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polymorphisms with oxidative stress in breast cancer: a case-control study


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Association of CYBA gene (-930 A/G and 242 C/T) polymorphisms with oxidative stress in breast cancer: a case-control study

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Background

Oxidative stress (OS) is a key characteristic feature in cancer initiation and progression. Among multiple cancers, NADPH oxidase (NOX) dependent free radical production is implicated in oxidative stress. P22phox, a subunit of NADPH oxidase encoded by the CYBA gene has functional polymorphisms associated with various complex diseases. The present study was aimed to examine the importance and association of the functional polymorphisms of CYBA gene (-930 A/G and 242 C/T) with the oxidative stress in breast cancer (BC) development and progression.

Materials and Methods

We have performed a case-control study on 300 breast cancer patients and 300 healthy individuals as controls to examine the role of CYBA gene -930 A/G and 242 C/T single nucleotide polymorphisms (SNPs) using As-PCR and PCR-RFLP assays and its association with OS as measured by plasma MDA levels. Linkage disequilibrium (LD) plots were generated using Haploviewtool and Multifactor dimensionality reduction (MDR) analysis was applied to assess high-order interactions between the SNPs. The Insilco analysis has been performed to predict the effect of SNPs on the gene regulation using online tools.

Results

We have found that genotype frequencies of CYBA gene -930 A/G and 242C/T polymorphism were significantly different between controls and BC patients ($p < 0.05$). The haplotype combination -930G/242C and -930G/242T were associated with 1.44 & 1.56 folds increased risk for breast cancer respectively. Further, the MDA levels were higher in the patients carrying -930G/242C and -930G/242T haplotype ($p < 0.001$). Our results have been substantiated by Insilco analysis.

association with higher MDA levels in breast cancer patients, signifying that elevated oxidative stress might aid in increased risk for breast cancer initiation and progression.

Introduction

Breast cancer (BC) is one of the most frequent malignant tumors, and its morbidity and mortality rates have been increasing in developing countries such as, India ([Gupt Shridhar & Dhillon, 2015](#)). The breast cancer etiology is complex, involves dynamic interactions of genetic and environmental factors ([Abdulkareem, 2013](#)).

Oxidative stress (OS) is a key risk factor for cancer initiation and progression ([Jezierski Drutel, Rosenzweig & Neumann, 2013](#)) resulting from an imbalance between Reactive Oxygen Species (ROS) production and antioxidant defenses, contributes to cellular damage, apoptosis, lipid peroxidation and interferes with the body's normal metabolic activity, leading to the occurrence and development of diseases ([Visconti & Grieco, 2007](#); [Fiaschi & Chiarugi, 2012](#)). Malondialdehyde (MDA) is one of the end products of lipid peroxidation and it is also formed as a product of the cyclooxygenase reaction of prostaglandin metabolism.

Intracellular compartments such as mitochondria, is the major site of ROS production ([Poyton et al., 2009](#)). Enzymes involved in ROS-generating chemical reactions are peroxidases, Nicotinamide adenine dinucleotide phosphate oxidase (NOX), xanthine oxidase (XO), lipoxygenases (LOXs), glucose oxidase, myeloperoxidase (MPO), nitric oxide synthase, and cyclooxygenases (COXs) ([Kulkarni, Kuppusamy & Parinandi, 2007](#)).

The oxidation of NADPH to NADP⁺ catalyzed by NADPH oxidase generates superoxide radical from oxygen. NADPH oxidase enzyme present in cytoplasmic membrane of phagocytic cells was described first as an enzyme involved in the generation of ROS in these phagocytic cells ([Rossi & Zatti, 1964](#)). This enzyme comprises two membrane-bound proteins (p22phox and gp91phox), three cytosolic proteins (p67phox, p47phox, and p40phox), and a small G-protein Rac. Gp91phox and p22phox form a heterodimer that is bound to the plasma membrane. The p22phox subunit is coded by the CYBA (cytochrome b245 alpha) gene, which is mapped to chromosome 16q24.3 ([Powell et al., 2002](#)). Genetic factors might regulate NADPH-oxidase-driven O₂⁻ production. Several polymorphisms of the NADPH oxidase encoding gene have been described, some of which have been associated with increased ([San José et al., 2004](#)) or diminished NOX activity ([Guzik et al., 2000](#)), as well as reduced ROS generation ([Schirmer et al., 2008](#); [Bedard et al., 2009](#)).

To date little is known about the association of -930 A/G polymorphism ([rs993258](#)) located in the promoter and the 242 C/T polymorphism ([rs4673](#)) located in the exon 4 of the CYBA gene, and the level of oxidative stress in BC patients. Therefore, the present study was aimed to examine the importance and association of the functional polymorphisms of CYBA (-930 A/G and 242 C/T) with the oxidative stress in BC development and progression.

Materials and Methods

Study population

In our study, a total of 600 subjects were enrolled comprising of 300 histopathological confirmed female patients with breast cancer and the control group included 300 unrelated healthy women with no self-reported history of any cancer. The study followed the Helsinki declaration and was approved by Institutional Ethics Committee, MNJ Institute of Oncology & Regional Cancer Centre. Patients with breast cancer were enrolled from the Department of Radiation Oncology, MNJ Regional Cancer Centre, Hyderabad from August 2013 to August 2017 and during the same time controls subject were enrolled from the local population and women with any other cancer or other systemic inflammatory disease were excluded from the case and control group.

All subjects were explained about the purpose of the study and were ensured that the information collected from them would be confidential. Subsequently written informed consent to participate in the study was obtained from each individual. Each subject completed a questionnaire on their demographic characteristics, area of living, lifestyle

Sample collection

Following an overnight fast 4 ml of blood sample was collected by antecubital venipuncture in EDTA vacutainer from each individual for estimation of MDA & genomic DNA extraction

Plasma MDA levels estimation

Lipid peroxidation, as evidenced by the formation of malondialdehyde (MDA), was assayed by the method described previously (Gavino et al., 1981; Rajesh et al., 2011). Briefly, 0.5 ml of freshly obtained plasma and an equal volume of 0.9% saline and trichloroacetic acid (TCA) was added and incubated at 37 °C for 20 min, and centrifuged for 10 min at 3,000 rpm. A total of 0.25 ml of thiobarbituric acid (TBA) was added to 1 ml of protein free supernatant (TCA extract) and the reaction mixture was heated for 60 min at 95 °C till faint pink color develops. After cooling, the color intensity was measured at 532 nm with Eppendorf UV 240-Spectrophotometer. 1,1,3,3-Tetraethoxypropane (1–100 nmol/ml) was used as the standard. The lipid peroxidation activity was expressed in “nano moles” MDA equivalents/ml of standard 1,1,3,3-Tetraethoxypropane.

Genomic DNA extraction and genotyping analysis

Genomic DNA was isolated from blood sample using a non-enzymatic method (Milk Dykes & Polesky, 1988). Polymorphic regions in the CYBA gene were identified by Allele specific polymerase chain reaction (PCR) and PCR-Restriction fragment length polymorphism (RFLP) assays for -930 A/G and 242 C/T polymorphisms respectively. Cases and controls were randomized during genotyping and 10% of the samples were genotyped in duplicate to assess the genotyping error rate. Concordance of genotypes were 100%.

Statistical analysis

Demographic, clinical, and biochemical variables are expressed as the mean \pm SD. All statistical tests were two-sided, a *P*-value lower than 0.05 was considered statistically significant. For comparison of continuous variables in demographic data between controls and breast cancer patients, Student's *t*-test was performed. Observed genotype frequencies were tested for deviation from Hardy-Weinberg equilibrium with the chi-square goodness-of-fit test (χ^2). Risk estimates were calculated for co-dominant, dominant and recessive genetic models using SNPStats. Odds ratios (OR) and their 95% confidence intervals (CI) were estimated using a univariate analysis. Linkage Disequilibrium (LD) plots were generated using Haploview (v.4.2) software. Multifactor dimensionality reduction (MDR) analysis was performed to identify high-order interaction models that were associated with BC risk using open-source MDR software (v.2.0 beta 8.4).

Bioinformatics analysis

Prediction of presumptive changes in transcription factor binding sites (TFBS) caused by nucleotide alterations in the promoter region was performed with AliBaba software 2 (<http://gene-regulation.com/pub/programs/alibaba2/index.html>) (Grabe, 2002). Pre-mRNA secondary structure prediction of 242 C/T polymorphic variants was carried out using the ViennaRNA fold webserver (<http://rna.tbi.univie.ac.at/cgi-bin/RNAWebSuite/RNAfold.cgi>) online tool (Zuker & Stiegler, 1981). The 3D models for CYBA wild type and variant proteins with 242 C/T SNP were generated using homology modeling tool I-TASSER (<https://zhanglab.ccmb.med.umich.edu/I-TASSER/>) (Roy, Kucukural & Zhang, 2010).

Results

The baseline characteristics are summarised in Table 1. In the present study, the frequency of individuals with lifestyle habits such as, mixed diet (Non-vegetarian), habit of smoking and alcohol consumption were found to be high with breast cancer ($p < 0.05$).

| Characteristics | Controls <i>N</i> = 300 (%) | Cases <i>N</i> = 300 (%) | OR(95% CI) | <i>p</i> |
|-------------------------|-----------------------------|--------------------------|------------------|------------------|
| Age (years) (mean ± SD) | 46.34 ± 7.97 | 47.98 ± 10.8 | – | 0.034 |
| Lifestyle habits | | | | |
| Vegetarian Diet | 87 (29) | 43 (14.34) | | |
| Non-vegetarian Diet | 213 (71) | 257 (85.56) | 2.44 (1.62–3.67) | <0.005 |
| Non-smokers | 273 (91) | 245 (81.66) | | |
| Smoker | 27 (9) | 55 (18.34) | 2.27 (1.38–3.71) | 0.0004 |
| Non-alcoholics | 243 (81) | 179 (59.6) | | |
| Alcoholics | 57 (19) | 121 (40.4) | 2.88 (1.99–4.16) | <0.001 |

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Notes:

OR

odds ratio

CI

Class interval

*

p-value by Student's *t* test (continuous variables)

χ^2 test

categorical variables

The genotypic and allele frequency distribution of the CYBA -930 A/G polymorphism represented in [Table 2](#). In the present study the GG genotype was significantly higher cases and was found to be associated with an increased risk of BC compared homozygotic AA genotype carriers (OR 2.15, 95% CI [1.16–3.98], *p* = 0.034). The allele distribution has revealed that the prevalence of the G-allele was significantly higher cases and conferred increased risk for breast cancer compared to A-allele (OR 1.27, 95 CI [1.01–1.6], *p* = 0.035).

controls and breast cancer patients.

| Model | Genotype | ControlsN (%) | CasesN (%) | OR (95% CI) | χ^2 p-value |
|---------------|----------|-------------------|-------------------|-------------------------|------------------|
| Co-dominant | A/A | 85 (28.3) | 62 (20.7) | 1.00 | |
| | A/G | 192 (64) | 202 (67.3) | 1.44 (0.98–2.11) | 0.034* |
| | G/G | 23 (7.7) | 36 (12) | 2.15 (1.16–3.98) | |
| Dominant | A/A | 85 (28.3) | 62 (20.7) | 1.00 | |
| | A/G–G/G | 215 (71.7) | 238 (79.3) | 1.52 (1.04–2.21) | 0.029* |
| Recessive | A/A–A/G | 277 (92.3) | 264 (88) | 1.00 | |
| | G/G | 23 (7.7) | 36 (12) | 1.64 (0.95–2.85) | 0.074 |
| Over dominant | A/A–G/G | 108 (36) | 98 (32.7) | 1.00 | |
| | A/G | 192 (64) | 202 (67.3) | 1.16 (0.83–1.62) | 0.39 |
| Log-additive | – | – | – | 1.46 (1.09–1.94) | 0.0094 |
| Allele | A | 362 (0.6) | 326 (0.54) | 1.00 | |
| | G | 238 (0.4) | 274 (0.46) | 1.27 (1.01–1.6) | 0.035* |
| HWE(p) | | <0.0001 | <0.0001 | | |

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Notes:

* χ^2 p-value <0.05 is considered statistically significant.

The genotype and allele frequency distribution of CYBA 242 C/T polymorphism among the controls and patients with breast cancer is presented in Table 3. Under the dominant model, carriers of at least one minor allele T (CT + TT) were found to be associated with significantly increased risk of BC compared to major allele homozygous (CC) carriers (OR 1.42, 95% CI [1.02–1.98], $p = 0.036$). The allelic association revealed that the minor allele T of 242 C/T polymorphism was associated with an increased risk of BC (OR 1.36, 95% CI [1.04–1.78], $p = 0.02$).

controls and breast cancer patients.

| Model | Genotype | ControlsN (%) | CasesN (%) | OR (95% CI) | χ^2 p-value |
|---------------|----------|---------------|--------------|-------------------------|------------------|
| Co-dominant | C/C | 197 (65.7) | 172 (57.3) | 1.00 | 0.1 |
| | C/T | 82 (27.3) | 99 (33) | 1.38 (0.97–1.98) | |
| | T/T | 21 (7) | 29 (9.7) | 1.58 (0.87–2.88) | |
| Dominant | C/C | 197 (65.7) | 172 (57.3) | 1.00 | 0.036 |
| | C/T–T/T | 103 (34.3) | 128 (42.7) | 1.42 (1.02–1.98) | |
| Recessive | C/C–C/T | 279 (93) | 271 (90.3) | 1.00 | 0.24 |
| | T/T | 21 (7) | 29 (9.7) | 1.42 (0.79–2.55) | |
| Over dominant | C/C–T/T | 218 (72.7) | 201 (67) | 1.00 | 0.13 |
| | C/T | 82 (27.3) | 99 (33) | 1.31 (0.92–1.86) | |
| Log-additive | – | – | – | 1.31 (1.02–1.68) | 0.036 |
| Allele | C | 476 (0.79) | 443 (0.74) | 1.00 | 0.02 |
| | T | 124 (0.21) | 157 (0.26) | 1.36 (1.04–1.78) | |
| HWE(p) | | 0.16 | 0.027 | | |

DOI: [10.7717/peerj.5509/table-3](https://doi.org/10.7717/peerj.5509/table-3)**Notes:** χ^2 p-value <0.05 is considered statistically significant.

We further have analysed the haplotype frequencies with respect to CYBA ger polymorphisms in association with risk of breast cancer. Our analysis has revealed a tot of four haplotypes as shown in [Table 4](#). Comparison of haplotype frequencies between controls and BC patients revealed a significant difference in haplotype frequencies, where -930G/242C and -930G/242T combinations were found to be significantly associated with an increased risk of breast cancer by more than 1.44 fold (95% CI [1.00–2.07]; $p = 0.0$ and 1.56 (95% CI [1.11–2.20]; $p < 0.05$) respectively compared with the common haplotype (-930A/242C).

and BC patients.

| Haplotype ^a | Overall(N = 600) | Controls(N = 300) | Cases(N = 300) | OR (95% CI) | p-value |
|------------------------|------------------|-------------------|----------------|-------------------------|--------------|
| A-C | 0.5116 | 0.547 | 0.4752 | 1.00 | – |
| G-C | 0.2542 | 0.2463 | 0.2632 | 1.44 (1.00–2.07) | 0.05 |
| G-T | 0.1724 | 0.1503 | 0.1503 | 1.56 (1.11–2.20) | 0.011 |
| A-T | 0.0617 | 0.0563 | 0.0682 | 1.40 (0.75–2.59) | 0.29 |

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Notes:

^aOrder of SNPs in CYBA gene haplotypes: -930 A/G, 242 C/T; OR, Odds ratio; CI, Class interval.

*Interactive Chi-Square *p*-value < 0.05 is statistically significant.

Pairwise LD was computed for CYBA -930 A/G and 242 C/T polymorphism in cases and controls separately. LD plots revealed a moderate LD ($D' = 56$) between the markers in BC patients and a weak LD ($D' = 31$) between the markers in controls as shown in the Fig. Further, MDR analysis with respect to CYBA gene polymorphism has shown that 242C polymorphism was the best single locus model with a significant risk for breast cancer. The bivariate model showed a strong interaction between -930 A/G and 242 C/T polymorphism as seen in Fig. 2. Our analysis has revealed a synergistic interaction between SNPs (gain of information).

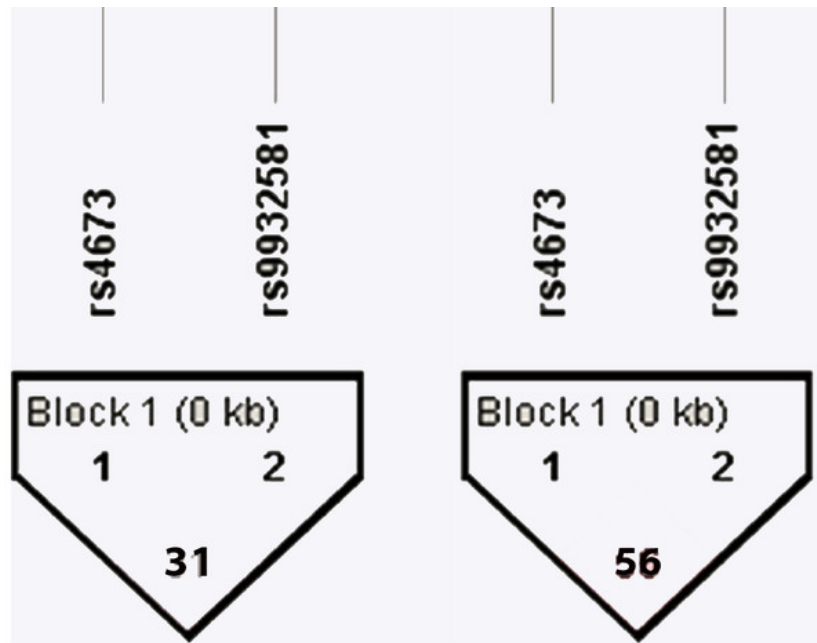


Figure 1: Plot of pair-wise linkage disequilibrium (LD) analysis of SNPs of CYBA genes in controls and BC patients.

(A) LD plot of controls (B) LD plot of Cases. D' values are shown in the plot. A value of 100 represents maximum possible linkage disequilibrium.

