JIGYAASA

A Multidisciplinary
Research Initiative of KC College, Mumbai

Volume IV; Issue II
2020 - 2021
ISBN 978-93-94138-17-9

Chief Editors
Dr. Sagarika Damle
Dr. Shalini R Sinha

HSNC UNIVERSITY, MUMBAI
KISHINCHAND CHELLARAM COLLEGE

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Third Edition – 2021

Price – Rs. 300/-

Published by:

Shailja Prakashan
57 P – Kunj Vihar II, Yashoda Nagar,
Kanpur, 208011
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Editorial

This year proved that the brave and intrepid can always find opportunities even during the most challenging times. While Covid 19 lockdown placed restrictions upon physical presence, it, however, gave free reign to the never-say-die research spirit of our Certificate Programme for Commerce & Arts (CPCA) and Jigyaasa Science Honours Program (SHP) students of this year.

The number of quality research papers this year were so many that we had to launch not one but two issues of Jigyaasa - multidisciplinary research compendiums. This Issue II of Jigyaasa Volume IV stands testimony to the efforts undertaken by the students and their teacher mentors in virtual conditions.

This year was also the launch of the HSNC Cluster University and KC College was ably supported in all its endeavours by the leaders of this newly established University, even under the severely limiting constraints of the growing pandemic. The blended classrooms opened up more challenging yet possible avenues of conducting research in an online mode using internet facilities. Though the human exposure and actual hands-on activities were reduced, the availability of hybrid online mode offered more opportunities to connect with research groups at the National and International levels.

Thus, the result of this double gift of accomplishment in bringing out two issues of Jigyaasa Volume IV, is very satisfying. This Issue, like the others, too is a compendium of selected research papers based on research projects of the students enrolled in the above-mentioned undergraduate research programs. The chapters include interesting research papers from different fields such as Computer Science, Chemistry, Physics, Statistics, Sociology and Psychology.

We are sure that the readers would like to dwell upon the ideas outlined and analyzed in chapters included in Jigyaasa Volume IV Issue II. They include varying range of topics under Chemistry such as Analysis of Tatoo ink and its effect on Human skin; Study of Mechanisms used by Retailers against Online Shopping under Statistics; Tachyons and its strange behavior under Physics; Chat Application based on

Speech Recognition under Computer Science; Binge-watching and its link to Sleep, Depression, Anxiety and Stress under Psychology and Sex-Workers: Voices from Within under Sociology. These articles are a testament of the efforts taken by the research guides and students, at the same time serving as a stepping stone for the future batches of students who might be inspired to carry forward certain interesting possibilities of their predecessors and discover yet another life lesson.

As was once said by the great scientist, Einstein, "A student is not a container you have to fill, but a torch you have to light up". These well written, research-based articles are brimming with courage, hope and passion, even during the testing times of Covid -19 pandemic. Existence of such compendiums indicate gainful engagement and the confidence generated in students who are ready to publish their research work to the outside world through this compendium. The support of the HSNC University was invaluable in this endeavour of helping the staff and students to build bridges between the challenges and opportunities.

By -
Dr. Sagarika V. Damle (Convener SHP)
Dr. Shalini R. Sinha (Vice Principal and Coordinator CPCA)

Foreword

This year 2020-21 has been a landmark year in more ways than one. While it was a difficult year due to the pandemic lockdown, yet it was the birth year of the HSNC Cluster University, Mumbai. This University is fully aligned to the paradigms of the New Education Policy 2020 and is moving full steam ahead to fulfil its aims of providing quality multidisciplinary education to all.

We, at K.C College, continued striving to meet our goals and trying our best to fulfil the responsibility of being a Constituent College of the HSNC Cluster University. K.C College with its multi-faculty disciplines is at the centre stage of the HSNC University and will lead from the front in achieving the objectives of this University. Amongst all the other goals, producing quality research is a prime objective of the HSNC University. K.C College's strong research culture is reflected in its two innovative research-based programmes like Certificate Programme for Commerce and Arts (CPCA) and Jigyaasa Science Honours Program (SHP), which has led to the creation of the multidisciplinary research compendium – Jigyaasa Vol IV.

Jigyaasa Vol IV is the culmination of the efforts of a few young researchers with their teacher mentors, who have taken to research like duck to water, only because of the learning achieved from interactive online sessions, knowledge of committed resource persons and capability of their teacher guides who mentored students, never once looking at the clock. The result of this effort is that two Issues of Jigyaasa Vol IV have now been compiled in this one year itself. This 2nd Issue of Jigyaasa Vol IV, even under such challenging circumstances of the lockdown, gives me great joy. Both the CPCA and Jigyaasa SHP programmes have outdone themselves and the students' and teacher mentors' enthusiasm and dedication are simply outstanding.

These two programmes not only nurture young minds but also offer them a variety of platforms for holistic development, such as strengthening communication skills, developing confidence through presentations, awareness towards the environment and social responsibilities.

This compendium, Jigyaasa Volume IV Issue II, showcases research in the modern era of these budding researchers from various disciplines such as Chemistry, Physics, Statistics, Computer Science, Psychology and Sociology. This 2nd Issue of Volume IV of Jigyaasa displays commitment, devotion and sincerity and shows that even severe challenges can be overcome.

I congratulate all the contributors for offering us this double bonanza and hope the spirit of curiosity and scientific enquiry is always alive in them and takes them forward in life.

Dr. Hemlata K. Bagla
Principal, K. C. College,
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SECTION 1 – CHEMISTRY

Chapter 1 - Analysis of Tattoo Ink and its Effect on Human Skin

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ABSTRACT:

A tattoo is a form of body modification where a design is made by inserting ink, dyes and pigments either temporary or permanent into the dermis layer of the skin. The tattoo industry is growing day by day however people are not aware of the complications associated with it. The primary objective of this study was to analyze the tattoo ink with respect to metals present in it and to study its effect on the human skin. The research consisted of three parts- the analysis part, the effect part (in the form of secondary research) and a survey based on awareness of complications associated with tattooing. Also, the research was comparative in nature as both local and branded inks were taken (as branded ones are thought to be safer than local ones). From the survey it was known that most of the people are unaware about the side effects of tattooing. Also, from the analysis it was known that local and branded ink consisted almost same amount of metals.

KEYWORDS: tattoo, complications, survey, metals, side effects, analysis

INTRODUCTION:

Tattoo is a picture or pattern that is marked permanently on somebody's skin. Tattoo inks consists of pigments combined with a carrier and are used in tattooing. They are used as expressions of independence, for religious or cultural reasons, or to adorn one's body. The purpose may differ from one individual to another. However, people are not aware about the complications associated with it. Food and Drugs

Administration (FDA) does not regulate inks that are placed under the skin. Therefore, it is up to the makers to make tattoo inks without revealing its contents. Hence every ink has different ingredients according to Northern Arizona University. Also, the branded tattoo inks are thought to be safer than the local one's. Thus, this work aims to (I) comparatively study the metallic content of both branded and local tattoo ink using qualitative and quantitative inorganic estimations, (II) find out whether branded inks are safer than local tattoo inks, (III) conduct an online survey to determine whether people are aware of side effects of tattooing.

MATERIALS AND METHODS:

1. **Dry Aching:** About 1.0 gm of sample was taken from both local and branded tattoo ink and each was transferred into a separate crucible. The vessels were then placed in the muffle furnace and gradually heated from room temperature to 660°C for about 2 hours.
2. **Qualitative Metal Detection:** Procedure for confirmatory test:

Formation of original solution:

After cooling, the residual ash of both inks was dissolved in 10 ml of 1:1 HCL and filtered to make original solution.

Confirmatory test for Barium:

1 ml of O.S + 1 ml of sodium hydroxide solution + 1 ml of sodium rhodizonate.

Reddish brown spots were observed, Barium confirmed (only in branded ink sample)

Confirmatory test for Calcium:

1 ml of O.S + 1 ml of ammonium oxalate

White precipitate was observed, Calcium confirmed (in both ink samples)

Confirmatory test for Iron:

1 ml of O.S + 1 ml of potassium ferrocyanide Blue colour was observed, Iron confirmed (in both ink samples)

Confirmatory test for Aluminium:

1 ml O.S + 1 ml of dilute hydrochloric acid + 1 ml of cobalt nitrate

Blue mass was observed, Aluminium confirmed (only in branded ink sample)

Confirmatory test for Lead:

1 ml O.S + 1 ml of 10% sodium rhodizonate

Purple colour was not observed, Lead absent (in both ink samples)

Confirmatory test for copper:

1 ml of O.S + 1 ml of potassium ferrocyanide + 1 ml of acetic acid

Green colour was observed, Copper confirmed (in both ink samples)

Confirmatory test for Cobalt:

4 drops of O.S + 1 drop of acetic acid + 2 drops of 1% alpha nitroso beta napthol

Red spots were observed, Cobalt confirmed (in both ink samples)

Confirmatory test for Zinc:

1 ml O.S + few drops of acetic acid + 1 ml of potassium ferrocyanide Greenish white precipitate was observed, Zinc confirmed (in both ink samples)

Confirmatory test for Nickel:

1 ml O.S + 1 ml ammonium hydroxide + 1 ml Dimethyl glyoxime. Scarlet red precipitate was not observed, Nickel absents (in both ink samples)

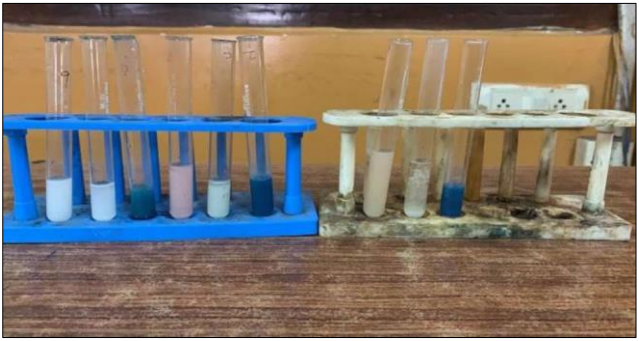


Fig 1: Qualitative Analysis of Branded Tattoo Ink

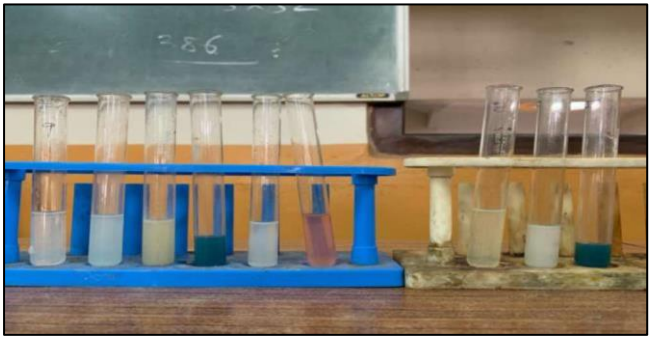


Fig 2: Qualitative Analysis of Local Tattoo Ink

3. Quantitative Metal Analysis:

Formation of original solution: About 1.0 gm of sample of both branded and local inks were taken and transferred into a separate crucible. The vessels were then placed in the muffle furnace and gradually heated from room temperature to 660 C for about 2 hrs. After cooling, the residual ash of both inks was boiled in 10 ml of dilute Hydrochloric acid and 2 ml of Nitric acid and then diluted to 100 ml to use in titrations.

4. Metal analysis using complexometric titrations:

Iron: 10 ml of solution with Tin (II) chloride and Magnesium chloride was added in the flask. Solution was heated and Ammonium chloride and Ammonium hydroxide along with 10 ml of concentrated

Hydrochloric acid was added. Solution was then filtered and Diphenylamine was added as indicator. The solution was then titrated against Potassium dichromate in the burette. The colour change from silky white to blue was seen (in both the samples).

Copper: 10 ml of solution was taken into a flask along with ammonium chloride and ammonium hydroxide each 2 ml as buffer. The solution was then titrated against EDTA. The colour change from violet to orange was seen (in both the samples).

Calcium: 10 ml of solution was taken into a flask along with Erichrome Black T as an indicator. Ideal pH conditions were maintained using 2 ml of acetate buffer. The solution was then titrated against EDTA. Colour change from wine red to blue was observed (in both the samples).

Aluminium: 10 ml of solution was pipetted from volumetric 100 ml flask into a conical flask. Ideal pH conditions were maintained using 2 ml of acetate buffer. Zinc acetate was added and the solution was titrated against EDTA. Colour change from green to silky white was observed (only in branded ink sample).

Zinc and Cobalt: 10 ml of solution was pipetted from volumetric 100 ml flask into a conical flask. Ideal pH conditions were maintained using 2 ml of acetate buffer. A pinch of Erichrome Black T along with few drops of Ammonium chloride was added in the flask. The solution was titrated against EDTA. Colour change from violet to light brown was observed (in both the samples).

Barium: 10 ml of solution was taken in the flask along with Erichrome Black T and few drops of ammonia buffer. The solution was titrated against EDTA. Colour change from light green to bright pink was observed (only in branded tattoo ink).

Online Survey:

An online survey was conducted on 24th August, 2019 to know whether the people are aware of the complications associated with tattooing. 40 responses were collected out of which 21 were male and 19 were female.

The following were the questions asked:

- Gender?
- At what age did you get your first tattoo/tattoo? Have you tried to find out the ingredients of your tattoo ink?
- Have you tried to find out whether your tattoo artist have a license for tattooing?
- Have you done a patch test before tattooing?
- Do you know that tattoos may partially block the reabsorption of sodium and other electrolytes released during perspiration?
- Do you know that researchers have found "strong evidence for both migration and long-term decomposition of toxic elements and tattoo pigments" from tattoos on skin into lymph nodes?
- Do you know that not using a sterile needle while tattooing can cause blood borne disease like HIV, hepatitis, etc.?
- Are you aware of the fact that red, blue, yellow, green dyes can cause allergic reactions, even years after tattooing?
- Do you know that tattoo might cause swelling and burning during magnetic resonance imaging (MRI)?
- Do you know that tattoos can hide possible signs of skin cancer or other skin conditions?
- Do you know that compared to non-inked skin, tattooed skin releases about 50% less sweat?


Fig 3 and 4: Side effects of tattoo ink

OBSERVATIONS AND RESULTS:

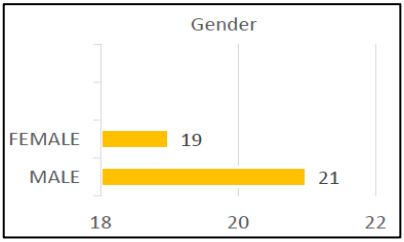
Metals	Branded Ink	Local Ink
Aluminium	Present	Absent
Calcium	Present	Present
Iron	Present	Present
Nickel	Absent	Absent
Copper	Present	Present
Zinc	Present	Present
Lead	Absent	Absent
Cobalt	Present	Present
Barium	Present	Absent

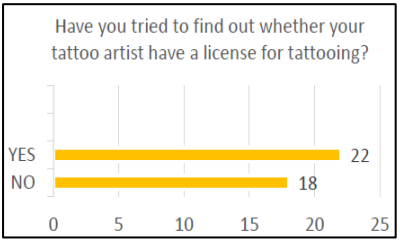
Table 1: Comparative qualitative analysis of branded and local tattoo ink

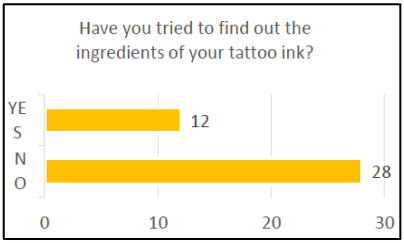
Metals	Branded Ink (ppm)	Local Ink (ppm)
Zinc and Cobalt	28.9	33.6
Iron	17.29	35.1
Calcium	20.0	21.6
Aluminium	Trace Amount	Absent
Copper	Trace Amount	Trace Amount
Barium	Trace Amount	Absent

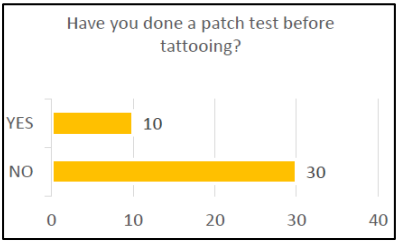
Table 2: Comparative quantitative analysis of branded and local tattoo ink

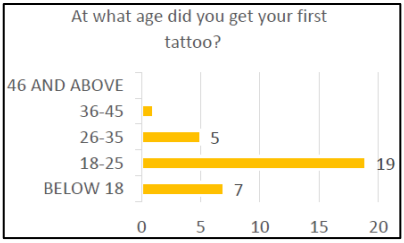
RESULTS OF ONLINE SURVEY:

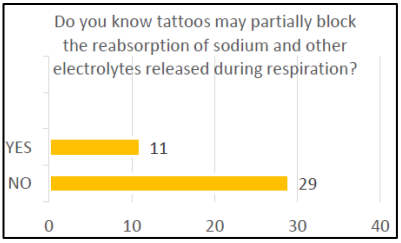


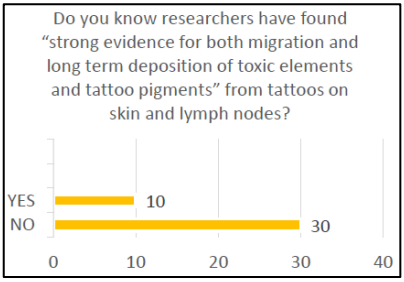


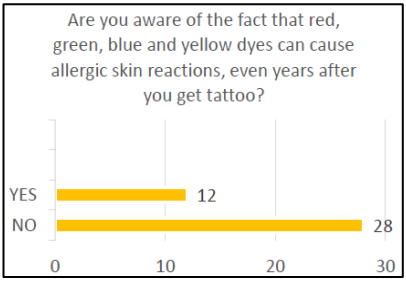


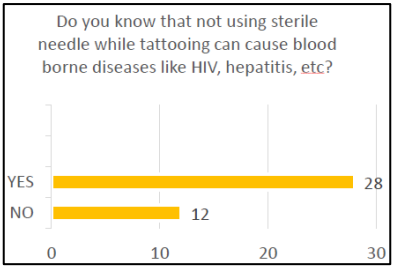


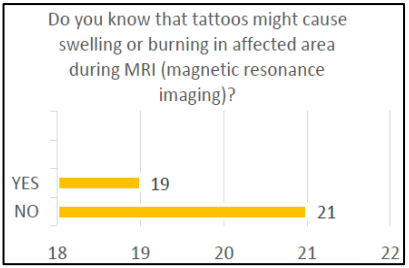


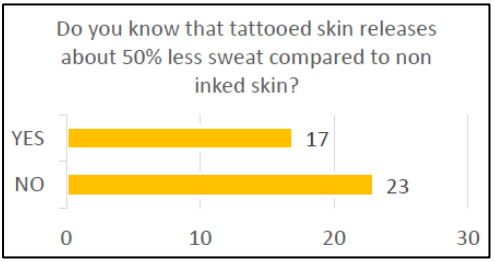












CONCLUSION: Qualitative analysis:

From the qualitative analysis it was known that branded tattoo ink consisted more metals as compared to local tattoo ink thus proving that it is not safer than the local ink even though it costs almost double the amount of local tattoo ink.

Quantitative analysis: From the qualitative analysis it was known that local and branded inks consisted more or less same amount of metals.

Online Survey: From the survey it was known that most of the people are unaware about the side effects of tattooing.

Secondary Research: From literature it was known that many people have reported side effects of tattoo on skin. In most of the cases an allergic reaction on skin was seen. Some also complained about skin infections after which many inks were tested and some inks showed microbial contamination.

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Chapter 2 - Comparison of the Total Polyphenolic Content and Total Antioxidant Capacity in Three Commercial Fruit Juice Brands

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ABSTRACT:

Researchers and food manufacturers have become increasingly interested in polyphenols, in the past 10 years. The chief reason for this interest is the recognition of the antioxidant properties of polyphenols, their great abundance in our diet and their probable role in prevention of various neurodegenerative and cardiovascular diseases. The Total Phenolic content (TPC), Anthocyanin content (TA) and the Total Antioxidant capacity (TAC) of three popular local fruit juice brands were measured using spectrophotometric methods. TPC was evaluated using Folin Ciocalteau method, TA was measured using pH differential method and TAC was evaluated using DPPH assay. Among the three samples Sample 1 shows best results in all flavours compared to the others. It was observed that out of the chosen fruit juice flavours- Pomegranate, Apple, Orange, Litchi and Mixed Fruit- Pomegranate contained the highest polyphenolic content, followed by Orange, Mixed Fruit, Apple and Litchi flavours. Whereas the trend in TA has Pomegranate as the highest monomeric anthocyanin content followed by Apple, Orange, Litchi and Mixed fruit flavours. The TAC that is most important shows us a trend of (highest to lowest TAC) Pomegranate, Orange, Apple, Litchi, and Mixed Fruit respectively. This research helps us conclude that commercial Pomegranate Juice has the highest content of TPC and TAC. The trends in each category also show that although the fruit has a high TPC or TAC the juices commercially marketed are not completely pure and can possibly fulfil the nutritional content stated with added preservatives.

KEYWORDS: Fruit juice, polyphenols, anthocyanin, antioxidants

INTRODUCTION:

Scientific advances in fundamental and applied research of polyphenols have provided us with the knowledge about the profile of phenolic compounds in plants and plant-derived foods. Polyphenols are mainly classified as flavanols, flavanones, hydroxycinnamates, flavonols, and anthocyanins. Polyphenols show highly diverse structures and over 500 different molecules are known in foods [4]. The main sources of polyphenols include seasoning group- clove, celery seed, Fruits- berries, grapes, litchi, pomegranate, vegetables and cocoa products to name a few. Most polyphenols arise from a common origin: the amino acids phenylalanine or tyrosine. These amino acids are deaminated to cinnamic acids, which enter the phenylpropanoid pathway [1]. Phenols are H-donating antioxidants that scavenge reactive oxygen species (ROS), and do not allow new radicals to be formed. The polyphenols are a part of the conjugated metabolites in the body. The cells respond to polyphenols by direct interactions via receptors and enzymes that result in a series of redox dependent reactions. The detection, identification, and estimation of polyphenols can be carried out through various protocols. Due to their complexity of structure and nature they cannot be detected by normal titration, therefore HPLC, spectroscopy, voltammetry, and various extraction methods have been carried out. The classical method to measure the polyphenolic content is by colorimetric or spectrophotometric methods using the Folin-Ciocalteau reagent [6][10][13]. This method helps in measuring TPC in large number of samples simultaneously. The blue and red pigments in fruits- anthocyanins- are detected and measured spectrophotometrically and are identified by various chromatographic techniques. The antioxidant capacity can be estimated by various assay like the DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay or FRAP (Ferric ion Reducing antioxidant power) assay. Commercial Juices undergo various processes, hence industrially their components do get affected.

This research has incorporated the comparison of antioxidant capacity and polyphenolic content across five fruit flavours - apple, Orange, litchi, pomegranate and mixed fruit. This choice of fruit juice flavours have

been considered due to their high consumption in the Indian market [6][7]. A comparison between freshly prepared apple, orange, pomegranate juices and commercial fruit juices of these fruit flavours has also been carried out for a better approach and understanding.

MATERIALS AND METHODS:

1. **Sample Collection:** Samples of three popular commercial fruit juice brands were collected from the local market. Flavours - Apple, Orange, Litchi, Pomegranate and Mixed Fruit. 200ml tetra packs were purchased and stored in the refrigerator at 4-6 degree Celsius. 30 minutes before carrying out any procedure the samples were taken out. A total of 15 Samples were collected. The fresh fruits-apple, orange and pomegranate were washed, peeled, grated and then squeezed in a double muslin cloth, separately. They were diluted to 50ml using distilled water.
2. **Phytochemical Screening:** Tests for phenols, terpenoids, cardiac glycosides, flavonoids, anthracyanine, anthraquinones, tannins and saponins were performed for all the commercial and fresh fruit samples [18].
3. **Total Polyphenolic Content:** Folin Ciocalteau reagent was used to determine the total phenolic compounds [3]. To 0.5g of Gallic acid add 10ml of Ethanol. Dilute this to 100ml in a standard measuring flask using distilled water. This is the stock solution. 10g of Sodium Carbonate in 50ml of distilled water to obtain a 20% Sodium Carbonate solution.

   FC reagent is diluted with distilled water (1:2). Standards were prepared as - 0, 2.5, 5.0, 7.5, 10.0 and 12.5mg/ml (R2= 0.977).The content of TP was expressed as mg of Gallic acid equivalent (GAE) per 1 L of fruit juices. All measurements were carried out in triplicates.
4. **Total Monomeric Anthocyanin:** The total anthocyanin content of the fruit juices was determined using the pH-differential method [3]. Buffer solutions of Potassium Chloride (KCl, 0.025 M, pH- 4.5), Sodium Acetate (CH3COONa, 0.4 M, pH 1.0) was prepared

(DF=10). Absorbance (A) was measured at 520nm and 700nm using spectrophotometer. The calculation was as follows:

$A = (A_{520} - A_{700})_{pH\ 1.0} - (A_{520} - A_{700})_{pH\ 4.5}$

The monomeric anthocyanin (MA) pigment concentration was calculated as:

$MA = A \times M \times DF \times 100/E \times I$

M- Molar mass of malvidin-3-glucoside,

M= 449.2 g /mol

DF- Dilution factor, DF= 10

E - Molar extinction coefficient for cyanidin-3-glucoside, E= 26.9 m3 / mol cm. The final anthocyanin concentration is expressed as milligram per 1L of fruit juice sample of cyanidin-3-glucoside. All measurements were carried out in triplets.

