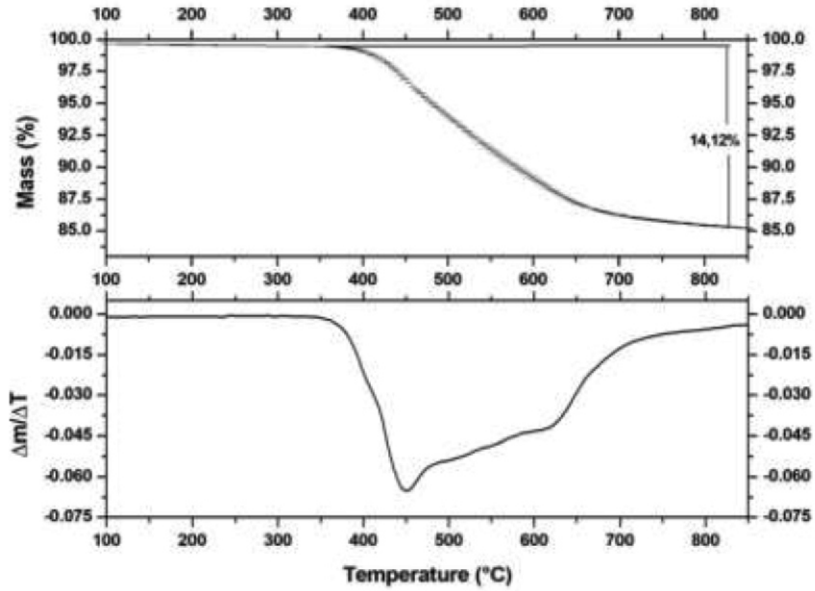

Fig. 4. TG/DTG curves of sample LG submitted to reduction with H_2 (60 mL/min; 10°C/min), after thermal decomposition

Following the thermal decomposition of sample LG under inert atmosphere (N2–99.9990%), the resulting solid product was reduced with H2 gas and this experiment was monitored by TG/DTG analysis (Fig. 4). Assuming that the main chemical elements are present as oxides in sample LG (Fe2O3, SiO2, NiO e MgO) and their activities are equal to 1, diagrams in Fig. 5 show that the only oxides that would be reduced under an H2 atmosphere (99.999%) would be iron and nickel oxides. Thus, if we presume that all of the iron is present as hematite and the nickel as NiO, the theoretical mass loss would be 11.04%. In the TGA curve, this loss corresponds to 14.12%, and, give or take a slight difference in composition, this

no remarkable differences were observed in the TMAN values within Broiler, Desi and Aseel chicken breeds. The current findings were similar to the study of Goulas & Kontominas (2005), who evaluated the quality of salted and smoked chub mackerel and reported 1% TMAN values. TMAN represents the degree of breakdown of proteins and non-protein nitrogen compounds (Zhao et al, 2019). It is formed from the microbial and enzymatic amino acid decarboxylation, thus reflects the extent of meat spoilage (Raeisi et al, 2019). Among the nitrogenous components, urea and trimethylamine oxide (TMAO) are broken down into volatile ammonia-based compounds by microbial action. Kahraman et al, (2015) reported an acceptable level of 10 mg TMAN for fresh poultry meat that can serve to be a fine detector of biogenic amines due to its volatile nature.

3.8.Reducing Sugar

The current study investigated no effect of cooking on the reducing sugar contents of Broiler, Desi and Aseel chicken varieties (Table III). Likewise, Tengilimoglu-Metin & Kizil (2017) explored the glucose and fructose contents of 0.15 mg/g and 0.16 mg/g in raw chicken meat, respectively and found no effect of cooking on reducing sugar levels in meat. However, Gibis & Weiss (2010) and Liao et al, (2009) found that the glucose level significantly decreased during frying. Reducing sugars tend to contribute to the Maillard reaction with free amino acids and creatinine, thus leading to the formation of heterocyclic amines in meat at temperatures above 150°C (Haskaraca et al, 2014). However, these no remarkable differences were observed in the TMAN values within Broiler, Desi and Aseel chicken breeds. The current findings were similar to the study of Goulas & Kontominas (2005), who evaluated the quality of salted and smoked chub mackerel and reported 1% TMAN values. TMAN represents the degree of breakdown of proteins and non-protein nitrogen compounds (Zhao et al, 2019). It is formed from the microbial and enzymatic amino acid decarboxylation, thus reflects the extent of meat spoilage (Raeisi et al, 2019). Among the nitrogenous components, urea and trimethylamine oxide (TMAO) are broken down into volatile ammonia-based compounds by microbial action. Kahraman et al, (2015) reported an acceptable level of 10 mg TMAN for fresh poultry meat that can serve to be a fine detector of biogenic amines due to its volatile nature.

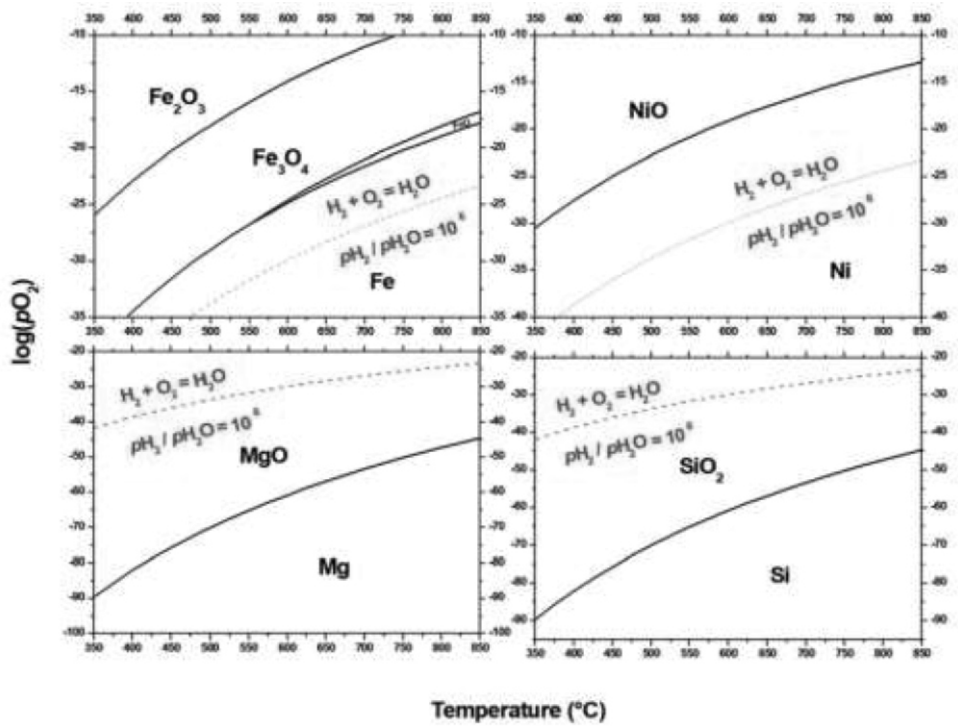

Fig. 5. Diagram's log(pO2) as a function of T for iron, nickel, magnesium, and silicon oxides. The red dotted lines represent the pressure of O2 generated by the H2 (99.999 %) atmosphere as a function of temperature

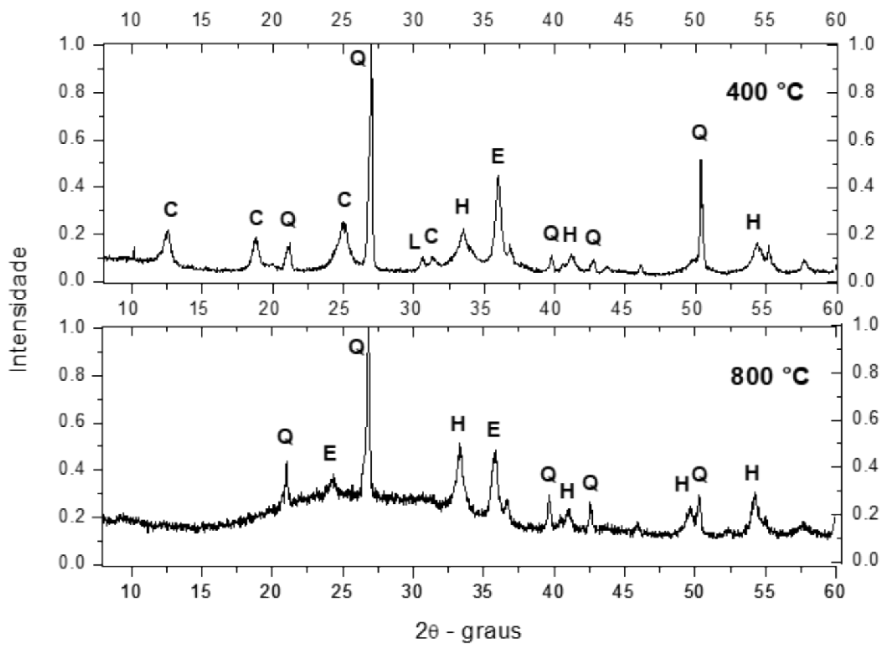

Fig. 6. X-ray diffractograms for sample LG after thermal treatments at 400°C and 800°C. (C) chlorite; (Q) quartz; (H) hematite; (E) eskolaite; (L) pleonaste