DOI: [10.7717/peerj.5509/fig-1](https://doi.org/10.7717/peerj.5509/fig-1)

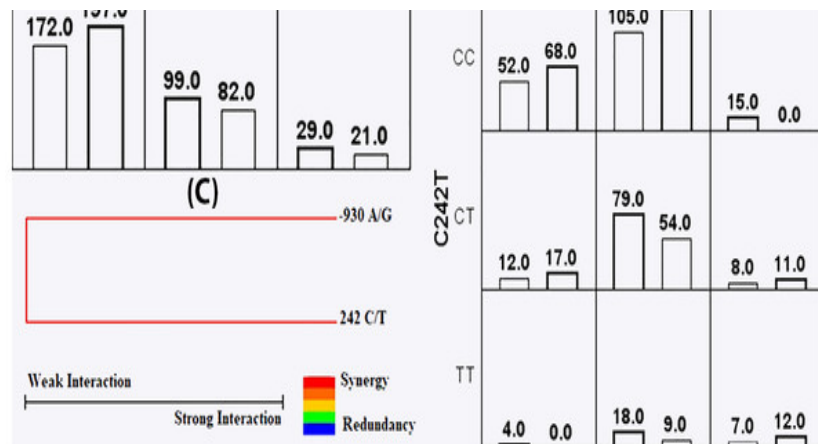


Figure 2: Multifactor dimensionality reduction (MDR) analysis of CYBA gene polymorphisms in association with breast cancer.

(A) Univariate and (B) Bivariate analysis—In each block, the first bar represents the breast cancer patients group and the adjacent bar represents the control group respectively. (C) Interaction dendrogram—The interaction dendrogram was used to confirm, visualize, and interpret the interaction model. The colours used to depict the degree of synergy, ranging from red (highest information gain) to blue (highest information redundancy).

DOI: [10.7717/peerj.5509/fig-2](https://doi.org/10.7717/peerj.5509/fig-2)

Furthermore, the TFBS analysis with respect to -930 A/G promoter polymorphism has revealed that substitution of A nucleotide by G leads to a loss of C/EBPbeta site as depicted in Fig. 3. The comparison of the wild type and variant pre-mRNA secondary structures with respect to 242 C/T polymorphism is given in Fig. 4, wherein, the stability, as depicted by minimum free energy (MFE) change has revealed that the T-allelic structure had an MFE of -37.61 Kcal/mol and the C-allelic structure had an MFE of -37.91 Kcal/mol respectively. In addition, an altered 3D structure was also observed corresponding to loss of cavities with respect to variant structure when compared to wild type structure as seen in Fig. 5 (Table 5).

Segments:

| | | | | | |
|----------------|----|-----|-------------|------------|---------------|
| <u>2.3.1.0</u> | 50 | 63 | ==== | | |
| <u>2.3.1.0</u> | 61 | 70 | ====Sp1==== | | |
| <u>1.1.3.0</u> | 69 | 78 | | =C/EBPbeta | |
| <u>1.3.1.2</u> | 85 | 94 | | | ====USF==== |
| <u>9.9.539</u> | 86 | 95 | | | ====NF-1== |
| <u>2.3.1.0</u> | 95 | 107 | | | =====Sp1===== |

CYBA -930 G-allele

=====

seq(60.. 119) ccggaggcaggaatgctggtttattcccatggccaccggggcc

Segments:

| | | | | | |
|----------------|----|-----|-------------|--|---------------|
| <u>2.3.1.0</u> | 50 | 61 | == | | |
| <u>2.3.1.0</u> | 61 | 70 | ====Sp1==== | | |
| <u>1.3.1.2</u> | 85 | 94 | | | ====USF==== |
| <u>9.9.539</u> | 86 | 95 | | | ====NF-1== |
| <u>2.3.1.0</u> | 95 | 107 | | | =====Sp1===== |

Figure 3: Effect of the CYBA -930 A/G polymorphism on transcription factor binding sites.

DOI: [10.7717/peerj.5509/fig-3](https://doi.org/10.7717/peerj.5509/fig-3)

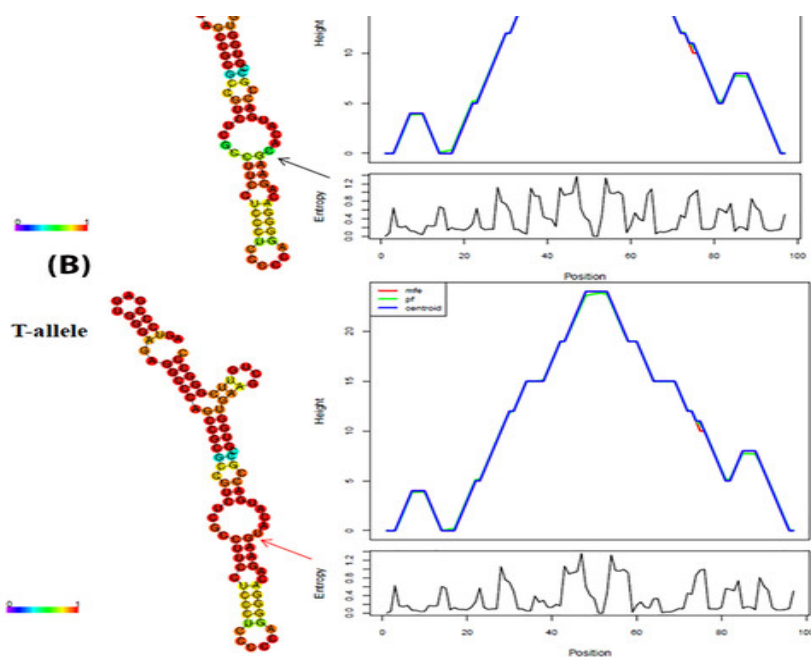


Figure 4: Computational analysis of CYBA 242 C/T polymorphism based pre-mRNA secondary structures.

Predicted minimal free energy based RNA structure of (A) major (C-allele) and (B) minor (T-allele) alleles of 242 C/T polymorphism using the RNA fold program in the Vienna RNA package (Zuker algorithm). Structure colours encode base-pair probabilities and arrow denotes the location of polymorphism. The mountain plot is a XY -graph that represents a secondary structure including MFE structure, the thermodynamic ensemble of RNA structures (pf), and the centroid structure in a plot of height versus position. “mfe” represents minimum free energy structure; “pf” indicates partition function; “centroid” represents the centroid structure.

DOI: [10.7717/peerj.5509/fig-4](https://doi.org/10.7717/peerj.5509/fig-4)

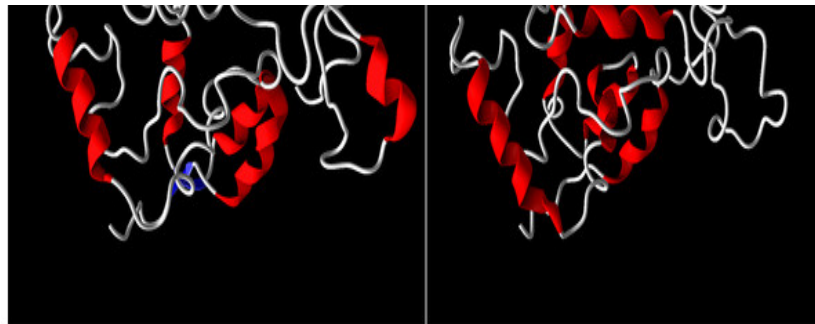


Figure 5: 3D structures of CYBA 242 C/T polymorphic variants as predicted by I-TASSER.

The 3D structures of the CYBA 242 C/T polymorphic variants were modeled on I-TASSER server. (A) displays the wildtype structures, and (B) exhibits the relevant variant structure.

DOI: [10.7717/peerj.5509/fig-5](https://doi.org/10.7717/peerj.5509/fig-5)

The plasma MDA levels were measured in all the subjects in the present study, o results revealed that patients with breast cancer had significantly higher MDA level (6.84 ± 2.42 nmoles/ μ l) compared to the control (2 ± 0.69 nmoles/ μ l) group as depicted [Fig. 6A](#). Further, MDA levels were stratified with respect to CYBA genotypes, where v found that individuals with GG genotype of -930 A/G polymorphism had higher MDA level compared to those with AA genotype as shown in [Fig. 6B](#). Furthermore, the MDA level with respect to CYBA gene haplotypes has shown that -930G/242C haplotype combinatic was associated with higher MDA levels in breast cancer patients compared to oth haplotypes at $p < 0.05$ as summarized in [Fig. 6C](#).

Discussion

Breast cancer is a common disease worldwide and also one of the leading cause of canc deaths in India ([Ferlay et al., 2015](#); [Malvia et al., 2017](#)). Breast carcinogenesis involves cascade of multiple intracellular mechanisms such as genetic alterations, sign transduction pathways, etc, ([Kurose et al., 2001](#)). However, it also depends on th oxidative stress (OS) and the predominance of endogenous antioxidant system f manifestation of disease. Oxidative stress induces uncontrolled lipid peroxidation wi produces aldehyde end-products, such as free fatty acids, malondialdehyde (MDA) th might cause cell injury and death. In addition, cancer initiation and progression have al been shown to be associated with oxidative stress by causing DNA mutations or inducir DNA damage, genome instability, and cell proliferation ([Srivastava et al., 2009](#); [Visconti Grieco, 2009](#); [Wang et al., 2011](#); [Wu et al., 2017](#)).

In the present study, a higher frequency of breast cancer patients with smoking alcohol habits was observed. Multiple reports have also shown that habit of smoking alcohol consumption were associated with increased risk for breast cancer as they a more exposed to free radicals leading to oxidative damage to lipids, proteins and DNA th may aid in cancer progression ([Kumari et al., 2018](#); [Scheideler & Klein, 2018](#)). In contras several reports have been inconsistent, wherein no significant association was observe with respect to smoking and alcohol consumption in breast cancer patients ([Byrne, Rocke & Holmes, 2002](#); [Allen et al., 2009](#); [Gathani et al., 2017](#)).

| Cavity | Volume (A ³) | |
|--------|--------------------------|--------------|
| | Wild type | Variant type |
| 1 | 53.248 | 132.09 |
| 2 | 51.2 | 28.67 |
| 3 | 22.01 | 17.92 |
| 4 | 19.96 | 13.312 |
| 5 | 18.94 | – |

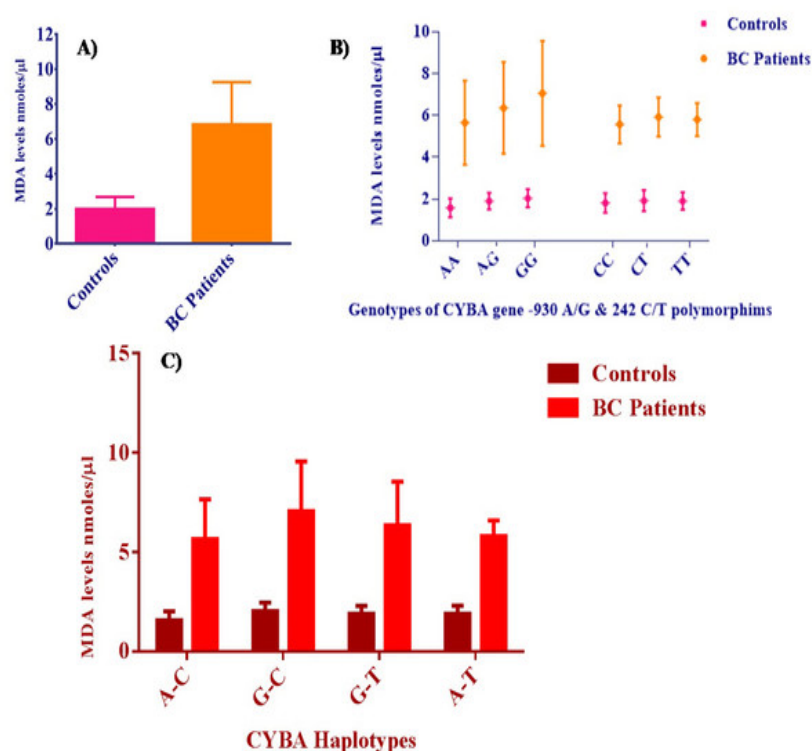
DOI: [10.7717/peerj.5509/table-5](https://doi.org/10.7717/peerj.5509/table-5)

Figure 6: MDA levels in controls and breast cancer patients.

(A) Malondialdehyde (MDA) levels in the control group and breast cancer patients (B) MDA levels with respect to CYBA polymorphic genotypes and (C) MDA levels with respect to CYBA gene haplotypes in controls and breast cancer patients.

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Alteration in expression of enzyme system that produces ROS such as NADPH oxidase (NOX) has been shown to be an important susceptibility factor for cancer (Arcucci et al 2016). The most significant sources of ROS are NOXs, which include two membrane bound subunits Nox2 and p22phox. The p22phox encoded by the CYBA gene has several functional polymorphisms. In view of the above, in this study we attempted to determine the association of oxidative stress with -930 A/G and 242 C/T polymorphisms of CYBA gene

promoter activity. Furthermore, the frequency of the G allele was higher than the A allele in hypertensive individuals (Moreno et al., 2003). Recent large population study on -930 A/G polymorphism has also reported that the GG genotype confers susceptibility for hypertension (Kokubo et al., 2005). Therefore, we have investigated the association between this SNP in association with breast cancer risk. In the present population the G allele was found to be significantly higher in breast cancer patients compared to healthy controls conferring a 1.27-fold risk towards breast cancer. The promoter region SNP affects gene expression by altering promoter activity, transcription-factor binding, DNA methylation and histone modifications (Deng et al., 2017). Interactions between transcription factors (TFs) and target binding sites determine the expression of gene. Since the -930 A/G polymorphism has a potential binding site for C/EBPβ (CCAAT/enhancer-binding protein) transcription factors it has been speculated that it might modulate CYBA transcriptional activity (San José et al., 2004). Our *in silico* analysis of transcription-factor binding sites with respect to -930 A/G polymorphic variants revealed that the substitution of A by G results in the loss of repressor C/EBPβ transcription factor site that might increase transcriptional activity.

The C242T polymorphism has been demonstrated to be related to multiple diseases (Guzik et al., 2000; San José et al., 2008; Vibhuti et al., 2010; Schreiber et al., 2011; Zhang & Zhao, 2015). Results of the present study had showed that individuals with the CT/T genotype of 242 C/T polymorphism had a 1.42-fold higher risk for breast cancer compared to those with the CC genotype. Our finding was consistent with reports showing significant association with vascular disease (Ito et al., 2000). The C242T polymorphism located in exon 4 encodes a CAC →TAC codon change thus resulting in a non-conservative substitution of His72 for a tyrosine residue that may alter the haem-binding site of the p22phox protein (Tahara et al., 2008; Fu et al., 2016). Finding 3D structure of proteins is helpful in predicting the impact of SNPs on the structural level and in showing the degree of alteration. Our analysis has shown an altered 3D structure with a change of histidine residue in the variant protein that might contribute to functional impairment.

MDA is a naturally occurring endogenous product of lipid peroxidation and prostaglandin biosynthesis, but is mutagenic and carcinogenic. Oxidative stress as measured by an increase in MDA levels was established in gastric, colorectal adenomas, prostate and lung cancer (Bakan et al., 2002; Leuratti et al., 2002; Zhang et al., 2008; Chole et al., 2010). In this study we have also demonstrated an increase in lipid peroxidation due to oxidative stress in breast cancer patients. Previous studies have also reported increased levels of MDA in breast cancer patients compared to healthy controls (Gönenç et al., 2001; Göner et al., 2006; Yeh et al., 2005) suggesting that elevated oxidative stress contributes to increased risk for breast cancer development and progression. Further, comparison of MDA levels with respect to CYBA gene haplotypes revealed that -930G/242C and -930G/242T haplotype carriers in the patients with breast cancer showed higher MDA levels than other haplotypes; this could be in line with observation that states presence of G-allele could increase the transcriptional activity, elevating ROS production resulting in oxidative stress in breast cancer patients.

There are several limitations in this study. The foremost limitation to our study concerns the use of limited sample size, which prevented us from drawing causal relationships. Owing to its importance as an oxidative stress indicator, we have measured MDA levels; however, MDA levels alone are not a sole indicator of oxidative stress and we have not directly quantified the NADPH oxidase activity. Further studies on CYBA gene polymorphisms/haplotypes, along with different oxidative stress markers, should be done in a multicenter, multi-ethnic population and with a large number of patients to strengthen our findings.

Conclusion

In conclusion, our results suggest that the individuals with GG genotype of -930 A/G polymorphism, -930G/242C and/or -930G/242T haplotypes of CYBA gene may predispose to increased oxidative stress. Therefore, more attention should be paid to oxidative stress-related pathological manifestations in individuals with the risk genotype/haplotype, as it plays an important role in development and progression of breast cancer.

Competing Interests

The authors declare there are no competing interests.

Author Contributions

[Mohini A. Tupurani](#) conceived and designed the experiments, performed the experiment analyzed the data, contributed reagents/materials/analysis tools, prepared figures and/tables, authored or reviewed drafts of the paper, approved the final draft.

[Chiranjeevi Padala](#) conceived and designed the experiments, analyzed the data contributed reagents/materials/analysis tools, authored or reviewed drafts of the paper.

[Kaushik Puranam](#) analyzed the data, contributed reagents/materials/analysis tool authored or reviewed drafts of the paper.

[Rajesh K. Galimudi](#) conceived and designed the experiments, analyzed the data contributed reagents/materials/analysis tools.

[Keerthi Kupsal](#) conceived and designed the experiments, contribute reagents/materials/analysis tools.

[Nivas Shyamala](#) contributed reagents/materials/analysis tools, authored or reviewed draft of the paper.

[Srithatha Gantala](#) contributed reagents/materials/analysis tools.

[Ramanjaneyulu Kummari](#) contributed reagents/materials/analysis tools.

[Sanjeeva K. Chinta](#) samples, analysis tools, approved the final draft.

[Surekha R. Hanumanth](#) conceived and designed the experiments, analyzed the data contributed reagents/materials/analysis tools, authored or reviewed drafts of the paper approved the final draft.

Human Ethics

The following information was supplied relating to ethical approvals (i.e., approving body and any reference numbers):

Our study was approved by the Ethics committee of MNJ Institute of Oncology at Regional Cancer Centre, Hyderabad.

Data Availability

The following information was supplied regarding data availability:

The raw data are provided in a [Supplemental File](#).