5. **Measurement of the DPPH Scavenging Activity:** 0.002% of DPPH is prepared by dissolving 2mg of DPPH powder in 100ml of Ethanol. The colour is led to develop into a violet black colour. Preparation is done in dark conditions to prevent any photo oxidation or autoxidation for 30 minutes. 100ug/ml Ascorbic acid (standard) is made by dissolving 1mg of Ascorbic acid powder in 100ml of distilled water. Aliquots of AA are prepared of Conc 0, 10, 15, 20, 25, 50, 75, and 100 ug/ml. The solution mixtures were read at 517nm and absorbance was noted. Percentage Inhibition is calculated as follows:

$$\% \text{ inhibition} = (OD_{DPPH} - OD_{sample}) \times 100 / OD_{DPPH}$$

IC50 is also calculated from the readings.

RESULTS AND DISCUSSION:

1. **Qualitative Phytochemical Screening:** All the samples were detected positive for the phytochemical tests that were carried out. From among these tests - Phenol, Cardiac glycosides, Flavonoids and Anthracyanine were detected stronger in the Pomegranate flavour. Among Commercial samples, Sample 1 showed better results followed by Sample 2 and Sample 3.

   Fresh fruit juices of Apple, Orange and Pomegranate showed comparatively better results from all the three commercial samples.

Hence the qualitative superiority of the fresh fruit juices can be considered.

2. **Estimation of Total Polyphenolic Content (TPC):** The measure of the blue hetero-complex spectrophotometrically enables the estimation of the total polyphenolic content. FC reagent reacts with the phenols reducing it to form a chromogen [6]. Among Commercial samples- Sample 1 shows better results across all the flavours, followed by Sample 2 and Sample 3. Among the flavours Pomegranate shows the highest results across all samples of 16199mg/L of GAE followed by Orange, Apple, Mixed fruit and Litchi. The fresh fruit juices show a comparatively lower polyphenolic content compared to the commercial juice samples ranging from 9-13mg/ml of GAE [Fig 1].

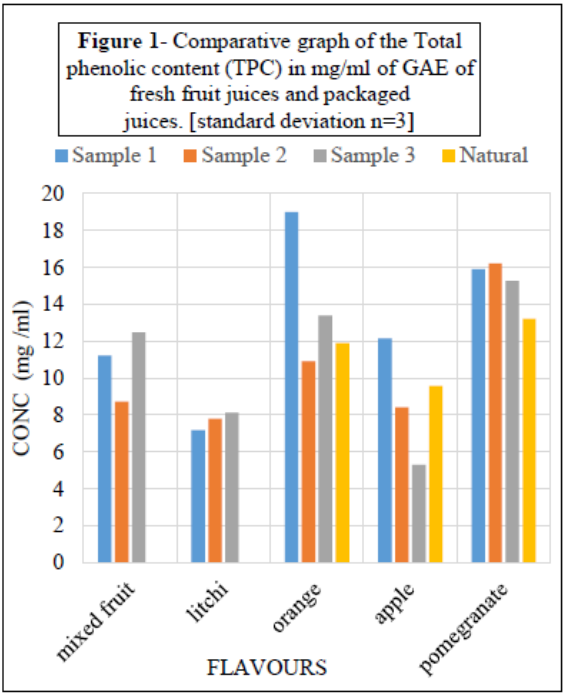

Figure 1- Comparative graph of the Total phenolic content (TPC) in mg/ml of GAE of fresh fruit juices and packaged juices. [standard deviation n=3]

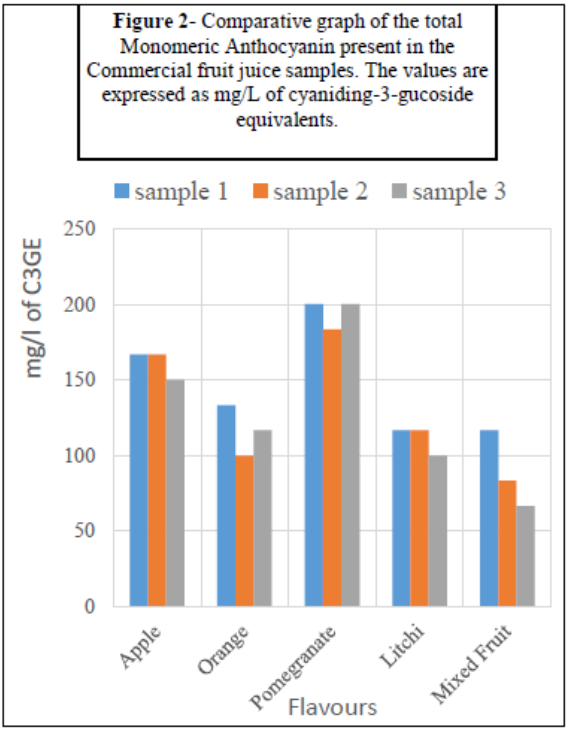

Figure 2- Comparative graph of the total Monomeric Anthocyanin present in the Commercial fruit juice samples. The values are expressed as mg/L of cyaniding-3-gucoside equivalents.

3. **Estimation of Monomeric Anthocyanins (MA)**: In the pH differential method, Reversible structural transformation takes place due to the difference in absorbance. That is proportional to the concentration of the pigment. The MA is calculated as mg/l of cyanidine-3-glucoside equivalent. Commercial sample 1 shows best results with pomegranate – 200.38 mg/l C3GE. Followed by other samples with MA ranging between 110-200mg/l of C3GE [Fig 2]. Among all the fruits pomegranate shows better results due to its rich red pigment.
4. **Estimation of Total Antioxidant Capacity (TAC) using DPPH free radical assay:** Antioxidant activity is seen by the visible change in colour from purple to pale yellow. This means that the solution is free of radicals. The % inhibition and the DPPH scavenging activity are directly proportional. Ascorbic Acid (AA)

standard was observed to have an IC50 of 10.310ug/ml. Trend across the Commercial samples is similar to TPC. Apple flavour juices show high antioxidant activity but lower polyphenolic content compared to Orange flavoured juices. Commercial apple juices show DPPH scavenging activity of about 82-84%. Whereas commercial orange samples are around 80-82%. Highest DPPH scavenging activity is seen in pomegranate of 88% [Fig 3].

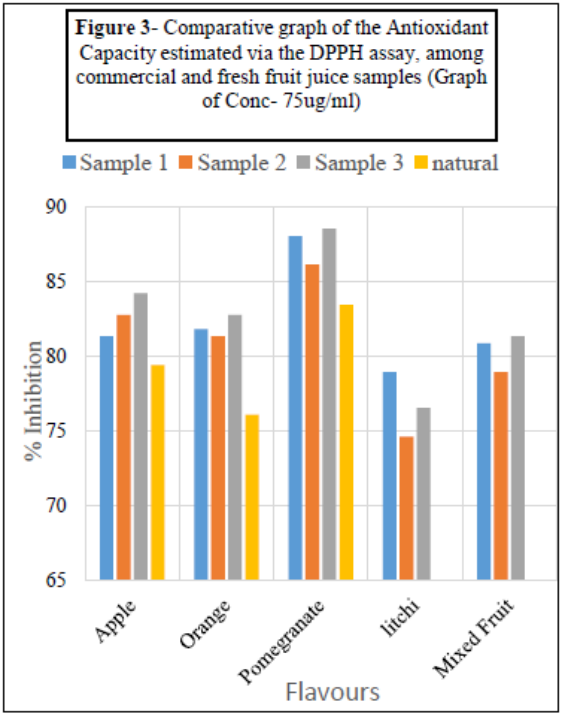

Figure 3- Comparative graph of the Antioxidant Capacity estimated via the DPPH assay, among commercial and fresh fruit juice samples (Graph of Conc- 75ug/ml)

CONCLUSION:

Statistics show that around 9-14% of the gastrointestinal diseases and heart diseases are caused due to insufficient intake of fruits and vegetables in the daily diet [6]. The change of lifestyle, has generated a need of instant and portable food products [2]. The claims put forth by various brands led to the increase in consumption of commercial fruit

juices. Gradually these juices not only replaced the carbonated beverages but also the fresh fruit juices made at home. This research was carried out to identify the qualitative and quantitative nature of commercial fruit juices for their anti-oxidative properties. The samples were stored and monitored daily for any signs of visual or chemical degradation that could cause errors in the results. The fresh fruit juices were refrigerated for maximum 48 hours, so that the tests could be carried out when the nutrients are adequately present. Pomegranate shows the best results in all qualitative and quantitative assays carried

out. Hence proving that it possesses properties beneficial for human health [10][13]. The method used for determining the Antioxidant capacities of fruit juices was DPPH assay [3]. Ferric ion reducing antioxidant power (FRAP) can also be used for the estimation of TAC [2][6][10]. There are various other methods like using Trolox that measures TAC as Trolox Equivalent (TE) values [2][13]. The results and conclusions obtained in this research can be further supported with Total Flavonoid Content (TFC) values of fruit juices to know an in-depth presence of polyphenols majorly present in the fruit juices. A positive correlation can be drawn between total polyphenolic content and the antioxidant capacity of fruit juices [7]. Prior researches show that Litchi is a very good antioxidant and has high polyphenolic content [6]. The difference in the results obtained in this research can be due to various reasons. Additives and preservatives used to increase shelf life and to fulfil the nutrient content could probably cause the difference. There could also be a probability of the use of synthetic antioxidants like ANS300 in commercial fruit juices. Certain research papers also suspect the presence of polyphenols in the package material of Commercial fruit juices to increase shelf life.

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Chapter 3 - Hazardous Metals/ Chemicals in Instant Food Products

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ABSTRACT:

"Globalization' is the sweet term to bring the world together. This has eventually resulted in excess of stress and more workaholic approach of life due to global competition. This has increased the working hours per day and nobody has the time and energy to cook homely healthy food, natural shifting the inclination to fast food / instant food. Instant food or fast food is capable of filling up the stomach, saving time on making food, which is tasty and with variety of options available or ready to order fast food available round a clock. The ultimate results are various psychological disorders and even in some cases untimely deaths. This attracted our attention as chemist to the chemical composition of this fast / instant food and food products, like noodles, soup mixtures, ready to cook vegetables, packed ready to serve type food items etc.

Two samples (brands) each of Noodles, Soup mixes and oats are studied for the hazardous metal content in this work. These fast food items were boiled in water without adding other additives suitably, then the total contains were adjusted to a fix volume using 0.1 M HCl (equivalent to the digestive juice) and stirred well for 4 hours. The resultant clear solution was filtered and used for estimation of metals like Sodium, Potassium, Nickel, Zinc, Lead, cadmium and Chromium. The amount of essential elements (Na and K) was absolutely under acceptable limits but that of hazardous metals was shocking, as the presence of Nickel, Zinc and Lead were found in all samples, Cadmium was found in only one sample while excluding that particular sample all other were positive for Chromium.

INTRODUCTION:

Instant food or fast food is capable of filling up the stomach, saving time on making food, which is tasty and with variety of options available or ready to order fast food available round a clock. This change in the life style has added to stress in life again. All these food items are having certain level of preservatives, coloring and taste / flavoring agents as a basic ingredient of the pack. It will be very interesting to understand what we are eating to manage our hunger by saving time on cooking good, healthy, hygienic and natural food? Is it along with its cost, eating away our immunity and life span? Is it the cause by chemical nature for psychological / neurological disorders? Hence it became a point of interest for us to study the presence of hazardous metals / chemicals in the instant / fast food items (if any). As a chemist this is an attempt to truly test and learn, whether the so called advertised healthy brand food is really the same as advertised or a slow poison wrapped in the glittering words.

The objective of this work is to study the safety level of certain instant food / fast food / packaged ready to serve food items with respect to presence of essential elements like sodium and potassium along with the hazardous metals like Nickel, Zinc, Lead, cadmium and Chromium. Some selective instant food items (Soups, Noodles and oats) of some brands (two brands each) easily available in the market were collected and analyzed for their metal contain using Flame photometry (Na and K), spectrophotometry (Cr) and Differential Pulse Voltammetry (DPV) for Ni, Zn, Pb and Cd.

CHEMICALS AND PROCEDURES:

1. Chemicals:

The source of metal ions Sodium, Potassium, Nickel, Zinc, Lead and Cadmium, were prepared from respective AR Grade salts of Sodium Chloride (NaCl), Potassium Chloride (KCl), Nickel Chloride ($NiCl_2.6H_2O$), Zinc chloride ($ZnCl_2$), Lead nitrate ($Pb(NO_3)_2$) and Cadmium Nitrate ($Cd(NO_3)_2.4H_2O$), procured from SD fine Chemicals India Ltd. All standard solutions (1000 PPM ± 2.0 PPM) were prepared

by weighing (using single pan 0.1mg sensitivity balance) the required quantity of the oven dried (70 - 80^{o}C) directly into water with minimum exposure to air. Then required lower experimental concentrations were prepared by subsequent dilution taking required aliquot using calibrated graduated pipettes and standard flasks. The solution was then preserved in refrigerator and the standardization was checked by the same method at regular interval. Stock solution for metal ions, acids / base of different strength prepared at regular intervals. All experimental apparatus and glassware were soaked overnight in chromic acid followed by washing with running tap water and several times rinsing with distilled water.

All the volumetric glassware were calibrated by standard weighing method [1].

2. Preparation of sample solutions:

Weighed quantity of the selected commercial sample (two each of soup, noodles and Oats) was boiled with water. Then sufficient amount of AR grade HCl was added to create the concentration of HCl to about 0.1M in the total volume. The solution was allowed to soak for 4 hrs with occasional stirring. Then contains were diluted to preset volume with 0.1M HCl. The resultant mixture was then filtered to get clear solution, which was used as stock sample solution.

3. Experimental procedures:

Flame photometric measurements were carried out using Systronic make Flame photometer using standard addition method.10.0 ml of the filtrate was taken in 6 numbered 100 ml standard flasks. Then 0, 10, 20, 30, 40 and 50ml of 1000 PPM Na (0, 1, 2, 3, 4 and 5 ml of 100 PPM K) standard solution was added. The volume was then finally diluted to 100 ml with 0.1M HCl. The emission intensity was measured against 0.1M HCl as blank. Spectrophotometric measurements were carried out using Equiptronics make UV Vis spectro-photometer using standard addition method. The diphenylcarbazede method [2] reagent method was used for analysis of chromium by taking 10.0 ml of the filtrate was taken in 6 numbered 100 ml standard flasks.

4. Differential Pulse Voltammetry (DPV):

A regular computerized three electrode system (Mercury working electrode, Ag/AgCl reference electrode and Platinum auxiliary electrode) Metrohm make, model 797VA computrace was used in this analysis. The instrumental operating parameters of Voltammetric instrument set as per the instruction manual [3][4] are given in Table 1. 30 ml 0.1 M KCl and 1.0 ml acetate buffer [1] was used as supporting electrolyte 1.0 ml of food sample solution was added to supporting electrolyte to record the DPV curve. Similarly, a calibration curve was prepared for all metal ions under study and the peak current vs concentration calibration curve was used for quantification of metal present in food sample.

Parameters	**Description**
Working electrode	Hanging Mercury Dropping Electrode
Calibration	Standard addition method
Number of replications	3
Drop size	Medium
Mode	Differential Pulse
Initial purge time	150s
Addition purge time	10s
Pulse amplitude	0.05 V
Start potential	-1.3 V
End potential	0.05 V
Voltage step	0.006 V
Voltage step time	0.1 s
Sweep rate 0.06 V/s	0.06 V/s
Peak potential (Zn)	− 0.80 V
Peak potential (Ni)	− 1.00 V
Peak potential (Cd)	− 0.64 V
Peak potential (Pb)	− 0.38 V

Table 1: Operating parameters for Voltammetric Instrument [3][4]

RESULTS AND DISCUSSION:

Estimation of Sodium and Potassium:

Flame photometric measurements were carried out using standard addition method. The emission intensity measured as a function of added standard concentration is given in Table 2 for sodium and Table 3 for potassium in all samples. The representative standard addition curve for the soup sample 2 is shown in Fig 1 for Sodium estimation and Oats sample 1 is given in Fig 2 for estimation of Potassium. It was observed that the amount of these essential elements is well within the acceptable limits.

Sr. No	Vol. Std Solution	Conc. (ppm)	Noodle 1	Noodle 2	Soup 1	Soup 2	Oats 1	Oats 2
1	0.0	0.0	35	41	43	40	25	30
2	1.0	1.0	38	46	50	45	28	34
3	2.0	2.0	41	50	54	48	31	36
4	3.0	3.0	45	56	58	54	33	39
5	4.0	4.0	47	60	61	58	36	44
6	5.0	5.0	51	65	66	62	40	49

Table 2: Flame emission intensity of sodium at various concentration of standard added

Sr. No	Vol. Std Solution	Conc. (ppm)	Noodle 1	Noodle 2	Soup 1	Soup 2	Oats 1	Oats 2
1	0.0	0.0	15	17	24	30	14	17
2	1.0	1.0	26	28	36	42	26	26
3	2.0	2.0	33	34	44	49	34	35
4	3.0	3.0	44	45	54	61	44	42
5	4.0	4.0	55	54	64	70	54	53
6	5.0	5.0	64	63	75	81	65	62

Table 3: Flame emission intensity of Potassium at various concentration of standard added

Estimation of Chromium:

The amount of chromium present in the samples was tested by standard addition method and Spectrophotometric technique.

Though chromium can be detected using spectrophotometry in visible range the sensitivity is relatively low as the golden yellow colour is very light at low concentration level. Hence a diphenylcarbazide was used to generate reddish brown coloured complex was used to get better measurements at 530 nM. The absorbance as a function of added standard concentration is given in table 4 for all samples. The representative graph of absorption against standard concentration is shown in Figure 3 for noodle sample 1. Chromium was detected in all samples excluding Noodle sample 2, while Cadmium was detected in only this sample 2 of Noodle.

.	Vol. Std Solution	Conc. (ppm)	Noodle 1	Noodle 2	Soup 1	Soup 2	Oats 1	Oats 2
1	0.0	0.0	0.26	Not Traced	0.24	0.33		0.17
2	1.0	1.0	0.36		0.32	0.42	0.20	0.22
3	2.0	2.0	0.40		0.38	0.48	0.27	0.30
4	3.0	3.0	0.46		0.44	0.57	0.34	0.35
5	4.0	4.0	0.51		0.54	0.62	0.40	0.43
6	5.0	5.0	0.58		0.65	0.69	0.45	0.52

Table 4: Spectrophotometric measurements of chromium at various concentration of standard added

Voltammetric measurements:

Voltammetry is one of the very sensitive techniques used for determination of very low to trace concentrations of metal ions [5][6][7]. As mentioned in the procedure section under instrumental parameters (Table 1) the voltammetric measurements were carried out. Initially a Differential Pulse Voltammogram was recorded for supporting electrolyte over the full range of applied potential from -1.90 V to 0.3V. Then 10 ml of 100 PPM solution of all four metals was added to the supporting electrolyte (25.0 ml distilled water + 5.0 ml 0.1M KCl + 1.0 ml acetate buffer [1] solution pH 4.6 total volume 31.0 ml) to get 10.989

PPM of all metal ions under study in a same solution. After removal of dissolved oxygen by purging nitrogen, a Differential Pulse Voltammogram was recorded over the full range of applied potential. Both the voltammograms are shown, as response of instrument (computed from the data by the instrumental printer) in Fig 4 and the Table 5 gives the details of peak potential (Ep) and Peak Current (iP) for all Four metal ions under study at 10.989 PPM concentration.

The purpose of doing this basic experiment was to verify the peak potential values [8] for all metals under study, and no interference of supporting electrolyte in the range of applied potential against Ag/AgCl reference electrode. The peak potential values obtained in this experiment were used to qualitatively identify the metal ions present in the real industrial samples (Chapter 5) studied for the removal of metal ions by adsorption, as applications of these studies.

Though the concentration of metal ions in the filtrate was determined using standard addition method (refer procedure 3.7.2(d)), the response of the voltammetric measurement in terms of peak current as a function of change in concentration was studied by calibration curve method using Differential Pulse Voltammetry (DPV) It was considered important to calibrate the instrumental response and generate the peak current against metal ion concentration graph for calculation purpose. The representative instrumental response as current (i) against applied potential (V) voltammogram at various concentration of cadmium in DPV is reported in Fig 5. The curves of Peak current for Nickel, Zinc, Cadmium, and Lead were recorded and used for quantitative determination of these metals in the sample solution.

	id (µA)			
	Ni (II)	**Zn (II)**	**Cd (II)**	**Pb (II)**
Ep(V) against Ag/AgCl	-1.0	-0.80	-0.64	-0.38
C = 10.989 ppm	14	21	16	22

Table 5: Peak potential (Ep) and Peak Current (ip) of metal ions (at 10.989 PPM concentration)

Sr. No	Metal	Technique	Noodle 1	Noodle 2	Soup 1	Soup 2	Oats 1	Oats 2
1	Na	Flame	4.0	4.7	5.2	4.5	3.2	3.6
2	K	Flame	0.038	0.040	0.04	0.05	0.038	0.041
3	Cr	Spectro.	0.10	nil	0.15	0.14	0.09	0.12
4	Ni	Voltam metry	0.14	0.08	0.11	0.12	0.07	0.05
5	Pb		0.20	0.14	0.09	0.07	0.12	0.12
6	Cd		nil	0.12	nil	nil	nil	nil
7	Zn		0.22	024	0.15	0.17	0..12	0.14

Table 6: Percentage of metals present in the commercial samples

CONCLUSION:

The percentage amount of sodium, potassium, nickel, Zinc, Cadmium and Lead in the samples calculated based on the results obtained in this work and reported above are given in Table 6 for all samples. It needs the proper attention to the values observed as the concentration of hazardous metals in these instant food products is alarming in almost all cases. The further studies may be using stripping voltammetry for more accurate and with higher sensitivity are to be carried for reconfirmation of results and detection of other hazardous metal ions present in trace amounts.

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Chapter 4 - Study of Phytochemical Analysis of *Moringa Oleifera* Leaves and *Musa Acuminata* Inflorescence to support their role in some biological activities

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ABSTRACT:

The use of medicinal plants in the management of several ailments is gaining popularity nowadays. Recently, WHO estimated that 80 percent of people worldwide rely on herbal medicines for some aspect of their primary health care needs. According to WHO, around 21,000 plant species have the potential for being used as medicinal plants. Because of the large and growing use of natural derived substances in all over the world, we decided to research on 2 plant species - *Moringa oleifera* (leaves) and *Musa acuminata* (flower). These two plant species are mostly found in tropical and subtropical regions of India. Moringa Oleifera has been known to be detoxifier anthelmintic as well as a very good immune booster. And on the other hand, *Musa acuminata* flowers are rich source of dietary fiber, antioxidant compounds and Flavonoids. Diseases like malaria are a major problem in our country. Various drugs used to cure these diseases show side effects and costs Indian economy in millions. Plants have always been a good source of anti-malarial and anti-microbial compounds and have been used in the traditional treatment for thousands of years so are safe for human consumption. Therefore, we also studied the antimalarial and anti-microbial properties of the same. *Moringa oleifera* leaves shows better anti-microbial activity whereas inflorescence of Musa acuminate shows good anti-malarial activity. Summing up, we determined their phytochemical properties and compared both the results. We obtained that leaves of *Moringa oleifera* were rich in phytochemical than flower of *Musa acuminata*. Also, many versatile plant proteins are used as medicinal agents as they are produced

by using molecular tools of biotechnology. These natural proteins are obtained by isolation procedures depending on the physicochemical properties of proteins. Therefore, isolation of proteins from the selected plant species was done. Purification of proteins is quiet challenging and, therefore, for this we used SDS-PAGE. The procedure involved localizing the protein on interest on the gel following SDS-PAGE, eluting the protein from the gel, removing SDS from the eluted sample, and finally renaturing the protein. The results showed that good amount of proteins was found in *Moringa oleifera* as compared to *Musa acuminata*. The comparative results of all the tests are discussed in this work.

KEYWORDS: Phytochemicals, proteins, anti-microbial, anti-malarial, gel electrophoresis.