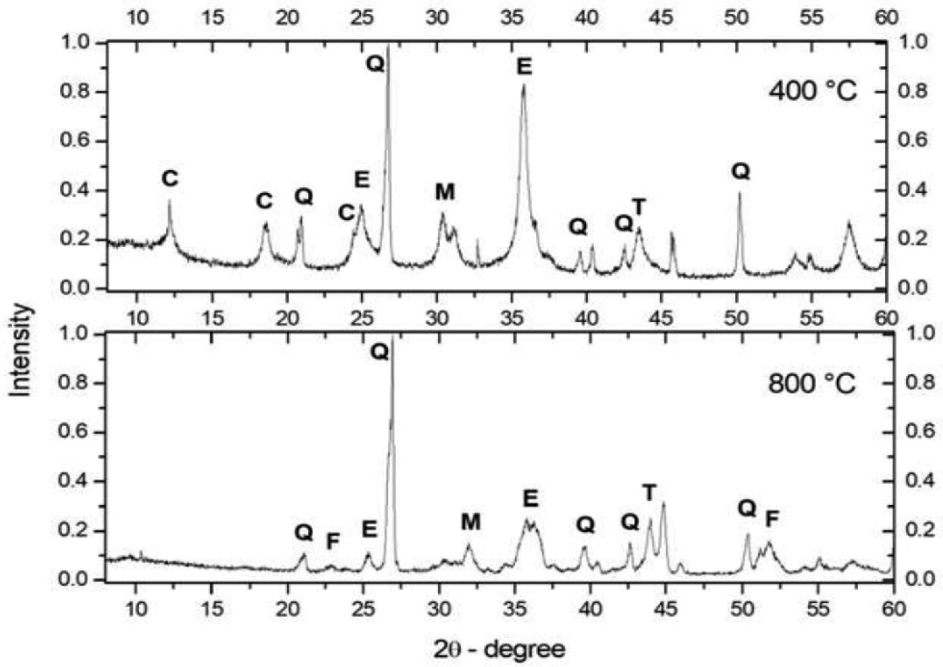

Fig. 7. X-ray diffractograms for sample LG after reduction with H2 at 400°C and 800°C. (C) chlorite; (Q) quartz; (E) eskolaite; (M) magnetite; (F) fosterite; (T) tetrataenite

After the thermal treatments at 400 and 800°C, the samples were subjected to a magnetic separation operation. The recovery values and the contents of the main elements in the fractions generated by using a low density of 52mT ± 7.0 are shown in Fig. 8. For the LG sample without heat treatment, it is evident that only the iron content is increased in the magnetic fraction and this can be explained by the considerably higher nickel content in silicate minerals than in minerals containing iron as a major element (goethite); therefore, if no mineral changes are made in the sample, it is expected that the phase containing more silicon and magnesium (non-magnetic fraction) is richer in nickel. The results also show that most of the magnesium (≈70 %) was recovered in the non-magnetic fraction and that there was practically no preferential distribution of iron and nickel between the two fractions. It is worth mentioning that nickel and iron are widely distributed in all minerals present in lateritic ore and (c.f. Fig. 2 - EDS), therefore, although these elements are more concentrated in certain mineral phases, the contribution of this concentration in the distribution between fractions was not significant.

After the thermal treatment at 400°C, the minerals from the chlorite group were not decomposed and, therefore, the behavior of magnesium was practically the same as that found for the sample LG. At this temperature, goethite is decomposed to hematite and, although iron and nickel levels have increased, the distribution of these elements in the magnetic and non-magnetic fractions followed the same behavior of sample LG without treatment. However, the content of nickel and iron in the magnetic phase was reduced. Finally, when the thermal treatment was carried out at 800°C, it was possible to recover most of the nickel (> 80 %) in the magnetic fraction and reduce the magnesium content in that fraction. The results also show that the thermal decomposition of chlorites favored the recovery of magnesium in the magnetic fraction.

The contents of the elements nickel, iron, and magnesium in each of the fractions generated after magnetic separation by applying a magnetic flux density of 52 mT ± 7.0 (Table 3) indicate that it was possible to reduce the magnesium content under all experimental conditions used and that the thermal treatment of the sample increased the nickel content in the magnetic fraction. It is worth mentioning that magnesium is the main consumer of acid in the HPAL process and, therefore, high levels of this element in lateritic ore prevent its use as a raw material for this process. Table 3 also shows that all magnetic fractions generated can be classified as limonitic ore.

There was no significant change in the contents of nickel, iron, and magnesium for the sample LG when the flow density of the magnetic separation was increased to 97.5 mT ± 10.6 (Fig. 9). On the other hand, the content of nickel and iron in the magnetic fraction was considerably higher (> 60 %) whereas no preferential recovery of magnesium in any of the fractions was observed. In other words, a comparison of these results with those obtained with a lower flow density indicates that, since iron is present in almost all mineral phases, separation of the fractions is less efficient when a higher magnetic flow density is used.

The results also show that for the higher magnetic flow density (97.5 mT ± 10.6) the increase in the thermal treatment temperature improved the contents and the recovery of nickel and iron in the magnetic fraction. For the experiments carried out after heat treatment at 800°C, just a small amount of magnesium was removed from the magnetic fraction although the contents of this element were reduced in the magnetic fraction.

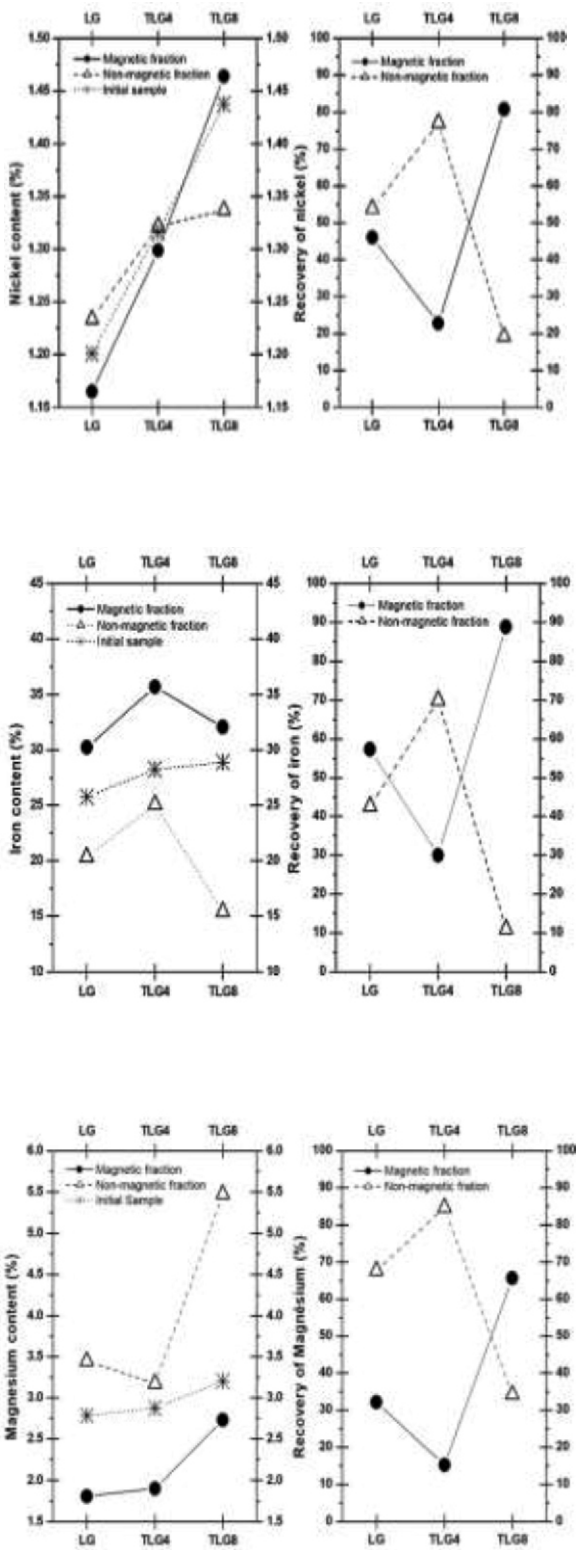

Fig. 8. Plots showing the content and recovery of nickel, iron, and magnesium for sample LG after thermal treatment at 400 and 800°C, and magnetic separation with a magnetic flow density of 52 mT ± 7.0.