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AN EMPIRICAL STUDY ON SURVIVAL STRATEGIES OF SMALL- SCALE INDIVIDUAL ENTREPRENEURS - THE NEW NORMAL

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Abstract

Entrepreneurship is a backbone of any economy. Small Scale Individual Entrepreneurs play a vital role in economic growth of developing countries. They are important because they help in increasing employment and standard of living of people. Small Scale Individual Entrepreneurs are those industries in which the manufacturing, production and rendering of services are done on a small or micro scale. It provides employment to skilled and unskilled people of different strata. A Small- Scale Enterprise, or simply a small business is marked by a limited number of employees and a limited flow of finances and materials. Small Scale Individual Entrepreneurs organizes business processes and incurs the risk of running an operation based on the opportunity to make a profit. They focus on sales rather than business development and are concerned more about functional steps instead of strategic growth. The Covid-19 effected Small Scale Individual Entrepreneurs globally. The focus of most businesses for now is on protecting employees understanding the risk to their business and in managing supply chain disruptions. This is very important for safeguarding jobs and incomes preserving financial stability and to revive growth by minimizing disruptions to trade and global supply chains. As, Covid-19 continues its disruptions the livelihood of small business owners has been threatened. In this background the paper seeks to study the Small-Scale Individual Entrepreneurs in the New Normal.

Key words; Small Scale Individual Entrepreneurs, Survival strategy, New normal.

Introduction

Corona virus disease is an infectious disease caused by a virus. This is transmitted through droplets when an infected person coughs, sneezes or exhales. The outbreak first observed in Wuhan city of China and had spread rapidly in many parts of the world. Covid-19 had a huge impact on our economy. India is among one of the most affected economies due to Covid. When lockdown was announced in India people thought it may leave them in a day or week, but it continued for months as the situation became worse. Almost everyone had trouble from a small vendor to large Entrepreneur. The economy plunged. It was a do or die situation for many people. The rich people somehow managed the situation but the poor, daily wage earners, Small Scale Industries, Small Scale Individual Entrepreneurs were affected a lot. As soon as the lockdown was lifted and restrictions were removed, many were back to their work field to earn their livelihood. They are trying new ways to cope up with the situation, but return to their business is not the same. They have seen a decline in their revenue, less customers, low orders but still they have not given up. They took it as a challenge and started using new strategies in this New Normal. They are planning and implementing the ways to bounce back to their business.

New Normal

A New Normal is that where people/society adopt to a situation or settles down following a crisis. As the pandemic led to huge difficulties, individuals had to take actions to reduce risk and minimize transmission by maintaining social distancing, face masks, hand washing etc. The New Normal is adopting isolation, lockdown, new working styles and social life. Small Scale Individual Entrepreneurs play a key role in economic growth of developing countries. He is an organizer and a risk taker who uses opportunity to make a profit. Small businesses include service or retail operations such as small grocery stores, bakeries, hairdressers, photographer's etc. Small businesses vary a great deal in terms of size, revenues and regulatory authorization. These are privately owned corporations that have fewer employees. They use different strategies to earn Profits. Strategies are the collection of techniques for selling products and services directly to the customers. The announcement of countrywide lock down dragged Small Scale Individual Entrepreneurs, employees and external stakeholders in unexpected times, lock down had negative impact on supply of finished goods, procurement of raw materials and availability of employees to work in production and supply processes. These Entrepreneurs faced many challenges related to debt repayment, wages/ salaries, statutory duties etc. Many Entrepreneurs laid off their workers because of inability to pay salaries and halted their production due to less demand.

According to a recent Entrepreneurship survey by GoDaddy, 83% of Indian small business reported a reduction on their revenues and most of them had to shut down their operations. Due to the current situations, many businesses are having to reconsider the way they operate in the New Normal environment. Small Scale Individual Entrepreneurs, Startups and Self - employed workers have not received any kind of financial assistance from the Government. Some of them have received ₹500 under the Pradhan Mantri Garib Kalyan Package but there are no specific policies for them. They need urgent relief from Government. Entrepreneurs of any size in India are facing issues related to procurement of raw materials, credit need market linkages quality, pricing etc. Despite the challenges many Individual Entrepreneurs have adopted to the New Normal and working to bring their business back to profits. Entrepreneurship survey also highlights that more than 60% of small businesses in India are confident enough that despite of negative impact due to lock down, their business will recover and continue to thrive. They are also expecting to grow up to 50% in the coming years.

Objectives of the Study

- 1.To analyse the impact of Covid -19 on Small Scale Individual Entrepreneurs.
- 2.To study the Survival strategies adopted by Small Scale Individual Entrepreneurs.

Scope

The scope of the study extends to a selected respondents residing in Marredpally, Secunderabad, State of Telangana. 30 samples are taken into consideration to find out the survival strategies of Small Scale Individual Entrepreneurs in the New Normal.

Limitations

- The study is limited to 30 respondents only.
- The study is confined to the respondents of Marredpally of Secunderabad only .
- The analysis is based on the responses given by the respondents may or may not be true..

Research Methodology

An Empirical Study on Survival Strategies of Small Scale Individual Entrepreneurs in the New Normal is based on basic research methods, both Primary and Secondary data are taken into consideration.

a) Sample design

This study focuses on Survival Strategies of Small-Scale Individual Entrepreneurs in the New Normal. The data has been collected from 30 respondents using simple random sampling techniques for collecting the Primary data.

b) Sources of data

- Primary Data: A Questionnaire is drafted and information is collected from the respondents of all those who are Individual Entrepreneurs through Informal Personal Interview.
- Secondary Data: Research papers, articles, websites are the other tools to aid the research.

c) Statistical tools and techniques: The data has been analyzed using simple tables, graphs, and simple percentages. M.S. Excel and M.S . Word has also been used to analyze the data

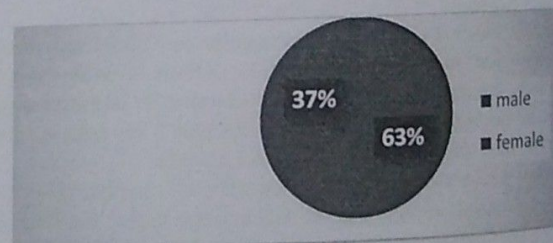
Data Analyses And Interpretation

A Study was conducted with the help of the Questionnaire on a sample size of 30 and the following results were obtained. The data consisted of members from different walks of life, age, profile, occupation and gender. This study focuses on Survival Strategies of Small Scale Individual Entrepreneurs in the New Normal.

The following questions were asked ;

1.Gender

| Options | No of respondents |
|---------|-------------------|
| Male | 19 |
| Female | 11 |
| Total | 30 |



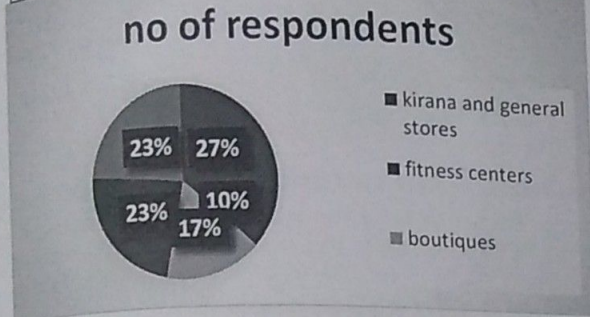
Interpretation

The above pie diagram indicates that 63% of respondents are male and 37% of the respondents are female

2.Occupation

| Options | No of respondents |
|---------------------------|-------------------|
| Kirana and General stores | 8 |
| Fitness centers | 3 |

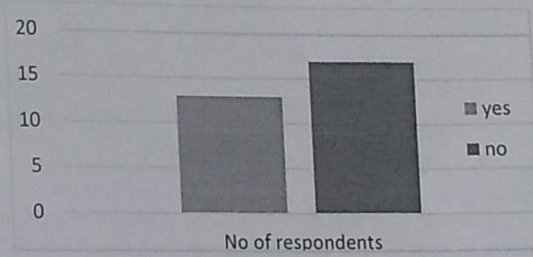
| | |
|-----------|----|
| Boutiques | 5 |
| Saloons | 7 |
| Others | 7 |
| Total | 30 |



Interpretation
27% respondents are from Kirana and General Stores, 10% of respondents belong to Fitness Centres, 17% of respondents have Boutiques, 23% of respondents are from Saloons and 23% respondents belong to other category.

3. Do you have Employees working in your business.

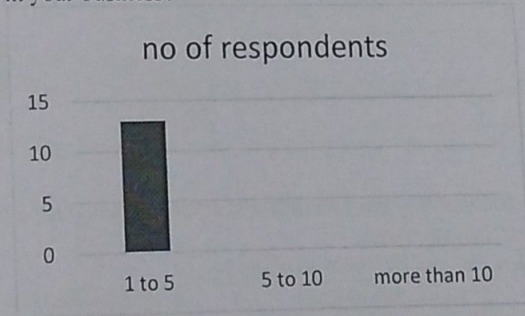
| Options | No of respondents |
|---------|-------------------|
| Yes | 13 |
| No | 17 |
| Total | 30 |



Interpretation
43% of respondents said that they have employees working in their business. 57% respondents said that they do not have any employees working.

4. If yes, how many no. of Employees are working in your business?

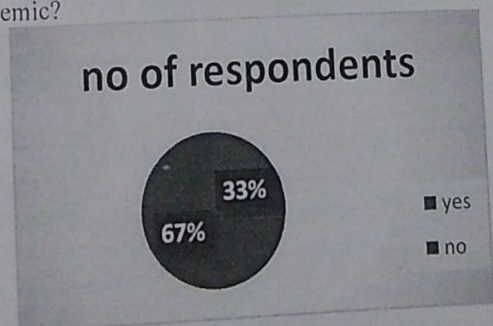
| Options | No of respondents |
|--------------|-------------------|
| 1 to 5 | 13 |
| 5 to 10 | Nil |
| More than 10 | Nil |
| Total | 13 |



Interpretation
100% of the respondents said that the no. of Employers working in their business are below 5.

5. Was your business in operation during pandemic?

| Options | No of respondents |
|---------|-------------------|
| Yes | 10 |
| No | 20 |
| Total | 30 |

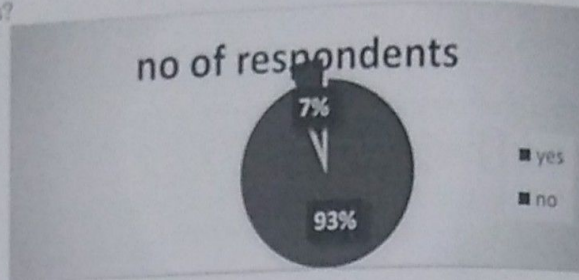


Interpretation

33% of the respondents said that they operated their business during the Pandemic. 67% of the respondents said that they did not operate their business

6. Has Pandemic effected your business?

| Options | No of respondents |
|---------|-------------------|
| Yes | 28 |
| No | 02 |
| Total | 30 |

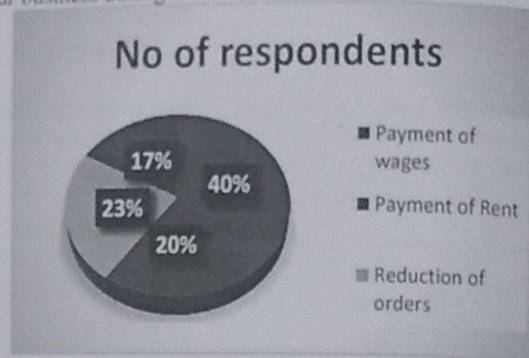


Interpretation

93% of the respondents said that their business has affected during Pandemic and remaining 7% of the respondents said that their business is not affected during Pandemic.

7. What was the most significant problem for your business during outbreak?

| Options | No of respondents |
|---------------------|-------------------|
| Payment of wages | 12 |
| Payment of Rent | 6 |
| Reduction of orders | 7 |
| Repayment of loans | 5 |
| Total | 30 |

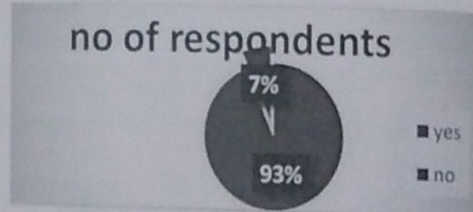


Interpretation

40% of the respondents said that they had faced problem in paying wages, 20% of the respondents said that they had problem towards payment of rent, 23% of the respondents said that their orders were reduced and 17% of the respondents said that they had problem in repayment of loans.

8. Did you pay the salaries to the employees during the Pandemic?

| Options | No of respondents |
|---------|-------------------|
| Yes | 6 |
| No | 7 |
| Total | 13 |

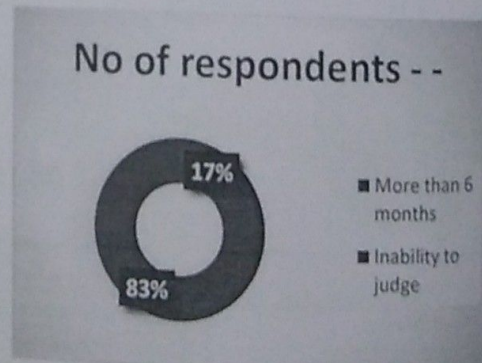


Interpretation

46% of the respondents said that they paid salaries to their employees during the Pandemic. 54% of the respondents said that they did not pay the salaries to the employees.

9. What was the time taken for your business recovery?

| Options | No of respondents |
|--------------------|-------------------|
| Less than 3 months | - |
| 3 to 6 months | - |
| More than 6 months | 5 |
| Inability to judge | 25 |
| Total | 30 |

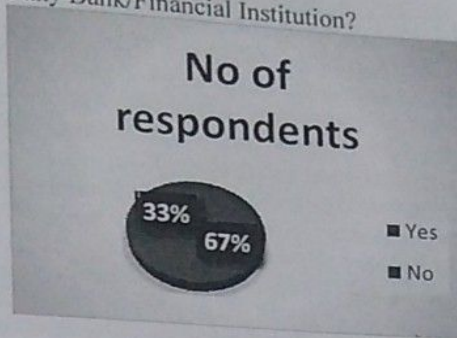


Interpretation:

17% of the respondents said that it took more than 6 months for their business recovery and 83% of the respondents were unable to judge their business recovery.

10. Did you seek any financial assistance from any Bank/Financial Institution?

| Options | No of respondents |
|---------|-------------------|
| Yes | 20 |
| No | 10 |
| Total | 30 |

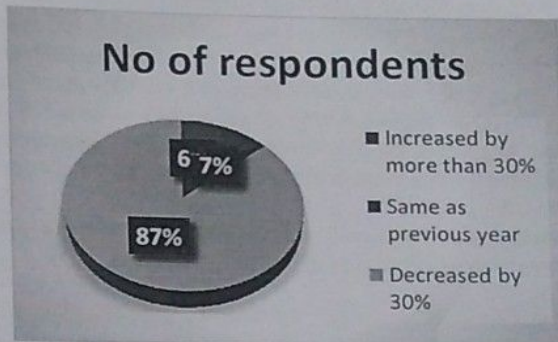


Interpretation

67% of the respondents said that in order to survive during the pandemic they have taken financial assistance from Banks, Financial Institutions, Money lenders and 33% of the respondents did not seek any financial assistance.

11. Compare your business revenue of 2020 with 2019?

| options | No of respondents |
|----------------------------|-------------------|
| Increased by more than 30% | 2 |
| Same as previous year | 2 |
| Decreased by 30% | 26 |
| Total | 30 |



Interpretation

6% of the respondents said that their revenue has been increased by 30%, 7% of the respondents said that there is no change in their revenue, 87% of the respondents said that their revenue has been decreased by 30% compared to 2020 with 2019.

12. What methods/steps/strategies did you take to overcome the losses or bounce back into the business?

Interpretation

Saloons adopted a strategy of rendering personalized services with proper precautions and also provided packages for their customers.

Boutiques offered discounts in order to attract customers to retain in the market.

Fitness centers has given offers and also followed Covid -19 precautions so that customers show an interest to join in their centers.

All the Entrepreneurs have told that they are maintaining social distancing, sanitizing their premises and following strict rules of covid in order to stay safe and healthy

These are the New normal strategies which they are following in order to bounce back to their business profits.

Findings of the Study:

63% of respondents are male and 37% of the respondents are female.

27% respondents are from Kirana and General Stores, 10% of respondents belong to Fitness Centres, 17% of respondents have Boutiques, 23% of respondents are from Saloons and 23% respondents belong to other category.

33% of the respondents said that they operated their business during the Pandemic. 67% of the respondents said that they did not operate their business.

93% of the respondents said that their business has affected during Pandemic and remaining 7% of the respondents said that their business is not affected during Pandemic.

40% of the respondents said that they had faced problem in paying wages, 20% of the respondents said that they had problem towards payment of rent, 23% of the respondents said that their orders were reduced and 17% of the respondents said that they had problem in repayment of loans.

17% of the respondents said that it took more than 6 months for their business recovery, and 83% of the respondents were unable to judge their business recovery.

67% of the respondents said that in order to survive during the pandemic they have taken financial assistance from banks, financial institutions, money lenders and 33% of the respondents did not seek any financial assistance.

6% of the respondents said that their revenue has been increased by 30%, 7% of the respondents said that there is no change in their revenue, 87% of the respondents said that their revenue has been decreased by 30% compared to 2020 with 2019.

Entrepreneurs used different strategies to bounce back their business.

Conclusion:

We here by Conclude that Fitness centers, Saloons and Boutiques were adversely affected during the pandemic, Medical shops revenue has been increased. kirana and General stores played a vital role in rendering their services to the customers in this tough times. 87% of the respondents said that their revenue has decreased by 30% compared to 2020 with 2019. Also many Entrepreneurs couldn't pay salaries to their workers and laid them off. In the New Normal all these Small-Scale Individual Entrepreneurs are adopting new strategies and maintaining social distancing, sanitizing their premises and ensuring each customer wears a mask and trying to bounce back to their profits by giving some discounts and offer packages especially by Saloons, Fitness centers etc. Pandemic brought a great change in the lifestyle of every individual. It gave a positive side and a hope that things will change and better days are ahead. The Covid-19 Crisis had led to dramatic shifts in consumer behavior. As a result the Entrepreneurs have to work hard to meet the ever evolving customer preferences, in order to gain profits and remain relevant.