INTRODUCTION:

Globally, infectious diseases become the people every day. Development of unscrupulous diseases due to various microorganisms has led to decrease in the survival rate of patients drastically. Phytomedicines derived from herbal plants are widely used in many parts of the world due to the presence of diverse bioactive compounds. According to World Health Organization (WHO) estimated, nearly 75-80% of the world population utilizes medicinal plants for their primary health care needs. This dragged the attention of the researchers to identify and develop new antimicrobial agents derived from medicinal plants in order to fulfil the current therapeutic problem. India is a hub of medicinal plants and use traditional medicines like Siddha, Ayurveda and Unani for treating various diseases. Phytoconstituents from plant extracts are considered as secondary metabolites to cure various human diseases. *Moringa oleifera* (leaves) [4] has many common names such as ben oil, drumstick, horseradish, and miracle tree. *Moringa oleifera* is a widely distributed species of the family *Moringaceae*. It is a small graceful, deciduous plant with thin foliage and can grow up to 8m height. *Moringa* is native to Western and sub-Himalayan regions, India, Pakistan, Asia and Africa and it is distributed throughout the world in arid and semi-arid climate. *Moringa* trees are having a remarkable range of medicinal properties as

high as nutritional values. The leaves are rich source of both macro- and micronutrients, such as protein and many vitamins. Fresh leaf juice inhibits the growth of human pathogens. *Moringa* contains specific plant pigments., alpha- carotene and beta-carotene, lutein and phytochemical constituents such as alkaloids, flavonoids, saponins, sterols, phenols and tannins. The therapeutic effects of Moringa oleifera could be due to the combined actions of various bioactive components found in the plant, including trace metal ions, vitamins, alkaloids, polyphenols and other elements they collectively act on broad physiological processes including metabolism and immunity. Banana is the common name for herbaceous plants of the genus Musa. Binomial nomenclature of banana plant is Musa acuminate which belongs to family Musaceae. It is a tropical plant grown all over the world as a source of food and income for the cultivators. Various parts of banana plant are also used as medicine from the ancient time onwards. Traditionally, all parts of the banana plant such as fruit, stem juice and flowers were used for treating various diseases such as diarrhea, dysentery, menorrhagia, diabetes. It has medicinal properties such as antioxidants, antidiabetics, antitumoral, antimutagenic, antibacterial, antifungal, hepatoprotective, hypocholesterolemia, antihemorrhagic, anthelminthic, antiulcerogenic also. It also has properties such as hair growth promotor, wound healing, and inflammation, pain and snakebite.

MATERIAL AND METHODOLOGY:

1. Study Area:

The research work was carried out at K. C. College analytical lab, Churchgate, Mumbai, Maharashtra, India. *Moringa* leaves were collected from Belapur and *Musa Acuminata* inflorescence was collected from Virar. The samples were identified and authenticated.

2. Plant Material:

Fresh samples from Moringa leaves and Musa flower were dried and blended as fine powder using normal electrical grinder and kept in air tight container for further analysis.

3. **Plant Extraction:**

All extracts were prepared using soxhlet extraction [1] by reflux method. 100g of sample powder was used for preparation of samples. Three different solvents were used on the basis of their polarities. Petroleum ether, Chloroform and Ethanol were used [5]. 100g of both samples were made into thimbles and used for soxhlet extraction with PET ether after obtaining extracts in PET ether the same thimble was extracted out in chloroform following ethanol. Three extracts of *Moringa* leaves and 3 extracts of *Musa* inflorescence were prepared.

4. **Qualitative Phytochemical Screening:**

The Quantitative phytochemical screening of both the plant extracts *Moringa oleifera* [2] and *Musa acuminata* [3] was done. Each extract was tested for presence of alkaloids, flavonoids, saponins, glycosides, terpenoids and proteins and amino acids using different methods. The tests were performed in triplicates to ensure the accurate results. All the tests were performed using references.

5. **Quantitative Phytochemical Screening:**

The Qualitative phytochemical screening of both the plant extracts *Moringa oleifera* [3] and *Musa acuminata* [10] was done. Different methods were used to determine the amount of the required constitutes in the leaves and flower based on gravimetric tests. Three replicates were used for each test to ensure the accuracy.

6. **Anti-Microbial Analysis:**

Anti-microbial activity of the ethanolic extracts [9] were performed by Agar Well Diffusion method. About 20ml of liquified agar medium was seeded with 0.1ml of inoculum which was then transferred into the sterile petri dish having an internal diameter of 8.5cm and allowed the medium to form uniform thickness. After complete solidification of medium cork bore having 6mm diameter was used to make wells. Extracts having different concentrations were added carefully into the well and the plates were kept for pre diffusion for about 30mins. After this they were

incubated for 24 hours and zone of inhibition for its anti-microbial activities was measured in mm.

7. **Anti-Malarial Analysis:**

All the synthesized compounds were screened for antimalarial activity in the Microcare laboratories, TRC, Surat, Gujarat. The in vitro antimalarial assay was carried out in 96 well microtiter plates according to the micro assay protocol of Rieckmann and co-workers [12] with minor modifications [13]. The cultures of *P. falciparum* [15] strain were maintained in medium RPMI 1640 supplemented with 25 mM HEPES, 1% D-glucose, 0.23% sodium bicarbonate and 10% heat inactivated human serum. The asynchronous parasites of *P. falciparum* were synchronized after 5% D-sorbitol treatment to obtain only the ring stage parasitized cells. For carrying out the assay, an initial ring stage parasitemia of 0.8 to 1.5% at 3% hematocrit in a total volume of 200 µl of medium RPMI-1640 was determined by Jaswant Singh Bhattacharya (JSB) staining to assess the percent parasitemia (rings) and uniformly maintained with 50% RBCs (O+). A stock solution of 5mg/ml of each of the test samples was prepared in DMSO and subsequent dilutions were prepared with culture medium. The diluted samples in 20 µl volume were added to the test wells so as to obtain final concentrations (at fivefold dilutions) ranging between 0.4 µ g/ml to 100 µg/ml in duplicate well containing parasitized cell preparation. The culture plates were incubated at 37°C in a candle jar. After 36 to 40 h incubation, thin blood smears from each well were prepared and stained with JSB stain. The slides were microscopically observed to record maturation of ring stage parasites into trophozoites and schizonts in presence of different concentrations of the test agents. The test concentration which inhibited the complete maturation into schizonts was recorded as the minimum inhibitory concentrations (MIC). Chloroquine was used as the reference drug [16].

8. **Isolation of proteins:**

They were isolated by gel electrophoresis [6][7]. 2g of both the fresh plant samples were weighed. They were crushed using liquid nitrogen in mortar and pestle. Then the crushed powder was transferred into 50ml

centrifuge tubes containing 10ml of protein extraction buffer. Then each sample was vortexed for about 30mins (intermediately cooling the sample on the ice bath).it was then centrifuged at 8000rpm for 15mins at 4°C. Then the supernatant was transferred into a clean 50ml centrifuge tube to measure the supernatant volume. Then acetone was added 4 times the volume of the supernatant. It was mixed well and kept for 1hr at -20°C. it was again centrifugated. The supernatant was discarded and the samples were kept overnight for drying.

RESULTS:

1. **Qualitative Phytochemical screening:** The tests were performed using ethanol extracts for both the plant samples of *Moringa oleifera* and *Musa acuminata*

Phytochemical Analysis	**Ethanolic extract of *Moringa oleifera***	**Ethanolic extract of *Musa acuminata***
Alkaloids	Present	Absent
Carbohydrates	Absent	Present
Terpenoids	Present	Present
Glycosides	Present	Present
Flavonoids	Present	Present
Saponin	Present	Present
Proteins and Amino Acids	Present	Absent

Table 1: Qualitative Phytochemical screening of *Moringa oleifera* and *Musa acuminata*

2. **Quantitative Phytochemical Screening:** These were the results obtained for quantitative phytochemical Analysis of the plant *Moringa oleifera*.

Phytochemical	**Mean Concentration (mg)**
Flavonoids	2.64
Saponins	3.52
Alkaloids	0.74

Table 2: Quantitative Phytochemical screening of *Moringa oleifera*

These were the results obtained for quantitative phytochemical Analysis of the plant *Musa acuminata*.

Phytochemical	Mean Concentration (mg)
Flavonoids	4.20
Saponins	1.63

Table 3: Quantitative Phytochemical screening of *Musa acuminata*

3. Anti-microbial analysis:

Different concentration of ethanolic extracts of samples of *Moringa oleifera* and *Musa acuminata* were made. The ethanol control for both the microorganisms was done. Zone of inhibition for different concentrations of ethanolic extracts of samples are as follows:

For *Moringa oleifera*:

Plant Extract (mg/ml)	Zone of Inhibition (mm)
30	3.17
60	5.29
90	5.90
120	9.30

Table 4: Antimicrobial activity of *E. coli*

Plant Extract (mg/ml)	Zone of Inhibition (mm)
30	2.17
60	4.29
90	5.90
120	9.30

Table 5: Antimicrobial activity of *S. aureus*

For *Musa acuminata*:

Plant Extract (mg/ml)	Zone of Inhibition (mm)
30	1.8
60	2.9
90	3.8
120	5.2

Table 6: Antimicrobial activity of *E. coli*

Plant Extract (mg/ml)	Zone of Inhibition (mm)
30	2.1
60	2.8
90	3.4
120	4.9

Table 7: Antimicrobial activity of *S. aureus*

4. Anti-malarial analysis:

The anti-malarial tests were performed according micro assay protocol of Rieckmann and co-worker. *Moringa oleifera* showed the required antimicrobial activity when 0.89µg/ml (according to mean IC50 values) of sample was used and *Musa acuminata* showed the required antimicrobial activity when 0.54µg/ml (according to mean IC50 values) of sample was used. Mean values in representative assay. All experiments were performed in duplicate STANDARD Chloroquine: IC50 0.020µg/ml.

5. Isolation of proteins:

The standard protocol for isolation of proteins was followed using 2g of both the Samples. The plant proteins were isolated from the *Moringa oleifera* and *Musa acuminata* and then were separated using SDS-PAGE and detected using Silver staining. As we can see that *Moringa oleifera* has proteins of molecular weights 35kDa, 71kDa, 91kDa etc. and *Musa acuminata* has proteins of molecular weights 27- 28kDa. (Lane 2- *Musa acuminata*, Lane 3- *Moringa oleifera*).

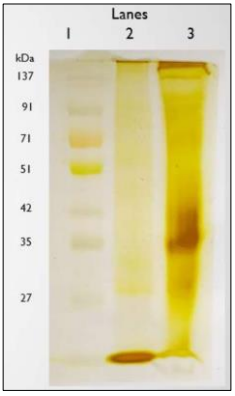

Fig 1: Isolation of Proteins using SDS-PAGE

DISCUSSIONS:

All the tests were performed for both plants *Moringa oleifera* and *Musa acuminata*. In *Moringa oleifera* quantitative phytochemical analysis we could see that phytochemicals such as Alkaloids, terpenoid, glycosides, flavonoids, saponins, proteins and amino acids were present whereas

carbohydrates were only absent. In *Musa acuminata* we could see that except of alkaloids and proteins and amino acids all the other phytochemicals such has terpenoids, glycosides, flavonoids and saponins were present. Then in quantitative phytochemical analysis of *Moringa oleifera* it was seen that flavonoid content was around 2.64mg, saponin was around 3.52 mg and alkaloids were 0.74mg. Then the quantitative phytochemical analysis of *Musa acuminata* it was seen that flavonoid content was around 4.20mg, saponin was around 1.63 mg. In anti-microbial analysis the zone of inhibition was recorded for the plant extracts *Moringa oleifera* and *Musa acuminata*. Both the plants were also screened for antimalarial activity by using Rieckmann and co-worker protocol with some modifications and the results obtained were satisfactory in comparison with the standard drug of quinine and chloroquine. Finally, the protein analysis for both the plants was done by SDS-PAGE.

CONCLUSION:

In *Moringa oleifera* the major phytochemicals present were Alkaloids, Flavonoids, Saponin, Proteins and amino acids whereas the major phytochemicals present were flavonoids, saponin, glycosides and terpenoids. The biological properties that were shown by the plants A and B were antimicrobial and anti-malarial activity. *Moringa oleifera* shows better results for antimicrobial activity whereas *Musa acuminata* shows better results for antimalarial activity. It has a good amount of protein present it, and proteins present here are of higher molecular weights ranging from 35kDa to 91kDa. It has traces amount of proteins present in it, and the proteins here are of lesser molecular weights ranging from 25kDa to 27kDa.

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SECTION 2 – STATISTICS

Chapter 5 - Impact of economic decisions on Bombay Stock Exchange

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ABSTRACT:

Stock market is an important part of the economy of a nation. Hence plays pivotal role in the growth of the industry and commerce of the country that eventually affects the economy of the country to a great extent. This paper analyses the impact of economic decisions on the Bombay Stock Exchange (BSE). The parameters under economic decisions considered in this research are announcement of Union budget, Demonetization and GST. The objective is to study the performance and behavior of sectoral indices of BSE namely Automobile, Bankex, Healthcare, Oil & Gas, Information Technology, Capital Goods, Realty, Consumer Durables and FMCG. Secondary Data is collected for the study and the time period of data taken is from 2015 to 2019 considering the daily closing prices of BSE index. Statistical tools used are paired t-test using software PSPP. The pre and post announcement period data for 30 days, 10 days and 3 days were used to compare the means of sectoral indices for pre and post period respectively. On basis of paired t-test, conclusion was made which period (30,10 or 3 days) was affected due to Union Budget announcement, Implementation of GST and Demonetization. The purpose of doing this research is to have a better understanding of variability of the sectoral indices when the announcement and implementation of the economic parameters take place. The results of this study can be useful for an investor to make rational decision and diversified investments.

KEYWORDS: Stock market, BSE sectoral indices, Union budget announcement, GST, Demonetization

INTRODUCTION:

The stock market refers to the collection of markets and exchanges where regular activities of buying, selling, and issuance of shares of companies take place. The increase and decrease in stock prices can influence numerous factors in the economy such as consumer and business confidence which can, in turn, have a positive or negative impact on the economy as a whole. This study focuses on impact of economic decisions taken by the governing administration of India and its effects on the various sectoral indices of the Bombay Stock Exchange (BSE). The economic decisions considered for this study are annual Union Budget Announcement, GST and Demonetization. BSE sectoral Indices represent different sectors of the Indian economy. These indices represent performance of the companies and their movements in particular sector. Indices chosen for this study are Automobile, Bankex, Healthcare, Oil &Gas, Information Technology (IT), Consumer Goods (CG), Consumer Durables (CD), Reality and FMCG.

According to the Article 112 of the constitution, the Union Budget is an annual financial statement of the estimated revenues and expenditures of the government for a fiscal year; which runs from 1st April to 31st March (Verma Gakhar, 2015). Earlier the union budget was announced at the end February now it is presented during the month of February so that it can be materialized before the start of a new financial year. It is observed that the announcement of the budget has an effect on the stock exchange which is an indirect assessment of the budget announced. The annual union budget consists of many structural or policy changes for every different sector and hence there is an impact on that particular sectoral index of the stock exchange The reaction of the stock market on the budget announcement are never steady so if there is an immediate impact it also holds a probability of being diluted with time and hence the structure of study includes the pre and post impact of sectoral indices on three different time periods which are 3 days (short term), 10 days (mid-term) and 30 days (long term).

The authority to levy a tax is derived from the Constitution of India which allocates the power to levy various taxes at the central and state level. An important restriction on this power is Article 265 of the Constitution which states that "No tax shall be levied or collected except by the authority of law". The latest change in taxation system was done by introducing Goods and Services Tax (GST), implemented on 1st July, 2017. GST is a consumption-based tax levied on sale, manufacture and consumption on goods & services at a national level. This tax will be a substitute for all indirect tax levied by state and central government. GST is a consumption-based tax. Since the change in taxation system forces most of the businesses to change their existing taxing structure and hence an immediate impact can be seen in some sectors and in sectors which the net tax has been reduced after the change in taxation they fare better in the overall market. We have followed the same approach to understand the impact on sectoral indices once these taxation system were implemented by comparing the pre and post effect on time periods which are 3 days (short term), 10 days (mid- term) and 30 days (long term).

Demonetization is the act of stripping a currency unit of its status as legal tender. On 8th November 2016 the Prime Minister of India Mr. Narendra Modi announced the demonetization of all Rs.500 and Rs.1000 Indian currency notes. This decision was taken to counter black money and fake notes circulating in the country and with an objective of pushing people to pay taxes for the unaccounted pile of cash, curb terrorism and promote the digital India movement. It was a bold move and since the initiative was confidential, the announcement of demonetization bought an immediate impact to businesses and the common man. This move was intended for a long-medium term benefit but it caused a lot of disruption in the economic activity in the short-term level as hard cash is still a preferred method used by the people of India. During this phase how different sectors reacted was assessed using the pre and post stock closing values for time periods which are 3 days (short term), 10 days (mid-term) and 30 days (long term).

RESEARCH METHODOLOGY:

The study analyzes the impact of Union Budget announcement, Implementation of GST and Demonetization on sectoral indices of Bombay Stock Exchange. The data was taken from 2015- 2019 daily closing prices of the BSE index. The tool used for analysis is PSPP. PSPP is a free software application for analysis of sampled data, intended as a free alternative for IBM SPSS Statistics. To check normality of data, Q-Q plot was used. The Q-Q plot showed that both the sets pre and post-closing prices of BSE sectoral indices truly came from Normal distributions. Hence paired t-test was used to conduct the analysis. The sub objective of the study includes the following:

- To analyze the effect of announcement of Union Budget on S&P BSE indices closing prices in the pre-budget announcement and post budget announcement period.
- To analyze the effect of Introduction of GST on S&P BSE indices closing prices in the pre- GST announcement and post- GST announcement period.
- To analyze the effect of introduction of demonetization on S&P BSE indices closing prices in the pre-Demonetization announcement and post- Demonetization announcement period.

Null Hypothesis:

- H01- There is no significant difference in pre and post period closing prices of BSE sectoral indices due to Union Budget announcement.
- H02- There is no significant difference in pre and post period closing prices of BSE sectoral indices due to implementation of GST.
- H03- There is no significant mean difference in pre and post period closing prices of BSE sectoral indices due to announcement of demonetization.

Alternative Hypothesis:

- H11- There is significant difference in pre and post period closing prices of BSE sectoral indices due to Union Budget announcement.

- H12- There is significant difference in pre and post period closing prices of BSE sectoral indices due to implementation of GST.
- H13- There is significant difference in pre and post period closing prices of BSE sectoral indices due to announcement of Demonetization.

Period of Study:

Pre	**Pre**	**Pre**	**Budget, GST and Demonetization announcement day**	**Post**	**Post**	**Post**
30 days (X_3)	10 days (X_2)	3 days (X_1)	(Z)*	30 days (Y_3)	10 days (Y_2)	3 days (Y_1)

*[Z indicates the day of Budget, GST and Demonetization was announced]

Table 1: Period of Study

RESULTS:

1. Union Budget Announcement:

The Union budget announcement dates for 2015- 2019 were 28th Feb 2015, 29th Feb 2016, 1st Feb 2017, 1st Feb 2018 and 5th July 2019 respectively. Using paired-t test the results obtained for each year of impact of Union budget announcement on BSE sectoral indices- Automobile (Auto), Bankex, Healthcare, Oil & Gas, Information Technology (IT), Realty, Capital Goods (CG), Consumer Durables (CD) and FMCG.

The table values have been obtained for AUTO sector under announcement of Union Budget for the year 2015.

Pre and Post – Closing Values	**Mean**	**Lower**	**Upper**	**T**	**d.o.f**	**Sig. (2-tailed)**
30 Pre and 30 Post (Long Term)	188.84	62.43	315.26	3.06	29	0.005
10 Pre and 10 Post (Mid Term)	64.73	-98.43	227.89	0.90	9	0.393
3 Pre and 3 Post (Mid Term)	-174.77	-925.35	575.81	-1.00	2	0.422

Table 2: Values has been obtained for AUTO sector under announcement of Union Budget for the year 2015

The p-value > 0.05 for mid and short term hence we do not reject H01 and conclude there is no significant difference between the closing price of pre and post period. Whereas for Long term the p-value < 0.05 hence we reject H01 and conclude that Auto sector was affected due to announcement of Union Budget for the year 2015 for long term.

For the remaining BSE sectoral indices the same method of analysis as used above has been carried out for announcement of union budget, years

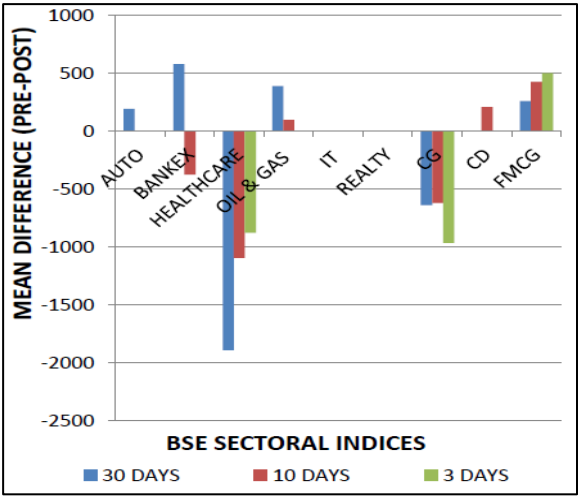
2015-2019. Summarizing the analysis of all sectoral indices for 2015-2019 announcement of Union Budget using graphical representation:

Note 1 - The mean value is the average of difference between Pre-closing values of BSE sectoral indices and Post-closing values of BSE sectoral indices (Pre-Post). Hence negative mean value indicates [Pre<Post] and positive mean value indicates [Pre> Post].

[Pre < Post] - That is Pre-closing values of BSE sectoral indices were less than Post-closing values of BSE sectoral indices which indicates union budget announcement had a positive impact on BSE sectoral indices.

[Pre > Post] - That is Pre-closing values of BSE sectoral indices were greater than Post-closing values of BSE sectoral indices which indicates union budget announcement had a negative impact on BSE sectoral indices. Hence the graph shows which indices were affected due to Union Budget announcement in 2015. The X-axis has BSE sectoral indices and the Y-axis is the mean difference of pre and post period.

2. 2015 Union Budget Announcement:



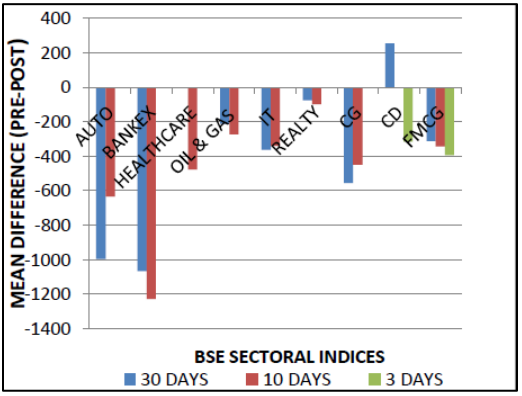
Graph 1: Impact of Union Budget 2015

The graph shows that Healthcare, Capital Goods and Bankex had a positive impact due to budget announcement on 28th February, 2015.

- Healthcare was the best performing sector after Union Budget announcement. Some of the reasons for Healthcare sector performing good were:

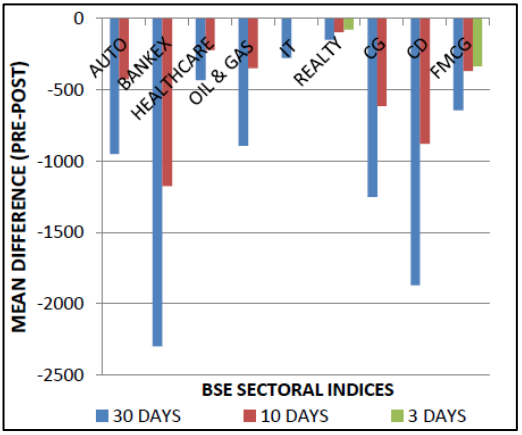
1. **Funds allocated to healthcare:** The fund was used in increasing the use to health care schemes which were operating under the Nation Rural Health.
2. **Premium benefits regarding Health Insurance:** The Finance Minister had increased the tax deduction limit of health insurance premium which encouraged more people to take up health insurance in order to do efficient tax saving and thereby making treatments affordable to all.
3. **Setting of AIIMS**: In 5 states Jammu and Kashmir, Himachal Pradesh, Punjab, Assam and Tamil Nadu, setting up of AIIMS was introduced.
4. The Finance Minister announced that Forwards Market Commission (FMC), the regulator for commodity future markets will be merged with SEBI, the regulator for securities market in India. This merger proved to be a big advantage for the Capital Goods sector. Hence Capital Goods sector was positively impacted.
5. The merge was also one of the reasons for Bankex sector prices to rise because the merge paved the way for participation of banks and other financial institutions in the commodity futures market.
6. One of the main reasons for FMCG sector Prices to fall was increase in excise duty on cigarettes in budget 2015 which created loss.

3. 2016 Union Budget Announcement:



Graph 2: Impact of Union Budget 2016

4. 2017 Union Budget Announcement:



Graph 3: Impact of Union Budget 2017

For both years 2016 and 2017 the budget announcement had a positive impact on sectoral indices. For both the years, after the union budget announcement Bankex sector was the best performing sector.