Table 3. Composition of the samples generated after magnetic separation with a magnetic flow density of 52 mT ± 7.0

Sample		Ni (%)	Fe (%)	Mg (%)	Typology
LG	Magnetic	1.17	30.26	1.81	Limonitic
	Non-magnetic	1.23	20.34	3.45	-
TLG4	Magnetic	1.30	35.74	1.9	Limonitic
	Non-magnetic	1.32	25.07	3.18	-
TLG8	Magnetic	1.46	32.09	2.73	Limonitic
	Non-magnetic	1.33	15.40	5.48	-

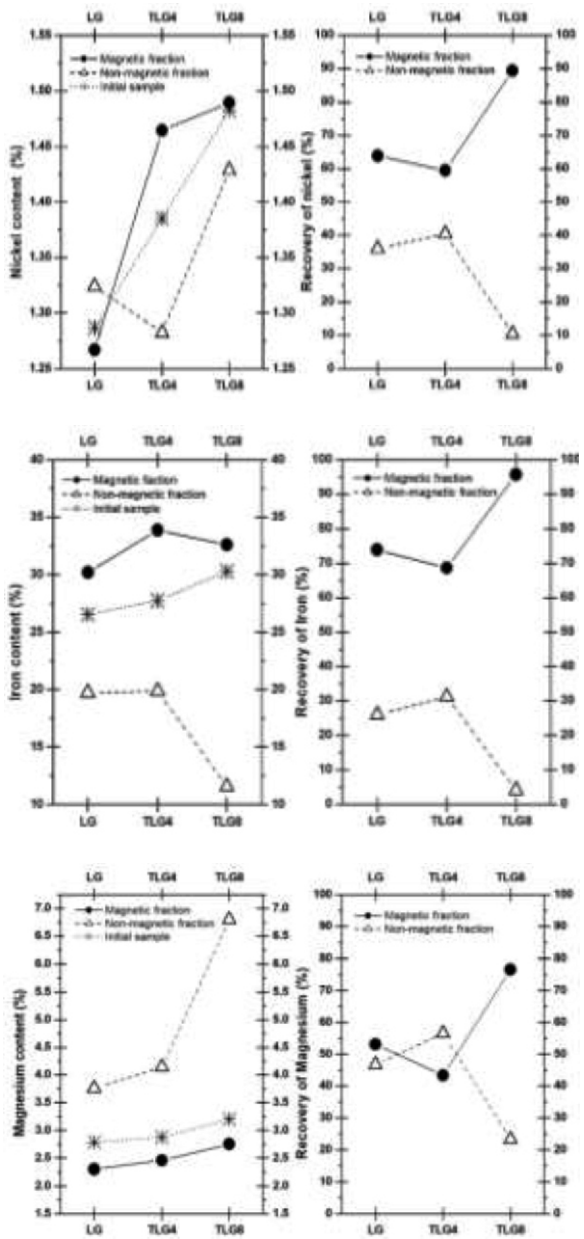

Fig. 9. Plots showing the content and recovery of nickel, iron, and magnesium for sample LG after thermal treatment at 400 and 800°C, and magnetic separation with a magnetic flow density of 97.5 mT ± 10.6

With a higher magnetic flow density (97.5 mT ± 10.6) it was possible to reduce the magnesium content in the magnetic fractions under all experimental conditions uses and the nickel content in these fractions increased after the thermal treatment of the sample (Table 4.

The sample LG was also submitted to magnetic separation operations after reduction experiments at temperatures of 400°C and 800°C and, as a first approach, a magnetic flow density of 52mT ± 7.0 was used. In this case, the contents of Ni and Fe were higher and the content of Mg was lower in the magnetic fraction (Fig. 10) than those found for the pristine LG sample, regardless of the reduction temperature used.

The nickel content in the RLG8 sample was 33 % higher than that of the LG sample. Recovery values show that when magnetite formation took place (sample RLG4), there was no selectivity in the separation of the mineral phases since the sample became very magnetic.

By increasing the temperature to 800°C the sample became less magnetic since magnetite was reduced to metallic iron and, consequently, the separation was more selective. Table 5 shows that the contents of all elements in the generated magnetic fractions allow classifying this fraction as a limonitic ore

Fig. 10. Plots showing the extraction and yield of nickel, iron, and magnesium for sample LG after reduction with hydrogen at 400 and 800°C, and magnetic separation with a magnetic flow density of 52 mT ± 7.0.

Table 4. Composition of the samples generated after magnetic separation with a magnetic flow density of 97.5 mT ± 10.6

Sample		Ni (%)	Fe (%)	Mg (%)	Typology
LG	Magnetic	1.27	30.23	2.30	Limonitic
	Non-magnetic	1.32	19.73	3.76	-
TLG4	Magnetic	1.47	33.88	2.46	Limonitic
	Non-magnetic	1.28	19.88	4.15	-
TLG8	Magnetic	1.49	32.63	2.75	Limonitic
	Non-magnetic	1.42	11.59	6.80	-

Table 5. Composition of the samples generated after magnetic separation, following reduction with the hydrogen of LG sample, with a magnetic flow density of 52 mT ± 7.0

Sample		Ni (%)	Fe (%)	Mg (%)	Typology
LG	Magnetic	1.17	20.34	1.81	Limonitic
	Non-magnetic	1.23	25.05	3.45	-
TLG4	Magnetic	1.31	28.54	2.78	Limonitic
	Non-magnetic	1.29	7.54	6.16	-
TLG8	Magnetic	1.67	38.04	2.54	Limonitic
	Non-magnetic	1.36	24.08	3.47	-

Table 6. Composition of the samples generated after magnetic separation, following reduction with the hydrogen of LG sample, with a magnetic flow density of 97.5 mT ± 10.6

Sample		Ni (%)	Fe (%)	Mg (%)	Typology
LG	Magnetic	1.27	30.23	2.30	Limonitic
	Non-magnetic	1.32	19.73	3.76	-
TLG4	Magnetic	1.39	28.95	3.02	Limonitic
	Non-magnetic	1.38	8.62	6.02	-
TLG8	Magnetic	1.69	36.85	2.67	Limonitic
	Non-magnetic	1.15	8.62	4.27	-

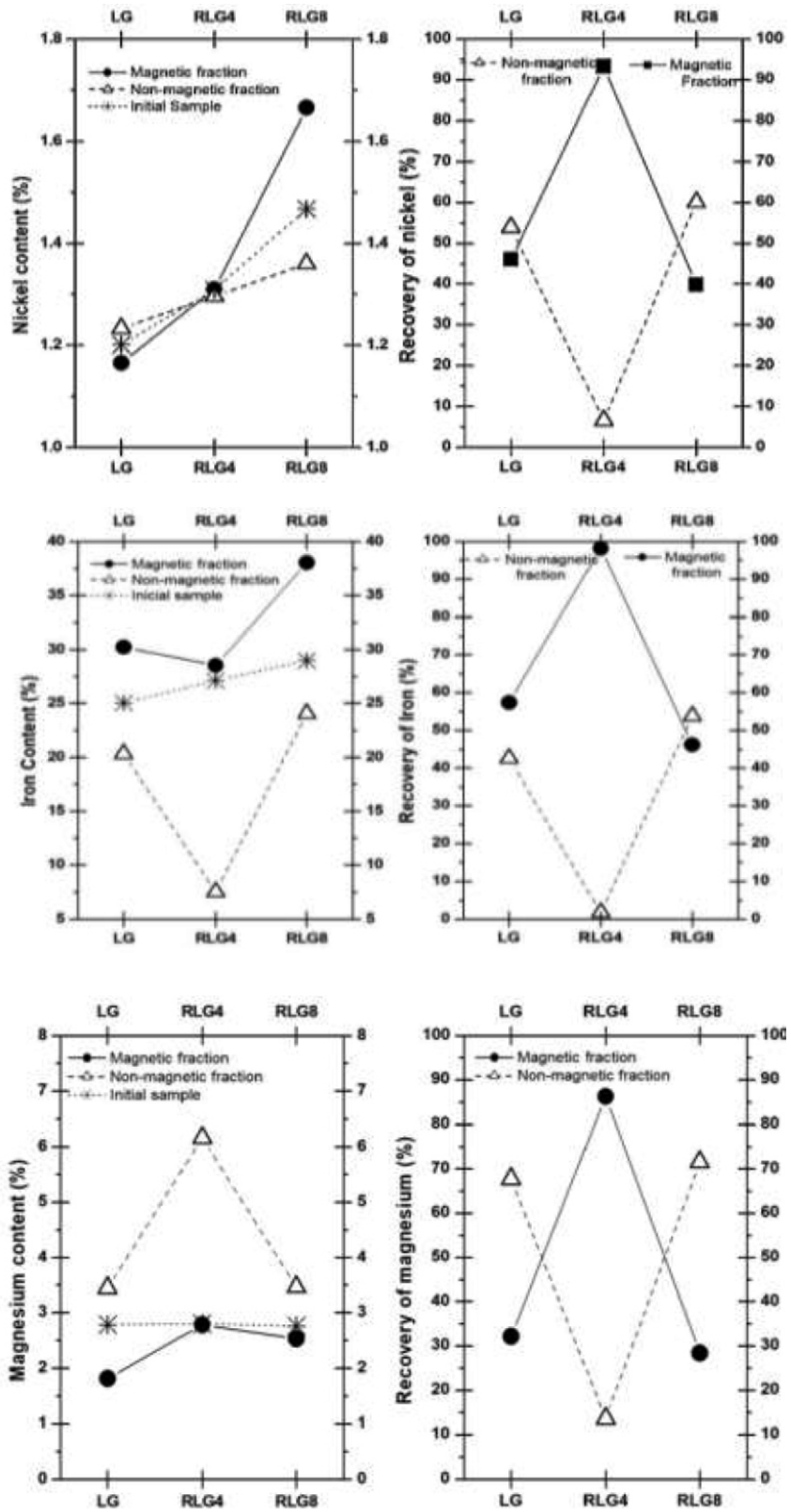

Fig. 10. Plots showing the extraction and yield of nickel, iron, and magnesium for sample LG after reduction with hydrogen at 400 and 800°C, and magnetic separation with a magnetic flow density of 52 mT ± 7.0