Suggestions:

- Kirana and General stores should offer home delivery services if possible and can go digital for payment.
- Fitness centres should maintain social distancing among customers which not only keep them safer but also gives them peace of mind. Group classes have to be limited by providing different slot timings. Customers should be provided sanitizing wipe throughout to clean the equipment before and after the use. The Entrepreneur should ensure that the equipment and premise should be properly sanitised. They can also offer at home fitness solution/virtual classes which will not only allow them to provide value but also bring in another stream of revenue to keep their business alive during these trying time.
- Boutiques and Saloons can provide personalised services and if possible, they can exhibit their skills on social media to grab customers attention.
- Every Entrepreneur must make sure that their premises is clean and to follow Covid precautions. They must be in touch with their customers through communication.

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Implications of DTQW on quantum devices

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Abstract

The dynamics of DTQW can be accelerated by adjusting the evolution parameter over time (AQW). This paper shows how accelerated DTQW dynamics can be used to control and enhance system entanglement. Destruction of the coin characteristics in space and time can cause spatial and temporal disorder. Disordered DTQW can simulate Anderson localization, weak localization, and analyse localised dynamics. By accelerating the parameter in a disordered DTQW system, the disordered system can be de-localised.

Introduction

DTQW has been realised on many quantum devices. On an NMR system, nuclear spins represent the coin and position state. Radio frequency is used to tune spin coupling between two neighbouring nuclei. Ion-trap simulates the coin state as being hyperfine, and position states as being quantized energy states caused by ion oscillation[1-3] wave-guides, q-plates, phase shifters, and beam splitters are used in photonic systems to implement quantum walk and evolution operations. In cavity QED, atoms' electronic levels are coin states, and photon numbers map to position states. The atomic level resonant interaction is linked to the coin operation and the change in photon numbers to the shift operation. Determining the practicality of DTQW algorithmic applications on quantum circuits is critical[4]. The first quantum circuit based DTQW implementation was on multi-qubit NMR. The number of steps is limited by the number of qubits and coherence time. One must map the position state to the multi-qubit state for DTQW on quantum circuits. Recently, one such mapping on $N + 1$ -qubits superconducting system was reported to implement N -steps of DTQW.

Its postulates are to identify the “mathematical universe” for modelling quantum phenomena (as n-dimensional Hilbert spaces with n the maximum number of distinguishable states of the system); to establish a correspondence between a quantum system and its mathematical abstraction (a quantum state is a “ray” in n-dimensional Hilbert space); and to describe the spontaneous eigenstates of quantum systems. Atomic or sub-atomic particle states hold quantum information. A qubit is a quantum information unit. Today's qubit physical embodiments include:

Photon polarization encodes the information.

- An atom. The information is encoded in the electron spin.
- QDs. Little devices with a small number of free electrons.

Quantum dots can have a single electron or a cluster of thousands of electrons, depending on their size and form. Semiconductor materials; diameters range from nanometres to microns.

The information is encoded as electron presence/absence. • An optical cavity atom.

- An ion in a trap has two states.
- NMR liquid (Nuclear Magnetic Resonance).

Lattices NMR.

- macro-gas clouds
- Diamond nitrogen vacancies
- Josephson nexus

Quantum data has unique properties: We can't reliably distinguish non-orthogonal quantum states due to superposition. The randomization of a quantum computer's internal state owing to environmental interactions is known as decoherence[5-6].

Conceptually, decoherence can be avoided by using quantum fault-tolerant circuits, quantum error-correcting codes, and entanglement purification and distillation. Significant progress should be achieved in all of these areas before quantum computing is feasible. This tutorial introduces basic quantum computing and quantum information theory ideas and applications.

Then we give some experiments that reveal quantum effects. We review the fundamental quantum mechanics ideas required to comprehend quantum devices. Quantum gates and quantum circuits are used to change a quantum system's state and so process information. Each of these gates is a classical logic gate[7-8]. We can also mimic any n -qubit quantum circuit using one-qubit gates and CNOTs. These global quantum gates show: To perform any unitary transformation A on n qubits, U_k must act on two or fewer computational basis states. (ii) Each transformation U_k is a product of one-qubit gates and CNOTs. (iii) A one-qubit gate's transformation can be approximated well by the three gates in the set (H, S, T).

Mathematical calculations, internet searches, economic modelling, weather forecasting, and other tasks tax even the most powerful computers. Computers are fundamentally inefficient, not because microprocessors are slow. Modern (classical) computers work by dividing a task into elementary operations, which are then executed serially, one by one. Parallel computing has been attempted for some time, but progress has been slow and patchy[9]. The reason is because microprocessor logic is essentially serial (typical computers appear to be executing multiple tasks at once, such running a word processor and a spreadsheet software, but in reality the central processor is merely cycling fast between jobs). A parallel computer's nature would imply simultaneity. It would be able to search quickly through a huge list of options to find the one that solves the problem. These machines exist. QCs (Quantum Computers Quantum parallelism is the more fascinating aspect of quantum computing. A quantum system is in a "quantum state" which is a superposition of multiple classical or classical-like states. This is the linear superposition concept used to build quantum states. In order to avoid undesired entanglement with the environment (decoherence), a quantum computer must be shielded from unwanted entanglement. Quantum parallelism on a serial machine[10].

To compute all values of a function $f(x)$ of a binary vector x of length n , we require either one copy of the circuit and 2^n time steps (assuming one time step to compute one input) or one time step and 2^n copies of the circuit. In one time step, a quantum circuit can compute all 2^n values of the function. The circuit's output is a superposition of all possible f values (x). We illustrate quantum parallelism with a "oracle" that can determine whether a binary function is balanced (the Deutsch problem). A practical example of a test to verify if a function is balanced is a voting

machine. Suggestion: use two input buttons one for each candidate and an output display. We analyse the results as we press each button[11].

If the findings are same, the machine is broken. If the two results differ, the machine may or may not work. A quantum circuit for Deutsch's dilemma and show how to calculate a quantum circuit's output: It is necessary to split the circuit into stages, compute the transfer matrix of each stage as tensor product of the transfer matrices of each gate changing each qubit, and calculate the state of the circuit at the input as tensor product of ket vectors (in Dirac's notation). This technique is repeated for each stage until we have the output state. While discussing quantum information theory, we briefly touch on dense coding and quantum teleportation. Quantum computers and quantum information theory have incredible promise.[12] Reversible quantum computers avoid conceptually irreversible processes and can dissipate energy arbitrarily efficiently. Solid state devices from 2000 require 31018 Joules/switching operation. Ralph Merkle of Xerox PARC calculated in 1992 that a 1 GHz computer with 1018 gates in a volume of around 1 cm³ would dissipate 3 MW of power. Solid state device power consumption grows with clock rate cube.

In the single-particle DTQW dynamics, any parameter can be disordered. The Anderson localization (strong localization) and weak localization (disordered DTQW) have been widely studied. Using the quantum coin operator and a phase operator, we may add acceleration and disorder to the quantum walk dynamics. This allowed us to investigate the impact of localization in strengthening and preserving entanglement between two initially separated particles across a large number of quantum steps. Particle Anderson localization has been experimentally simulated [12]. The two particles are initially separated but after a few steps of walking they entangle and how disorder in such a movement affects localisation. The interaction between the particles and their limitation to one spatial dimension due to bosonic/fermionic nature is also introduced. Along with the well-established link of quantum walks with enormous Dirac equation [13-15], these inter-winding connections can be used to examine the connection of acceleration, mass, and entanglement in relativistic quantum mechanics and quantum field theory. Based on these findings, we will be able to model the dynamics of accelerated quantum particles using quantum walks. An analytical investigation is followed by a dynamic analysis of

the dispersion relations, with numerical data supplementing the analysis. single- and two-particle AQW dispersion relation and transfer matrix This shows how the probability amplitude changes from one point to another for a particular time-step and how it depends on the evolution operator's parameter. Then, to explore weak and strong (Anderson) localization in the accelerated DTQW, temporal and spatial disorder is introduced in one of the evolution operator's parameters (coin operator).

With increasing acceleration, AQW probability amplitude extends over more space. In one dimension, two-particle DTQW entanglement is similar to single-particle AQW. We also show that in the case of two particles, even if the initial state is separable, the particles entangle after a few steps of quantum walk, but the entanglement decays with time. [16-17] The decay time decreases with acceleration. A similar trend holds for disordered two-particle AQW.

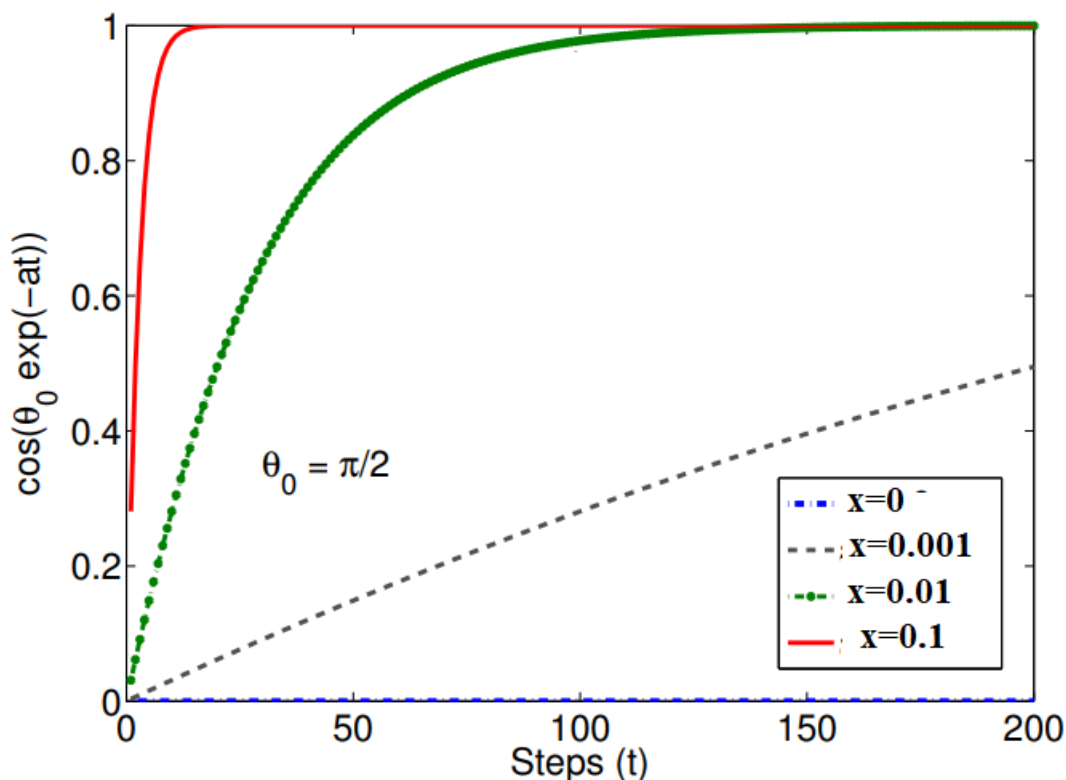


Fig Effect of accelerating parameter a on quantum component

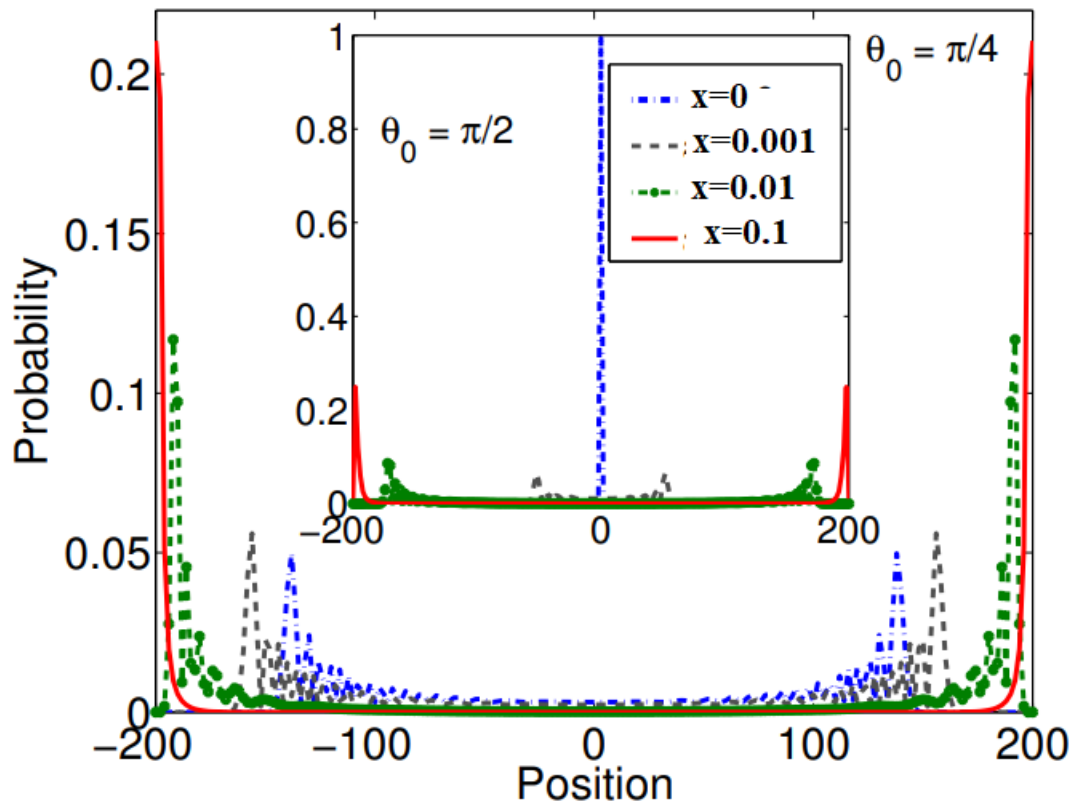


Fig. 2 Probability distribution

Conclusion

Enhancement of entanglement between the particle and the space in which it moves Single-particle DTQW's entanglement between its particle and its position space reaches its maximum value faster for faster acceleration and then reaches its maximum value and then stops. There have been earlier results that show that entanglement between particles and space increases because of temporal disorder. This fits in well with that. A lot of the time, entanglement gets better because of how quantum coins work, but this is just one example of how randomness in time can make it even better.

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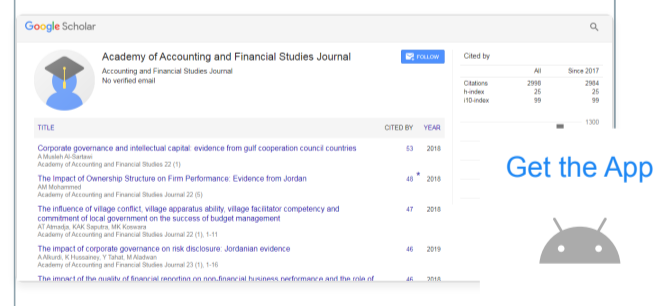
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INVESTORS BEHAVIOR ROLE IN MARKET DECISION - AN IMPACT OF VIX FUTURES ON VIX SPOT

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ABSTRACT

The present study has focused on the investors' behavior role in investment decision making. The study has considered the irrational and rational behavioural aspect and collected the primary data with the simple random methodology. The study also considered the secondary data of volatility base index VIX from nse India. The VIX will tell us the market volatility picture of National Stock Exchange India. The present study made an attempt to know impact of Volatility Index – VIX future on the Spot market volatility. The study has considered the historical data of NSE India from the period of 2015 to 2020. In the study VIX future influence on the VIX spot has been examined with the statistical method of Ordinary least square and the result reveals that the VIX future significantly influenced the VIX spot market and with the ARCH family model Volatility of VIX future impact on the Volatility of VIX spot examined. The GARCH test result reveals that the VIX future volatility influenced positively the VIX spot market.

Keywords: Future Index, Hueristic behavior, Irrational Behaviour, Nifty, Rational Behaviour, Stock Market, Spot, VIX and Volatility.

INTRODUCTION

An investor investing in the stock exchange typically expects some changes in the stock indexes or overall market and then take the investment decisions. Indexes not only measure investors' income, they also calculate the actual state of the economy. The industry has common use of the future by investors, in the same time that speculators are other major beneficiaries of these contracts, to protect themselves against hostile future price fluctuations. The majority of retail investors and block dealing are reportedly tracking the trade volume market, overcoming price fluctuations that these indicators indicate.

Across the globe, shareholders buy or sell shares in periods of uncertainty or high volatility with greed and fear. Incidents like the one that happened in Lehman Brothers in 2008 led investors to the panic in stocks that sparked the global financial crisis. The crisis made investors scared to classify investment strategies on the basis of underlying and forward-looking indicators. Buyers from the post-crisis crisis centered with changing unsafety on diversifying their portfolios. As a result, the 'Volatility Index (VIX)' was developed in stocks around the world and India to measure volatility. VIX is designed to quantify corporate risk and is also used to assess market reactions as an investor anxiety gauge. The price and the net value of volatility are calculated based on the price of different options. A high value for VIX would mean a substantial increase in the stock index of the investor. A low value of VIX only predicts slight improvement, and hence the relationship between the two is negative. The study will analyse the various measures of demand and their effect on the business flow. This analysis has implications both for academics and practitioners. The analysis has straightforward proof of how the value of the stock index is

influenced by changes in selected variables.

Volatility Index is determined on the basis of the price of various options and the net value of volatility is extracted. A high VIX value would imply that the investor assumes significant improvements in the market index, whereas a low VIX value expects just marginal improvement and thus there is a negative connection between the two. Our analysis would analyse the different demand metrics and their effect on the flow of the market. This research has consequences for scholars and clinicians alike. We have clear proof as to how shifts in chosen variables influence the value of the Stock Index.