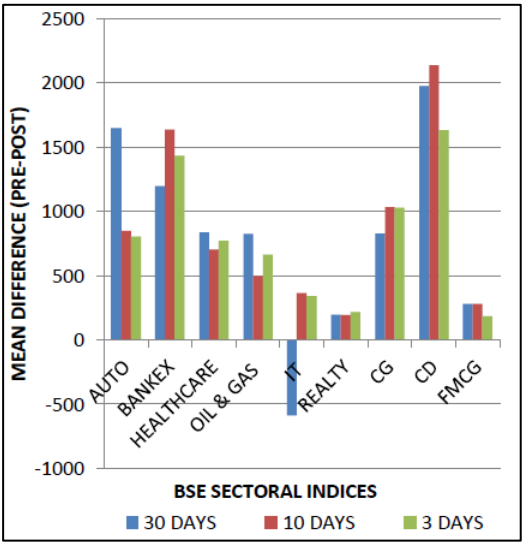
- Both the budgets included big infrastructure push (development of roads), boost to affordable housing, tax concession (decrease in

corporate tax rate and reduction in personal income tax) and also proposals to create more jobs and measures which helped increase credit off take for banks, which led to boost the Bankex sector.

- Allocation towards funding of the electric vehicle program led to push up in demand for commercial vehicles and rise in sales. Hence there was positive impact on Automobile sector.
- Agricultural credit target for long term irrigation fund and milk processing was increased. Stocks from most consumer centric sectors rose on the hopes of boost in rural incomes. Hence Capital Goods shares also increased.

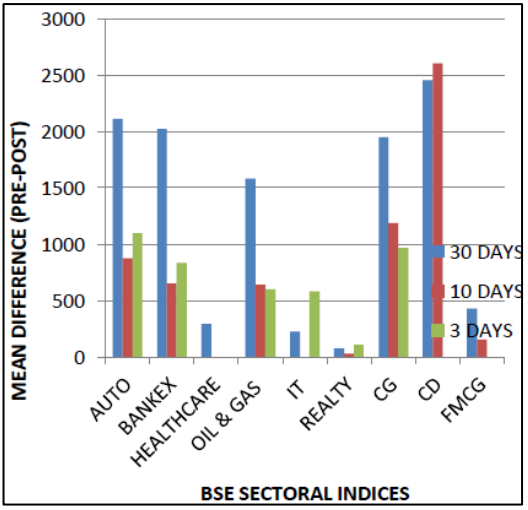
Therefore, FMCG, Consumer Durables and Capital Goods sector's prices raised after budget announcement in 2016 and 2017.

5. 2018 Union Budget Announcement:



Graph 4: Impact of Union Budget 2018

6. 2019 Union Budget Announcement:



Graph 5: Impact of Union Budget 2019

For both years 2018 and 2019 the budget announcement had a negative impact on sectoral indices. For both the years, after the union budget announcement Consumer Durables sector was the worst performing sector. Some of the reasons for negative impact can be noted as:

- Heavy selling pressure in CD, Bankex, CG and Auto stocks added to the downward trajectory of the indices.
- Raise in fiscal deficit target affected all the sectors.
- It can also be observed that all the sectors were very sensitive to Budget 2018 and 2019. Hence the sectors were affected in short period only.

7. Implementation of GST:

Goods and Services tax introduced on July 1, 2017, was said to be a biggest tax reform in India. The last change in taxation had taken place on April 1st, 2005, when Value added tax (VAT) was introduced. GST is a type of indirect tax which was implemented with the idea of simplifying the tax structure and maintaining uniformity of the tax slab throughout the country.

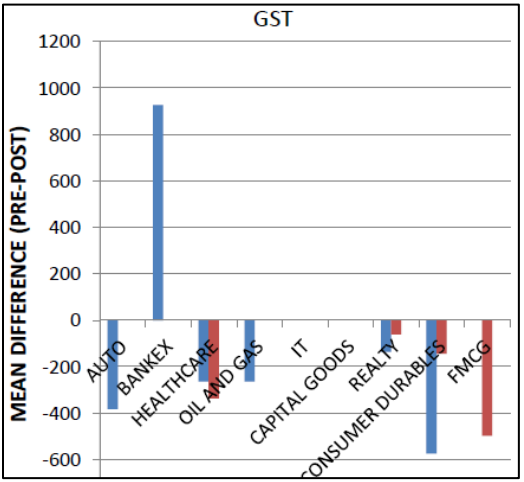
The following table values has been obtained for AUTO sector under implementation of GST:

Pre and Post – Closing Values	**Mean**	**Lower**	**Upper**	**T**	**d. o. f**	**Sig. (2-tailed)**
30 Pre and 30 Post (Long Term)	-383.83	-520.60	-247.06	-5.74	29	0.000
10 Pre and 10 Post (Mid Term)	-167.53	-568.64	233.57	-0.94	9	0.369
3 Pre and 3 Post (Mid Term)	-237.77	-540.13	64.59	-3.38	2	0. 077

Table 3: Values obtained for Auto sector under implementation of GST

The p-value > 0.05 for mid and short term hence we do not reject H02 and conclude there is no significant difference between the closing price of pre and post period. Whereas for Long term the p- value < 0.05 hence we reject H02 and conclude that Auto sector was affected on announcement of GST for long term.

For the remaining BSE sectoral indices, the same method of analysis as used above has been carried out. Summarizing the analysis of all sectoral indices due to the implementation of GST using graphical representation:



Graph 6: All sectoral indices due to the implementation of GST

Impact of GST on the BSE sectoral indices were as follows-

- It was observed that there was no short term (3 days) effect on any indices.
- The only sector which witnessed a decrease in the stock return prices was Bankex, in long term (30 days) effect. Reasons which could justify this outcome would be change in polices in banking sector like Branch regulation rule was changed, CENVAT was reduced by 50% and accounting and compliances were needed to be upgraded.
- Consumer durables and FMCG were the top two indices which benefited the most.
- FMCG is a fastest growing industry in India. The reasons why it benefited is that the logistics distribution cost which used to be 2% - 7% that dropped by 1.5%. Companies benefited as now they could set up their inventory and manufacturing plant in any state without the hassle of different tax structure.

- Realty sector showed positive impact as affordable housing under GST was slated under a minimum tax rate. Rental market most benefited from this sector as GST was exempted for residential properties using for residential use with a market cap rate of rupees 40 lacs.

8. Announcement Of Demonetization:

The announcement of demonetization was an unannounced event and hence the BSE sectoral indices showed a vast impact. It was observed that all the indices showed a negative impact at all term effects that is 3, 10 and 30 days.

- The two sectors which showed a short-term effect were Realty and Consumer Durables sector.
- Reason of realty sector being hit is because this sector entirely works on hard cash as most of the people employed under this sector are daily wagers and hence showed a significant impact to Demonetization. The following table values has been obtained for AUTO sector under announcement of demonetization:

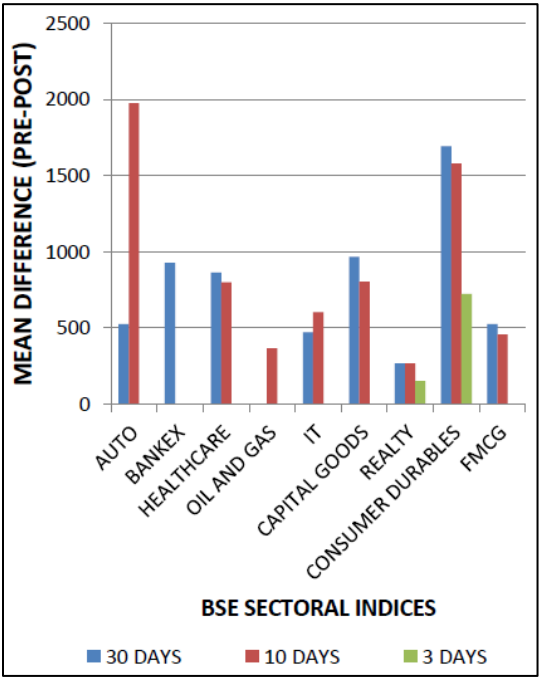
Pre and Post – Closing Values	**Mean**	**Lower**	**Upper**	**T**	**d.o.f**	**Sig. (2-tailed)**
30 Pre and 30 Post (Long Term)	525.84	470.23	581.45	19.34	29	0.000
10 Pre and 10 Post (Mid Term)	1974.83	1399.65	2550.02	7.77	9	0.000
3 Pre and 3 Post (Mid Term)	632.03	-862.32	2126.39	1.82	2	0.210

Table 4: Values obtained for AUTO sector under announcement of demonetization

The p-value > 0.05 for short term hence we do not reject H03 and conclude there is no significant difference between the closing price of

pre and post period. Whereas for long and mid-term the p-value < 0.05 hence we reject H03 and conclude that Auto sector was affected due to announcement of Demonetization for long and mid-term period.

For the remaining BSE sectoral indices, the same method of analysis as used above has been carried out. Summarizing the analysis of all sectoral indices due to the announcement of Demonetization using graphical representation:



Graph 7: All sectoral indices due to the implementation of Demonetization

The top two sectors which were negatively impacted were Auto and Consumer Durables. Auto sector saw its lowest in 16 years decline in sales. Consumer durables were affected as the purchasing power of the customer was reduced which in turn had an effect on how much stock a

retailer will purchase and in short it affected all the levels (production, wholesale and retail) of business in consumer durables.

CONCLUSION:

The outcome of this research indicates that the most influencing sectors during Union budget announcement are Auto, Bankex, Capital Goods, Consumer Durables and FMCG. Hence the retail investors need to be cautious while investing in these sectors. They can reduce the losses. The least affected sectors during union budget announcement were Information Technology (IT) and Realty.

Also the impact of union budget announcement every year on BSE sectoral indices are independent of each other. That indicates the investors cannot predict the impact of current year budget announcement with respect to last year.

Due to Implementation of GST the most affected sector was Bankex. The prices of shares in Bankex sector had fallen down tremendously. Whereas the sectors which benefitted the most were FMCG and Consumer Durables (CD). During the implementation of new tax system it is noticed that the BSE sectoral indices are not immediately affected. Hence the investors have the time to sell or buy their shares before the market is affected.

During implementation of Demonetization all the BSE sectoral indices were negatively impacted. The prices of shares had fallen down drastically but there was no immediate impact observed in any sectors. Hence the investors should be cautious and take instant decision during implementation of major economic decision which can crash the market.

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Chapter 6 - Prospective Study of Life Insurance Sector in India

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ABSTRACT:

Country's financial stability and growth depends on the preparation for uncertainty by the country and its citizens. If the financial risk is not minimized by an individual, it can create a large burden on their financial well-being. Individuals can protect themselves by opting for various Insurance schemes. Our aim is to analyze the sector's growth in India, its effect on India's growth rate, awareness about the industry among the public. The study also aims at suggesting ways to expand the sector. We have further divided the sector into public and private.

The research is being carried out using Primary and Secondary data collected from sources like IRDAI (Insurance Research and Development Authority of India), datagov.in and customer surveys. Tools like MS Excel, Python Programming and R Studio were used to compile and analyze the data. Post research the growth in the insurance sector is highlighted and effect of insurance sector on India's economic growth is measured. Suggestions are given regarding the ways to improve awareness among individuals about the importance of holding an insurance policy.

KEYWORDS: IRDAI, Life Insurance, Life Insurance Council of India, LIC, Insurance India

INTRODUCTION:

Insurance is a contract, represented by a policy, in which an individual or entity receives financial protection or reimbursement against losses from an insurance company. An insurance company pools client's risks to make payments more affordable for the insured (KAGAN, 2020).

Insurance policies are used to hedge against the risk of financial losses, both big and small, that may result from damage to the insured or her property, or from liability for damage or injury caused to a third party (KAGAN, 2020). A recent report on out-of-pocket healthcare expenditure in India, suggested that 70 percent of healthcare expenses incurred by Indians are from their pockets, of which 70 percent is spent on medicines alone, leading to impoverishment and indebtedness (Rao, 2018). On an average, 6 crore Indians die each year due to medical debt (DNA Web Team, 2018). Despite these startling facts, less than one-third of Indians are covered under health insurance (Quint, 2019).

OVERVIEW:

The India's Insurance industry consists of 57 insurance companies. These 57 companies consist of 24 life insurance companies and 33 are non-life insurance companies. Among the life insurance companies, Life Insurance Corporation of India (LIC) is the sole public sector company and the market leader in terms of the market share of the life businesses. Apart from that, among the non-life insurers there are six public sector companies i.e., General Insurance Corporation of India, The New India Assurance Company Limited, United India Insurance Company Limited, The Oriental Insurance Company, Limited and National Insurance Company Limited (IRDA, n.d.).

ROAD AHEAD:

The future looks promising for the life insurance industry with several changes in regulatory framework which will lead to further change in the way the industry conducts its business and engages with its customers. The overall insurance industry is expected to reach US $280 billion by 2020. Life insurance industry in the country is expected grow by 12-15 per cent annually for the next three to five years (Indian Insurance Industry Overview & Market Development Analysis, 2020).

Demographic factors such as growing middle class, young insurable population, and growing awareness of the need for protection and retirement planning will support the growth of Indian life insurance.

HISTORY:

Insurance in this current form has its history dating back to 1818, when Oriental Life Insurance Company was started by Anita Bhavsar in Kolkata to cater to the needs of European community. The pre-independence era in India saw discrimination between the lives of foreigners (English) and Indians with higher premiums being charged for the latter. In 1870, Bombay Mutual Life Assurance Society became the first Indian insurer (History of insurance in India, 2007). The oldest existing insurance company in India is the National Insurance Company, which was founded in 1906, and is still in business. The Government of India issued an Ordinance on 19 January 1956 nationalizing the Life Insurance sector and Life Insurance Corporation came into existence in the same year. The Life Insurance Corporation (LIC) absorbed 154 Indian, 16 non- Indian insurers and 75 provident societies 245 Indian and foreign insurers in all. In 1972 with the General Insurance Business (Nationalization) Act was passed by the Indian Parliament, and consequently, General Insurance business was nationalized with effect from 1 January 1973. 107 insurers were amalgamated and grouped into four companies, namely National Insurance Company Ltd., the New India Assurance Company Ltd., the Oriental Insurance Company Ltd and the United India Insurance Company Ltd. The General Insurance Corporation of India was incorporated as a company in 1971 and it commenced business on 1 January 1973 (History of insurance in India, 2007). The LIC had monopoly till the late 90s when the Insurance sector was reopened to the private sector. Before that, the industry consisted of only two state insurers: Life Insurers (Life Insurance Corporation of India, LIC) and General Insurers (General Insurance Corporation of India, GIC) (India Today Web Desk, 2015).

AIM:

Objective of our study was:

1. To conduct a prospective study of the growing insurance sector in India.
2. To understand its impact on our economy.

3. To analyze the distribution and the trend it follows.
4. To conduct a survey on awareness of the advantages of Insurance Schemes in the general public.

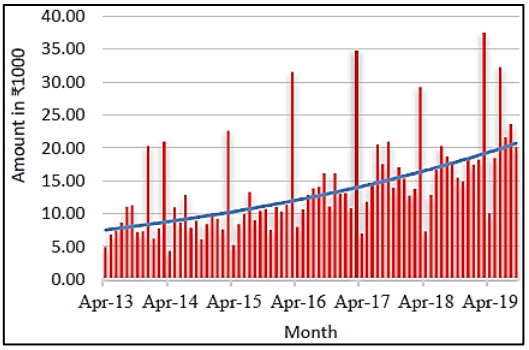
TECHNIQUES:

1. Statistical techniques like Mathematical Methods and Probability Theory, Simple Random Sampling and various other statistical techniques were used to analyse and interpret the results from the data being gathered.
2. MS Excel, R software and EasyFit software were used to sort, analyse and to fit a distribution to the secondary data
3. An online survey was carried out using the technique of Simple Random Sampling.
4. Google forms were used to conduct survey.

DATA:

1. Primary Data was collected by conducting a survey on General Awareness among public in India about Insurance. Google Form's link was shared with each sampling unit for collecting the information. Entire survey was conducted online.
2. A sample size of 130 was used for analysis.
3. Secondary data was collected from Insurance Regulatory and Development Authority of India and datagov.in (Life Insurance Council, n.d.).
4. This data consisted of monthly new business (revenue) of life insurance companies from period April 2013 to September 2019. We had a total of 2160 data points to analysis.

ANALYSIS: Overall Trend in Life Insurance Sector: To understand the sector and the trends it is following; we plotted a graph of combined revenue of Insurance Sector of India.

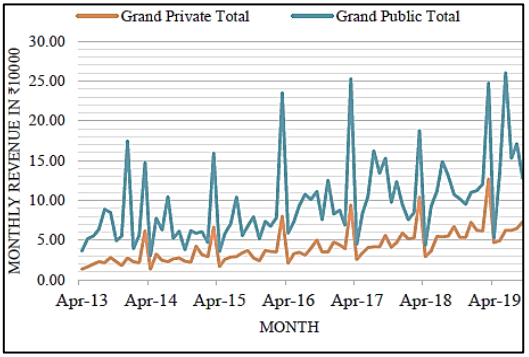


Graph 1: Combined New Business (Private and Public Companies)

1. From the graph, it can be observed that the insurance sector is seeing an overall increase in revenue (market size).
2. An upward trend can be observed in the graph. This trend is exponential in nature with formula:

$$y = 0.0001 \times e^{0.0004x}$$

3. The revenues of Private and Public sector were plotted to check whether both sectors are growing or only one of them is growing.



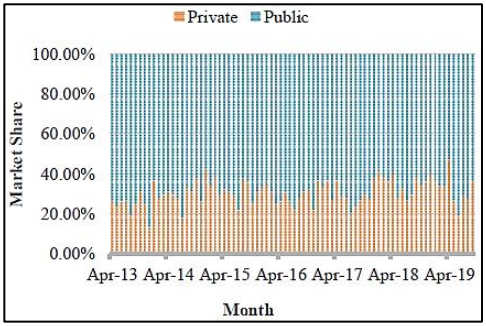
Graph 2: New Business of Public and Private Sector

Hence, the trend shown above depict that both sectors are growing in revenue.

Market Share Distribution Between Public and Private Companies:

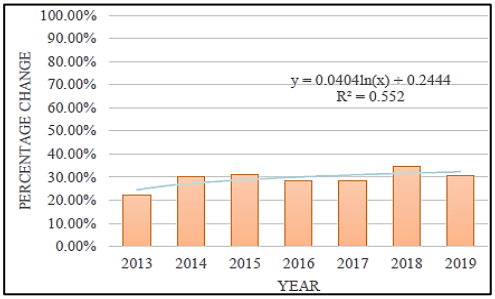
There are 23 private Insurance companies and 1 public life insurance company operating in India selling Life Insurance policies. The public life insurance sector only consists of Life Insurance Company of India, also called as LIC.

1. We plotted a graph to understand the market share distribution between public and private life insurance sector.

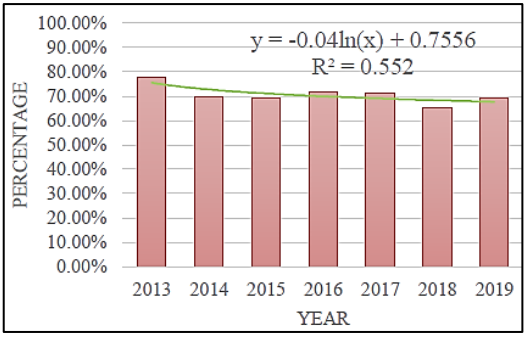


Graph 3: Market share distribution between public and private life insurance sector

2. From the graph, it is being noticed that the public sector dominates the life insurance sector. On an average the private sector forms only 29.36% whereas the public sector forms 70.64% market share.
3. A separate graph of "Percentage of market share" was plotted to understand the change in market share.



Graph 4: Market Share of Revenue for Private Companies (Yearly)



Graph 5: Market Share of Revenue for Public Companies (Yearly)

4. From the graph, it can be noticed that there is indeed a percentage change in market share from public sector to Private sector, however, it is very small. If you notice the pie charts for market share for 2013 and 2019, you will notice that in 6 years' time there has not been enough change.

Trends in Private Sector:

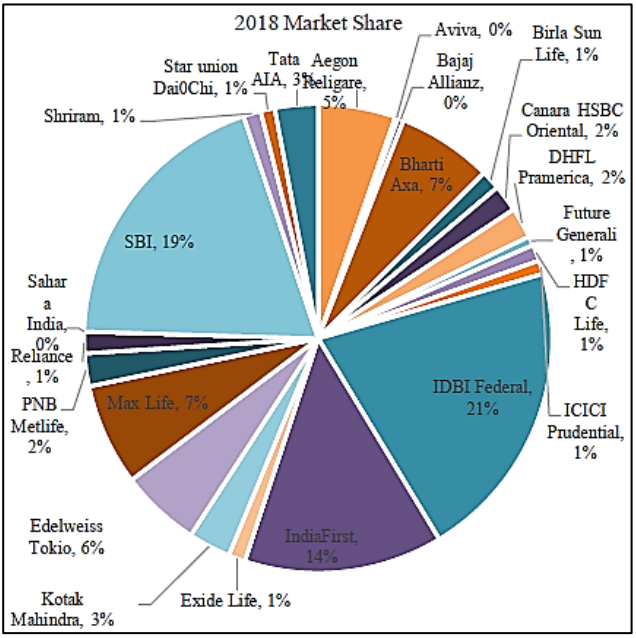
There are 23 private companies selling life insurance schemes in India.

Companies Selling Life Insurance in India

Name	2014	2015	2016	2017	2018	2019
Aegon Religare	1%	0%	1%	5%	5%	4%
Aviva	2%	1%	0%	0%	0%	0%
Bajaj Allianz	7%	7%	6%	1%	0%	0%
Bharti AXA	1%	1%	3%	7%	7%	7%
Birla Sun Life	6%	5%	5%	1%	1%	1%
Canara HSBC Oriental	1%	2%	2%	2%	2%	2%
DHFL Pramerica	2%	2%	2%	2%	2%	1%
Future Generali	1%	1%	0%	0%	1%	1%
HDFC Life	15%	14%	2%	1%	1%	1%
ICICI Prudential	14%	15%	1%	1%	1%	1%
IDBI Federal	1%	3%	17%	18%	21%	21%

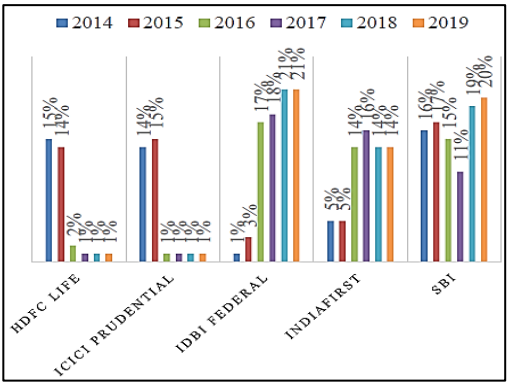
India First	5%	5%	14%	16%	14%	14%
Exide Life	2%	2%	1%	2%	1%	1%
Kotak Mahindra	4%	5%	4%	2%	3%	2%
Edelweiss Tokio	0%	1%	5%	6%	6%	6%
Max Life	8%	7%	7%	7%	7%	7%
PNB Metlife	2%	3%	2%	2%	2%	2%
Reliance	7%	4%	2%	2%	1%	1%
Sahara India	0%	0%	5%	7%	0%	0%
SBI	16%	17%	15%	11%	19%	20%
Shriram	1%	2%	2%	1%	1%	1%
Star union Dai Chi	2%	2%	1%	1%	1%	1%
Tata AIA	1%	1%	2%	2%	3%	4%

***2019 data is for until September**



Graph 5: Market Share of Private Companies Selling Life Insurance in India

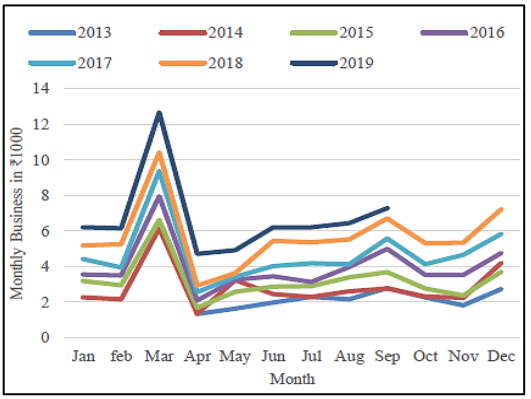
Earlier, HDFC LIFE and ICICI Prudential dominated the public sector. Currently, IDBI Federal, India First and SBI sells the maximum of Life Insurance Schemes among private companies. They together formed 55% of private sector's market share and 16.82% of overall combined market in 2019.