By increasing the magnetic flow density to 97.5 mT ± 10.6 the formation of magnetite rendered the

sample very magnetic and, again, the operation was not selective (Fig. 11). On the other hand, upon increasing the reduction temperature to 800°C, the nickel content in the magnetic fraction increased by 35 % and the yield of this same element was ≈75 %. Under these experimental conditions, the contents of all the elements studied fall within the range associated with a limonitic ore (Table 6).

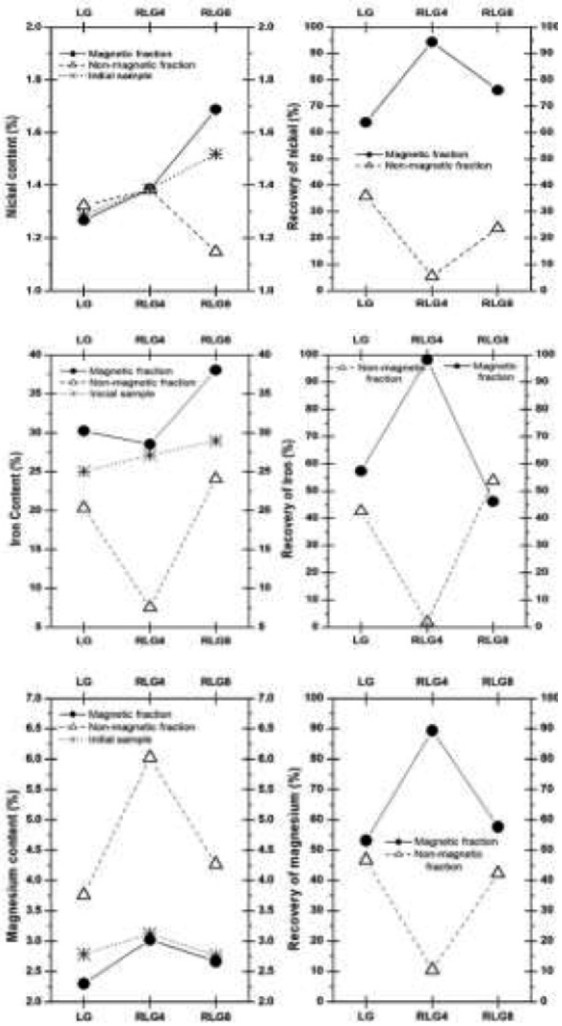

Fig. 11. Plots showing the extraction and yield of nickel, iron, and magnesium for sample LG after reduction with hydrogen at 400 and 800°C, and magnetic separation with a magnetic flow density of 97.5 mT ± 10.6

4. Conclusions

Experiments of thermal decomposition and reduction with the hydrogen of a lateritic ore in the transition zone were carried out in a tubular oven at temperatures of 400°C and 800 ° C and the products were subjected to magnetic separation operations. The main mineral transformations were identified by the X-ray diffraction technique. The results showed that it was possible to increase the nickel content present in the transition ore by 35 % with a yield of approximately 75 % when the reduction with H2 was carried out at 800°C and a magnetic flow density of 97.5 mT ± 10.6 was used. The magnesium content in the magnetic fractions was reduced for all experiments carried out and these fractions could also be classified as limonitic ore.

Acknowledgments

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References

Burkin, A.R. (1987). Extractive metallurgy of nickel. *John Wiley & Sons, New York.*

Bunjaku, A., Kekkonen, M., Pietilä, K., & Taskinen, P. (2012). Effect of mineralogy and reducing agent on reduction of saprolitic nickel ores. *Mineral Processing and Extractive Metallurgy,* 121(3), 156-165.

Chang, Y. F., Zhai, X. J., Yan, F., LI, B. C., & ZHANG, T. A. (2008). Phase transformation in reductive roasting of laterite ore with microwave heating. *Transactions of Nonferrous Metals Society of China*, 18(4), 969-973.

Valix, M., & Cheung, W. H. (2002). Study of phase transformation of laterite ores at high temperature. *Minerals Engineering,* 15(8), 607-612.

Crundwell, F., Moats, M., Ramachandran, V., Robinson, T., & Davenport, W. G. (2011). Extractive metallurgy of nickel, cobalt and platinum group metals. *Elsevier.*

Dalvi, A. D., Bacon, W. G., & Osborne, R. C. (2004). The past and the future of nickel laterites. *In PDAC Int. Convention, Trade Show & Investors Exchange* (pp. 1-27). Toronto, Ontario.

Dlugogorski, B. Z., & Balucan, R. D. (2014). Dehydroxylation of serpentine minerals: Implications for mineral carbonation. *Renewable and Sustainable Energy Reviews*, 31, 353-367.

Guo-lin, Z., De-qing, Z., Jiang, P., Qi-hou, L. Yue-ming, A., and Zhi-hong, L. (2014). *J. of Central South Uni. Tech.* vol. 21, pp. 1771-1777.

Hršak, D., Malina, J. and Hadžipašić, A.B. (2005). *Materiali in Tehnologije,* vol. 39, pp. 225-227.

Kaya, Ş., & Topkaya, Y. A. (2011). High pressure acid leaching of a refractory lateritic nickel ore. *Minerals Engineering,* 24(11), 1188-1197.

Kekkonen, M., Bunjaku, A., & Holappa, L. (2011). Thermal behaviour of hydrous Ni-Mg silicates when heating up to 750° C. *Mineral Processing and Extractive Metallurgy,* 120(3), 139-146.

Kim, J., Dodbiba, G., Tanno, H., Okaya, K., & Fujita, T. (2010). Calcination of low-grade laterite for concentration of Ni by magnetic separation. *Minerals Engineering,* 23(4), 282-288.

Landers, M., & Gilkes, R. J. (2007). Dehydroxylation and dissolution of nickeliferous goethite in New Caledonian lateritic Ni ore. *Applied Clay Science,* 35(3-4), 162-172.

Landers, M., Gilkes, R.J., & Wells, M. (2009). Dissolution kinetics of dehydroxylated nickeliferous goethite from limonitic lateritic nickel ore. *Applied Clay Science,* 42(4), 615-624.

Li, G., Shi, T., Rao, M., Jiang, T., & Zhang, Y. (2012). Beneficiation of nickeliferous laterite by reduction roasting in the presence of sodium sulfate. *Minerals Engineering,* 32, 19-26.

Li, J., Li, X., Hu, Q., Wang, Z., & Li, L. (2009). Effect of pre-roasting on leaching of laterite. *Hydrometallurgy,* 99(1-2), 84-88.

Li, Y. J., Sun, Y. S., Han, Y. X., & Peng, G. A. O. (2013). Coal-based reduction mechanism of low-grade laterite ore. *Transactions of Nonferrous Metals Society of China*, 23(11), 3428-3433.

Liu, W. R., Li, X. H., Hu, Q. Y., Wang, Z. X., Gu, K. Z., Li, J. H., & Zhang, L. X. (2010). Pretreatment study on chloridizing segregation and magnetic separation of low-grade nickel laterites. *Transactions of Nonferrous Metals Society of China,* 20, s82-s86.

Liu, H., Chen, T., Zou, X., Qing, C., & Frost, R. L. (2013). Thermal treatment of natural goethite: Thermal transformation and physical properties. *Thermochimica Acta,* 568, 115-121.

Ma, B., Wang, C., Yang, W., Yin, F., & Chen, Y. (2013). Screening and reduction roasting of limonitic laterite and ammonia-carbonate leaching of Ni-Co. to produce a high-grade iron concentrate. *Minerals Engineering,* 50, 106-113.

Mudd, G.M. (2010). Global trends & environmental issues in nickel mining: Sulfides versus laterites. *Ore Geology Reviews,* 38(1), 9-26.

Norgate, T., & Jahanshahi, S. (2011). Assessing the energy & greenhouse gas footprints of Ni-La Proc. *Minerals Engineering,* 24(7), 698-707.