REVIEW OF LITERATURE

Gopal, (2019) investigate that effect of Volatility Index (VIX) impact of India Stock exchange. It found that VIX influences future prices (positively) are directly and indirect influence on open interest and turnover and estimated that VIX indirectly influences spot prices (negative) far less than its direct effect on open interest, future prices and turnover. The study concluded that open interest and turnover prices are often known as fluctuations and are mirrored in the underlying Spot Prize and suggested that different demand metrics will have significant impact on market movement. Tapal, (2017) aimed to examine the volatility in the India VIX. For this purpose data for six calendar years from 2011 to 2016 is extracted and analyzed yearly, half-yearly and quarterly and tested the hypothesis whether the variance is significant among years, half-years and quarters. The study found that there is no significant difference in the volatility among the six year period implying volatility has been consistent for the selected period of six years. Bantwa, (2017) examined the “*relationship between India VIX and NIFTY*” and to find the usefulness of the Volatility Index as a risk management tool for trading on the stock market. It is found that the relationship between NIFTY and VIX is strong as the market moves down and vice versa. It found that two indices were moving in the opposite direction. There is a significant Linear regression between India VIX and NIFTY . It Suggested that there the rates of return for different holding periods in the future CNX Nifty Index and the CNX Midcap 50 Index. In the researcher of Sadarskyc, (2016) mainly focused on Market volatility for CARB countries with respect to uncertainties in economic policy shocks and shocks to commodity price. It reveals that volatility of the stock market is positive impact will rise in the countries stock prices and also stated that investors and policy maker will be more beneficiaries will keen observing the movement of CARB countries volatliy index. Park, (2015) focused on the variance equivalence relation that must exist between the SPX options and VIX derivatives . It was found that during Lehman Brother crisis SPX option prices were cheaper than the VIX derivatives. It was also found out that only SPX option prices adjusts to eliminate the disturbance . These asymmetric results indicated that most of the price discovery occurs in the VIX derivatives rather than in the SPX options. In the researcher of Chandra et al., (2015) investigate the “*Asymmetrical relationship between the Indian Volatility Index (india VIX) and stock market returns*” and demonstrate that the returns of Nifty are linked negatively with shifts in Indian VIX levels, but the values on these two indices are likely to shift separately in the event of high upward moves. The relationship is less important for larger amounts as the demand moves dramatically downwards. “*India VIX is a keen advocate for a risk management tool in which derivatives based on the Volatility Index can be used as a portfolio protection tool against the worst losses*”. The study also find that India VIX capture stock volatility better than conventional volatility steps, including the model class ARCH/GARCH . It concluded that, whether changes can be used as a signal for portfolios in India VIX. In order to keep positive portfolio returns, our timing strategy analysis based on shift in India VIX shows that moving to larger (mid-cap) portfolis when India VIX rises (declines) by a certain percentage point.

Mall et al., (2014) examined the relationship between India VIX and nifty returns. By implementing Johanson's co-integration and Granger causality methods. VECM was applied and the output shows that there was significant relationship exists between VIX Index with returns of Nifty. It also concluded that VIX index has significant positive impact on return prices of Nifty. Nicholas et al., (2011) focused to examine the relationship between stock returns and volatility. The study estimated that during the crisis period, volatility change quickly for most stocks, with persistent changes. It stated that before the crisis, more investors are rewarded for market risk, and fewer stocks show a positive relation between equity revenues and volatility during the crisis. It concluded, most inventories have no positive and statistically significant leverage effects. Gahan et al., (2012) analyses the pre and post-derivative volatility patterns of "BSE Sensex and NSE Nifty". They estimate the variance, considering both pre- and post-derivative styling characteristics of volatility such as durability, asymmetry, etc. During the periods of 1992-2012 and 1995-2012, they use the regular closing index levels of "BSE Sensex and NSE Nifty". In the post-derivative phase, volatility is lower than the pre-derivative. It stated that there is a more volatile effect than the time before the derivative in the post-derivative period. They also notice the asymmetrical impact on volatility has increased through adding derivative materials. During the period of January 2005 to June 2009 in the Indian BSE Sensex Indian index Tripathy et al., (2009) investigate the "relationship between leverage effect and daily stock returns, volume and volatility". The study found that the residue has significant ARCH effects and the volatility shocks on the market have been very persistent. They also found that newer news as well as old news have an effect on stock volatility. They find evidence of an impact on the stock market asymmetrical and leverage. It also stated bad news has more impact on trade volumes and market volatility. And concluded that GARCH asymmetries fit better than the GARCH symmetry model and suggested that only the arrival of new information is expected to result to systematic fluctuations in trading volume. Al-Ajmi, (2008): In his research, he discovered new data on the risk aversion determinants of individual investors in Bahrain. Many results were uncovered by the survey of 1000 investors, such as men having a strong risk appetite level, schooling and income being heavily associated with risk appetite level, and so on. Bahrainis were found to be more influenced to invest in the equity market than non-Bahrainians. Investment firms and financial sector advertisers were among those who suggested developing programmes to meet the unique needs of various types of buyers.

Kim et al., (2004) investigates that there is a "positive bond volatility and stock premium ratios is more decisive when the volatility feedback effects" are considered for the period from January, 1926 to December, 2000 a result of significant and sustained shifts in market volatility. It estimate a formal volatility feedback model based on market volatility from Markov. It found that "there is a positive reaction between stock market volatility" and equity price found to be a negative and substantial volatile. Samanta, (2003) explores the role of the stock market with regard to excess return and volatility in forecasting Indian economy's growth in production. He considers that past values suggest that the stock market has important volatility-feedback effects. In recent years, excess revenue has also been very closely correlated with uncertainty. However there is no simple position for stock market yield and volatility to forecast growth in future production. In order to understand the relationship between stock market returns and volatility and potential production growth in India's economy, further in-depth research is therefore required. Yaraswy, (1993): The author examined how turnaround stocks provide large returns to ambitious buyers. The author have focused on these securities have extraordinary potential and are already underpriced. The stock market, as a barometer of the economy, strongly tracks the patterns of the economy as a whole, because when fundamentals are down, so is the stock market. This scenario presents a better chance for bargain seekers who are naturally bullish buyers. They can follow the watch

with caution policy. In its reporting period of May 1992 to February 1996 Song et al., (1998) addressed the connections of Shanghai's and Shenzhen stock exchanges' returns and volatility in China. GARCH models are used to evaluate the relationship of volatility and returns. It notice that the correlation between returns and volatility is positive. It also found that there is “*Transmission of volatility between the two markets (the spill-over effect of volatility)*”. Results in the month ahead of ex ante estimates indicate a similar trend in the conditional return variations of both capital markets. The relationship between stock sales and stock volatility is reviewed by French et al., (1987). During the time between January, 1928 and December 1984, they use regular values of the “Standard and Poor” (S&P) composite portfolio. They use “*Auto-regressive Integrated Moving Average*” (ARIMA), “*Auto-Regressive Conditional Heteroscedasticity*” (ARCH) and the GARCH model. The anticipated market risk premium is associated positively with predictable stock return volatility. It also find that unforeseen “Stock Market Returns” linked to unforeseen shifts in stock return volatility.

Research Gap

Based on the above mentioned review of literature, it is evident that many researcher’s have focused on the volatility effect on the stock market. The following are the reviews, which are in different directions. They are

1. Few papers have focused on the derivative products impact on the market volatility with the comparison of index and non-index stocks.
2. The studies have also highlighted spot market volatility effect on the future security volatility.
3. There were papers, which have focused intra-country stock market volatility
4. The studies also examined the nature of volatility between the different asset classes.
5. The stock returns have measured with the VIX volatility relationship.

Therefore, no research has been attempted to know the investors behavior aspect role investment decision, which place the crucial role in market volatility. The study also makes an effort to examine the effect of VIX future volatility on the VIX spot market volatility. Therefore, the present study is making an attempt to know the role of VIX future volatility in spot market volatility.

OBJECTIVES OF THE STUDY

1. To examined the investors’ behavior role in stock market investment decision
2. To know the impact of VIX Futures on VIX Spot of equity market
3. To examine the Volatility effect of VIX Futures on VIX Spot of equity market.

Hypotheses of the study

H0₁: VIX Futures has no impact on VIX Spot

H1: VIX Futures has impact on VIX Spot

H0₂: There is no Volatility effect of VIX Futures on VIX Spot.

H1₂: There is Volatility effect exist of VIX Futures on VIX Spot.

RESEARCH METHODOLOGY

The study adopted the exploratory and qualitative research methodology. The study has considered the secondary and primary data for the examination of framed objectives. The

study has collected the primary data from the equity market investors, who are having minimum three years of experience in stock market.

Sampling Methodology

The study applied the simple random methodology to determine the sample size. The study has collected the primary data from Hyderabad region investors with the framed questionnaire. The study has collected the 384 responses relating to investors behavior. The investor's behavior has been classified in two segments i.e. Irrational and Rational Behavior. The study has considered the three major parameters under the Irrational behavior. They are

1. Heuristic behavior – 4 Factors
2. Prospect Behaviour – 3 Factors
3. Herd behavior – 3 Factors

Rational Behaviour

Under this behavior seven factors were considered, which place the crucial role for the investor's decision making in stock market.

Exploratory Factor Analysis

The study applied the exploratory factor analysis to identify the higher loading factors among the investors' behavior segments of Irrational and Rational. The extracted factors plays the vital role for investors' behavioural role in market investment decision.

The study has considered the secondary data of closing values of India VIX and the closing Prices of India VIX Futures were collected from the National Stock Exchange (NSE) website. The study contains the Value of India VIX and India VIX Futures Closing prices for time period 2014-15 to 2019-20 with total of 1663 daily observations each. All statistics values are calculated with E-views 10 software.

Granger's concept (1969, 1988) is used to check the Causality among the variables. Granger proposed a time series data based approach to determine causality. As per Granger X is a cause of Y if X is able to increase the accuracy of the prediction of Y with respect to a forecast, considering only the past values of Y in forecasting Y. As our study deals with the time series data, the problem with time series data is the non-stationarity. In absence of stationarity, the results of Granger concept will be spurious. So, here the researchers follow the step by step process to apply granger causality test. So, in the first step to check the stationarity of the data ADF test is applied at level and at 1st difference followed with final step to check causality Granger Causality concept is used.

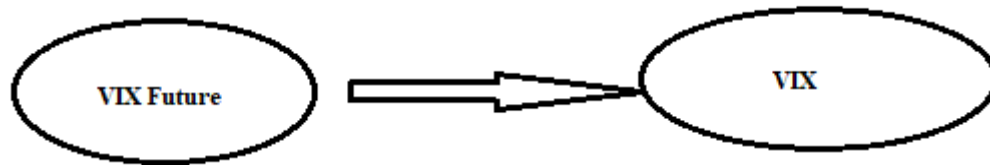
The present estimation of the VIX futures term structure (following Aijio, (2008); Krylova et al., (2009); Fassas, (2012)) has conducted on each trading day by fitting a linear model of the available futures prices and spot VIX level based on the Ordinary least squares criterion. In this study, it estimated the impact of VIX future on VIX by using Ordinary least Square.

Auto Regression Conditional Heteroscedasticity is applied to know the volatile effect in VIX.

Conceptual Framework

The study examined the role of VIX future price effect on the VIX spot market and volatility of spot is having influence by the future volatility. The conventional studies will

examine the spot effect on the future market but in the present study is making a different approach, where VIX derivative is having the impact on the price volatility.



The VIX future has been considered as independent variable and the VIX spot market considered as dependent variable. The study framed the VIX derivative – Future effect on the VIX spot market

DATA ANALYSIS & INTERPRETATION

Objective – 1: To examine the investor's behavior role in stock market investment decision.

The study has considered the primary data from the experienced equity market investors in likert scale opinion structured questionnaire. The study applied the sample adequacy test to run the exploratory factor analysis in Table 1.

| Table 1 SAMPLE ADEQUACY TEST | | |
|--|--------------------|---------|
| KMO and Bartlett's Test | | |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .872 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 131.169 |
| | Df | 136 |
| | Sig. | .021 |

Source: Primary Data

KMO test calculated values is 0.872 that is above the recommend level (0.70) which signifies adequate of data sampling. Further, Bartlett’s test of sphericity indicates that chi square calculated value is greater than critical value that concluded significant of data. Thereby confirming that, segments considered in the study are considered for Factor Analysis in Table 2.

| Table 2 INVESTORS BEHAVIOUR ROLE IN INVESTMENT DECISION | | | | | |
|--|-------|--------------------|--------------------|---|---|
| Factors | 1 | 2 | 3 | 4 | 5 |
| Over confidence | 0.655 | Heuristic behavior | | | |
| Representativeness | 0.492 | | | | |
| Anchoring | 0.859 | | | | |
| Gamblers’ fallacy | 0.285 | | | | |
| Risk aversion | | 0.754 | Prospect Behaviour | | |
| Loss aversion | | 0.642 | | | |
| Mental accounting | | 0.268 | | | |

| | | | | |
|---|--------------------|--|-------|---------------|
| Other investors' decision of purchasing and selling | | | 0.381 | Herd behavior |
| Other investors' decision of the stock volume | | | 0.683 | |
| Other investors' decision on the type of stock | | | 0.285 | |
| Personal and Financial Needs | | | | 0.382 |
| Firm Image | | | | 0.721 |
| Accounting and Financial Information | | | | 0.298 |
| Neutral Information | | | | 0.515 |
| Advocate Recommendation | | | | 0.682 |
| Decision Making Process | | | | 0.584 |
| Stock Indices Performance | Rational Behaviour | | | 0.783 |

Source: Primary Data

Component 1

The table above explains regarding investors behavior towards market volatility. The outcome have determined in the heuristic behavior is, the highest parameter needed to concentrate is “*Anchoring*” with 0.859, next is “*over confidence*” 0.655 this means that there is more the over confidence levels in the investors behavior and the anchoring which needs to be said understandably for the investor so that he/she could be able to invest in the market which leads to increase in the market volatility. 0.492 is the value for the factor “*Representativeness*” which presents the person representing the keen about the investor. Here the least factor which are lower loading are “*gamblers fallacy*” with 0.285.

Component 2

In this prospect behavior the high loading factor is “*risk aversion*” (0.754) and “*loss aversion*” (0.642) implies the state of risk an investors can handle and loss he is capable enough of baring is important to enhance or decrease the market volatility. As per investors behavior market will change vice-versa.

Component 3

Herd Behavior that explains the “Other investors' decision of the stock volume” with 0.683, “*Other investors' decision of purchasing and selling*” with 0.381 and “*Other investors' decision on the type of stock*” with 0.285. Here, the results indicated that the investors with the herd behavior has the impact of it on market volatility with respect to the decision taken by investor on the stock volume and the lowest factor that affects market volatility is investors decision regarding the type of the stock that he/she chose to invest (Blasco, 2011).

Component 4

Rational Behaviour implies the highest loading factor seemed to be in all the factors except “*accounting and financial information*” with 0.298 and “*personal and financial needs*” with 0.382. The results of the study implies the highest in all these factors are mainly “*stock indices performance*” 0.783 which implies that there is the huge impact through the investors behavior on the market volatility is by stock indices and next is followed by “*firm image*” depending upon certain organization fame or image the market prediction will change. The market volatility is changed through the investors behavior can be by mainly stock indices performance and the respective firm image.

Objective 2: To know the impact of VIX Futures on VIX Spot of equity market

This objective made attempt to know the impact of VIX Futures on VIX Spot. The study is based on secondary data for the period of 6 years i.e., from 2014-15 to 2019-20. Ordinary Least Method applied, before the Granger Causality test applied to know the directional effect of the variables. Below table, explain as follows Table 3

| Table 3 PAIRWISE GRANGER CAUSALITY TESTS | | | |
|---|------|-------------|-------|
| Sample: 1 1662 | | | |
| Lags: 2 | | | |
| Null Hypothesis : | Obs | F-Statistic | Prob. |
| NVIX does not Granger Cause SVIX | 1660 | 46.6641 | 0.032 |
| SVIX does not Granger Cause NVIX | | 10.7293 | 0.014 |

Source: Compiled through Secondary data

Table represents the granger causality with respect to VIX Future and VIX Spot. The result indicates that from f-statistic the calculated value for the VIX Future to VIX Spot and VIX Spot to VIX Future is greater than the critical value and from the p-value it say that “*there is a bi-directional effect exist between the VIX Future and VIX Spot*”. Thereby, the study result stated there is a granger cause of VIX Future to VIX spot.

Below Table 4 depicts the Ordinary Least Square with respect to VIX Future on VIX Spot.

| Table 4 IMPACT OF VIX FUTURE ON VIX SPOT | | | | |
|---|-------------|-----------------------|-------------|----------|
| Dependent Variable : SVIX | | | | |
| Method: Least Squares | | | | |
| Sample : 1 1662 | | | | |
| Included observations : 1662 | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| NVIX | 0.983325 | 0.005758 | 170.7744 | 0.0000 |
| R-squared | 0.637903 | Mean dependent var | | 17.41964 |
| Adjusted R-squared | 0.637903 | S.D. dependent var | | 7.285828 |
| S.E. of regression | 4.384213 | Akaike info criterion | | 5.794499 |
| Sum squared resid | 31926.61 | Schwarz criterion | | 5.797757 |
| Log likelihood | -4814.228 | Hannan-Quinn criter. | | 5.795706 |
| Durbin-Watson stat | 0.155843 | | | |

Source: Compiled through Secondary data

The table represent the influence of VIX Future on VIX Spot for the period of 2014-15 to 2019-20. Here, the study considered VIX Future closing prices as Independent variable and VIX spot closing prices as Dependent Variable. The result indicates that VIX Future coefficient value is 0.9832, which indicates unit increase in the Future VIX will increase the Spot VIX by 0.983 units. From p-value it signifies that “*rejection of null hypothesis and acceptance of Alternative hypothesis*” i.e., VIX Future has significant positive impact on VIX Spot.

3rd objective: To examine the Volatility effect of VIX Futures on Spot of equity market.

This objective made attempt to identify the Volatility effect of VIX Futures on VIX Spot for the period of 6 years. Kwon et al., (1997) stated that the stock market is index of

emotions that can have negative or positive effects on the Volatility Index. To justify this GARCH model has been and to apply GARCH model, the study should satisfy Condition 1 (Heterokedasticity test) and Condition 2 (Residual Graph) and the following is the hypothesis as follows.

H_0 : There is no ARCH effect exist with respect to VIX Future and Spot.

H_1 : There is an ARCH effect exist with respect to VIX Future and Spot.