Graph 6: Change in Market Share of Private Companies

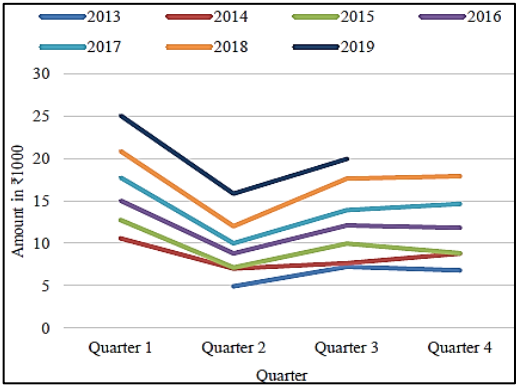
To understand the trends in the private life insurance sector graphs were plotted of private sector revenue.

1. First graph depicts monthly private sector revenue.



Graph 7: Monthly Private Sector Revenue

Private Sector shows a seasonal trend. The data suggests that the revenue rises in March and falls in April. The huge increase in sales in March might be because March marks an end of financial year and individuals and companies buy life insurance scheme to get tax relief. On an average there is a 135% increase in March and 74% decrease in April. The second graph was for quarterly private sector revenue



Graph 8: Quarterly Private Sector Revenue

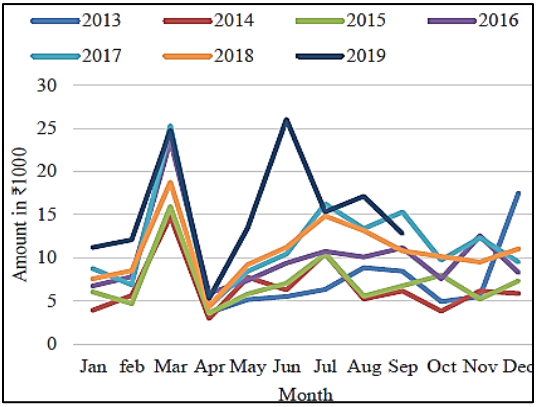
The seasonal trend is more apparent in quarterly graph. Private Sector sees huge revenue in Quarter 1, followed by a downfall in Quarter 2 and constant sales in Quarter 3 and 4.

Trends in Public Sector:

In India, public sector of life insurance sector only consists of one company i.e., Life Insurance Company of India (LIC). It forms on an average 70.64% of India's life insurance sector.

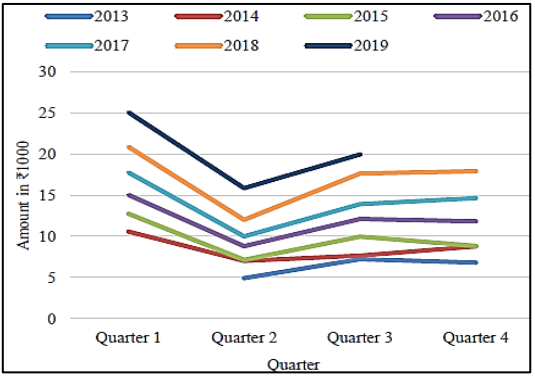
To understand the trends in the private life insurance sector we plotted the graphs of private sector revenue.

1. The following graph is for the monthly new business for public sector.



Graph 9: Monthly New Business for Public Sector

2. Public Sector follows a seasonal trend. It always sees a rapid rise in March and then huge fall in sales in April. The huge increase in sales in March might be because March marks an end of financial year and individuals and companies buy life insurance scheme to get tax relief. At average there is 198.98% increase in sales in March and 78.35% decrease in sales in April
3. Our second graph was for quarterly public sector revenue.



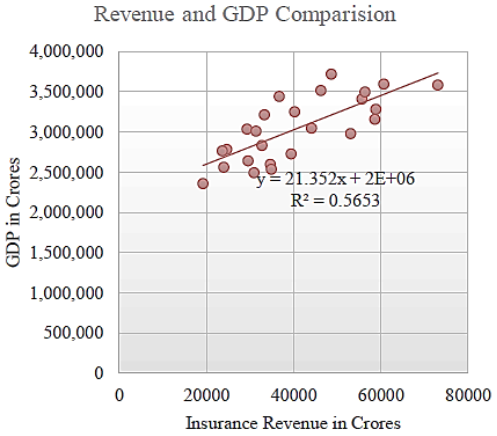
Graph 10: Quarterly Public Sector Revenue

4. The seasonal trend is more apparent in quarterly graph. Public Sector sees huge revenue in Quarter 1, followed by a downfall in quarter 2, increase in sales in Quarter 3 and then fall in Quarter 4.

Correlation Between GDP and Insurance Sector:

We aim to understand the relation between GDP and Insurance Sector and whether both are correlated with each other. We made 2 sets of comparison. We compared actual figures and we compared percentage growth rate.

1. We first compared GDP and Insurance Sector in revenue figures by using a scatter plot.



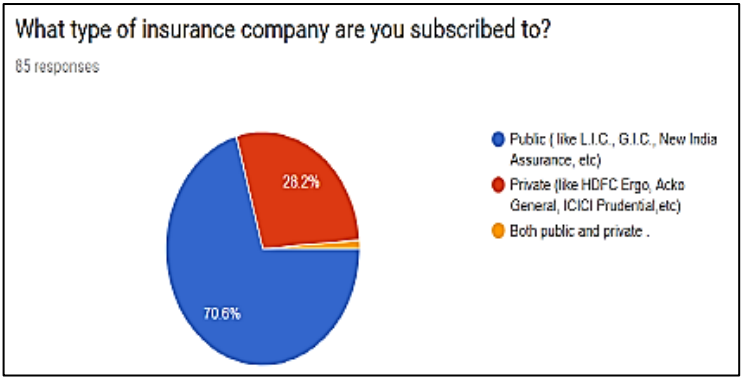
Graph 11: Correlation Between GDP and Insurance Sector

From the graph, we concluded that GDP and Insurance sector are positively correlated (75% correlation). Their relation can be plotted as y = 21.352x + 2E + 06, where y is the GDP in crores and x is the insurance sector revenue in crores.

Analyzing the Results from our Survey:

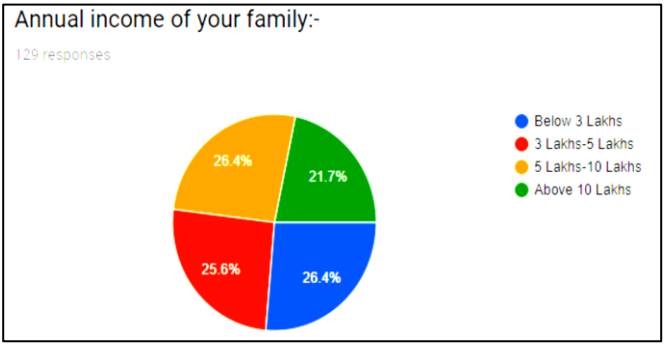
A survey was conducted on "General Awareness among public in India about Insurance Sector" using google Forms. The following results were obtained from the survey.

1. From the survey it is noticed that just like in the data obtained from IRDAI, even in the survey 70.6% of responders had insurance from public sector and 28.2% of responders had insurance from private sector. Only 1.2% responders had bought insurance from both private and public company. Thus, our survey results correspond with IRDAI data.



Graph 12: Type of Insurance Respondents are Subscribed to

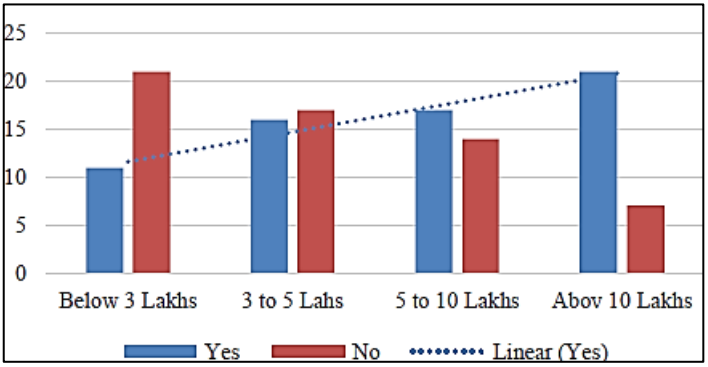
2. Responders belonged to 4 annual income groups with each group approximately forming 25% of our responders.



Graph 13: Annual Income Groups to which the Responders Belong

3. Comparison between Annual Income and whether person has an insurance scheme. From the graph, it can be observed that increase in a person's annual income leads to an increase in their tendency to

buy insurance. From the graph we observed that increase in a person's annual income, their tendency to buy insurance increases.

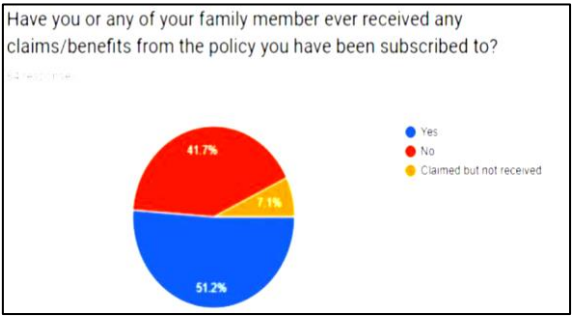


Graph 14: Annual Income's Effect on Tendency to Buy Insurance

Respondents were also asked whether people had received benefits. From the survey it was observed that out of 58.3% (51.2% +7.1%) people who applied for claims, 12% claims were rejected. This indicates that the Indian Life Insurance sector needs to increase its benefits pay-out ratio.

CONCLUSION:

1. The Insurance sector observes an increasing trend in revenue.
2. The sector is dominated by the public sector which only has one company LIC. This dominance causes a lot of pressure on the government to provide life insurance scheme.



Graph 15: Insurance Claimed

3. However, the market distribution is at a very slow rate changing from public to private sector.
4. Both sectors follow a seasonal trend and observes huge sales in March due to ending of financial year and then a subsequent huge downfall in revenue in April.
5. GDP and Insurance sector are positively correlated in volume.
6. An increase in an individual's annual income leads to increase in tendency to buy insurance scheme.
7. The insurance scheme has a very high claims pay-out rate.

SUGGESTIONS:

1. Government should create programs and run awareness campaigns to increase awareness among public about insurance and create policies to increase sales.
2. Since Private Sector sees a huge decrease in sales in Quarter 2 and Public sector sees huge decrease in sales in Quarter 2 and 4, government and firms should create policies and campaigns to target customers during these quarters.
3. Since public sector forms huge portion of life insurance sales, it puts a huge pressure on the government to provide life insurance schemes. Government would have to provide subsidiaries and utilize other methods to boost the private sector.
4. While government already runs lowcost subsidized insurance schemes targeted towards lower income sections, awareness about these schemes is very low. Campaigns should be built that specifically targets these sections and policies.
5. Overall, the number of people who have life insurance schemes in India are very low. There is a huge market that can still be captured. These allows new companies to enter and old firms to grow.

Initiatives Taken by the Government:

The Government of India has taken several initiatives to boost the insurance industry. Some of them are as follows:

1. In September 2018, National Health Protection Scheme was launched under Ayushman Bharat to provide coverage of up to Rs

500,000 (US$ 7,723) to more than 100 million vulnerable families. The scheme is expected to increase penetration of health insurance in India from 34 per cent to 50 per cent.

2. Over 47.9 million famers were benefitted under Pradhan Mantri Fasal Bima Yojana (PMFBY) in 2017-18.
3. The Insurance Regulatory and Development Authority of India (IRDAI) plans to issue redesigned initial public offering (IPO) guidelines for insurance companies in India, which are to looking to divest equity through the IPO route.
4. IRDAI has also passed legislations to allow establishment of micro insurers. These micro insurers provide smaller benefit compared to bigger companies but are also cheaper in nature. Because these firms have small working areas, they will be able to better target customers. Instead of having to run Pan India campaigns, they can run campaigns targeting specific regions.

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Chapter 7 - Study of Mechanisms used by Retailers against Online Shopping

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ABSTRACT:

With the day-by-day remarkable and unrestricted growth of e-commerce giants, it is an overlooked fact that the small-shop retailers are bearing the brunt of this booming business. The deep discounts and schemes often offered by such websites have made it difficult for the retailers to compete in the price wars and are consequently losing out on their business. This study conducted focuses on the methods adopted by retailers in different areas of South Mumbai to keep their business afloat. Many retailers and small-shop owners have come up with different strategies to survive against the impact of online business worldwide. Considering the popular opinion of how electronics and clothing were the two most purchased products online, we decided to focus on them as our two main commodities. The research methodology involved the preparation of a questionnaire for the retailers as well as one for customers. A detailed survey was conducted to get information from retailers on the basis of one-to-one interviews and/or filled-in questionnaire approach. The customers were asked their opinion on various aspects of online and in-store shopping. The data so collated was analyzed with the following objectives:

- To find out the impact of online shopping on retailers.
- To find the coping mechanism used by retailers/small shop owners.
- To study which adopted mechanism yields the most promising results.
- To analyze the customer's opinions to find which aspects of shopping are most important to them.

KEYWORDS: E-commerce giants, small shop retailers, coping mechanism, online shopping.

INTRODUCTION:

Internet penetration into the daily lives of all individuals, ranging from the rich to poor, young to old, amateurs to professionals, for professional reasons to recreational purposes, has increased over the time. With increased use of the internet, people have started doing transactions of goods and services using online platforms. This buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions is referred to as Ecommerce. E- commerce has revolutionized and brought changes to how goods and services are normally purchased and also improved the experience.

The earliest online stores went into business in 1992, and online retailing took over a significant segment of the retail market during the first decade of the twenty-first century, as ownership of personal computers increased and established retailers began to offer their products over the Internet [1]. E- commerce was first introduced in India by Government of India in 2002, when they introduced IRCTC online passenger reservation system. This was followed by the eventual boom which saw many big companies and retailers taking their business online and almost all products and goods becoming available to the customers. Since then, ecommerce has evolved to make products easier to discover and purchase through online retailers and marketplaces [2].

This research is mainly going to focus on the efforts that retailers put in and will need to improve on to ensure that they can cope with loss of business due to online shopping. A retailer is an entity that sells goods such as clothing, groceries, and other goods directly to the consumers through various distribution channels with the goal of earning a profit. This merchant can be a physical building or online and retail is a process of selling goods and services to customers through multiple channel of distribution.

The main focus is to see the effects of e-commerce on sales of the shops that have been established since before the e-commerce times and how

they are coping up in these times of growing e- commerce popularity. Inputs from both the parties, retailers and consumers, have been used to carry out this research.

PROJECT STATEMENT:

To study the effectiveness of the mechanisms used by small-shop retailers to cope with the loss in business owing to an increased preference for online shopping.

Objective:

The customers were asked their opinion on various aspects of online and in-store shopping. The data so collated was analyzed with the following objectives:

1. To find out the impact of online shopping on retailers.
2. To find the coping mechanism used by retailers/ small-shop owners.
3. To study which adopted mechanism yields the most promising results.
4. To analyze the customer's opinions and find which aspects of shopping are most important to them.

HYPOTHESIS:

H0: There is no association between different coping mechanisms and the different indices of store status.

H1: There is at least one measure showing association against the indices of store status.

LITERATURE REVIEW:

There are many research papers that state how online shopping has affected the profitability of retail stores and to study the change in business patterns in order to attract a huge number of customers.

Vaishali Nikalje (2018) in her paper "A study to determine the impact of emerging online shopping sites on conventional model of buying and selling with reference to Pune City" talks about reasons why customers prefer shopping online and in small shops, the various numbers of

problems customers face while shopping online or in conventional stores. Her methodology included primary and secondary sources. Under primary sources a questionnaire was circulated amongst 80 people. It was observed that large percentage of customers faced problems with slow billing processes and unavailability of products while shopping in store. On the other hand, the major problem faced by customers while shopping online was lack of touch and feel of the product placed for order. Some other problems while shopping online were disclosure of personal information, lack of trust on confidentiality, and doubtful on delivery. So therefore, online and in-store retailers both need to work on their business tactics in order to bring satisfaction to customers.

Kavya (2016) in her paper "A Conceptual study on the Impact of Online Shopping towards Retailers and Consumers" highlights the objectives as to why there has been decline of shopping by customers in retail stores due to the emergence of E-stores and review various strategies to be taken by retailers to improve their business. There are various pros and cons of online shopping listed out. Some of the pros being convenient method of shopping, offers better prices, large variety of products, 24/7 availability. The cons being no physical experience and shipping cost. Some of the strategies that offline retailers can adopt are upgrading their sites to start online providing a better convenience for customers to purchase products, they should give pick up and drop points, they should incorporate virtual showrooms in their stores which can take customers to a trip into the stores and various products so that easily make their decisions on purchase.

RESEARCH METHODOLOGY:

The study encompasses miscellaneous types of methods. A detailed survey was conducted to get information from the retailers on a one to one basis in a Questionnaire approach and Personal Interview method. The information was collected from a conveniently available pool of respondents based on the proximity. Thus, Convenient Sampling method was used. Only those retailers, whose products were sold online as well, were interviewed. Responses from 100 retailers were collected through surveys.

The tools used for data analysis were Descriptive Statistics, Graphs, Spearman Rank Correlation, Discriminant Analysis and Chi-square test for Independent Samples for testing hypotheses using MS Excel, SPSS and Jamovi software.

The different types of analysis used are average to conclude which store indices were affected most by online shopping, Spearman's rank correlation has been used to study how the different coping measures and the store indices are correlated, Chi square analysis of independent samples has been conducted to study whether there is a significant relationship between different factors and the coping mechanisms. Discriminant analysis was performed to see the extent to which different independent factors affected the dependent factors. The independent factors being the coping mechanisms and the dependent factors being the various indices.

DATA ANALYSIS:

Correlation Analysis

Hypothesis

H0 - There is no correlation between the factors that affected businesses due to online consumerism and the tools that have been used to cope up with it.

H1 - There is correlation between the factors that affected businesses due to online consumerism and the tools that have been used to cope up with it.

The p-value corresponding to store traffic and profit margin, products offered and discounts and sale services, products offered and brand availability, profit margin and after sale services, profit margin and payment mechanism are less than 0.05 so H0 is rejected and it is concluded that there is positive correlation for the following pairs:

1. Store traffic and profit margin
2. Products offered with discounts/sales and brands availability

3. Profit margin with publicity, after sale service, profit margin and payment mechanism.

Chi-Square analysis

On performing Chi-square analysis for different measures that were assumed that the retailers would have adopted to cope with online shopping and the various store indices the following was observed:

1. Hypothesis

H0 - Reducing expenses as a coping mechanism for incurring losses has no impact on store traffic

H1 - Reducing expenses as a coping mechanism for incurring losses has an impact on store traffic.

Decision criteria - Reject H0 if p-value < 0.05 for 5% level of significance.

Since the p-value is less than 0.05 we reject H0 and conclude that reducing expenditures as a coping mechanism for incurring losses affects store traffic.

2. Hypothesis

H0 - Measures to maintain stock of goods as a coping mechanism has no effect on store traffic.

H1 - Measures to maintain stock of goods as a coping mechanism has significant effect on store traffic.

Decision criteria - Reject H0 if p-value < 0.05 for 5% level of significance.

Since the p-value is less than 0.05 we reject H0 and conclude that Measures to maintain stock of goods as a coping mechanism has significant effect on store traffic.

3. Hypothesis

H0 - Increase in number of shops selling more goods as a coping mechanism has no effect on profit margin.

H1 - Increase in number of shops selling more goods as a coping mechanism has significant effect on profit margin.

Decision criteria - Reject H0 if p-value < 0.05 for 5% level of significance.

Since the p-value is less than 0.05 we reject H0 and conclude increase in number of shops selling more goods as a coping mechanism has significant effect on profit margin.

4. Hypothesis

H0 - Changing the quality of goods as a coping mechanism has no significant effect on customer loyalty.

H1 - Changing the quality of goods as a coping mechanism has significant effect on customer loyalty.

Decision criteria - Reject H0 if p-value < 0.05 for 5% level of significance.

Since the p-value is less than 0.05 we reject H0 and conclude that changing the quality of goods as a coping mechanism has significant effect on customer loyalty.

DISCRIMINANT ANALYSIS:

After performing discriminant analysis it was concluded that to what extent the various store indices like profit margin, store traffic, customer loyalty, and products offered are dependent on the different coping mechanisms like advertising, discounts and sales services, payment mechanism, brand availability, exchange offers, product variety.

The following was observed: The dependent variable being the store index - profit margin against a set of independent variables being coping mechanisms to see the extent by which the mechanisms used affect the store indices. The mechanisms that can affect the profit margin significantly are after sale services (0.675), profit margin (0.751) and brand availability (-0.992). The positive and negative signs depict the extent to which the mechanisms will help for a change in the profit

margin. All the other factors also affect the profit margin but to a smaller or negligible extent.

The dependent variable is the customer loyalty. The coping mechanisms that can affect the customer loyalty significantly are discount/sales and offers (-0.869), after sale services (0.828), profit margin (0.687), payment mechanisms (0.7) and exchange offers (1.362). The positive and negative signs depict the extent to which the mechanisms will help for a change in the profit margin. All the other factors also affect the profit margin but to a smaller or negligible extent.

The dependent variable is store traffic. The coping mechanisms that can affect the store traffic significantly are discount sale/offers (0.746), after sale services (1.757), profit margin (0.785), product variety (1.365), exchange offers (-1.88), and payment mechanisms (-1.323).The positive and negative signs depict the extent to which the mechanisms will help for a change in the profit margin. All the other factors also affect the profit margin but to a smaller or negligible extent.

The dependent variable is products offered. The coping mechanisms that can affect the products offered significantly are profit margin (0.670) and brand availability (-0.824). The positive and negative signs depict the extent to which the mechanisms will help for a change in the profit margin. All the other factors also affect the profit margin but to a smaller or negligible extent.

CONCLUSION:

The inferences from the data analysis performed can be used to the benefit of the retailers who find their business affected due to online stores and shopping sites that have booming businesses with low prices and frequent discounts and sales offers which attract more customers.

Primarily, it can be seen that changing the profit margin will help boost the business. This may involve reducing the existing profit margins. This may result in an immediate fall in revenues but the lower prices will lead to customers being attracted to the lower prices. This will lead to an improvement in the volume of transactions and hence keep bringing in

more customers through the door. Eventually, after observing a good, steady flow of income and business, the retailers can think about increasing their profit margins little-by-little. It can, therefore, be perceived that the long-term effects of following through with decreasing the profit margin will be desirable.

Secondly, providing after sales services to customers has also been indicated as a useful mechanism to improve all the conditions taken into consideration that have been affected the most in retail shops. Providing delivering options, guarantee/warranty on certain goods for a certain period, reparation services, etc. can attract customers to the store. Offering such services will also encourage the customer to opt for newer and higher quality of goods even if they might be more expensive. The customers' satisfaction with the quality, the goods and overall service offered by the store and retailers might then persuade the customers to establish a loyalty to the store. This can also lead to the strengthening of the customer base of the store.

Apart from the above mechanisms, others that can be useful include advertising the store and all it has to offer, offering a variety of products, providing a variety of payment options and giving discounts and other such sales offers. The publicity and advertisements will help to spread news regarding the offers given by the store which will in turn help to improve the store traffic.

Another mechanism that should be given importance is diversifying by their business by either establishing an online store of their own or merging with other e-commerce giants by striking up a deal revolving around the supply of goods. The diversification can also be done by setting up more branches of the stores or introducing new varieties or types of goods.

LIMITATIONS:

This study is restricted only for the retailers dealing in electronics and clothing since these are two most purchased products online sample size is 100.

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SECTION 3 – PHYSICS

Chapter 8 - Tachyons and its Strange Behaviour

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ABSTRACT:

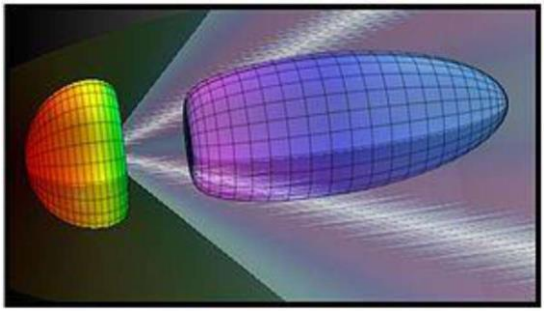
Tachyons are hypothetical particles that always travel faster than light without breaking the law of causality and Relativity. According to Relativity nothing can go faster than light as it would break the causality of our universe and will have an imaginary mass associated with it or could travel back in time. Relativity speaks of nothing could travel faster than light from a state of rest to exceeding the speed of light, but conversely it also means that something which is/was always travelling faster than speed of light could still exist. Even after the big bang occurred and universe started expanding, the space-time inflated as if it's going faster than light speed in all directions spreading infinitely with low to none curvature. It is also speculated by some physicists that if space is inflating then what causes this inflation and why is it filled with almost 95% dark matter & dark energy (27% dark matter & 68% dark energy), and this is where tachyons could come into play. On the other hand, tachyonic fields play an important role in modern physics. Perhaps the most famous is the Higgs boson of the Standard Model of particle physics, which has an imaginary mass in its uncondensed phase. In general, the phenomenon of spontaneous symmetry breaking which is closely related to tachyon condensation plays an important role in many aspects of theoretical physics, including the Ginzburg–Landau and BCS theories of superconductivity. Another example of a tachyonic field is the tachyon of bosonic string theory.