O'Connor, F., Cheung, W.H., & Valix, M. (2006). Reduction roasting of limonite ores: effect of dehydro. *Int. J. of Min. Pro*, 80(2-4), 88-99.

Oxley, A., & Barcza, N. (2013). Hydro–pyro integration in the processing of nickel laterites. Minerals Engineering, 54, 2-13.

Oxley, A., Mark, E.S. and Omar, C. (2016). *Minerals Engineering,* vol. 88, pp. 53-60.

Oliveira, D.V., Lana, R.D.J.T., Da Silva, & Dos Santos, C. G. (2020). Kinetic Studies of the Reduction of Limonitic Ni-Ore by Hydrogen. *Met. & Mat. Tran. B,* 51(4), 1418-1431.

Pickles, C. A., & Elliott, R. (2015). Thermodynamic analysis of selective reduction of nickeliferous limonitic laterite ore by carbon monoxide. *M. Pro. & Extractive Metallurgy,* 124(4), 208-216.

Pickles, C. A., Forster, J., & Elliott, R. (2014). Thermodynamic analysis of the carbothermic reduction roasting of a nickeliferous limonitic laterite ore. *Minerals Engineering*, 65, 33-40.

Rhamdhani, M. A., Hayes, P. C., & Jak, E. (2009). Nickel laterite Part 2–thermodynamic analysis of phase transformations occurring during reduction roasting. *Mineral Processing and Extractive Metallurgy*, 118(3), 146-155.

Rao, M., Li, G., Jiang, T. A. O., Luo, J. U. N., Zhang, Y., & Fan, X. (2013). Carbothermic reduction of nickeliferous laterite ores for nickel pig iron production in China: a review. *The Minerals, Metals & Materials Society,* 65, 1573-1583.

Reddy, B. R., Murthy, B. V. R., & Ray, H. S. (1995). Correlation of Ni-Extraction with iron reduction in oxidic Ni-ore by a thermogravimetric method. *Thermochimica acta,* 264, 185-192.

Ribeiro, P. P. M., dos Santos, I. D., Neumann, R., Fernandes, A., & Dutra, A. J. B. (2021). Roasting and Leaching Behavior of Nickel Laterite Ore. *Metallurgical and Materials Transactions B,* 52(3), 1739-1754.

Samouhos, M., Taxiarchou, M., & Devlin, E. (2012). Microwave reduction of a nickeliferous laterite ore. *Minerals Engineering,* 34, 19-29.

Chen, S. L., Guo, X. Y., & Li, D. (2010). Extraction of valuable metals from low-grade nickeliferous laterite ore by reduction roasting-ammonia leaching method. *J.C.S. Uni. T.* 17(4), 765-769.

Shuai, Y. U. A. N., Zhou, W. T., Li, Y. J., & Han, Y. X. (2020). Efficient enrichment of nickel and iron in laterite nickel ore by deep reduction and magnetic separation. *Transactions of Nonferrous Metals Society of China,* 30(3), 812-822.

Utigard, T. A., Wu, M., Marin, T. (2005). Reduction kinetics of Goro nickel oxide using hydrogen. *Chemical Engg. Science,* 60(7), 2061-2068.

Wang, Z., Chu, M., Liu, Z., Wang, H., Zhao, W., Gao, L. (2017). Preparing Ferro-Nickel Alloy from Low-Grade Laterite Ni-Ore Based on Metallized Reduction–Magnetic Separation. *Metals,* 7, 313.

Yang, J., Zhang, G., Ostrovski, O. (2013). Changes in an Australian laterite ore in the process of heat treatment. *Minerals Engineering,* 54, 110-115.

Zevgolis, E., Zografidis, C., & Devlin, E. (2010). Phase transformations of nickeliferous laterites during preheating and reduction with carbon monoxide. *J. th. A. & C.,* 100(1), 133-139.

Zhai, Y., Mu, W., Liu, Y., Xu, Q. (2010). Coarsening rate of microstructure in semi-solid aluminium alloys. *Transactions of Nonferrous Metals Society of China*, vol. 20, 1, pp. s65-s70.

Zhu, D. Q., Yu, C., Hapugoda, S., Vining, K., & Jian, P. (2012). Mineralogy and crystal chemistry of a low-grade nickel laterite ore. *Tran. of Nonferrous Metals S. of China*, 22(4), 907-916.

Zhu, D. Q., Yu, C., Hapugoda, S., & Jian, P. (2012). Mineralogy and crystal chemistry of a low-grade nickel laterite ore. *Transactions of Nonferrous Metals Society of China*, 22(4), 907-916.

Zhu, D. Q., Cui, Y., Vining, K., Hapugoda, S., Douglas, & Zheng, G. L. (2012). Upgrading low nickel content laterite ores using selective reduction followed by magnetic separation. *Int. Journal of Mineral Processing,* 106, 1-7.

Zhu, D., Pan, L., Guo, Z., & Zhang, F. (2019). Utilization of limonitic nickel laterite to produce ferronickel concentrate by the selective reduction-magnetic separation process. *A. P. Tech.,* 30(2), 451-460.

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Reduction of Power losses by Repetitive Controller and Phase Modulation based DVR

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Abstract. The utility voltages are experiencing significant power quality problems like grid voltage dip, unbalanced 3- phase voltage, and voltage fluctuations owing to diverse load conditions and increasing disturbances at the distribution side of the power system. Among all other Custom power devices to solve grid control issues, the dynamic voltage restorer (DVR) consisting of a power electronics converter can nurture the load amid grid voltage variations; hence protect the sensitive electronic equipment, whereas current quality can be improved using Hybrid Active Power Filter. The purpose of this article is to address the issues related to grid voltage sag and swell compensation and the diminishment of total harmonic distortion. In this paper power, quality improvement through DVR with two control methods is investigated and the results are compared for both techniques. The outcomes of proposed control techniques, DVR and HAPF are discussed, correlated, and validated using MATLAB simulation software.

Keywords: Dynamic Voltage Restorer; Power Quality; Phase Modulation, Repetitive Controller, MATLAB.

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1. Introduction

Electricity plays a vital role to run machinery in factories and industrial units, to light our metropolises and powering equipment, H. Arango (2002). To maintain the power quality maintain is the real challenge as the large current carrying capacity of devices makes them prone to power losses, overheating in contrast to transmission lines which carry high voltages and low current, H.De Keulenaer and Rosli Omar (2003, 2011). The utility voltage dip and surge are the critical grid power quality issues that are dangerous to electric power equipment and cause huge financial loss to industries annually, F.A.L Jowder (2009). The different types of problems related to electric power are voltage flicker, dip, surge, interruption, and distortion (C. Chang, Y. Ho 2000, P. Loh, R. Targosz and J. Manson 2007). Usually, around 10 to 90% of PQ issues are produced by voltage sags and swells J. Y. Chan and J. V. Milanovic (2015). Inrush currents, faults, lightning strokes are the reasons for voltage sags whereas voltage swells are caused due by a single line to ground fault or sudden lowering of loads F. C. Trindade, K. V. do Nascimento, and J. C. Vieira (2013). Voltage dip is the drop in voltage amplitude for 1 min that lasts for half cycle can be from 0.1 Pu to 0.9 Pu (A. M. Rauf and V. Khadkikar 2015, C. Benachaiba and B. Ferdi 2008, P. Li and Y. Hu 2017). Even if these defects last for a short interval, they can cause damage to computer and electrical equipment

E. Babaei, M. F. Kangarlu (2012). Voltage surge is the rise in voltage level for 1 min that lasts for half cycle can be from 1.1 pu to 1.8 pu. Electrical loads during grid voltage variations, a dynamic voltage restorer DVR is usually employed F. Z. Peng, L. Chen, and F. Zhang (2003).

Furthermore, (PLL) control is utilized for the compensation of nonlinear voltages with DVR. FUZZY control-based DVR is suggested for the enhancement of voltage stability in a grid-connected system. Similarly, DVR structure based on buck-boost converter topology is utilized to overcome voltage disturbances M. R. Banaei, R. Alizadeh, N. Jahanyari, and E. S. Najmi, (2016). Effective utilization for the transfer of bulk power on an existing transmission line is done with the help of using Matrices converter-based DVR by injecting desired voltage M.-K. Nguyen, Y.-G. Jung, and Y.-C. Lim (2009). PWM direct converter-based DVR is used for fast control of voltage flicker, harmonics current, frequency, and voltage regulation 4Rosli Omar, et al (2011). The cascaded topology is employed to provide improved stability of system J. Anderson and F. Z. Peng (2008).