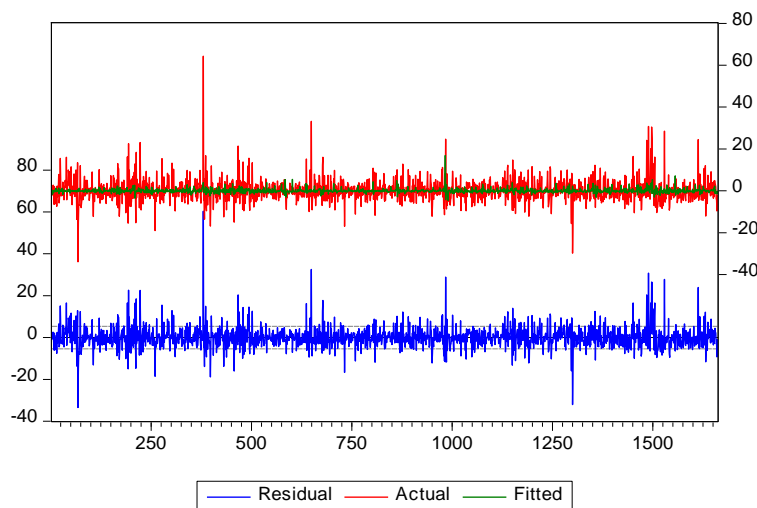
Heterokedasticity test - Condition 1

Before applying ARCH models, it is mandatory to examine whether ARCH effect is exist or not. If it exists, then the next step is to run condition 2 i.e. residual graph, if condition 1 and condition 2 are satisfied, then the study made an attempt to determine the ARCH effect is exist between the variable. In order to determine ARCH effect exist on the data set, Heteroskedasticity test is applied and shown in Table 5.

| Table 5 | | | |
|--------------------------------|---------|----------------------|---------|
| HETEROSKEDASTICITY TEST | | | |
| Heteroskedasticity Test: ARCH | | | |
| F-statistic | 4.29627 | Prob. F (1,1659) | 0.02783 |
| Obs*R-squared | 4.71554 | Prob. Chi-Square (1) | 0.02713 |

Source: Compiled through Secondary data

From the Table 4, it is found that, the F-statistic calculated value (4.29) is noticed to be greater than the critical value (3.8508), and the chi-square probability value seem to be statistically significant at five per cent level of significance ($p < 0.05$), which signifies condition 1 is satisfied Figure 1.



Source: Compiled through Secondary data

Figure 1
RESIDUAL GRAPH

Graph represents the residual line with respect to VIX Future and Spot closing price; here the blue line i.e., the residual line is crossing the fitted line, which formed at different interval for the period of 2014-15 to 2019-20. Therefore, it indicates as ARCH effect exist which states condition 2 is satisfied. Hence, condition 1 and condition 2 found to be satisfied

which indicates rejection of Null hypothesis and Acceptance of alternative hypothesis i.e., ARCH effect is exist.

ARCH Family

Since, ARCH effect is exist with respect to VIX Futures and Spot, it is inferred that the ARCH family models can be used to determine whether the effect of VIX futures on Spot. Here, for the selection of the optimum model among the ARCH family, criteria such as the Akaika Information Criterion (AIC) and the Schwarz Information Criterion (SIC) are used which indicate that the model with the lowest AIC and SIC values would be the optimum model for estimating the effect of VIX Futures on Spot and result as follows Table 6.

The table depicts the one of the economic factors i.e., VIX Futures effect on VIX Spot using ARCH family models. The following is the hypothesis

H0: VIX Futures has no effect on VIX Spot.

H1: VIX Futures has no effect on VIX Spot.

| Table 6 | | | | |
|--|-------------|-----------------------|-------------|----------|
| GARCH EFFECT OF VIX FUTURE VOLATILITY ON VIX SPOT VOLATILITY | | | | |
| Dependent Variable : RSVIX | | | | |
| Method: ML ARCH – Normal distribution (BFGS / Marquardt steps) | | | | |
| Sample (adjusted) : 2 1662 | | | | |
| Included observations : 1661 after adjustments | | | | |
| Convergence achieved after 20 iterations | | | | |
| Coefficient covariance computed using outer product of gradients | | | | |
| Presample variance: backcast (parameter = 0.7) | | | | |
| GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1) | | | | |
| Mean Equation | | | | |
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
| RNVIX | 0.149843 | 0.012706 | 11.79330 | 0.0000 |
| Variance Equation | | | | |
| C | 3.929810 | 0.623829 | 6.299503 | 0.0000 |
| RESID(-1)^2 | 0.090470 | 0.009353 | 9.672319 | 0.0000 |
| GARCH(-1) | 0.777597 | 0.027686 | 28.08632 | 0.0000 |
| R-squared | 0.827156 | Mean dependent var | | 0.148682 |
| Adjusted R-squared | 0.837156 | S.D. dependent var | | 5.455413 |
| S.E. of regression | 5.380830 | Akaike info criterion | | 6.135464 |
| Sum squared resid | 48062.53 | Schwarz criterion | | 6.148505 |
| Log likelihood | -5091.503 | Hannan-Quinn criter. | | 6.140297 |
| Durbin-Watson stat | 2.064107 | | | |

Source: Compiled through Secondary data

It observed from GARCH model that the coefficient value is 0.7775, which indicates unit increase in VIX Future will increase by 0.775 units. Further r-square of the model is 0.827 and probability of the model is less than 0.05 which indicates reject null hypothesis and accept alternative i.e., there is a significant volatility effect of VIX Futures and Spot.

FINDING OF THE STUDY

The study examined the investors' behavior role in market investment decision. The

study result found that over confidence and Anchoring plays the vital role in Heuristic behavior influencing the investor's decision. The study found that herd behavior factor i.e. stock volume generated by the volume influences the investors' decision. Rational behavior factors such as company image, recommendations and stock indices movement also plays the critical role in investors' decision making.

Volatility measures the pace of market upward or downward movement, and how wildly, in the near future, it will change, i.e. the 'rate and complexity of price changes'. Since VIX is an estimate of future volatility, it has a direct impact on the future price and spot market (VIX). "It has traditionally been believed that Volatility (VIX) plays a key role in price determination and by tracking volatility, price behaviour can be easily understood Shenbagaraman (2003)". The study found that the unit increase in the future Volatility will increase the spot by 0.775 units. It also states that VIX helps investors to manage risk effectively and diversify the portfolio and uses it to develop appropriate trading strategies that allow investors to decide when to enter or exit the market.

CONCLUSION OF THE STUDY

The present study has been focused on the investors behavior role in stock market investments decision making. The study has considered the irrational and rational behavior related factors role in the investments decision. The study adopted the qualitative and exploratory research methodology. The study applied the simple random methodology to determine the sample size for the collection of primary data. The study has considered the Hyderabad region of Telangana state with the minimum of three years of experience of stock market investments. The study observed that irrational and rational behavior factors plays the crucial role in decision making of the investors. The study examined the impact of the VIX future on the VIX spot market. Normally in the market spot will have the impact on the future but in this scenario futures effect the study examining on the spot for the volatility index of National Stock Exchange. The study has considered the historical time series data from the period of 2015 to 2020 years and standardized with the stationarity tests with support of E-Views software. The study examined the impact of Vix futures on the spot of Vix and the result stated that it is having the significant impact on the rise of the Vix spot market. The study also made an attempt to know the influence of future of VIX volatility on the spot volatility of Vix. The study result reveals that Vix spot volatility significantly influenced with the fluctuations future Vix.

Further Research Scope

The present study has been emphasized on the VIX future impact on the VIX spot volatility. Based on the present study it has been recommended that the effect of economic factors on the movement of VIX comparison with the Nifty future volatility.

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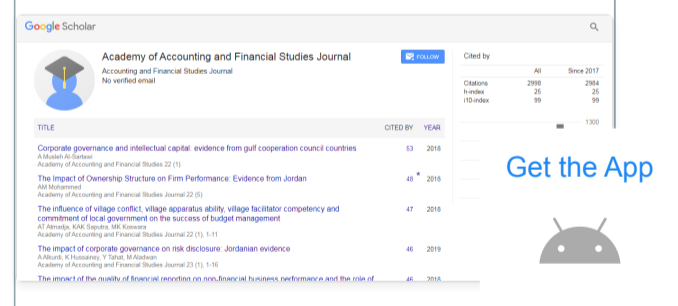
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Impact of Block Chain Technology on the Process Efficiency with Reference to Financial Markets A Study

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Abstract

The block chain technology is playing the vital role in various sector including financial sector across the globe. The present study has made an attempt in this direction to know the impact of block chain technology on the process efficiency in the financial markets. The study adopted the qualitative research methodology with the prime focus on the perception on the usage of block chain technology and impact on the adoption of technology for the efficiency improvement on financial markets. The study has framed the structured questionnaire and applied the statistical method of discriminant analysis and structure equation model. The study result found that Block chain technology will disrupt our industry. It means global transactions will influence the domestic market in capital market with the disruptive technology. The investors' perception level observed to be higher on the Block chain technology is broadly scalable and will ultimately achieve mainstream adoption. The study made an attempt to examine the impact of block chain technology on the adoption of technology for the process efficiency in financial markets and observed that Reduction in settlement period followed by the Smart Contracts will significantly improve the process efficiency. Therefore, it has been stated that block chain technology will change the global scenario in all aspects in near future, with enhanced transparency and accountability.

Keywords

Adoption of Technology, Block-chain Technology, Financial Markets, Process Efficiency, Smart Contracts.

Introduction

Block chain technology (BC) is a novel approach to data storage. Transaction data is exchanged and modified in real-time using computer algorithms using the BC infrastructure, with no third-party interference. When combined with other technology such as big data and the Internet of Things (IoT), BC has the potential to change the way businesses exchange data and perform purchases. It also increases the traceability, validity, and credibility of the good or service. This technology has the potential to benefit various economic sectors, especially decentralized currencies such as cryptocurrencies, smart contracts, and smart land. The disintermediation triggered by BC is projected to exist in all sectors of the economy, with the financial sector being the most affected. BC may have an effect on financial management, assurance, and corporate governance. External audit block chain has the potential to enhance audit efficiency while still increasing the validity and reliability of financial statements. Advocates argue that BC has the power to radically alter the accounting and auditing industries by shifting the accountant's position "from collector and aggregator to translator and observer." As a result, auditors must consider how BC impacts the operational climate in order to assess the effect on a company's financial statements. The implementations of BC in auditing focuses on the technological strengths of the technology rather than how auditors could use it (Ahmad Jumah, 2020).

The potential of block chain to render data secure, permanent, open, and autonomous has piqued the interest of industry and academia. However, it is the social appeal of block chain more than its data processing capabilities that has piqued the interest of academics. Apart from data immutability and verifiability, the primary benefits of block chain in this context are the assurance of confidence in a trustless world and efficient peer-to-peer transactions without the requirement for a central controlling authority ("the third party"). These characteristics correspond to the logic of contemporary science: it is multinational, decentralized there is no administrative authority that determines everything and grows as a result of confidence networks within the academic community (peer review system and invisible colleges). The parallel was not lost on some early observers: "Scientific knowledge, at its core, is a massive, complex body of information and data that is collaboratively generated, changed, utilized, and exchanged, which lends itself perfectly to block chain technology." [Get the App](#)

The appeal of block chain to industry and academia builds upon the promise to make data reliable, immutable, transparent, and decentralized. However, it is data handling, but the social appeal of block chain that has attracted the attention of academia. Principal advantages of block chain in this perspective, apart from the immutability and verifiability of data, is the guarantee of trust in the trustless environment and successful peer-to-peer interactions without the need for a central governing body ("the third party"). These features dovetail with the logic of modern science: it is international, decentralized there is no governing body that decides everything and develops thanks to networks of trust within the academic community (peer review system and invisible colleges). The analogy was not lost on a few early observers: "Scientific information in its essence is a large, dynamic body of information and data that is collaboratively created, altered, used and shared, which lends itself perfectly to the block chain technology".

A diverse range of research disciplines have investigated block chain technologies. Any scholars, for example, also investigated block chain's underlying technologies, such as distributed computing, peer-to-peer networking, cybersecurity, smart contracts, and consensus algorithms.

Review of Literature

Michael Crosb (2015): This paper was developed in an accessible classroom setting as part of a curriculum lead by Prof. Ikhlaq Sidhu at UC Berkeley's Sutardja Center for Entrepreneurship & Technology. The author have focused on the Block chain Technology beyond the Bitcoin. The opinions expressed are solely those of the writers and do not constitute those of the University of California, Berkeley. The findings state that there are number of investors increasing in the bitcoin market which results the usage of the Block Chain technology enabled to many industries. To conclude, Blockchain is the infrastructure that underpins Bitcoin. The distributed ledger capability of BlockChain, combined with its stability, allows it a very appealing technology for solving current financial and non-financial business problems.

Jesse Yli-Huumo (2016): The author explanation for the interest in Blockchain is due to its core characteristics, which include confidentiality, transparency, integrity without any third party entity in charge of the transactions, and hence it creates interesting research areas, especially in terms of technological challenges and limitations. The results show that focus in over 80% of the papers is on Bitcoin system and less than 20% deals with other Blockchain applications such as e.g.



smart contracts and licensing. The bulk of research is focused on exposing and enhancing Block chain's shortcomings in terms of safety and protection, but several of the suggested solutions ignore concrete assessment of their efficacy. Many other Blockchain scalability issues, such as throughput and latency, have gone unexplored. Researchers are given suggestions for potential research directions based on the findings of this report.

Laura Jutil (2017): The aim of this study is to provide a thorough understanding of the potential applications and challenges of blockchain technology. The thesis investigates how technology will impact and support the financial industry, which is the thesis's subject. It investigates how financial institutions will minimise risks and costs by using blockchain technologies, as well as how competitiveness among institutions would change. Since blockchain technology is a relatively recent phenomenon, there has been no study into its implications in the financial industry. As a consequence, estimations of potential outcomes are 5 unknown, and several of the predictions of what blockchain technology could allow in the future financial sector are hypotheses produced in this study.

Soonduck Yoo (2017): This paper explores the current business movements in the finance industry and associated utilities using blockchain. First, an examination of domestic and international cases reveals that the sectors where blockchains are most widely used in the finance industry are extending into arbitration, remittance, securities, and smart contracts. Simultaneously, as the ability to infringe on individuals' personal details has grown, so has the need for blockchain technologies as a result of organisations' attempts to protect it. This paper leads to a better explanation of the developments occurring in the finance industry as a result of the use of blockchain technology.

Dusko Knezevic (2018): The purpose of this paper is to conduct research on the effect of blockchain technology platforms on the financial sector through cryptocurrency, as well as the impact on other industries. This technology, as well as its industrial use, is the focus of study. To comprehend the platform, the study begins with an examination of how the technology works. Then, the benefits for market and economic transactions are identified, and finally, the paper discusses the effect of digital technology on business, including financial operations. The research findings indicate that the technology under consideration has already had a substantial effect on the financial market, that it is in the early stages of transforming several sectors, and that it is likely to transform them dramatically in the next five to ten years. Businesses are gradually discovering the potential of this technology to capitalise on the gains of the Fourth Industrial Revolution.

Sheetal Sinha (2019): The paper's aim is to perform analysis on the impact of block-chain technologies on the finance sector. The Block-chain is an immutable archive that records information facts, or, to put it another way, it is a virtual ledger containing all purchases, contracts, or other events that must be separately registered. One of the most important features of Block-chain is that this virtual database is distributed through a large number of computers and is not always guaranteed to be processed in a centralised location. The block-chain chain has already begun to shake the financial services sector, and it is this infrastructure that underpins the virtual money- bitcoin transaction. Block-chain improves data storage and transformation security, provides a shared and open network architecture, and greatly lowers operational costs. These remarkable characteristics render block-chain a very exciting and in-demand solution, even in a highly regulated industry like banking.

Ariana Polyviou(2019): In this article, we outline five separate finance market usage cases that would be fundamentally changed by the use of block chain technologies. Block chain supporters claim that these usage cases would become commonplace in the finance industry over the next decade. Initially, block chain technology was used as a public transaction database for cryptocurrencies. Beyond cryptocurrencies, block chain technology has lately been considered for a variety of other applications due to its specific properties such as decentralisation, encryption, openness, and anti-tampering. Such assets are particularly beneficial for a number of notable problems encountered in the financial field. As a consequence, block chain technology has the ability to revolutionize the banking world by altering the way various financial services are handled.

Malik Al-Essa (2019): Financial institutions are attempting to adapt to these trends by implementing different types of technologies in order to compete with the high rise in financial services demand and the massive increase in global financial market rivalry. Financial Technology (FinTech) is a modern methodology that aims to substitute conventional financial approaches in the distribution of financial services. As a result, the finance sector must assess the possibilities and threats that Blockchain Technology could bring. Blockchain technology is seen as an incentive for financial organisations and must be regarded as strategic in order for certain institutions to embrace it. The primary goal of this study is to determine the effects of Blockchain Technology on Financial Technology (FinTech).

Min Xu (2019): As a result, this thesis examines existing empirical literature on blockchain, especially in the fields of business and economics. Author investigate the top-cited papers, most productive nations, and most popular keywords using a comprehensive analysis of the literature collected from the Web of Science service. Furthermore, we do a clustering study and describe five research themes: "*economic gain*," "*blockchain technology*," "*initial coin offerings*," "*fintech boom*," and "*sharing economy*." This paper also includes recommendations for prospective research directions and realistic implementations. This article works on reviewing and synthesising articles in industry and economics. We want to locate the primary nodes (e.g., the most influential publications and journals) of relevant study and the core blockchain research topics in our discipline. Furthermore, we plan to make some recommendations for potential studies as well as some recommendations for companies who want to put blockchain into effect.

Aino Nordgren (2019): With the introduction of Bitcoin in 2009, block chain technology became well popular, and it has also received a lot of hype as a technology that could shake the world of financial services. Block chain has also been proposed as a potential alternative to the UK's boundary problems after Brexit. While many applaud block chain's promise to improve transaction speed and security, some are sceptical of its real-world applicability. Is block chain the internet of the transformative invention, or merely a fad? This paper examines block chain technology, its uses in finance and accounting, and block chain's transformative p these areas. Author give an outline of the criticism and roadblocks that must be overcome in order for block chain to realize its full potential.

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Petrov D (2019): Blockchain and distributed ledger are concepts that have just recently been coined. Their emergence and rising prominence was mainly lin the rapid growth of Bitcoin and other cryptocurrencies. However, the features of blockchain technology, which is built on distributed ledger technology, greatly exceed the capabilities of cryptocurrencies. The latest technology is likely to cause seismic shifts in the financial services industry. The nature of anticipated developments is framed by a comparative profile of possible possibilities and shortcomings of blockchain application in the financial domain. Nonetheless, there are a host of unanswered technical, legal, and ethical challenges that must be addressed until blockchain technology can be widely adopted. The findings and guidelines include advice for effectively addressing objective obstacles to blockchain implementation while also summarising the prerequisites for a potential evolutionary leap in the growth of the financial services sector/

Altiyev Kahramon Saidovich (2020): It should be remembered that in today's information-technology environment, it is possible to digitise the partnership between economic institutions within the global financial system and transition to e-government. Furthermore, the mainstream use of blockchain technology in public and private sector services has the potential to address a variety of economic challenges in a timely, cost-effective, and timely manner. In Uzbekistan, a variety of steps are being taken in this direction as well. The essay examines the potential applications of blockchain systems in different socioeconomic domains of society. The focus is on doing a SWOT review of the method of applying blockchain technology to corporate financial management. Furthermore, the method of applying Blockchain technology to corporate financial management, as well as the benefits and challenges, was examined.