KEYWORDS: Tachyons, Relativity, Causality, Dark Matter, Dark Energy, Black holes

INTRODUCTION:

Tachyons are hypothetical particles that always travel faster than light without breaking the law of causality and Relativity. The term "Tachyon" was coined by Gerald Feinberg in a 1967 paper titled "Possibility of Faster-Than-Light Particles". Feinberg was inspired by the science-fiction story "Beep" by James Blish. He studied the kinematics of such particles according to special relativity. In his paper he also introduced fields with imaginary mass (now also referred to as "tachyons") in an attempt to understand the origin such particles might have.

The first hypothesis regarding faster-than- light particles is sometimes attributed to German physicist Arnold Sommerfeld in 1904, and this idea was revisited some years later by Robert Ehrilch & E.C.G Sudarshan, independently of each other. Although, most of physicists do believe that faster-than-light particles should not exist because it violates some of the known laws of physics.



Relativity speaks of particles not travelling faster than speed of light from rest, but there can exist particles which are always at speeds faster than light. By Relativity and Lorentz invariant theory, rest mass ‘m’ is given by:

$$E^2 = (mc^2)^2 + (pc)^2$$

Where ‘p’ is the momentum of any bradyon & ‘c’ is the speed of light

Hence, we get,

$$E = mc^2/ (\sqrt{} (1 -(\upsilon^2/c^2))$$

By applying simple mathematics, we can see that when the velocity of the particle is lesser than light then the rest mass is real, and when the velocity of the particle is greater than light then the rest mass comes out to be an imaginary number. This could imply that the mass of the particle is either increasing or decreasing by an imaginary amount which is against the law of conservation of mass & energy.

When a Jet or a Rocket or any other thing that crosses/exceeds the sound barrier then it's called a sound boom or as we prefer the term "Super Sonic Boom", similarly, when a particle crosses or exceeds the light barrier i.e., if it exceeds the speed of light then it is known by the term "Cherenkov Radiation".

Application of Tachyonic theory in Modern Physics:

- As energy has to obey the law of conservation of energy and momentum, it has to give out some of the energy out or some of the mass has to change with the given time.
- This imaginary mass has been speculated by some physicists to be dark matter which fills up almost 27% of our universe and its expanding at a higher rate.
- Tachyonic particles travel at superluminal speeds and which require energy and the by-product of the energy provided to tachyons are speculated to be dark matter. But these are just assumptions and theories put forward by theoretical physicists and it's not yet proved.
- According to a paper published in European Physical Journal C by Herb Fried from Brown University and Yves Gabellini from INLN-Université de Nice, this model – like any model of such non-replicable phenomena as the creation of the universe – may be simply characterized as a tantalizing set of speculations. Nevertheless, it not only fits with data on inflation and dark energy, but also offers a possible solution to yet another observed mystery.

The Birth and Death of a Universe:

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Received: 5 August 2016/ Accepted: 14 December 2016/ Published online: 24 December 2016

Abstract This letter is meant to be a brief survey of several recent publications providing a simple, sequential explanation of dark energy, inflation, and dark matter. These para- graphs lead to an intuitive and qualitative picture of the why and the how of the Big Bang, and thence to a possible under- standing of the birth and death of a universe.

This review begins by noting a new, QED-based derivation of dark energy that is able to provide the amount of quantum vacuum energy density which astrophysicists believe is responsible for the continuing expansion of our universe. Figure 1 represents a picture of the shape of our energy density, where the horizontal axis is proportional to time, or to distance from the big bang.

We have then found a surprisingly simple but unexpected extension of that dark energy analysis to account for inflation, the violent explosion of matter and energy from the big bang, representing the very beginning and later components of our universe.

That extension was made possible by the necessary assumption of the existence of electrically charged, fermionic pairs of tachyons (T) and anti-tachyons (T^{-}) fluctuating in the quantum vacuum, in addition to corresponding lepton and quark pair fluctuations. The mass of such tachyons can be chosen to be slightly less than, on the order of, or even greater than the Planck mass, MP , which provide fine fits to the initial

and final times of inflation, and its corresponding energy density values, as listed in the cosmological tables for inflation.

A further question arises concerning the possibility of the extraction of such $T\,T^{-}$ pairs from the quantum vacuum into the real vacuum of the everyday world.

This event would surely be possible in a region close to the explosion of the big bang, where the huge energy fluxes would easily be able to tear such $T\,T^{-}$ pairs apart, and hurl them into the real vacuum, as an example of an extremely energetic Schwinger

mechanism. From the kinematics and Born approximation analyses of photon emission and absorption from and by an electrically charged fermionic tachyon, it is easy to see that a very high energy, charged tachyon could be a perfect example of a dark matter particle, which reabsorbs almost every photon that it emits.

The derivation of dark energy, inflation, and dark matter, qualitatively described in the above paragraphs, then leads to a possible understanding of the why and the how of the big bang, as well as to the title of these paragraphs. For this purpose, one must understand the current cosmological belief that an energy density, ρ, proportional to M^4 , is the largest value of such a density which our equations containing quantum mechanics, relativity, and gravity can support; were there to suddenly appear an energy density of value larger than that, then in the region of that ρ there must follow a breakdown of at least one of our standard descriptions of those three theories above.

With this in mind, consider a very high energy, charged, fermionic tachyon propagating in remote galactic space, which particle has received a large percentage of its high energy by absorbing CMB photons in the millions of years that it has been in motion. Suddenly, and unexpectedly, it meets a T^{-} of the same species; and they annihilate. At that tiny spot of annihilation, the energy density will be larger than the M^4 of the previous paragraph, and something has to give. Let us suppose that what immediately happens is that – at that spot of annihilation – the

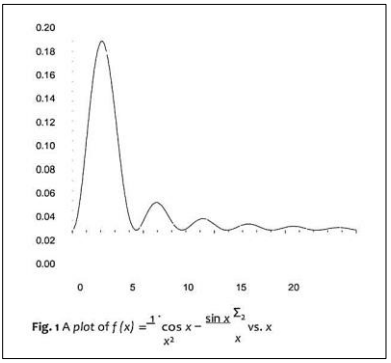


Fig. 1 A plot of $f(x) = \frac{1}{x^2}\cos x - \frac{\sin x}{x}$ vs. x

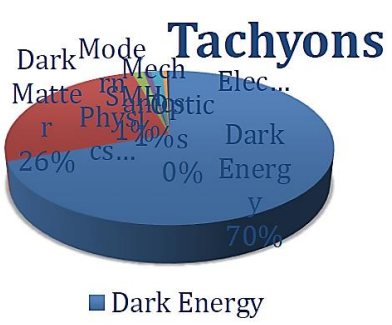
separation between the quantum vacuum and the real vacuum is disrupted, and the huge energies contained in the quantum vacuum can suddenly explode into the real vacuum. This is the big bang of a new universe, with origin at that point of annihilation, in which energy, and charge contained in the quantum vacuum of the old universe are blasted into the new universe, which has no memory of its origin. Some of that energy goes into the quantum vacuum of the new, and growing universe, while the remainder forms the mass of a part of this new universe

And what is the fate of the old universe? Consider a portion of its matter, an ordinary galaxy, which is located far from the origin of the new universe. What has kept that galaxy in existence for all of its previous lifetime is the energy stored in that part of the total quantum vacuum in its immediate vicinity, for it is that portion of the quantum vacuum which fights against the natural, gravitational attraction of each segment of its matter to collapse into each other. But now, with nothing to prevent the motion of the energy stored in the quantum vacuum, it would naturally tend to move and possibly with the speed of light to the point of annihilation, and its escape into the real vacuum. This would leave that galaxy with only a fraction of its defense against gravity, a fraction which gets smaller and smaller as time goes by.

And what is the fate of that old galaxy? It takes little imagination to realize that it will be squeezed out of exis- tence, forming a supermassive black hole; that is, a black hole containing the mass of perhaps a million of its previous suns. Eventually, that supermassive black hole will become the centre of another galaxy of the new universe; and on one of its planets, astronomers will one day discover as have ours, within the last few years that the black hole at the centre of their galaxy and of so many other galaxies is supermassive.

As a summary, our qualitative speculations provide a sequential and coherent picture of the three, modern cosmological mysteries inflation, dark matter, and dark energy and of the origin and possible fate of our universe, including the occurrence of supermassive black holes at the centres of galaxies.

Review of the Research paper: Herb Fried and Yves Gabellini in their Original research paper have tried to explain the origin/birth of new universes by using some advanced theories and concepts such as Inflation, Dark matter and Dark Energy. Their theory and assumptions are mostly based on Quantum Vacuum theory in which the energy stored in the QV (Quantum Vacuum) is normally large enough to counteract the gravitational tendency of galaxies to collapse in on themselves. In the theory of Fried and Gabellini, however, when a new universe forms, a huge amount of the QV energy from the old universe tachyon-anti-tachyon annihilation (the new Big Bang).



Eventually, even faraway parts of the old universe will be affected, as the old universe's QV energy leaks into the new universe like air escaping through a hole in a balloon. The decrease in this QV-energy buffer against gravity in the old universe suggests that as the old universe dies, many of its galaxies will form SMBHs (Super Massive Black holes) in the new universe, each the mass of the old galaxy's former suns and planets. Some of these new SMBHs may form the centres of new galaxies in the new universe. Also, tachyonic particles travel at superluminal speeds and which require energy and the by-product of the energy provided to tachyons are speculated to be dark matter.

As seen earlier that tachyons almost follows all the laws of physics within a certain limit, it still is impossible to be discovered. This is not

by fault of thesis but limitation of experimentation, maybe in the near future humans could be able to discover or even produce one of these particles then if applied with current scientific laws could give rise to endless possibilities for present as well as future generation of scientists.

CONCLUSION:

After years of research and hard work, scientists are still not able to find its existence and have failed terribly to reproduce one of them in their highly sophisticated labs and particle generators. Although, it has become a favourite topic of all the fiction writers to illustrate their weird ideas of time machine and people getting superpowers by just travelling faster than light without taking the enormous consequences it would have over someone's body or mind. Maybe someday we will find some legit proof and it will change the way we view our universe as a whole.

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SECTION 4 – COMPUTER SCIENCE

Chapter 9 - Real Time Monitoring Thermometer

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ABSTRACT:

In this window application, the sensor will be used to sense the body temperature. Then the captured data is compared with the fever temperature. If true then the data is stored in a file and also a graph is framed. The Buzzer is beeped for the same.

KEYWORDS: Fever, Infrared sensor, Thermometer, Temperature, Arduino, Ear.

INTRODUCTION:

Fever is the phenomenon of rising body temperature and has existed since the beginning of mankind. It is experienced by all multiple times during our lifetime, from infants to elderly people. Fever also called Hyperthermia [4] is a cause of many underlying conditions. Today, we have very simple mercury to very complicated digital and infrared thermometers. But a thermometer which

continuously monitors and alarms the person when body temperature increases is very difficult to find. And such a thermometer which is inexpensive and robust is even more difficult to find. Here, in this project we have created a thermometer which fits neatly in the ear (tympanic membrane, membrane which emits infrared waves).And continuously, in regular intervals of time measures the precise (upto 3 digits after decimal point) core temperature of the patient using an Arduino Uno and an infrared sensor.

MATERIALS:

For this project an Arduino Uno was taken with an infrared sensor (MLX9014BAA) [9] and connected together using a Printed Circuit Board. For the completion of the circuit a 0.1µF capacitor and two 4.7 K ohm were also required. The entire setup was created by modifying the circuit diagram of the datasheet [6] as follows.

1. The infrared sensor (MLX90614BAA) consists of 4 pins:

a. Pin 1 is connected to the A5 port of the Arduino. This is the Serial Clock Line; the line which pulses from high to low and for every pulse data is sent.

b. Pin 2 is connected to the A4 port of the Arduino. This is the Serial Data Line; the line through which sensor forwards the data to the Arduino.

c. Pin 3 is connected to the power supply which is 3.3V in the Arduino.

d. Pin 4 is connected to the ground in the Arduino.

2. A capacitor of 0.1uF is connected across pin 3 and pin 4 of the infrared sensor.

3. A 4.7K ohm resistor is connected across pin 2 and pin as well as another resistor across pin 1 and pin 3.

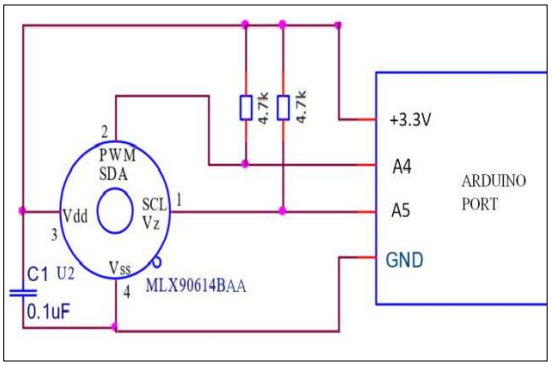


Fig 1: Circuit Diagram

To create the Windows application for the setup Visual Studio version 2015 was used and the application was built using windows forms and C# language. With this the sensor coding was done using Arduino C in the Arduino IDE with the help of the Adafruit and Wire libraries.

METHODS:

When the user connects the Arduino with the laptop, the Infrared Sensor starts reading temperatures. This particular Infrared sensor is calibrated to measure the range -70 ºC to 380 ºC (as per the provided datasheet [6]). The user opens the Windows Application and selects between whether to read the temperature of an existing patient or new patient. Subsequently a dashboard is displayed for the user for starting, stopping the sensor, clearing all the old data with the new button, and exiting the system. As soon as the user starts the program the sensor starts comparing the patients' temperature with the threshold fever value which is 100.4 [4][5][12]. Fahrenheit in the ear. If this is true a buzzer goes off for the user and values are displayed and plotted on the text view and graph subsequently and read data is stored for the user in a text file.

Step 1: The user connects the Arduino and the sensor.

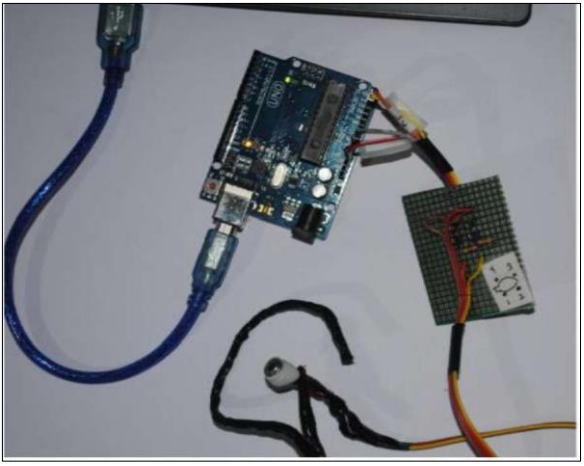


Fig 2: Entire Setup

Fig 3: Ear Piece

Step 2: The user opens the application and selects between existing and new patient.

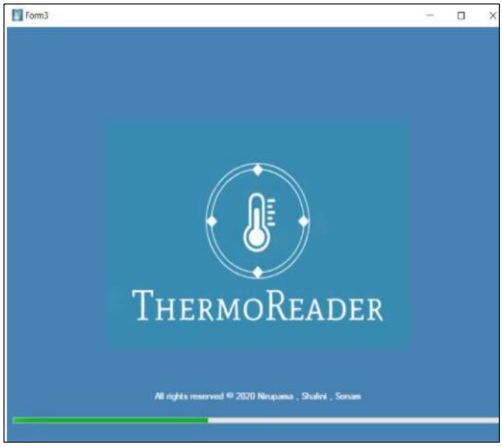


Fig 4: Splash Screen

Fig 5: Patient's Data Entry

Step 3: User starts viewing the patient's body temperature readings by clicking the Start button.

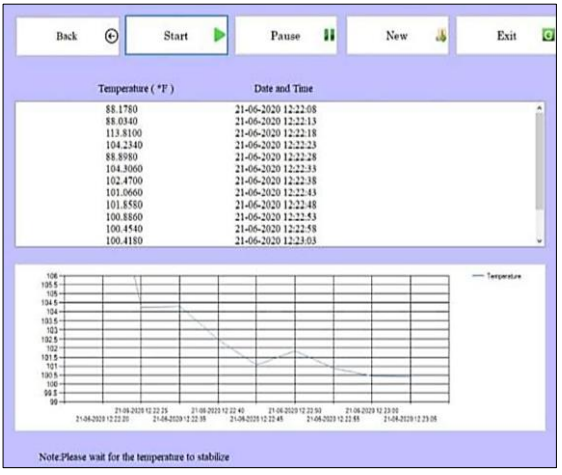


Fig 6

Step 4: Thermometer has started!

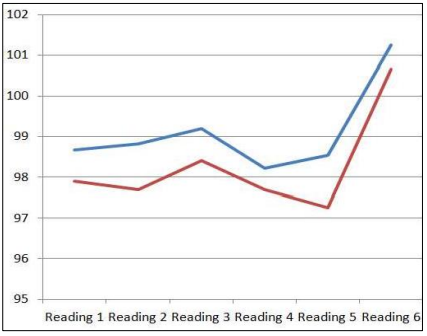
RESULTS:

The temperature measured by the sensor is compared with a digital thermometer's readings. The armpit (auxiliary membrane) temperature is 0.5 F – 1.5 F less than the ear (tympanic membrane) temperature [12].

Sr. No.	Digital Thermometer (in Fahrenheit)	Infrared Sensor (in Fahrenheit)	Difference in Temperature (Infrared-Digital)
1	97.9	98.67	0.77
2	97.7	98.83	1.13
3	98.41	99.21	0.8
4	97.7	98.22	0.52
5	97.26	98.54	1.28
6	100.67	101.258	0.58

Table 1: Comparison of temperature readings

From the above table it is clear that the Infrared Sensor in the ear measures accurate data and is always 0.5-1.5 F higher than the armpit reading.



-------- Digital Thermometer (Armpit)

-------- Infrared Sensor (Ear)

Fig 7

DISCUSSION:

- Firstly, the infrared sensor senses the temperature of the body which is done through the Arduino IDE. This code resides in the programmable flash memory of the ATMega16 in the Arduino.
- Then the reading is sends to the C# through SerialPort connection.
- Next, the conditions are checked :
  i. If the body temperature is greater than the normal body temperature (more than 100.4 F [4][5][12]) then a buzzer is beeped and the current temperature is shown.
  ii. But if the body temperature is normal, then the condition is not fulfilled and there is no change in the state of the buzzer.
- Then the measured body temperature in Fahrenheit with date and time is displayed in the textbox. And also a graph is plotted.
- Then, this data is stored in a text file.

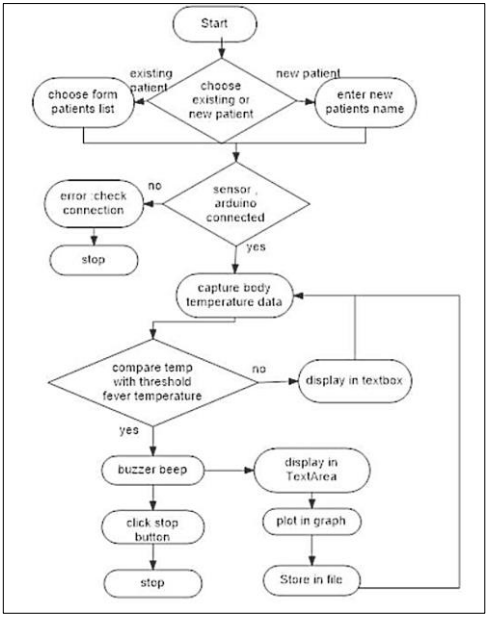


Fig 8

CONCLUSION:

In this paper, we have named all the numerous applications of the Real-time monitoring thermometer system. It is a Windows Application with multiple simultaneous patients' data. The observed core body temperature for a specific patient is monitored and stored when it crosses the threshold fever temperature. All the forms, designs and the coding for the system is built on Visual Studio 2015 in C# while the backend coding for Arduino Uno is done on Arduino IDE in Arduino C.

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Chapter 10 - Recipe Search and Filtering

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ABSTRACT:

A search and filtering system is a technology where information can be processed for customized results. It is a computerized procedure where a consumer's search history is used to display the most favourable results. This research paper aims to provide an easy and quick way to lead a healthy lifestyle. It recognizes the need for a healthy diet with easy solutions. Today, people are more inclined to consume packaged products due to time and priority constraints. A food recipe search system is essential for easy access to thousands of recipes which can be made at home and provides a better solution to consuming packaged products. The application has been built to provide the best results according to user search as well as enhance the experience for user to discover a wide range of recipes as per his/her needs.

KEYWORDS: Filtering system, Library, Tagging system, Live trending recipes, Search system.

INTRODUCTION:

An information filtering system is a system that removes redundant or unwanted information from an information stream using automated or computerized methods prior to presentation to a human user [1]. This filtering system has been built upon user's most widely used keywords. A recommendation system is essential for providing customized results according to individual needs. Searches can be conducted and information can be delivered to the user as per user needs. There is also a need to prepare recipes according to available ingredients. This feature has been implemented as well and users can receive the instructions for their desired recipes.

PROBLEM DEFINITION:

The development of technology has helped the human race to be more self- dependent and confident. It has improved our lifestyle and made us more health conscious. Mobile applications have hugely helped us in achieving our new goals. From online shopping to work-outs at home we have readymade app for every task of the day. Some of the applications need to be constantly connected to the internet for proper functionality while some work offline. To fulfill the increasing curiosity to learn new recipes at home, in this paper we present you an android application for searching food recipes. This app filters the recipes according to the ingredients entered by the user. It provides an easy user interface which can be used by anyone. These recipes are fetched from an API database. Since this is a research-based project a free database is used for the app. There are many high standard APIs available but for which a certain amount is to be paid. The aim of the application is to use best searching methods and provide fast and good results to the user. The application even provides you the trending recipes and also suggests recipes according to your previous searching history. This recipe app won't occupy much space on your mobile. No doubt there are many recipe apps available in the market but this is our small effort to make a useful app for our research. This app can be surely uploaded on play store in future.

PROPOSED METHODOLOGY:

First, the user logs into the system. This log in corresponds to a unique ID that each user is assigned automatically. Next, the main activity is loaded. This activity consists of two systems, the trending recipes and the recommended recipes. The trending recipes are all stored in a table on the database. This table is constantly updated as a user views the recipe preparation steps. Each recipe is unique. Currently the limit for trending recipes has been set to 30. The recommended recipes are displayed on the basis of tags. When a user first logs into the system, the recipes are fetched according to the user's preferred cuisine. When the user has performed searches onto the system, these search keywords are stored in a table on the database where each keyword is linked to the number of hits it has received by a particular user. This is the

implementation of the tagging system. On the basis of those hits, the user's most searched keywords are processed and substituted in the API call to Edamam. The search results are displayed in a recycler view. Users can perform searches on the application toolbar. The search terms are included as a query in the API calls. A pull of the navigation drawer holds the ingredient search tab. By tapping on it, the fragment to ingredient search loads. This page allows the user to search recipes on the basis of ingredients. Users can enter their ingredients into the basket and hit the green icon at the bottom for recipes related to those ingredients. Alternatively, the basket can be cleared.

DISCUSSION:

The results were expected to display recommendations based on the user's search history. These results would be based on a tagging system that allows users to get results relevant to their searches. In addition, this system should pick up on the user's most widely used search terms over the ones that a user has rarely searched. A user should also be able to search a recipe according to the ingredients available at home.

RESULTS:

The expected results have been achieved. The recommendation system picks up on a user's most widely used search terms and recommends recipes similar to those search terms. Similarly, users can filter out recipes on the basis of ingredients available at one's home. These features are not highly complex due to the API limitations but have helped us as students understand the complexity of these systems.

CONCLUSION:

This is an Android application. The search and filtering facilities display the appropriate results. The trending recipes display live results. A single refresh fetches the most recent results. Similarly the recommended recipes are closely related to a user's past search history. If the user has signed in for the first time, the recommended recipes are based on user's favourite cuisine. The ingredient search filtering system provides results with the ingredients mentioned. However, since we have used a free

version of the Edamam API, the ingredient search isn't guaranteed to provide 100% accurate results.

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Chapter 11 - Chat Application Based on Speech Recognition

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ABSTRACT:

Speech Recognition is a technology where the system understands human language and can interpret it through human voice and convert it into text. This research paper is about proposing a new chat system to establish a proof of concept towards the advancement of human communication with various language preference by using Speech Recognition as the main technology along with other technologies and services like translation API technology. By fusing these technologies, this chat application will prove a stepping stone for further advancement in communication through the Internet.