DVR is presented by A. M. Rauf and V. Khadkikar (2015) with the main focus of the design of urgent, voltage, active power, and characteristics, and the design is explained and discussed. In the structure work of H. Kim and K. Sul (2005) DVR, the design considerations of the DVR line filter are also explained. Repetitive control was introduced to ameliorate recurring interference and keep track of periodical reference signals with null tracking errors. Repetitive control was used to diminish speed variations in the electrical motors, although, later was widely used in the applications of power electronics. A complete investigation of the several repetitive control methods is being manifested. In a three-phase Zahra, S. et al.PWM inverter with constant voltage and constant frequency, repeated control is employed to achieve voltage at the output with less perversion. With a repeatable controller, the current at the output of the three-phase rectifier is utilized to reach zero tracking error and improve the PF. The RC introduced in this article can be applied more widely to improve voltage drop, harmonic voltage imbalance with the DVR system. Unlike other solutions that have significant applicability, only one of the controllers is required to overcome the three interferences synchronously. The control structure includes a network voltage feed-forward technique to ameliorate the nonlinear response of the system. In this paper DVR and HAPF accomplishing two control methods are modeled in MATLAB.

Several researchers have proposed different control approaches for improving power quality. In this paper, comparative analysis between phase modulation control and the repetitive controller is being manifested for the efficient performance of DVR. The proposed techniques for power quality improvement contains the following objectives,

- Power quality improvement (voltage dip/ surge and harmonics mitigation) using DVR.
- Comparative analysis of Phase modulation control method and HAPF based Repetitive Control method.

2. Dynamic voltage resistor

The typical circuit of a DVR that comprises of a 1-phase ac to ac converter and its input is connected to parallel with line voltage V-load load voltage and V-line line voltage are in series with its output through a line frequency transformer which provides essential electrical isolation and safety Z. Qin, P. C. Loh, and F. Blaabjerg (2016). Amid utility voltage dip and surge,

the converter is supposed to inject positive and negative voltage in series with line voltage, respectively, to balance the Vload J. Kaniewski, Z. Fedyczak, and G. Benysek (2014). It is primarily positioned between the supply side and the load. Other than overcoming voltage dips and swells, DVR can also compensate for harmonics, transients, and fault currents restrictions J. Anderson and F. Z. Peng (2008). DVR is a FACTS device that maintains a stable load voltage by compensating the supply voltage at the time of a dip or swell.

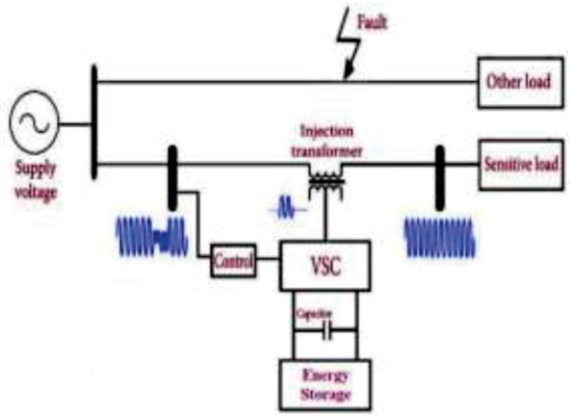


Fig. 1. Typical configuration of DVR

When the supply voltage decreases from a standard value caused by any defects, series voltage VDVR is infused via DVR, and the voltage is regulated to the required value

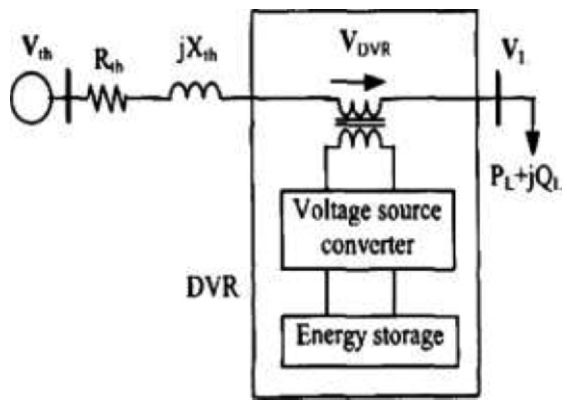


Fig. 2. DVR Equivalent Circuit

$$V_{DVR} = V_{Load} + Z_S * \mathrm{I}_{Load} \quad V_S \qquad (1)$$

Where Vload is Voltage at load, Zs = Source impedance, Iload = Load Current, Vs is Source voltage. Considering Iload as IL, Vload as VL, Zs as ZTh, and Vs as VTh. The load current IL is given as

$$I_L = \frac{[P_L + jQL]}{V} \qquad (2)$$

The equation (2) can be rewritten by considering VL as a reference:

Where ∝, β and δ are the angles of VDVR, ZTh, and VTh respectively. Θ is the power angle.

$$\theta = \tan^{1} \frac{Q_L}{P_L}$$

DVR injecting complex power injection is calculated as

$$S_{DVR} = V_{DVR} I^*$$

3. Hybrid Active Power Filter (HAPF)

Harmonic filters are used to control harmonics in a system. They are classified into 3 categories passive, active and hybrid. Passive filters are programmed to work on specific frequencies using an LC circuit and they are simple but unstable to change voltage and current. Active filters use inverter circuits to filter harmonics, they are very stable in the case of harmonics. Fig. 3 shows the 3 phase HPAF used in the proposed system.

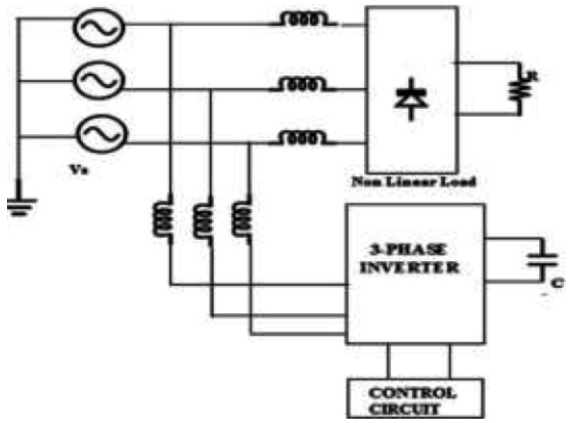


Fig. 3. Three Phase Active Power Filter

Fig. 4 displays the modeling of the tested system across the sensitive load with DVR.

4. Hybrid Active Power Filter (HAPF)

4.1. Phase Modulation Control method

The suggested method utilizes the error signal which is the distinction between the real data and the calculated data to provoke the inverter's switches.

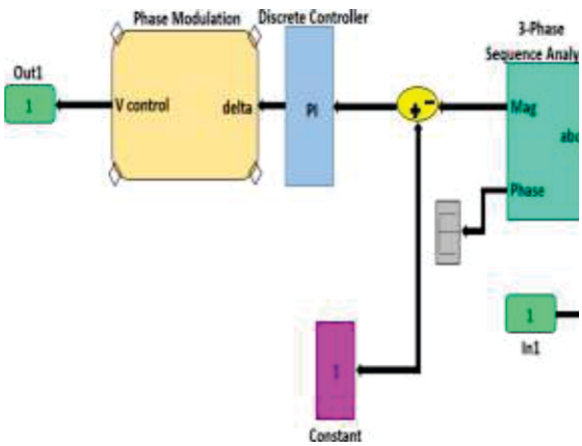


Fig. 5. Control Circuit

It employs a feed-forward approach that utilizes the above error signal to generate gate pulses. The values of load are determined by the sequence analyzer and are then compared with the reference value. PCC fed the desired voltage and current using the Pulse Width Modulation method. The control circuit is shown in Fig. 5. Three-phase fault causes sag/swell of voltage on load terminals. A sequence analyzer usually passes and senses the load voltage. The reference voltage (Vref) is compared with the magnitude, whereas (PWM) pulse width modulation is a technique that is validated for switching of inverter and causes 3-phase 50 Hz sinusoidal voltage on load side as well as maintaining 1 p.u across load terminals resulting in 1 p.u as base voltage. Fig. 6 shows the circuit of phase modulation.