Victor Chang (2020): This article discusses the influence and revolution of FinTech and Block-chain in the financial market, as well as the key features of such technologies. Then, author raise three important problems as well as three legal concerns about the use of Block-chain technologies. Researcher discuss the actual reasons for banks to investigate Block-chain, as well as the challenges they face. To get a thorough understanding of the market, a holistic approach was used, and sixteen experts were consulted. The findings of the study revealed that intelligence hiding was caused by affective, physiological, and cognitive tests. The interviewees also presented some guidelines and success drivers for overcoming existing Block-chain implementation challenges. As a result, four key have been created. Finally, this article suggests how financial institutions can adapt to this emerging technology and how to further handle informatio essay adds to the body of knowledge about the emerging entrepreneurial finance ecosystem for Block-chain.



Kohila Kanaga lakshmi (2020): A Block-chain technology is the foundation of Bitcoin, and has recently gained mainstream interest. It is also known as a distributed, irrefutable, and automated ledger since it records transactions in the same order in which they are made in near real-time. Transactions take place in a transparent way on the block-chain. Only with the consent of the network's members, defined as nodes, will additional transactions be added to the ledger. The resulting transfers may only be applied to the ledger with the consent of the network's members, defined as nodes. Block-chain implementations range from finance, digital currency and financial technology, risk control, social services, and the Internet of Things. This paper provides an overview of block-chain technologies in banking applications as well as recent advancements.

Ali (2020): New digitalization movements have totally disrupted and reshaped corporate processes, whole companies, and even whole sectors. Block chain technology is thought to be the most recent breakthrough in sectors such as finance, where confidence is critical. Block chain technology is a decentralized and coded encryption mechanism that allows for the creation of new digital services and networks using this evolving technology. A comprehensive overview of academic publications on block chain technologies in the financial industry is presented in this study. The author began by considering 227 papers and then narrowed this selection down to 87 articles. As a result, author propose a three-dimensional classification framework: block-chain enabled financial incentives, threats, and capabilities. This study explores consequences for potential block chain-related science and practice.

Kotishwar A (2020) examined the perception on the usage of blockchain technology implementation. The study used the primary data and the used the structure equation modelling. It was found that smart contract had a higher impact on the efficiency of financial transactions followed by digital currency.

Research Gap

There were many studies have focused on the block-chain technology and its importance in the various sectors

The above few mentioned reviews are in that direction. The existing extensive literature indicated that, there is a luke warm research took place in financial sector, where technology plays vital role for the seamless transactions. Few researches have focused as follows:

1. Many papers have focused on the Block chain Technology beyond the Bitcoin. The paper also stated that there are number of investors increasing in the bitcoin market which results the usage of the Block Chain technology enabled to many industries
2. Few papers were focused on the influence and revolution of FinTech and Block-chain in the financial market, as well as the key features of such technologies.
3. Few studies indicated that in today's information-technology environment, it is possible to digitise the partnership between economic institutions within the global financial system and transition to e-government.

The above mentioned reviews indicated that no research has been attempted to know the impact of Block chain technology on financial markets process efficiency. Thus, the present study is making an attempt to fill the research gap with title of "*The Impact of Block Chain technology on the process Efficiency with reference to Financial Markets*". The study focused on the perception on the usage of block chain technology.

Research Questions

Based on the research gap the following research questions were framed

1. Will investors have any perception on the usage of block chain technology in financial markets?
2. Does block chain technology will have any impact on the financial transactions process efficiency?

Objectives of Study

1. To examine the investors perception on the usage of block chain technology in financial markets.
2. To know the impact of block chain technology in the financial transactions process efficiency.

Hypothesis of the Study

H0: There is no impact of adoption of Block Chain on financial market process Efficiency

H1: There is an impact of adoption of Block Chain on financial market process Efficiency

Research Methodology

The study has adopted the qualitative research to examine the role of block chain technology in the financial markets transactions process efficiency. The study considered the various papers, which were studied on the block chain technology in the capital markets aspects.

Source of Data: The study has considered the primary data for the examination of proposed objectives. The data was collected with the help of Questionnaire by the researcher.

Sampling method: The study has taken primary data using Convenience Sampling method. Convenience sampling is a sampling method in which the first available primary data source is used without any additional study criteria. To put it another way, this sampling procedure entails locating participants wherever they can be found, which is usually wherever it is most convenient. In convenience sampling, no inclusion criteria were established prior to subject collection. Participation is open to all subjects.

Sample Units: The study has considered the equity market investment experiencing with technology knowledge. The study has considered the investors occupation is technology, who are working on the block chain technology. The study has considered the Infosys and Polaris software services companies employees, who are working on this technology and also understand the importance of block chain technology and future disruptive technologies.

Sample Size: The questionnaires were distributed to 140 and out of that 15 are partially and non-filled questionnaires have been received. Therefore, the study has considered the 125 completely filled questionnaires were considered.

Parameters Support: The present study has considered the block chain technology role in the financial markets transactions process efficiency. There were many studies have focused on the usage of block chain technology (San Frost, 2019). The study has considered the following Process efficiency of transactions related parameters such as, Faster Payments, Reduction in settlement period, Smart Contracts, Digital Record keeping, Digital Currency and Digital Assets

Questionnaire: The study has framed the questionnaire relating to two objectives. The responses were collected in likert scale structured 1 to 5 points

Data Reliability: The study applied the Cronbach's alpha for the primary data reliability for the questions. The calculated value observed to be 0.946, than base value of 0.7. Therefore, the study can consider the primary data for the analysis.

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Statistical Tools: The statistical tools used in the study were using SPSS Statistics software. The study applied the following statistical methods for the examination of framed objectives:

Discriminant Analysis: The study applied the discriminant analysis to know the investors perception on the usage of block chain technology in the financial markets transactions process efficiency. The discriminant coefficient values will depicts the level of perception of the investors fraternity.

Structure Equation Model: The study measured the impact of block chain technology on the process efficiency of the financial transactions. The study has considered the six variables based on the San Frost, 2019, which were studied on the capital markets in the US markets.

Tabulation of Data Analysis

Objective 1: To Examined the Investors Perception on The Usage of Block Chain Technology in Financial Markets

The study examined the investor's perception of the usage of block chain technology in the financial markets. The study had applied the discriminant analysis to know the perception level based on the coefficient values. The study applied the wilks lambda test to know the fitness for the application of discriminant analysis and the result reveals that all the parameters values were fallen near to 1 i.e. strongly fit of primary data for the proposed questions. The following is the output of the discriminant analysis in **Table 1**.

| Parameters | Coefficients | TDS Weights |
|---|--------------|-------------|
| Executive team believes there is a compelling business case for use of block chain technology | 0.372 | 16.83 |
| Planning to replace current systems of record in block chain | 0.291 | 12.05 |
| Block chain technology is broadly scalable and will ultimately achieve mainstream adoption | 0.721 | 17.59 |
| Suppliers, customers, and/or competitors are discussing or working on block chain solutions | 0.296 | 26.82 |
| Block chain technology will disrupt our industry | 0.835 | 17.8 |
| Will lose a competitive advantage if we don't adoption of block chain technology | 0.683 | 8.91 |

The above table depicts the equity markets investors' fraternity perception level on the usage of block chain technology. The coefficient values indicates that "Block chain technology will disrupt our industry" (0.835) followed by the parameter of "Block chain technology is broadly scalable and will ultimately achieve mainstream adoption" (0.721) are having the higher perception level among the investors on the block chain technology. The study observed that investors are having the lower perception level with the parameters such as "Planning to replace current systems of record in block chain" (0.291) followed by the "Suppliers, customers, and/or competitors are discussing or working on block chain solutions" (0.293). The study found that all the parameters coefficient values are observed to be differ with each other.

Objective – 2: To know the impact of block chain technology in the financial transactions process efficiency

The current study have explained regarding the Block Chain Technology. The analysis considered six factors as the independent variables namely faster payments, reduction in settlement period, Smart contracts, Digital record keeping, Digital currency and Digital Assets. For this, first the model-estimated goodness of fitness index followed by model consistency, which indicates the model, is significant. Structure Equation modeling (SEM) is a set of statistical models that seeks to explain relationships between multiple variables. It helps to simultaneously analyze interrelationships between several dependent and independent variable. First of all, the reasons for choosing SEM for data analysis were, SEM has the ability to test causal relationships with multiple measuring objects between constructs. Secondly, to deal with complex systems, it provides efficient and robust statistical procedures. Finally, the hypothesized model (SEM model) have framed to test the results of the estimated and the results are presented as follows in detail.

The following table portrays the Goodness of Fit, which involves Fit statistics, Recommended and Obtained value, and the result is explained below in **Table 2**.

| Fit statistic | Recommended Value | Obtained Value |
|-------------------------|-------------------|----------------|
| Chi square | | 6.884 |
| Df | | 5 |
| Chi square significance | $p < 0.05$ | 0.024 |
| Goodness Fit Index | >0.90 | .984 |
| Adj. Goodness Fit Index | >0.90 | .912 |
| Normed Fit indexes | >0.90 | .913 |
| Relative Fit Index | >0.90 | .863 |
| Comparative Fit Index | >0.90 | .941 |
| Tucker Lewis Index | >0.90 | .947 |
| RMSEA | <0.05 | .072 |

Goodness of fit index indicates the fitness of hypothesized model with respect to Adoption of Block chain. The result indicates that GFI (Goodness Fit Index) is 0.984 and Adjusted Goodness of fit Index is 0.912 that are observed to be above the recommended level. Normed fit Index seems to be greater than 0.913 and Relative fit index is 0.863. Goodness index like Comparative Fit index (0.941) and Tucker Lewis Index (0.947) are observe to be above the cut-off level. Root mean Square is 0.024, which implies that significant of the model. Hence, goodness of fit index concluded that the model is satisfactory in **Figure 1**.

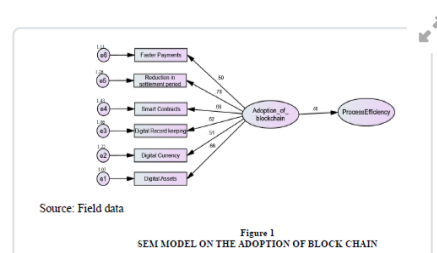


Figure 1 Sem Model on the Adoption of Block Chain



Note: There are two basic requirements for the identification of any kind of SEM Model: (1) there must be at least as many observations as free model parameters ($df \geq 0$), and (2) every unobserved (latent) variable must be assigned a scale (metric).

Table 3 illustrates the adoption of Block Chain on finance. The regression weights of each of the factor are explain in details as follows:

| Table 3 Regression Weights with Respect to Process Efficiency | | | | | | |
|---|------|-------------------------|----------|-------|----------|---------|
| | | | Estimate | S.E | C.R | P-value |
| Faster payments | <--- | Adoption of Block chain | 0.5 | 0.132 | 3.787879 | *** |
| Reduction in settlement period | <--- | Adoption of Block chain | 0.781 | 0.101 | 7.732673 | *** |
| Smart Contracts | <--- | Adoption of Block chain | 0.693 | 0.117 | 5.923077 | *** |
| Digital Record keeping | <--- | Adoption of Block chain | 0.622 | 0.13 | 4.784615 | *** |
| Digital Currency | <--- | Adoption of Block chain | 0.514 | 0.162 | 3.217284 | *** |
| Digital Assets | <--- | Adoption of Block chain | 0.662 | 0.074 | 3.945946 | *** |
| Process Efficiency | <--- | Adoption of Block chain | 0.862 | 0.184 | 0.394721 | *** |

Source: Primary Data

H0: There is no impact of adoption of Block Chain on financial market process Efficiency

H1: There is an impact of adoption of Block Chain on financial market process Efficiency

There are six factors considered in the Adoption of Block chain, they are faster payments, Reduction in settlement period, Smart contracts. Digital Record Keeping, Digital Currency and Digital assets. The results states the highest impact of estimate value signified to be in Reduction on Settlement period i.e. observed to be 0.781 meaning that through reducing the period of settlement there is chances of increasing the usage block chain technology, followed by Smart contracts 0.693 meaning that these are factors which effect upon the Block chain technology to improve the financial efficiency. The rest factors are Digital record keeping is 0.622 and Digital assets with 0.662 and Digital currency is tended to be 0.514 meaning that this factor through imposing currency digitally, will be useful for the growth of the economy and increase in the financial aspects. The end factor, which is obtained to be having the more influence on the adoption of the block chain is the Faster payments estimate value is tend to be 0.5 as the estimate value. The p-value is witnessed to be significant that is less than 0.05. Hence, there is a rejection of Null Hypothesis and acceptance of Alternative Hypothesis.

Findings of the Study

1. The study examined the investors' perception on the usage of block chain technology with the discriminant analysis and the result reveals that Block chain technology will disrupt our industry (0.835). Therefore, it means global transactions will influence the domestic market in capital market with the disruptive technology.
2. The study observed that "Block chain technology is broadly scalable and will ultimately achieve mainstream adoption" (0.721) are having the higher perception level among the investors on the block chain technology.
3. The study examined the impact of block chain technology on the process efficiency with the SEM and the result states that "Reduction in settlement period" (0.781) followed by the "Smart Contracts" (0.693) are having the stronger influence on the adoption of block chain technology.
4. The adoption of block chain technology significantly influenced the process efficiency of the financial markets, as the coefficient values (0.862) indicates the higher influence has been observed.

Conclusion of the Study

The study focused on the usage of block chain technology in the financial markets in the Indian context. The study has considered the investors who are working in disruptive technology since three years and how this plays the vital role in changing the present financial markets process. The study has adopted the qualitative research and with the convenient sampling method for the collection of the primary data. The study framed the two objectives based on the research gap, w
 been emerged with the literature survey. The study examined the investors perception on the usage of block chain technology in the financial markets and tl
 applied the discriminant statistical method. The study result stated that Block chain technology will disrupt our industry. It means global transactions will infl
 the domestic market in capital market with the disruptive technology. The investors' perception level observed to be higher on the Block chain technology is
 scalable and will ultimately achieve mainstream adoption. The study made an attempt to examine the impact of block chain technology on the adoption of
 technology for the process efficiency in financial markets with the statistical method of structure equation model and the observed that Reduction in settlement
 period followed by the Smart Contracts will significantly improve the process efficiency.

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Further Research Scope

There is need to do further research on the block chain technology, which is acting as a substitute to international currency dollar. Does the crypto will replace the global currencies in future with the support of block chain technology.

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ABSTRACT:

The study have aimed at knowing the impact of the Employee Retention Strategy and Organizational Effectiveness with reference to IT companies. The study have focused on identifying the factors influencing the Employee Retention strategy and identification of the impact of employee retention strategy on organization effectiveness. The study have considered the primary data for the study and conducted the survey and obtained 120 responses among the 149 responses given. The study have applied the Exploratory Factor Analysis and Structural equation model to know the factors influencing Employee retention strategy. The results of the study indicate that rewards/recognition is the crucial parameter of the employee retention essential to the organization. Organizational effectiveness and compensation is the factor that is effecting the most the parameters for the enhancement of the organizational effectiveness. The study have identified the employee performance and providing the fringe benefits will effect the employee and obtain the effectiveness of organization.

Keywords: Compensation, Employee Benefits, Effectiveness of organization, Fringe Benefits, Retention Strategies

INTRODUCTION:

Employee retention is a process. In today's world of fast economic growth and development as fast globalization, the competition for talent is getting fiercer. Any organization's most valuable asset is its talent or human resources. The corporation invests a significant amount of money in HR Practices recruiting, selection, and training programmes; but, what happens to the talents or workers leave the corporation quickly to pursue other opportunities? Organizations are increasingly recognizing the need to better grasp the supply-demand dynamic in order to use effective techniques to recruit and retain highly competent individuals, since they are facing unpredictable retention patterns and cutthroat worldwide competition. In an ideal world, employees would enjoy their jobs, enjoy their coworkers, work hard for their employers, are compensated for their efforts, have ample opportunities for advancement, and have flexible schedules so they could attend to personal or family needs when necessary while never leaving then there's the real world, and in the real world, people do quit, whether it's because they want more money, are dissatisfied with the company's working conditions, despise their coworkers, or their spouse finds a dream job in another state. Employee retention is critical to an organization's long-term health and profitability; but, companies throughout the world are finding it more challenging to recruit, motivate, and keep important talent. Employee turnover is a major problem for businesses all around the world. Retention rates continue to rise, and as the competition grows more fierce each year, it is becoming more important for companies to guarantee that their resources are motivated to stay with the firm for the greatest amount of time or until the project is completed. Employee retention benefits both the corporation and the labor. The major objective of the research was to determine the effect of motivation on employee retention with reference to IT companies. The study have considered the some factors for employee retention and their impact on compensation, training and development, work life balance, job satisfaction and motivation, organizational support with an impact on organizational effectiveness.

REVIEW OF LITERATURE:

Afenyo Sedem (2012): The primary goal of the study was to investigate the influence of motivation on employee retention in the private sector, utilising Zoomlion Company Ltd as a case study. According to the findings, the most important motivators for workers are income and monetary compensation, job stability, effective safety measures, an employee support programme, and health benefits. It is advised that private-sector management pay close attention to career planning and give motivating packages for their employees in order to retain them.

Ahmad Zaki Ismail (2015): The current research performed surveys in two countries, Malaysia and the United Arab Emirates, to determine the suitable reward/recognition and motivational variables. The findings are integrated, and prioritized lists of reward/recognition and motivational variables for both nations are generated. A comprehensive comparison of the two nations' results is presented. The study's results are anticipated to give guidance for building an effective incentive and recognition system for encouraging workers in Malaysia and the UAE.

Ashish Tripathi (2015): The term "employee retention" refers to keeping an employee in the organisation. In the firm, this is done either directly or indirectly. When a corporation establishes a legal bond with the workers for a certain amount of time, the employee might be directly retained. This may lower attrition to some level, but also raises the Recruiting rate of leaving the post open for an extended period of time. This article discusses the emerging trends used by Indian IT businesses to retain their staff and how they may affect their attrition rate. It will also concentrate on retention techniques at various levels and advantages from both the employee and company perspectives.