KEYWORDS: Speech Recognition, Chat Application, API Technology, Translation API, Automatic Speech Recognition

INTRODUCTION:

Speech Recognition is a technology where it interprets voice into text [1]. The system listens to the voice, identifies the words & phrases, converts it into machine language and displays it in the form of human-readable text. Through Speech Recognition, one can command the machine to perform actions like setting up alarms or reminders, doing a google search, or simply make a call. Speech Recognition also called automatic speech recognition or simply speech to text technology is also most commonly used in chat applications today [1]. However, all these chat applications with speech to text feature might have improved the way of sending text in various languages through voice, but it does not remove the communication barrier when engaged in multi-lingual communication. There are other chat applications which use speech to text or translation separately and the ones that support translation are limited to few languages [2]. This paper is to propose a new chat system

which can be used to increase the efficiency of translation of other apps and also to support more variety of languages in one application.

To overcome this communication barrier, an application must support a variety of languages and use of other technologies like the Translation API with Speech Recognition so that every individual can send or see text in their preferred language. This chat application will hence act as a first step or proof of concept towards the development of future communication technologies like having a multi-lingual video conference call without the communication barrier. A world without communication barrier will lead to efficiency in communication, better production in business deals and rapid development of technologies in almost all the fields [3][5].

PROBLEM DEFINITION:

The rapid development in communication has changed the way of how things work in the world. It brought people closer, eliminated the distance and changed the approach of businesses. The use of chat application is something that became part of our life and there are still occasions where we wished that it would become easier for us to connect with people without the communication barrier. This communication barrier might be caused either due to different native language speaking people unable to communicate properly or the inability of just text to express the right and correct emotions, as every person indeed have their accent which they use even when they type, which leads to a misunderstanding which we are not unaware of [2][4]. This research is an attempt to eliminate both problems and then increase its range of languages that it can support also serving as a platform of change and advancement in communication.

PROPOSED METHODOLOGY:

It is a step-by-step development towards establishing the proof of concept where first the basic user interface and working of a chat application is developed. The user will be able to register/login to the app. They will be able to view already joined private or group chatrooms or create one. After this, the mechanism of speech to text will be

developed which would start with supporting a single language for testing. After this has been established, we use translation API and other services to translate the chat real-time and then code algorithm to make it more efficient. After this is achieved, we use the speech-to-text to convert a language to text. The process of translation will be incorporated during the process of speech-to-text using an algorithm. Testing will be done where 2-3 different users will be used with different preferred native language. For each user, they would only send and receive the text in the language they chose. With time, the number of languages supported by this app will be increased and this will be a milestone (groundwork) for further taking this chat system to a video conferencing level.

DISCUSSION:

The results expected is that any user would be able to communicate without any communication barrier because the only language they would send and receive text would be the language they prefer. This would declare a groundwork for further developments in communication such as taking this system to a video conference level, where a Greek person would communicate with a French person but they would see subtitles in real time in their spoken language. This can be achieved by fusing multiple technologies and speech-to-text which can open an efficient way to make this vision a reality.

RESULT:

The groundwork for achieving a proof of concept is established. Multiple users are able to communicate in their preferred language. However, algorithms can be used to improve the efficiency. Languages like English, Swedish, German, Hindi and Afrikaans were used for testing phase. It is established that the translation is instant. This groundwork can be incorporated as chat system to other applications and can be dynamically modified.

CONCLUSION:

The proposed system is a proof-of-concept of a system to first eliminate the language barrier and then eliminate the misunderstanding through text. Although its primary goal includes providing more languages in an organized manner so more people can connect and also develop a community which will use this proposed system or flow of the system in their application to help in the research and development in communication. Its secondary goal provides a groundwork to making a multi- lingual conference call with native subtitles possible. As a scientist we explore and experiment without giving up for the development and benefit of the world, this proposed system is no different.

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Chapter 12 - Applications of Blockchain in Indian Context

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ABSTRACT:

Blockchain technology has been gaining momentum after the bitcoin boom, since then many researchers have been finding other use cases of this technology all over the world, similarly blockchain based solution to the problems of a low-trust country like India can save a lot of money, time and human resource. Using Blockchain the sectors of Education, Medicines and Law can benefit a lot. The proposal is to create Government regulated blockchains to manage data in a more better and secure way, easing out restrictions and increasing the trust between the people through secure algorithms and contracts. The research is focused on three main problems i.e., Fake documents, counterfeit medicine and tampering of evidence. Modern technologies python programming language and Postman has been used to implement the blockchain. The results show that if applied properly it can solve all the mentioned problems and change the dynamic of the country, however it requires a big push from the government plus training to implement it in large scale.

KEYWORDS: Blockchain, python, Indian context, postman, decentralisation.

INTRODUCTION:

Blockchain is a technology which was first characterised by Stuart Habert and W. Scott Stornetta in 1991 in their paper titled "How to time-stamp a digital document"[1] and was later in 2008 conceived first by a person/group called Satoshi Nakamoto in the research paper named “Bitcoin: A Peer-to-Peer Electronic Cash System” [2] focused on establishing a secure and trusted distributed p-to-p network without any third parties.

This research is to analyse various ways in which blockchain can be used to solve major problems faced by a country such as India where there is low-trust which results in waste of money, time or human resource. This Research is focused on three major problems of three important sectors Education, Medicine and Law.

PROBLEM DEFINITION:

1. Document authenticity verification:

In a diverse country like India the education sector is very complex and large with each state having its own School Boards/Universities and then a Central Board i.e. CBSE and then there are other International Boards such as ICSE and then hundreds of Universities, all this in a low-trust country results into a complete mess during admission especially the verification of documents which makes it very difficult, time consuming and stress full for students to take admission while shifting from one board/university to another board/university. Also there is a big problem of fake documents pertaining in the country. Here are some reports which show the depth of this problem:

- Du brings Forensic test for admissions this year [3]
- Engineering for Rs 75000 law certificate for Rs 2 lakh how the fake degree market flourishes [4].

2. Counterfeit Medicine:

A Country like India which is a hub for medical tourism and also a very big exporter of medicines to other countries there is a very big problem of counterfeit medicines harming the patients. Here are some reports which show the depth of this problem:

- Fake drugs constitute 25% of domestic medicines market in India: ASSOCHAM [5]
- Fake anti-cancer drugs made in bathroom found circulating in China and India [6].

3. Evidence Management:

In a country like India which ranks 78th on the global corruption list there is a big problem of changing of evidence by the police or anyone who can access the documents/physical evidence resulting in lack of trust between the people and for law in the country.

PROPOSED SOLUTIONS:

Here are the proposed solutions of the above problems using Blockchain:

1. Government regulated blockchain to solve the Educational document verification problem. A government regulated blockchain

where every Board, university, school and college has to register and every year a transaction will be saved in the blockchain, if student remains in the school/college then old and new codes are supposed to be put same. The structure of the block is shown below:

MEDI CHAIN	
Hash of Previous Block	
Name of the Student	
Grade (Class Ex 7th)	
Time Stamp	
Old School/College Code	
Old Board/College Code	
New School/College Code	
New Board/University Code	
Percentage	
Certification Number	

Table 1

2. Government regulated blockchain having smart contracts to solve the Counterfeit medicine problem:

   A government regulated blockchain having smart contracts where every medicine registration number is the contract id where every Drug/medicine maker, seller, reseller, chemist will have to register on it. There will be two transactions one the generation of contract when the medicine is made and the other the completion of contract when the medicine is purchased. The structure of the suggested contract blocks is mentioned below:

MEDI CHAIN	
Hash of previous block	
Medicine registration number	
Time stamp manufacturing	
Company code	
Number of tablets/pieces	
Chemist id	
Buying time stamp	

Table 2

3. A Government Regulated Blockchain For Evidence Management: A digital fingerprint of each document/ picture of the evidence etc

should be stored in the blockchain, every police station will register on it and soon as they find evidence they put the picture/audio/evidence in a database and its digital signature on the blockchain. Structure of the proposed block:

EVIDENCE	
Hash of previous block	
Database Location	
Time stamp	
Evidence Digital fingerprint/hash	
Type of Evidence (ex-Audio)	

Table 3

4. Technologies Used:

Following methods have been used to implement the applications:

1. **Python programming language** - to develop a block chain designed specifically for the research
2. **Postman** - to implement and display the use of the blockchain created in python language.
3. **A network of devices** - to test the blockchain.
4. **JSON**- to exchange data between devices.

RESULTS: Blockchains developed to implement the recommended solutions of the problems :

1. **Educational Document Verification Authentication**

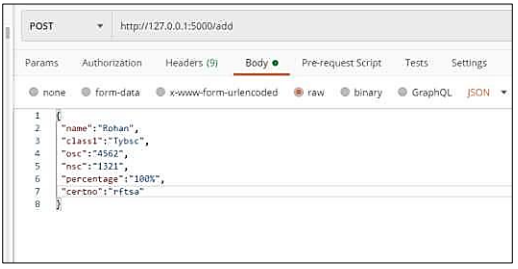

Fig 1

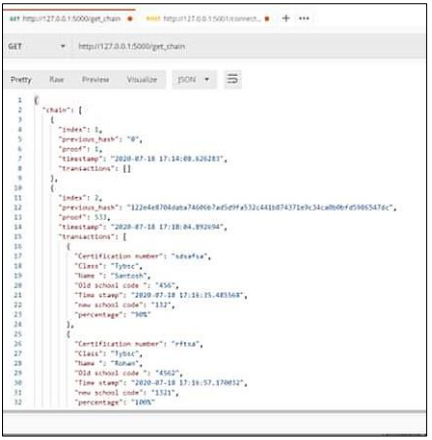

Fig 2

2. **Counterfeit Medicine**:

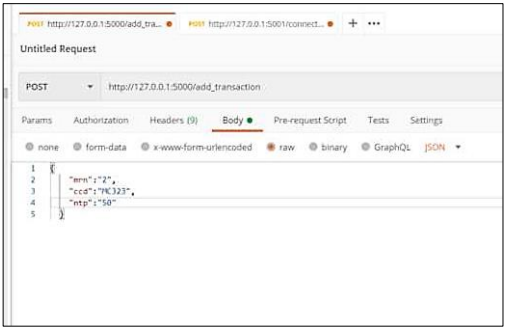

Fig 3

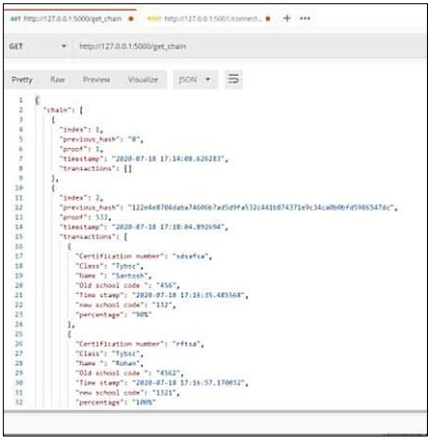

Fig 4

3. Evidence Management

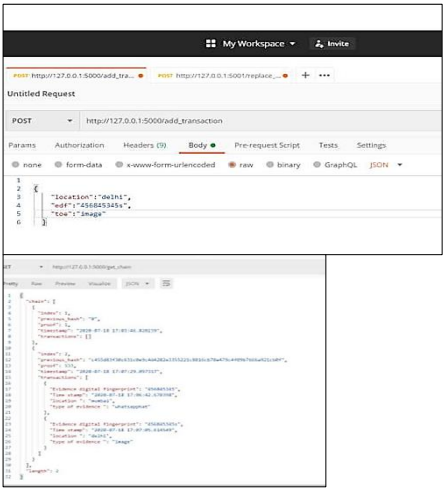

Fig 5

DISCUSSION AND COMPARISON:

There are other methods being used/proposed for above problems, this is to compare and see why The Blockchain way is better:

1. Educational Document Verification Authentication

Comparison with NAD (National Academic Depository) –

Security: As compared to the solution NAD is less secure as it is a centralised depository, so the problems faced like editing and etc can still happen in case of hacking while on the other hand in Blockchain it is next to impossible to edit a block without hacking every single of PC in the network.

Scalability: The NAD As less scalable since it is a centralised govt owned as compared to a govt regulated blockchain, multiple nations can share the blockchain making it more and more easier to study abroad.

2. Counterfeit Medicine

Comparison With Traditional Method

There doesn't exist any full-proof method till now for this problem, just raids by police on suspicion or complaint resulting in decrease of trust on medicines manufactured in India.

3. Evidence Management:

Comparison With Traditional Method Most of the evidence stored is either in physical (Written) or in centralised digital repositories, which makes it easier to change and edit the evidence, that is the reason the above proposed solution will make it more secure and increase the trust of people on LAW.

CONCLUSION:

I have analysed and implemented the solution to these three problems which can make a drastic change in a low-trust country like India also increasing the easiness and trust of people on the government, and saving a lot of money, time and human resource. These Blockchains which have been implemented at small scale for the research can easily scale.. All the above implemented solutions can easily be applied using the resources available in present at large scale.

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Chapter 13 - Heart Beat Measuring and Analysis

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ABSTRACT:

user presses a finger against the camera, an image processing algorithm detects the red component on the finger image to sense the blood flow and then calculates a reading.

KEYWORDS: Heart Rate, Measuring, Analyse, Monitoring, Image Processing Algorithm

INTRODUCTION:

Heart rate is the speed of the heartbeat measured by the number of contractions (beats) of the heart per minute (bpm). The heart rate can vary according to the body's physical needs, including the need to absorb oxygen and excrete carbon dioxide. It is usually equal or close to the pulse measured at any peripheral point. Activities that can provoke change include physical exercise, sleep, anxiety, stress, illness, and ingestion of drugs.

Heart rate monitors (HRMs) have become a widely used training aid for a variety of sports. High probability for human error. Searching data is inconvenient and tedious. The development of new HRMs has also evolved rapidly during the last two decades all the websites, software and web applications were not built with the intention to fulfil the needs of measuring.

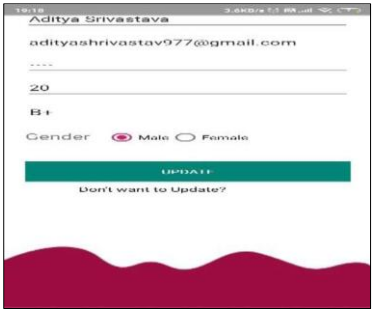
In addition to heart rate (HR) responses to exercise, research has recently focused more on heart rate variability (HRV). Increased HRV has been associated with lower mortality rate and is affected by both age and sex.

MATERIALS AND METHODS:

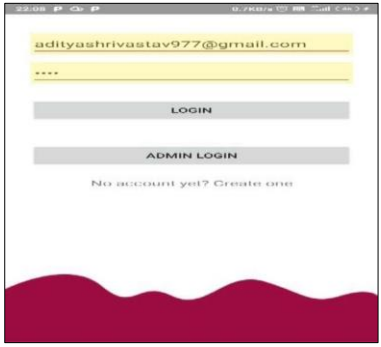
In this Android application, the phone’s camera will be used to capture the heart rate. When the app user presses a finger against the camera, an image processing algorithm detects the red component on the finger image to sense the blood flow and then calculates a reading.

The reading is averaged at the time span of one minute, and the heart rate is determined. Once we have the heart rate reading, the app streams the data in real- time to a monitoring dashboard.

Step1: User provides necessary details and register him/herself by providing few details i.e., Email-id, Full Name, Gender, Blood Group, Password and Date of Birth.



Step 2: The user logins into the Heat Beat Measuring Application by entering its email-id and password.

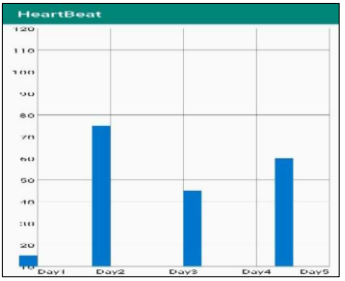


Step 3: Homepage gets displayed on the screen. It provides four options i.e. Heart Rate Measuring, Summary Report, Analysis Update Profile and top corner provides advise and also logout option.

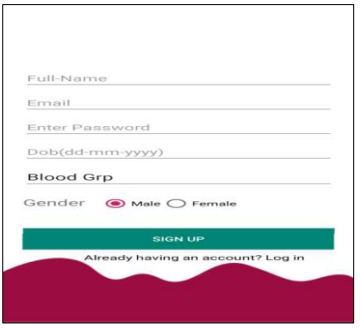
Step 4: By clicking on heart rate measuring that window will be opened and it automatically starts measuring your heartrate.

Step 5: By clicking on the summary button the user gets the report of his heart rate.

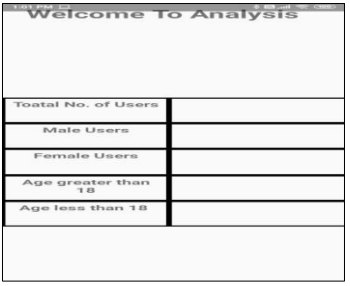
Step 6: By clicking on analysis window it will display information i.e. User Name, Age, highest heart rate, lowest heart rate Average heart rate and suggestion.



Step 7: By clicking on update window, user will be able to update his/her information.

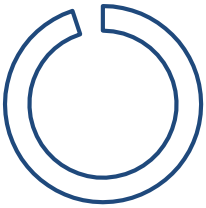


Step 8: Application admin will be able to view total no. of registered users gender wise and age wise.



RESULTS:

It provides the heart rate of a person with accuracy level of 95%. It provides average reading when user has measured minimum 8 readings.



Level of Accuracy

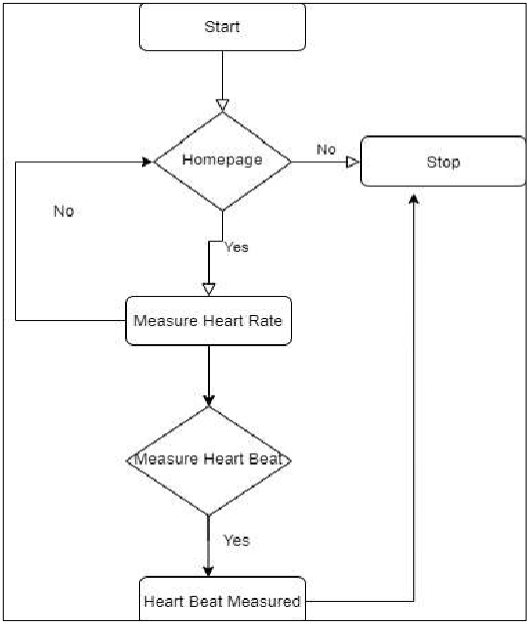
The reading is averaged at the time span of one minute, and the heart rate is determined. Once we have the heart rate reading, the app streams the data in real- time to a monitoring dashboard.

The observed changes user can view in a graphical format and also analyse his/her heart rate through analyse window. It also shows highest, lowest and average heart rate of a person with few suggestions.

DISCUSSION:

To avoid the complexity of the system, we have divided the entire code into different modules. This helps in error solving. Thus, the different modules are as follows:

- Creating a benchmark i.e. inserting the measured reading into the database for reference.
- The Start Page.
- Login Form/Sign in Form.
- Starting the camera, capturing the heartrate and closing the camera.
- Storing the measured reading into the database.
- Viewing the measured heartrate in a analysis window.



CONCLUSION:

It also provides user to update his/her profile information i.e. they had given during registration.

UI and background is made in Android and Java. In this Image Processing Algorithm is used to measure the heart rate.

This a for measuring heartbeat and it provides data analysis in graphical format, so user can easily monitor his/her heartbeat and keep his/herself healthy.

Using this application user can improve his/her heartbeat.

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SECTION 5 - PSYCHOLOGY

Chapter 14 - Binge-Watching and its Link to Sleep, Depression, Anxiety and Stress

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ABSTRACT

49% of Indian youths binge-watch content for two to three hours each day, and 65% of millennials and Gen Z choose to watch video content on an OTT platform instead of watching it on television. In the lockdown, most people began binge-watching several shows on several OTT (Over the Top) Platforms. This study aims to understand the link between Binge-Watching and Sleep Quality, Depression, Anxiety and Stress. The sample consisted of 113 participants between 18-30 years from India. To measure the Binge-Watching level of the participants, Binge-Watching Engagement and Symptoms Questionnaire Scale (BWESQ) was used. Sleep Quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). The Depression, Anxiety and Stress Scale (DASS-21) was used to measure the Depression, Anxiety and Stress levels. Product Moment Correlation Coefficients were computed to examine the relationship between Binge-Watching and the variables. Results suggest a moderate positive correlation between Binge-Watching and Depression and Binge-Watching and Stress. No significant correlation was found between Binge-Watching and Sleep and Binge-Watching and Anxiety. These findings have important implications on one's understanding of the extent of Binge-Watching among Indian youth and its link to various psychological factors.

Keywords – Binge-Watching, Depression, Anxiety, Stress, Sleep Quality

INTRODUCTION:

"Clearly the success of the Netflix model, releasing the entire season of 'House of Cards' at once, proved one thing: The audience wants the control. They want the freedom. If they want to binge as they've been

doing on 'House of Cards' and lots of other shows, we should let them binge. "

Kevin Spacey

2020 brought with it one of the worst global crises in the 21st century- the Corona Virus. It was a life-changing year for the entire world, and millions were afflicted not just physically, but also mentally. Being under lockdown and unable to socialise or go outside deteriorated people's mental health. A longitudinal study conducted in the UK found that the mental health of young adults was at the lowest at the start of the pandemic, i.e., in April 2020, and showed an improvement over time. However, around September 2020, their mental health declined again (Gutman, Stroud, 2021).

One of the ways that people coped with the uncertainties of the world around them was by escaping to another; in the form of watching shows. During the first week, *"Extraction"* drew 99 million views, *"Bridgeton"* received 82 million, and *"Money Heist"* earned 65 million. These are only a few of the several shows that became most popular during the pandemic. Previously, people waited till the evening or weekends to catch a glimpse of their favorite TV shows or movie, because of the monotony of their everyday lives. Dinner time eventually became the only time when television was routinely turned on.

With the lockdown announced, people had a lot of free time and little to do. Thus, most of them turned to binge-watching several highly anticipated "Must Watch" shows on various OTT (Over the Top) platforms - any streaming service provider that offers content over through the internet such as Netflix, Amazon Prime, Hotstar, YouTube etc.- and binge-watching went on to become the norm of the pandemic. (Baboori, 2021)

Binge-watching is defined as watching between 2-6 episodes of the same TV show in one sitting (Izydorczyk and Starosta, 2020) at a rapid rate. It can have several negative impacts on sleep since it can drastically alter people's sleep schedule and quality. Research by Liese Exelmans and Jan Van den Bulck (2017) found that higher binge-viewing frequency was associated with a poorer sleep quality. Another research of a total of 551 individuals, found that out of the total, 39.1% of participants experienced sleep disturbance sometimes. (Dixit, Marthoenis, Arafat, Sharma, & Kar, 2013).

Not only does binge-watching disrupt and alter sleep schedules, but it also has an impact on mental health. Previous research has linked binge-watching to depression, stress, and anxiety, among other psychological factors since people frequently use entertainment as a way to escape from the stresses and problems of everyday life. A study conducted by Chang and Sun (2021) found a positive correlation between binge-watching and depression, suggesting that people often resort to these means as an escape, thus decreasing the chances of using any other effective coping skills. Additionally, another study conducted by Ahmed (2017) also found a positive correlation between binge-watching and depression among Arab residents living in Abu Dhabi.

Anxiety is an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure. It is more associated with muscle tension and avoidance behaviour, among other psychological factors and affects almost 30% of adults at some point in life (American Psychiatric Association (APA). Few studies in the past have linked binge-watching to anxiety. A study conducted by Maxwell and Tefertiller (2018) found that there was a possible link between person's individual anxiety and their intention to binge-watch. Yet another study conducted on "Depression and Anxiety among Tunisian medical students "binge viewers" found an inverse relationship between anxiety scores and binge-watching frequency and exposure duration. (Boudali et al, 2017).

Stress is also an emotion that each one of us encounters at various points in time. While some of it is necessary, excessive stress can be detrimental to physical and mental health. It can be assumed that a lot of people, in order to cope better, might resort to binge-watching as a means of escaping that stress for some time. An interesting study which linked stress to binge-watching found that there was a positive relationship between binge-watching and higher perceived stress the next day in comparison to stress being a factor that caused binge-watching (Buschmeyer, 2020).

Young adults, among others, are one of the most active and receptive age groups. They have a lot on their plate- juggling between a job and a social life, as well as keeping up with everything going on around them. According to research, young adults aged 18 to 29 are more prone to alter their social and personal behaviours in order to catch a glimpse of the show they are watching. Around three-quarters of young adults were found to have stayed up all night to discover what happened to their

favourite characters, although just around half of all TV viewers said they binge-watched to the same amount. Approximately, 22% of young adults said they watched a show at work (Feldman, 2018).

Several studies have been undertaken linking binge-watching to sleep, depression, anxiety, and stress, with the majority of the findings indicating that excessive use has a detrimental impact on a large number of people.

Given the current social scenario and the peak usage of binge-watching, it would be reasonable to go more into this research and determine the influence it has on the young adult population, who is one of the primary users and victims.