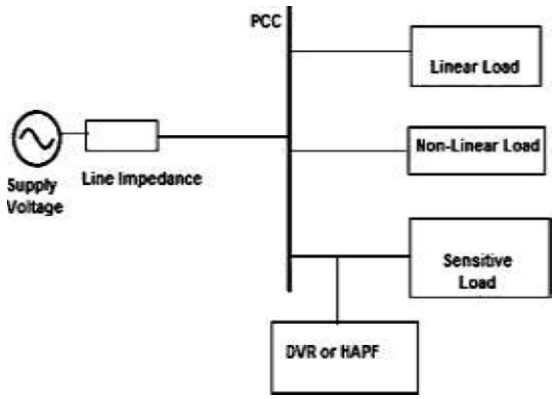


Fig. 4. Tested System across filter load

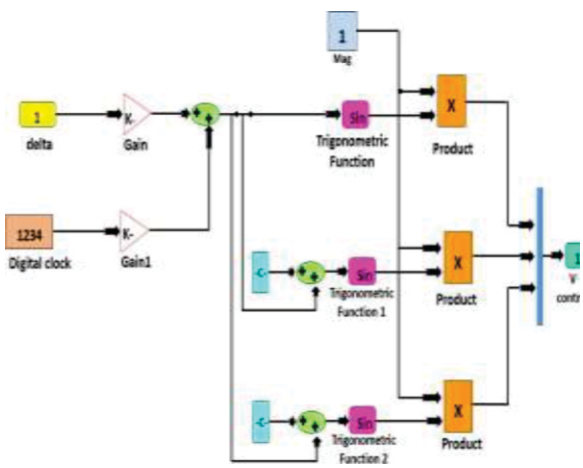


Fig. 6. Phase Modulation Control Circuit

4.2. Repetitive Controller

The fundamental use of this controller is to mitigate the voltage disturbances in case of occurrence of any

faults.

$$V(S) = e^{\frac{(-2\pi)S}{(W1)}} V^{*}(S) + \left[1 - e^{\frac{(-2\pi)S}{(W1)}}\right] e^{-t_0 S}$$

$$+ \left[1 - e^{\frac{(-2\pi)S}{(W1)}}\right] e^{-t_0 S} \left[(1 - e^{-t_0 S}) V_{pcc}(S) - P_2(S) I(S)\right]$$

The load voltage equation is given as (6) by using this controller, the delay t0 is not exactly known and the closed-loop system will not be stable. To check this problem a modified controller, C(S) is given.

$$C(S) = \frac{Q(S) e^{-(t-t0)S}}{1 - Q(S) e^{-Ts}}$$

By implementing this controller, the delay t0 is not exactly known and the closed-loop system will not be stable. To check this problem a modified controller, C(S) is given Where Q(S) is the transfer function of a low pass filter to is the estimated value of the time delay for DVR with

By implementing this controller, the delay t0 is not fully known and the closed-loop system will be unstable. To check the problem, a modified controller P(C) is given, where T(F) is the transfer function of the low-pass filter, where D (D) is the estimated value of the DVR time delay, where,

$$T = \frac{(2\pi)}{(W1)} - \beta$$

The transfer functions F(S), Fw(S), Fi(S) with the new modified controller C(S) are:

$$F(S) = \frac{\left[e^{-t_0 S} + Q(S) e^{TS} (e^{\delta S} - e^{-t_0 S})\right]}{1 + Q(S) e^{-TS} (e^{-\delta S} - 1)}$$

$$Fw(S) = \frac{\left[1 - e^{-t_0 S}\right]\left[1 - Q(S) e^{-TS}\right]}{1 + Q(S) e^{-TS} (e^{-\delta S} - 1)}$$

$$Fi(S) = \frac{\left[1 - Q(S) e^{-Ts}\right] P_2(S)}{1 + Q(S) e^{-TS} (e^{-\delta S} - 1)}$$

$$1 + Q(S) e^{-TS} (e^{-\delta S} - 1) = 0$$

$$G(S) = Q(S) e^{-TS} (e^{-\delta S} - 1)$$

With δ = t0 - t0^

The characteristic equation of the resulting closed-loop system is:

To ensure stability, the term G(s) in formula (11) must conform to the Nyquist criterion: if the number of unstable poles of the open-loop system G(s) is equal to zero (p = 0), then the term G (jω). The number of points (-1, 0) counterclockwise must be zero (N = 0. Since all poles of Q(S) are stable, which means that P = 0, then N must be zero to ensure stability, and sufficient conditions for Q(S) can be obtained by the following formula:

$$2 \left| \sin\left(\frac{\partial}{2}\omega\right) \right| \| Q(j\omega) | < 1 \forall \omega$$

5. Simulation Results

The test system of the DVR consists of a 3-phase, 415V, 50 Hz supply system. The output from the supply unit feeds the primary of a 3-winding transformer. Two parallel feeders are drawn. DVR is connected in series to one of the feeders whereas the other feeder is kept as it is. The parameters are given in Table 1.

Table 1 DVR Parameters

Supply voltage	3-phase, 415V
Supply frequency	50 Hz
Inverter parameters	IGBT based 3 arms, 6 pulses
Carrier frequency	1080Hz
Sample time	5μsec

The system is analyzed for voltage sag, voltage swell conditions. Fig. 7 shows the 50% of voltage sag. Voltage Sag of 0.5 p.u magnitudes is initiated for 0.3 seconds and the magnitude reduces from 1 p.u. to 0.5 p.u. during this period.

The three-phase programmable source was programmed to produce a 50% voltage sag that is to generate the voltage of amplitude 0.5 p.u. for 0.3 seconds. DVR in this mode injects the required voltage to overcome voltage dip and to give a balanced voltage at the load side.

A. Total Harmonic Distortion (THD)

Total Harmonic distortion is a measure of the degree of perversion in the signal. In the control system, the deadly interruption can cause serious damage. According to standard IEC 61000-3-2, the total harmonic distortion (THD) should be less than 7%.

Figs 7, 8 & 9. shows that the THD with traditional DVR is 14.94% which is not acceptable for the stable operation of the system. The THD for Repetitive Controller is 0.34 % that is better than Phase modulation Control and traditional DVR as shown in Figs. 6-8.

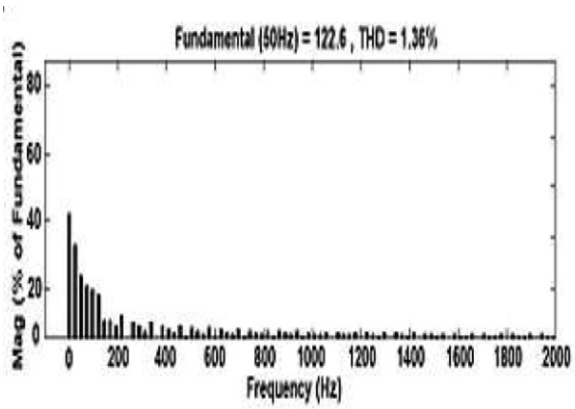


Fig. 7a. Via Phase Modulation

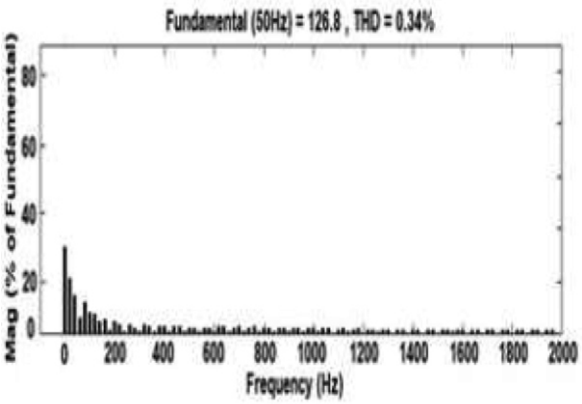
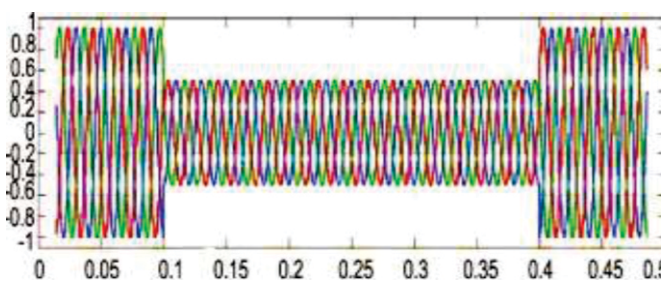
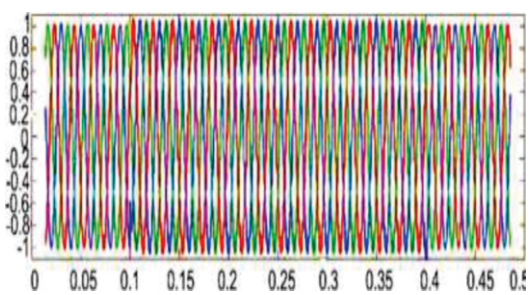
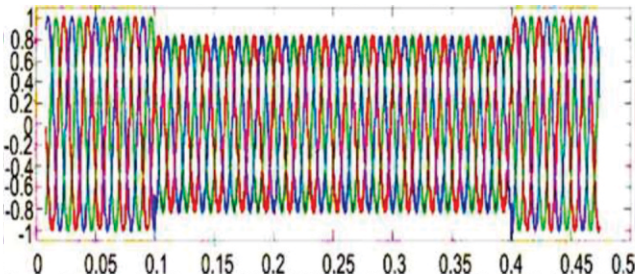