Anjali Paul (2018): The goal of this article is to investigate the concerns and obstacles that employers of beginning firms experience in inspiring and keeping their workers, as well as to give solutions to these obstacles. The study is based on primary data acquired from startup company employers, mostly founders, co-founders, and managers. The study's practical relevance is that it calls attention to the problem of staff turnover in startups and the necessity for managers to implement tactics that will motivate, retain, and improve their performance

Ernest Jebolise Chukwuk (2018): The purpose of this research is to conduct an empirical analysis of the impact of Human Resource Management Practices on Employee Retention and Performance in the Nigerian Insurance Industry. This research was inspired by the need to address the issue of excessive staff turnover in the Nigerian insurance industry. Employee turnover is a detriment to productivity and raises the cost of doing company. This study was led by two major goals, from which acceptable research questions and hypotheses were developed. This report strongly suggests that the government, via NASCOM, assist in reining in certain insurance companies' harsh treatment of its personnel.

Michelle De Sousa Sabbagha (2018): The primary focus of this research was to see if employee motivation and work satisfaction can be used to predict how long a foreign exchange bank's employees would remain with the firm. The structural equation modelling was employed in the study to see whether the predicted influence of employee motivation and work satisfaction on staff retention holds true. When it comes to finding ways to retain outstanding employees, an organization's talent management department should look for possible motivation and work satisfaction initiatives that may assist.

Krishantha (2018): This study focuses on employee well-being and its possible influence on workplace performance. There is little empirical data on the association between workers' subjective well-being and job performance as of yet. The purpose of this paper is to demonstrate that, while important, achieving business performance outcomes has obscured the importance of employee wellbeing at work. With this in mind, this paper seeks to investigate the effects of employee wellbeing on human resource management practises and organisational performance. The study examines the linked hypotheses and empirical evidences of employee well-being using a logical methodology. This study's research technique is a literature review.

Mahesh K Kempegowda (2019): The goal of this study is to identify the elements that influence employee motivation and to study the relationship between organisational efficiency and employee motivation. The study focuses on the repetition and compliance of two essential aspects, motivation

and employee retention, in order to improve performance. Employee motivation and organisational effectiveness also have a bearing on more people that are motivated to complete duties, the better the organisational performance.

Pushparaj Pal (2019): The main study goal was to study the work place safety and health of certain chosen pharmaceutical organisations in Uttarakhand and determine if there is any understanding of how the six factors out of 32 distinct elements of wellbeing and maintenance are the most influencing components prompting worker inspiration and maintenance. The study found that worker security and welfare drills had a significant influence on representation and maintenance, however working condition and condition and medical office had no impact on representative maintenance.

Zaha Noor (2020): This research demonstrates the significance of employee motivation and production employees at an Oman-based manufacturing organisation. The report shows that reward and recognition programmes demonstrate the overwhelming impact of reward and recognition on overall performance, and motivation. While concluding the primary results, both qualitative and quantitative data were evaluated, followed by recommendations to boost employee engagement through their incentives and recognition programme.

RESEARCH GAP

The present study based on the above review of literature it is clear that employee retention plays the vital role for the effectiveness of the organization in IT companies. Many academic scholars have done extensive research in this aspect and few of them are in the following:

- Few studies have concentrated on the leadership styles that are associated with organizational success.
- Performance appraisal role in retaining the employee, which leads the job satisfaction.
- The essence of retention strategies role in employee attrition.

Therefore, it is evident based on the above review of literature no study attempted by any scholar on retention strategies on the organizational success. Thus, the present study attempts to fill the research gap with the proposed title "Employee Retention Strategy and Organizational Effectiveness: Impact analysis with Reference to IT Companies".

OBJECTIVES OF THE STUDY

1. To know the factors influencing the Employee Retention Strategy.
2. To identify the impact of Employee Retention Strategies on Organizational effectiveness.

HYPOTHESES OF THE STUDY

H0: There is no impact of Employee Retention Strategies on Organizational effectiveness

H1: There is an impact of Employee Retention Strategies on Organizational effectiveness

RESEARCH METHODOLOGY

The present study has adopted the qualitative approach for the examination of Employee Retention Strategies on Organizational effectiveness in select IT companies.

Sampling Method: The study has considered the Convenience Sampling method to collect data from the employees. Convenience sampling is a type of sampling that employs available primary data source without requiring any additional research. To put it simply, the sampling method entails locating participants wherever they found, which the most convenient location is usually. Prior to subject selection, no inclusion criteria for convenience sampling identified. The study has collected the responses from 120 experienced employees, who were identified in selected IT companies.

Sampling Unit: The study has considered the IT companies located Hyderabad region of Telangana state. The study has considered the TechMahindra Satyam computers, Wipro and Infosys organizations, which are employing huge workforce.

Source of Data: The present study has considered the primary data through the drafted questionnaire for the examination of proposed objectives.

Questionnaire: The questionnaire consists of two broader segments, which were focused on the role of employee retention strategies in the organizational effectiveness. The opinions collected through the 5-Point likert scale from the respondents.

TABULATION OF DATA ANALYSIS

Objective 1: To know the factors influencing the Employee Retention Strategy.

The present study have examined to know the factors that influence the Employee retention strategy and will aimed to know the high factors that are loaded among all these Employee retention strategies. The results are observed to be shown as below.

Table – 1: Sample Adequacy Test

| | | |
|--|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .754 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 539.166 |
| | df | 136 |
| | Sig. | .000 |

Source: Primary Data

KMO test calculated values is 0.754 that is above the recommend level (0.70) which signifies adequate of data sampling. Further, Bartlett's test of sphericity indicates that chi square calculated value is greater than critical value that concluded significant of data. Thereby confirming that, segments evaluated in the study are valid for Factor Analysis.

Table – 2: Retention Strategies

| Factors | Component | | | | |
|---|-----------|-------|-------|-------|---|
| | 1 | 2 | 3 | 4 | 5 |
| Overtime salary is given to encourage the employees | 0.561 | | | | |
| Organization pays annual bonus to employees | 0.543 | | | | |
| Pay hike for employees of this organization are based on performance evaluation | 0.525 | | | | |
| Training program is designed to meet the individual job requirements. | | 0.546 | | | |
| Feedback is necessary after the completion of training program | | 0.512 | | | |
| Training induced greater management responsibilities to the employees | | 0.508 | | | |
| Fringe benefits provided by the company are good. | | | 0.666 | | |
| Recognition of employee for their achievement | | | 0.559 | | |
| Organization provides a harmonious place to work. | | | 0.538 | | |
| This organization offers a lot of security and facilities for employees. | | | 0.421 | | |
| A spirit of co-operation, co-ordination and team work exists. | | | | 0.583 | |

| | | | | |
|--|--|--|--|-------|
| The amount of job security provided in the organization is high. | | | | 0.693 |
| The promotional opportunities offered by the company is good. | | | | 0.572 |
| Token of appreciation helps the employee to enhance job satisfaction. | | | | 0.584 |
| The organization values the employee's contribution to its well-being. | | | | 0.413 |
| The organization succeeds to appreciate the employee's effort. | | | | 0.625 |
| Organization helps to create a clearly defined career path. | | | | 0.599 |

Source: Primary Data

The table above determines regarding the factors which are extracted highly among the all the factors in the Employee retention with respect to Organizational Effectiveness. Here, the study evolves through the increase of the Employee retention there is an increase in the organization effectiveness. It is been evaluated through the examination of the study above and there are three components derived from the study.

Component 1: The results portrays the highest loaded factor as "Overtime salary is given to encourage the employees" with respect to the compensation with the loading factor stated as 0.543. It examines that by this factor increment the employee retention will increase which results in organizational effectiveness improving in the organization. "Organization pays annual bonus to employees" estimated with the 0.543 and "Pay hike for employees of this organization are based on performance evaluation" with 0.525. It implies that the compensation factor that is the salary given to employees for their encouragement will increase the employee retention which results in the effectiveness in organization.

Component 2: The component 2 outcome derives the highest loading factor to be observed in "Training program is designed to meet the individual job requirements" with respect to training and development. The study have determines the rest factors more than 50% as the results that "Feedback is necessary after the completion of training program" and "Training induced management responsibilities to the employees".

Component 3: The study exaggerates regarding the employee retention enhancement through rewards, recognition and work life balance. The results perceived to be having more than 50% in three factors among them the highest is tended to be in "Fringe benefits provided by the company is good" meaning that the benefits that are provided for the employees will result in the continuous employees in the organization. Hence, there is a need for the increase in the "organization to offer lot of security and facilities for employees", that have 0.421 as the factor outcome.

Component 4: The results of this table have identified the highest loading factor as "the amount of job security provided in the organization is high" with respect to job satisfaction. The employee observes regarding the job security as the crucial aspect as he/she builds a career so if the employee is satisfied with this aspect they can agree with the other factors also. Here, the study portrays the lowest factor that effected in the job satisfaction is "the organization values the employee contribution to its well-being" with respect to management/ organizational support. The study intimates regarding the job satisfaction as well as management/ organizational support indicates increase in the retention of the employees.

Component 5: The study have focused on the results for the component 5, highest results are has the highest loading factor such as 0.625 with respect to "the organization succeeds to appreciate the employees effort" from the management/ organizational support. The study have estimated the lowest is obtained that "Organization helps to create a clearly defined career path" with the loading is 0.599.

The study have observed to be having the highest loading factors from all the above table is from the loading factor “Fringe benefits provided by the company are good” with respect to rewards/ recognition implies that recognizing the employee for their work and providing the benefits to them will raise the retention of employees and which will increase the organization effectiveness and the lowest factor which is need to be improved is “The organization values the employees contribution to its well-being” with 0.413 from the management/ support as the parameter. Hence, there is a need for the organization values need to be contributed for each employee for the effectiveness of organization.

Objective 2: To identify the impact of Employee Retention Strategy on Organizational Effectiveness.

Structural Equation Model and Hypotheses Testing

The study made an attempt the Employee retention Impact on the Organizational Effectiveness. Here, the Employee retention is considered as the independent variable and organizational effectiveness as the dependent variable. The parameters considered in the Employee retention are compensation, Training and Development, Rewards/ Recognition, Work Life Balance, Job satisfaction and Management/Organizational support. For this, first the model estimated goodness of fitness index followed by model consistency which indicates the model is significant. Finally, the hypothesized model (SEM model) have been framed to test the results of the estimated and the results are presented as follows in detail.

H0: There is no impact of Employee Retention Strategy on Organizational effectiveness.

H1: There is an impact of Employee Retention Strategy on Organizational effectiveness.

The below table determines about the retaining of the Employees impact upon the increase of the organizational effectiveness.

Table – 3: Model Fitness

| Fit statistic | Recommended Value | Obtained Value |
|-------------------------|-------------------|----------------|
| Chi square | | 11.73 |
| Df | | 9 |
| Chi square significance | $p \leq 0.05$ | 0.029 |
| Normed Fit indexes | >0.90 | 0.992 |
| Relative Fit Index | >0.90 | 0.948 |
| Comparative Fit Index | >0.90 | 0.969 |
| Tucker Lewis Index | >0.90 | 0.927 |
| RMSEA | <0.05 | 0.05 |

Source: Primary Data

Goodness of fit index indicates the fitness of hypothesized model with respect to impact of the employee retention on the Organizational Effectiveness. The result indicates that Normed fit Index is greater than 0.90 and Relative fit index is 0.948. Goodness index like Comparative Fit Index (0.969) and Tucker Lewis Index (0.927) are observe to be above the cut off level. Root mean square is 0.029, which implies that significant of the model. Hence, goodness of fit index concluded that the model is satisfactory.

Figure-1 SEM model for impact

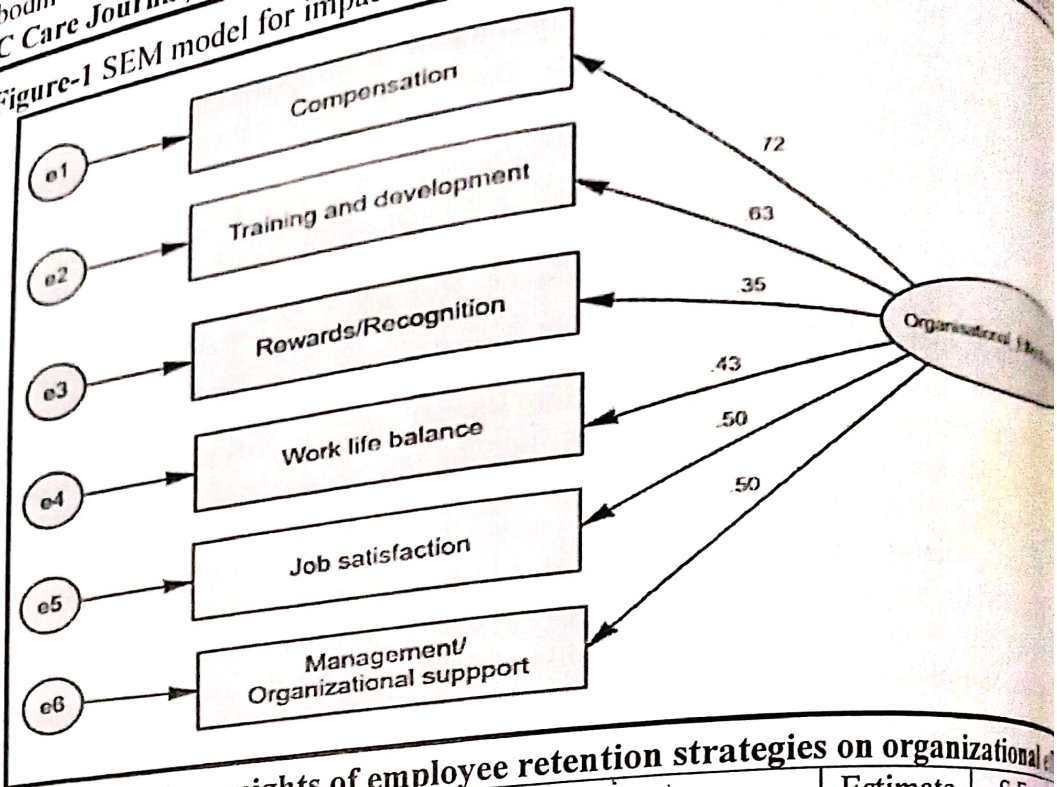


Table- 4: Regression weights of employee retention strategies on organizational effectiveness

| | | | Estimate | S.E. |
|-----------------------------------|------|------------------------------|----------|-------|
| | <--- | Organizational Effectiveness | 0.72 | 0.111 |
| Compensation | <--- | Organizational Effectiveness | 0.627 | 0.12 |
| Training and Development | <--- | Organizational Effectiveness | 0.348 | 0.149 |
| Rewards/ Recognition | <--- | Organizational Effectiveness | 0.434 | 0.11 |
| Work Life Balance | <--- | Organizational Effectiveness | 0.504 | 0.102 |
| Job Satisfaction | <--- | Organizational Effectiveness | 0.497 | 0.127 |
| Management/Organizational Support | <--- | Organizational Effectiveness | | |

Source: Primary Data

The study have explained the impact of the Employee Retention on the organizational with reference to IT companies. The study found that there is higher impact of the with 0.72 as the estimate value and standard error is signified as 0.111 meaning that paying the bonus to the employees, giving hikes to employees and by sanctioning the these all factors will encourage an employee to retain in the organization and will work that will increase the organizational effectiveness. The results signifies that training and have estimated value as 0.627 and job satisfaction also plays a vital role for organizational effectiveness. The least effecting parameters are rewards/ recognition balance. Management/Organizational support have been identified as the moderate parameter of employee retention on the Organizational Effectiveness.

FINDINGS OF THE STUDY:

1. The study found that fringe benefits have examined as the highest loaded contributing for the employee retention in the organization that meant the allocation of the rewards or recognizing the employee for their efforts will continue in the organization.
2. The study also found that factor which is need to be improved is "The organizational employees contribution to its well-being" with 0.413 from the management parameter. Since, the support from the management is required to determine seek to their career and increase in the organizational effectiveness.
3. The present study have resulted that for the employees by paying the annual paid for the extra work so that it will imply them to work with curiosity and

increase the effectiveness of the organization but there is a need to initiate in the providing the employees with the benefits and to give the recognition for their work which will enhance the effectiveness of organization.

CONCLUSION OF THE STUDY:

The study have explained regarding the impact of the organizational effectiveness on the Employee retention. The results explained that fringe benefits and the recognition for the efforts done by the employee should be improved as they are the persons who will raise the organization to the step ahead. The compensation which the organization providing is having the more impact has by authorizing the hike for their performance, obtaining the remuneration for their intense work and by sanctioning the annual bonus has resulted in the organizational effectiveness. Hence, the study concluded that compensation is enhancing the organization but there is a need to increase the rewards and recognition to rise the organizational effectiveness. (Daniel Esemé Gberevbíe 2008)¹

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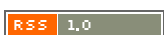
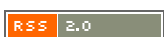
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Awareness of Healthy Eating and Implementation of Immune Boosting Superfoods in the Diet during COVID 19

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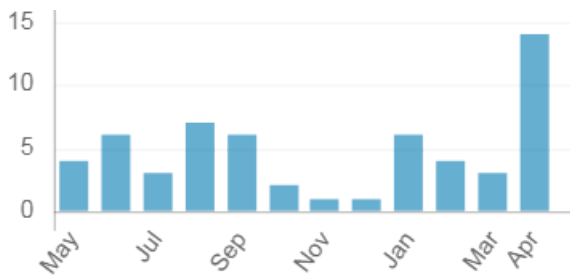
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Keywords: Coronavirus, Immunity, Medical conditions, Super foods

ABSTRACT

Background: Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome and Severe Acute Respiratory Syndrome. The most recently discovered coronavirus causes coronavirus disease COVID-19. Healthy patterns of eating optimize the function of the immune system and improve immunometabolism. Nutrition has a positive impact on COVID-19 as it may be a way to support people at higher risk for the disease, that is, older people and people with pre-existing conditions (non-communicable diseases). **Objective:** The objective of the study was to study the awareness and implementation of immune boosting super foods during the pandemic. **Methods:** A cross-sectional study was conducted in Hyderabad for 2 months and 174 participants were selected to volunteer study. All the participants were asked to fill the questionnaire designed to collect the data about dietary information, food frequency table, and anthropometric measurements. **Conclusion:** The questionnaire comprised “Immune boosting tips to prevent coronavirus infection” at the end to educate the participants on the same.

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