Fig. 7b. Via HAPF RC based DVR

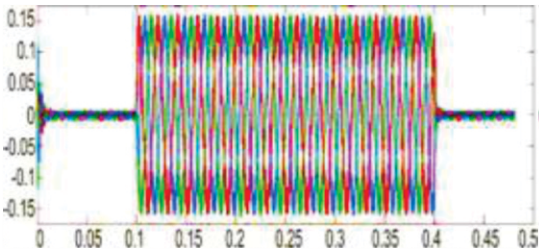




(a) Source voltage with sag 0.5pu



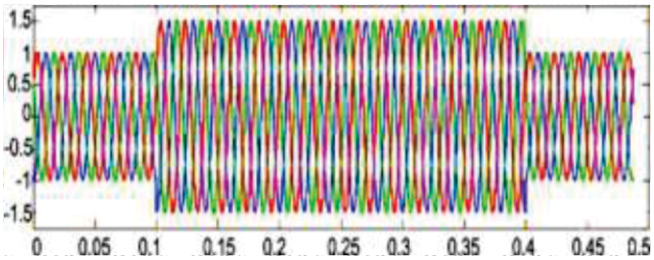
(b) Compensated Voltage via RC

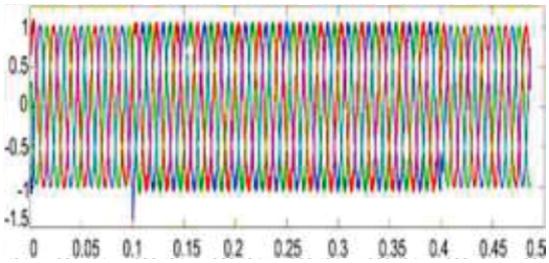


(c) Compensated Voltage via PM

(d) Injected Voltage

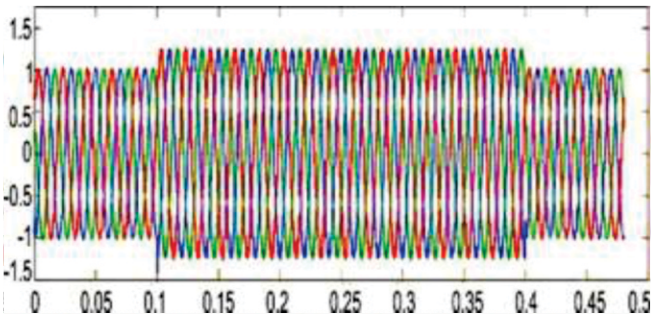
Fig. 8. Voltage dip compensation using RC and PM

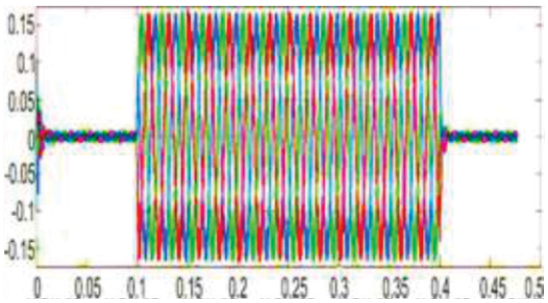




(a) Source voltage with swell 0.5pu

(b) Compensation of Voltage Via RC





(c) Compensation of Voltage Via PM

(d) Injected Voltage

Fig. 9. Voltage surge compensation using RC and PM

6. Conclusions

This paper deals with two control techniques for a grid-connected system. DVR is utilized to overcome variations in voltages and thence ameliorate the power quality. HAPF based Repetitive Controller is used to overcome the harmonics injected due to unbalance loads and hence makes the current drawn to be sinusoidal. MATLAB/SIMULINK is used to structure the proposed DVR and HAPF. Two techniques, phase modulation, and Repetitive control are compared for voltage THD of source and load. By employing the Repetitive control technique, the THD value has decreased from 4.94% of the phase control method to 3.36%. By contrasting the phase modulation method with the Repetitive control method, it is obvious that the Repetitive control method is more efficient for compensating the voltage dips using DVR and also harmonics with HAPF.

Nomenclature

DVR	Dynamic Voltage Restorer
PQ	Power Quality
RC	Repetitive Controller
PCC	Point of Common Coupling
P(C)	Modified ControllerK(S) Voltage gain
T(F)	Transfer Function
PM	Phase Modulation
HAPF	Hybrid Active Power Filter
PLL	Phase-Locked Loop
Zs	Source Impedance
View	Reference Voltage
Vlin	Line Voltage
THD	Total harmonic distortion
VDVR	Series Voltage
IL	Load Current

References

Ahmed, H. F., Cha, F., Khan, A. A. and Kim, H. G. (2016). A novel buck-boost ac–ac converter with both inverting and noninverting operations and without commutation problem. IEEE *Transactions on Power Electronics,* vol. 31, no. 6, pp. 4241–4251.

Anderson, J. and Peng, F.Z. (2008). A class of quasi-z-source inverters. *In Industry Applications Society Annual Meeting, IAS'08. IEEE,* pp. 1–7, Sept 2005.

Arango, H., Domingues, E.G., Abreu, J.P.G. and Camposilvan, D.M. (2002). "Applying real options methodology to value electrical power quality projects. In *Harmonics and Quality of Power, 10th International Conference on,* vol. 1, pp. 385–389, IEEE, 2002.

Babaei, E. and Kangarlu, M. F. (2012). Sensitive load voltage compensation against voltage sags/swells and harmonics in the grid voltage and limit downstream fault currents using DVR. *Electric Power Systems Research*. 83(1), 80-90.

Banaei, M. R., Alizadeh, R., Jahanyari, N. and Najmi, E. S. (2016). An ac Z-source converter based on gamma structure with safe-commutation strategy. *IEEE Transactions on Power Electronics,* vol. 31, no. 2, pp. 1255–1262.

Benachaiba, C. and Ferdi, B. (2008). Voltage quality improvement using DVR. *Electrical Power Quality and Utilization. Journal,* vol. 14, pp. 39–46.

Chan, J. Y., & Milanović, J. V. (2015). Assessment of the economic value of voltage sag mitigation devices to sensitive industrial plants. *IEEE Transactions on power delivery,* 30(6), 2374-2382.

Chang, C., Ho, Y. and Loh, P. (2000). Voltage quality enhancement with power electronics-based devices. I*n Power Engineering Society Winter Meeting, IEEE,* vol. 4, pp. 2937–2942, IEEE, 2000.

De-Keulenaer, H. (2003). The hidden cost of poor power quality. *European copper institute.*

Georgakas, K. and Safacas, A. (2010). Modified sinusoidal pulse-width modulation operation technique of an ac–ac single-phase converter to optimize the power factor. *IET Power Electronics,* vol. 3, no. 3, pp. 454–464.

Jowder, F. A. L. (2009). Design and analysis of dynamic voltage restorer for deep voltage sag and harmonic compensation. *IET generation, transmission & distribution,* 3(6), 547-560.

Jothibasu, S. and Mishra, M. K. (2015). An improved direct ac–ac converter for voltage sag mitigation. *IEEE Transactions on Industrial Electronics,* vol. 62, no. 1, pp. 21–29.

Kaniewski, J., Fedyczak, Z. and Benysek, G. (2014). Ac voltage sag/swell compensator based on a three-phase hybrid transformer with buck-boost matrix-reactance chopper. *IEEE Transactions on Industrial Electronics,* vol. 61, no. 8, pp. 3835–3846.

Kim, H. and Peng, K. S. (2005). Compensation voltage control in dynamic voltage restorers by use of feedforward and state feedback scheme *IEEE Trans. on P. E.,* vol. 20, no. 5, pp. 1169 – 1177.

Li, P. and Hu, Y. (2017). Unified non-inverting and inverting PWM ac–ac converter with versatile modes of operation. *IEEE Transactions on Industrial Electronics*, vol. 64, no. 2, pp. 1137–1147.

Nguyen, M. K., Jung, Y. G. and Lim, Y.C. (2009). Voltage swell/sag compensation with single-phase Z-source ac/ac converter. *In Power Electronics and Applications, 2009. EPE'09. 13th European Conference on, pp. 1–8, IEEE.*

Peng, F.Z., Chen, L. and Zhang, F. (2003). Simple topologies of PWM ac-ac converters. *IEEE Power Electronics Letters,* vol. 1, no. 1, pp. 10– 13.

Qin, Z., Loh, P.C. and Blaabjerg, F. (2016). Modulation schemes with enhanced switch thermal distribution for single-phase ac–dc–ac reduced-switch converters. *IEEE Transactions on Power Electronics,* vol. 31, no. 4, pp. 3302– 3313.

Rauf, A.M. and Khadkikar, V. (2015). An enhanced voltage sag compensation scheme for dynamic voltage restorer. *IEEE transactions on industrial electronics,* vol. 62, no. 5, pp. 2683– 2692.

Rosli, O., Rahim, N. A., & Sulaiman, M. (2011). Dynamic voltage restorer application for power quality improvement in electrical distribution system: An overview. *Australian Journal of Basic and Applied Sciences*, 5(12), 379-396.

Targosz, R. and Manson, J. (2007). Pan-European power quality survey. *In Electrical Power Quality and Utilization, EPQU 2007. 9th International Conference* on, pp. 1–6, IEEE, 2007.

Trindade, F.C., Nascimento, K.V. and Vieira, J.C. (2013). Investigation on voltage sags caused by dg anti-islanding protection. *IEEE transactions on power delivery,* vol. 28, no. 2, pp. 972–980.

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