The variables used in the study are described below:

Binge-watching

Binge-viewing is a term used for watching a large number of episodes of a television program in one sitting. With the emergence of entertainment streaming services that release full TV series or seasons without commercial breaks, the word has gained prominence in recent years (Ellingson, 2020).

There appears to be an upsurge in binge-watching in the present COVID-19 pandemic with a global lockdown state, as individuals have little to do. 49% of Indian youth binge-watch content for 2-3 hours a day. Millennials and Gen Z spend an average of 4 hours each day watching OTT video material. During the lockdown, users on average signed up for 3 new OTT platforms. 65% of millennials and Gen Z choose to watch video content on an OTT platform instead of watching it on television (ETBrandEquity, 2020).

Sleep

Sleep is the absence of wakefulness and loss of awareness of one's surroundings, accompanied by a typical body posture (such as lying down with eyes closed), the occurrence of dreaming, and changes in brain activity and physiological functioning, is the natural, easily reversible periodic state of many living things (Merriam Webster).

Sleep deprivation due to OTT platforms was the third most significant factor that made Indians sick in 2019 (Ranhotra, 2020). Since the country went into lockdown on March 25th to stop the spread of COVID-19, medical specialists say the number of consultations calls about abnormal

sleep cycles has increased dramatically. “Many people are living in a state of uncertainty and insecurity. Worrying about one's health, work, and financial stability, as well as juggling family responsibilities and office deadlines”, Gulshan Kumar, a neurophysiologist at the National Institute of Mental Health and Neurosciences said. “Working from home is one of the elements influencing our sleep quality”. India survey by *wakefit.co* revealed that 44% of 1,500 respondents were getting less than six hours of sleep during the lockdown (The Economic Times, 2020)

Depression

The American Psychiatric Society defines depression (Major Depressive Disorder) as “a common and serious medical illness that negatively affects how you feel, the way you think and how you act.” Depression tends to produce sadness and/or a loss of interest in previously preferred activities. According to a study published in Preventive Medicine Reports, adults who spent more than 6 hours per day watching TV and using the computer had an increased risk of developing depressive symptoms. (Madhav, Sherchand, and Sherchan, 2017)

According to a study published in Preventive Medicine, Adolescents who watched TV for more than 3 hours per day on average were roughly five times more likely to be diagnosed with depression in young adulthood. (Grøntved et al, 2015).

Anxiety

The American Psychological Association defines Anxiety as an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure. Anxiety disorders are characterised by persistent intrusive thoughts or concerns. People may avoid certain situations because they are anxious. Physical symptoms such as sweating, trembling, dizziness, or a rapid heartbeat may also be evident.

In a 2016 study, binge-watchers were 35% more likely to experience anxiety or depression than those who adhered to a more regular TV consumption pattern. Late-night binge-watching sessions also hamper our sleep schedule, which increases stress levels. (New York Post, 2017). Another study conducted on “Is Watching TV Series an Adaptive Coping Strategy During the COVID-19 Pandemic?” showed that during the pandemic lockdown, people spent more time watching TV series, especially women, who also reported higher levels of anxiety and stress

than men. Furthermore, anxiety symptoms and escapism motivation were equally caused by both non-problematic and problematic TV series watching behaviours; implying that watching TV series during the COVID-19 lockdown likely acted as a recovery strategy for dealing with such a stressful environment (Boursier et al, 2021).

Stress

Stress is defined as the physiological or psychological response to internal or external stressors (American Psychological Association). Stress activates your fight-or-flight response, which prepares you to fight or flee from the stressor. Constant stress might have a bad impact on your health in the long run. Stress can be both positive (eustress) and negative (distress). Some negative personal stressors can be the death of a spouse, unemployment, sleep problems, hospitalization (oneself or a family member) etc. Instances of positive personal stressors include starting a new job, marriage, buying a home, retiring etc.

A study by a Delhi-based mental health service platform- The Centre of Healing (TCOH) stated that 74% and 88% of Indians reported stress and anxiety respectively (The Hindu BusinessLine). Another study conducted on "Is Binge Watching Bad for You? Escapism, Stress, Self-Control and Gratifications?" indicated that individuals with high levels of stress did not benefit from binge-watching in terms of relaxation, social engagement, or enjoyment. Instead, binge-watching had negative impacts, including emotions of guilt and regret. A possible explanation is that since negative feelings of shame and remorse are strong, they can overwhelm binge-watchers, wiping out pleasant gratifications like relaxation and pleasure (Wang, 2019).

REVIEW OF LITERATURE

In a study conducted on the link between Binge-watching and Perceived Stress, the key findings reported that binge-watching was associated with higher perceived stress the next day. However, research on the reverse link between binge-watching and stress brought the conclusion that stress levels are not a predictor of binge-watching the next day. (Buschmeyer, 2020)

Another study of 117 participants, targeting the college student population between 18 to 24 in the United States used the Depression Anxiety Stress Scales (DASS 21) to assess symptoms of Depression, Stress, and Anxiety among the participants. Main findings from this

study indicated that participants with low anxiety scores tended to have low scores on binge-eating and drinking but high scores on binge-watching. Those who leaned towards high scores on anxiety tended to have low scores on binge-watching. Those with high stress and low anxiety scores tended to have high scores on binge-watching and eating. Anxiety, Stress, and gender were seen as significant predictors of binge-eating (Clarke, 2019).

Boursier et al (2021) conducted a study on TV series watching behaviours and motivations and their correlations to Depression, Anxiety, and Stress with a sample of 715 adults (71.5% female) from all over Italy. The researchers used the Italian version of the Binge-Watching Engagement and Symptoms Questionnaire (BWESQ) to measure the level of TV series watching involvement and problematic binge-watching. Psychopathological symptoms were assessed using the Depression, Anxiety, Stress Scale (DASS-21 Italian version). To measure TV series watching motivations, the Italian version of the Watching TV Series Motives Questionnaire (WTSMQ) was used. They found that women, in particular, continued to be more involved in watching TV series during the COVID-19 emergency, while also demonstrating higher levels of anxiety and stress than men. In this study, anxiety symptoms and coping/escapism motive for watching TV series, as well as emotional enhancement and social drives, were all favourably associated with TV series viewing.

In their study, Exelmans and Van den Bulck (2017) investigated the prevalence of binge-viewing, and its association with sleep and examined arousal as an underlying mechanism of this association. 423 adults aged between 18–25 years old (61.9% female) completed an online survey which assessed regular television viewing, binge-viewing, sleep quality (Pittsburgh Sleep Quality Index), fatigue (Fatigue Assessment Scale), insomnia (Bergen Insomnia Scale), and pre-sleep arousal (Pre-Sleep Arousal Scale). It was found that men binge-watched less frequently than women, but their binge periods lasted longer than women's. All sleep indicators were favourably associated with binge-watching frequency; however, the duration of binge-watching had no significant relationship with sleep variables. In conclusion, this study presented preliminary evidence that modern viewing habits such as binge-watching may have a negative impact on overall sleep quality, with cognitive pre-sleep arousal as the underlying mechanism.

In another study "The Relationships between Television Viewing Behaviours, Attachment, Loneliness, Depression, and Psychological Well-Being", a total of 186 individuals from Georgia Southern University's undergraduate Psychology courses were recruited from an online subject pool to partially meet a course requirement or extra course credit. There were 77 males, 107 females, and two people who did not specify their gender. Binge-watching behaviours were positively associated with television affinity, instrumental TV viewing motives, and ritualistic TV viewing reasons, according to the findings (Wheeler, 2015).

Starosta and Izydorczyk (2020) have written a systematic review of the phenomenon of binge-watching. The goal of this study is to convey the current state of knowledge about binge-watching, as well as the psychological effects of binge-watching. This systematic review, which includes 28 studies, looks at multiple ways of defining binge-watching, as well as varied reasons, personality traits, and hazards associated with it. Its findings suggest that there are two approaches to comprehending binge-watching. The first is concerned with recreation, pleasant emotions, cognition, and free time. The second viewpoint, on the other hand, emphasises the negative consequences of excessive binge-watching and the indicators of behavioural addiction. There is clearly a need for greater research on a variety of demographics in order to have a better grasp of binge-watching behaviour patterns.

From the above literature review, the present study aims to study Binge-watching and its link to Sleep, Depression, Anxiety and Stress among young adults from 18-30 years. The study hypothesizes that:

1. There is a relationship between Binge-watching and Sleep.
2. There is a relationship between Binge-watching and Depression.
3. There is a relationship between Binge-watching and Anxiety.
4. There is a relationship between Binge-watching and Stress.

METHODOLOGY

Participants - The sample consisted of 113 participants in the age group of 18-30 years of age, hailing from different areas in India. All the participants gave their consent prior to data collection. Out of the 113, 19 responses had to be omitted due to inadequate answers. The responses of 94 participants were analysed.

Measures

Once the participants had given their consent to fill out the survey, they were administered a five-part questionnaire. The first part covered the demographic questions, including the participants' age and gender. The second part included questions about their streaming behaviour. The last three parts include three psychological scales, which measured Binge-watching, Sleep Quality and Depression, Anxiety, Stress respectively.

Binge-Watching

Binge-watching level of the participants was calculated using the Binge-Watching Engagement and Symptoms Questionnaire (BWESQ). The scale was developed by Lovibond and Lovibond (1995). It is a 40-item scale assessing binge-watching engagement and features of problematic binge-watching. Items are scored on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree), with an average score being calculated for each subscale.

Sleep Quality

Sleep Quality of the participants was calculated using the Pittsburgh Sleep Quality Index (PSQI). It is a self-report questionnaire that assesses sleep quality over a 1-month time interval. The measures consist of 19 individual items, creating 7 components that produce one global score. The 19 self-rated items are combined to form seven "component" scores, each of which has a range of 0-3 points. In all cases, a score of "0" indicates no difficulty, while a score of "3" indicates severe difficulty. The seven component scores are then added to yield one "global" score, with a range of 0-21 points, "0" indicating no difficulty and "21" indicating severe difficulties in all areas.

Depression, Anxiety and Stress

The Depression, Anxiety and Stress of the participants was calculated using the Depression, Anxiety and Stress Scale (DASS-21). This is a set of three self-report scales that are used to assess depression, anxiety, and stress. Each of the three scales contains 7 items, which are divided into subscales with similar content. The Depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia. The Anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The Stress scale is sensitive to levels of chronic nonspecific arousal. It assesses difficulty relaxing,

nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient. Scores for Depression, Anxiety and Stress are calculated by summing the scores for the relevant items.

Procedure

The questionnaire was administered to participants all over India through an online survey. Following informed consent, the participants were asked to fill out a preliminary survey followed by the 3 study measures. The participants were guaranteed confidentiality about the information that they were providing. The time taken by each participant to complete the questionnaire was approximately 12 minutes.

Data analysis

After the descriptive statistics were computed for all variables, Pearson Product Moment Correlation Coefficient was used to measure the various correlations and examine the difference between means.

RESULTS

As shown in Table 1, 72 females, 20 males and 2 non-binary participants were selected for the sample (n=94) and means and standard deviations for all variables were reported.

Descriptive Statistics

Table 1 - Descriptive Statistics for Binge-Watching, Sleep, Depression & Anxiety among the participants

	N	Mean	Std. Deviation
Binge watching	94	15.77	4.37
Sleep	94	5.52	2.94
Depression	94	5.71	4.74
Anxiety	94	4.09	3.75
Stress	94	6.12	4.66
Valid N (listwise)	94		

The mean score of all participants on the dimension of Binge-Watching was 15.77, which is within the lower range of the Binge-Watching Engagement and Symptoms Questionnaire. The mean score of all participants on the dimension of Depression was 5.71 which is within the lower range of the Depression, Anxiety and Stress Scale. The mean score of all participants on the dimension of Anxiety was 4.09. The mean

score on Stress by the participants was 6.12. The mean score of all participants on the dimension of sleep was 5.52 which is within the normal range of the PSQI scale.

Table 2 – Frequency Distribution of the approximate video-streaming service participants use the most on a weekly basis

OTT Platforms	**Number of users**
YouTube	74
Netflix	72
Amazon Prime	56
Hotstar / Disney +	37
Sony Liv	6
Other	5
Voot	3
Zee 5	3
MX player	3
I do not use online streaming services	1

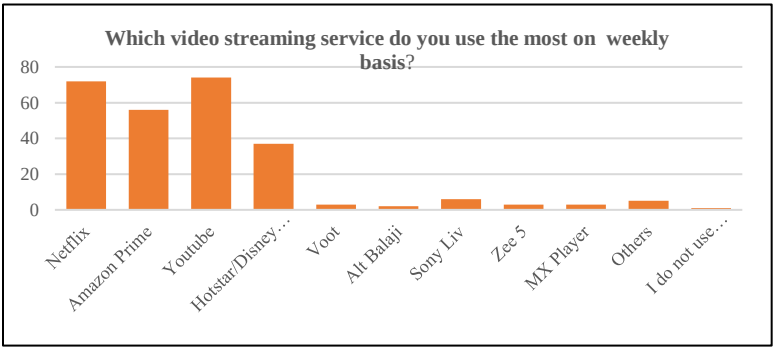

Figure 1 - Bar Graph of the frequency distribution of which video streaming service do the participants use the most on weekly basis.

Figure 1 shows that Netflix, YouTube, and Amazon Prime are the most used platforms, while Alt Balaji, MX player and Voot are the least used platforms among our participants.

Table 3 – Frequency Distribution of the number of days per week that participants make use of online-streaming services.

How many days per week do you make use of online-streaming services?	**Number of participants**
7 days	54
6 days	11
5 days	6
4 days	10
3 days	8
2 days	4
1 day	1

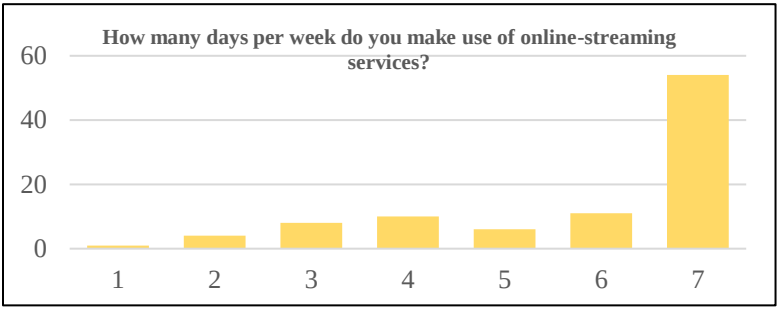

Figure 2 - Bar Graph of the frequency distribution of how many days per week the participants use the online streaming services.

Table 4– Frequency Distribution of the number of hours participants make use of online-streaming services on a daily basis.

On average, how many hours do you use online-streaming services on a daily basis?	**Number of participants**
11 hours	1
10 hours	2
9 hours	1
7 hours	1
6 hours	4
5 hours	6
4 hours	20
3 hours	26
2 hours	29
1 hour	4

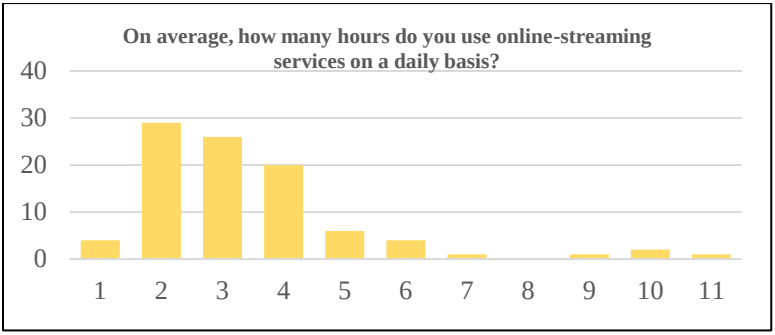

Figure 3 - Bar Graph of the frequency distribution of how many hours participants make use of online-streaming services on a daily basis.

Figure 3 shows that most of the participants engage in online streaming services for an average of 2-4 hours a day.

Table 5 – Frequency Distribution of the number of episodes participants watch in a row, per day.

On average, how many episodes in a row do you watch per day?	**Number of participants**
More than 7	4
7	1
6	1
5	5
4	15
3	23
2	34
1	9
0	2

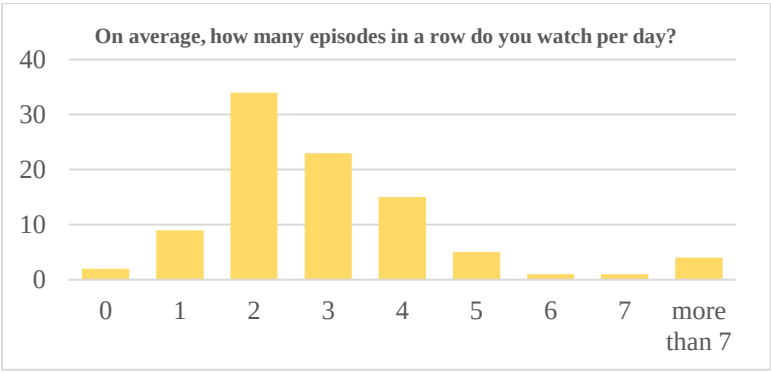

Figure 4 – Frequency Distribution of the number of episodes participants watch in a row, per day.

Figure 4 shows that the maximum number of participants watch 2 episodes per day, while a small number of participants also watch more than 7 episodes a day.

Analysis of the relationship between Binge-Watching and Depression

Correlation was used to examine the strength of the relationship between two variables- Binge-Watching and Depression.

Table 6- Correlation between Binge-Watching and Depression

		Binge-Watching	Depression
Binge-Watching	Pearson Correlation	1	0.296**
	Sig.		0.004
	N	94	94
**. Correlation is significant at the 0.01 level.			

Product Moment Correlation Coefficients were computed to examine the relationship between Binge-watching and Depression. Interpretations of the Correlation (refer to Table 6) reveal that, there was a positive moderate correlation between Binge-Watching and Depression ($r_{(92)} = 0.296$, $p < 0.01$).

Analysis of the relationship between Binge-Watching and Anxiety

Correlation was used to examine the strength of the relationship between two variables- Binge-Watching and Anxiety.

Table 7- Correlation between Binge-Watching and Anxiety

		Binge-Watching	Anxiety
Binge-Watching	Pearson Correlation	1	0.102
	Sig.		0.327
	N	94	94

Product Moment Correlation Coefficients were computed to examine the relationship between Binge-Watching and Anxiety. Interpretations of the Correlation (refer to Table 7) reveal that there was no significant correlation between Binge-Watching and Anxiety ($r_{(92)}$ =0.102, p=n. s).

Analysis of the relationship between Binge-Watching and Stress

Correlation was used to examine the strength of the relationship between two variables- Binge-Watching and Stress.

Table 8- Correlation between Binge-Watching and Stress

		Binge-Watching	Stress
Binge-Watching	Pearson Correlation	1	0.270**
	Sig.		0.009
	N	94	94
**. Correlation is significant at the 0.01 level.			

Product Moment Correlation Coefficients were computed to examine the relationship between Binge-Watching and Stress. Interpretations of the Correlation (refer to Table 8) reveal that there was a significant positive moderate correlation between Binge-Watching and Stress ($r_{(92)}$ =0.270, p<0.01).

Analysis of the relationship between Binge-Watching and Sleep

Correlation was used to examine the strength of the relationship between two variables- Binge-Watching and Sleep.

Table 9- Correlation between Binge-Watching and *Sleep*

		Binge-Watching	Sleep
Binge-Watching	Pearson Correlation	1	0.114
	Sig.		0.273
	N	94	94

Product Moment Correlation Coefficients were computed to examine the relationship between Binge-Watching and Sleep. Interpretations of the Correlation (refer to Table 9) reveal that there was a no significant correlation between Binge-watching and Sleep ($r_{(92)}$ =0.114, p=n. s).

DISCUSSION

The present study was conducted amidst the prevalent worldwide pandemic- Coronavirus which led to the nationwide lockdown in India from December 2020 to presently in 2021.

During this period, as people spent more time watching content, the aim of this study was to see how Binge-Watching is linked to Depression, Anxiety, Stress and Sleep Quality. The results of the present study provide sufficient evidence on the relationship between Binge-Watching and Depression and Stress, while insufficient evidence was found for the existence of a significant relationship between Binge-Watching and Anxiety, and Sleep.

For the first hypothesis, which states, "There is a relationship between Binge-Watching and Depression", a moderate positive correlation between both the variables was found. This is consistent with the findings obtained by Ahmed (2017) who studied the correlation of Binge-Watching with Loneliness and Depression among Arab residents ranging between 18-48 years living in Abu Dhabi and found a significant positive correlation between Binge-Watching and Depression. Further, differences in binge-watching were found among the respondents, with binge-watching being more prevalent among the younger age group (less than 30 years old) than the older age group and married respondents.

For the second hypothesis, which states, "There is a relationship between Binge-Watching and Anxiety", no significant correlation was found between both the variables. This is consistent with the study conducted by Boudali et al (2017) on "Depression and Anxiety among Tunisian medical students "binge-viewers", wherein binge-watching was measured among 50 students, and it was found that "binge-viewers" have

an inverse relationship between Anxiety scores and Binge-Watching frequency and exposure duration.

Possible reasons for no significant correlation between these two variables could be the genre of TV shows that participants choose to watch- happy, funny shows may not cause any anxiety. It could also be that watching with family or friends may decrease the possibility of feeling anxious.

For the third hypothesis, which states, "There is a relationship between Binge-Watching and Stress", a moderate positive correlation was found between the variables. This is consistent with the findings obtained by Buschmeyer (2020) who studied the relationship between Binge-watching and Perceived Stress among 42 participants, with the majority of them ranging from 18 to 30 years in age. Their major findings highlighted that Binge-Watching had an effect on perceived stress the next day.

The fourth hypothesis states, "There is a relationship between Binge-Watching and Sleep". No significant correlation was found between both the variables. This is inconsistent with the findings obtained by Liese Exelmans and Jan Van den Bulck (2017) who, on the contrary, found a positive association between Binge-Watching and Sleep among 423 young adults.

A reason for no correlation between Binge-Watching and Sleep Quality during the lockdown could be that the participants were able to compensate for their loss of sleep at night by sleeping for extended periods of the time during the day. This factor might have influenced the scoring. If it were not for the lockdown, participants may have shown poor sleep quality because they would not have been able to compensate for lost sleep.

Overall, our study shows that participant's viewing content has had a significant link to their mental health, that is, their depression and stress levels. This study can be used as a nudge to explore the link between Anxiety and Sleep further and to find if there is any positive correlation between the two.

LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

1. The results may be interpreted with caution when generalising to the larger population of other age groups since the sample size was limited.
2. The three questionnaires used to collect the data were self-report measures and therefore, there was no way of determining if the answers given to us were honest or if the participants responded in a socially desirable manner.
3. This research was conducted on Indian citizens only. Similar research can be conducted in different parts of the world to understand the relationships between Binge-Watching and its link to Sleep, Depression, Anxiety and Stress.
4. This research was only limited to young adults (18-30 years); but can be conducted on other age groups in and outside India to understand Binge-Watching and its link to Sleep, Depression, Anxiety and Stress.
5. For further studies, attention can be drawn to other variables that might influence Binge-Watching such as Eating behaviour, Loneliness, Guilt and more.
6. Our study focuses on the use of OTT platforms, hence further research can be done on Binge-Watching and its link to specific OTT platforms.
7. The study was conducted online via Google Forms due to the pandemic. Further studies can try to conduct it in an offline mode ensuring complete and honest participation of the participants.

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SECTION 6 - SOCIOLOGY

Chapter 16 - Sex Work: Voices from Within

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ABSTRACT

This piece of research is based on a qualitative feminist study on sex work. It seeks to capture the diversity of voices from within, ranging from the sex workers themselves to the social workers in the anti-trafficking cells who work in extremely hostile and unsafe terrain and offer support to one of the most vulnerable and marginalized sections of society. A study of this nature and sensitivity presented humongous challenges at different stages of field work. Issues of access to the research participants, key informants and gatekeepers along with a host of ethical issues including those of safety and security of the researchers' themselves proved to be formidable challenges, some anticipated and some totally unexpected. The researchers present some key findings from their numerous interactions with key informants and their multiple visits to the research site in order to familiarize themselves with the research environment. One of the key takeaways has been the resilience, courage of conviction and agency demonstrated by the sex workers notwithstanding societal perceptions of shame and stigma attached to their profession.

KEYWORDS: Sex work, legalisation, abolition, decriminalisation, constructs of men

INTRODUCTION

Sex trafficking and sex work are emotive issues about which much has been written with passion than objectivity because they touch the core of our beliefs about morality, justice, gender, and human rights. (George, Vindhya, Ray, 2010). On the one hand sex work is condoned provided it is kept out of view, and on the other public outrage condemns the hapless victim rather than the perpetrators of the system. Such convenient standards only succeed in forcing sex work behind closed doors which leads to the exploitation of women and children (Poonacha, 1992). There

have been very few studies on the narratives of sex workers themselves and their world view. This study is a modest attempt to close that gap and to capture the voices from the margins.

Kamathipura, the famous sex-trade area has been known as the biggest "Red-Light District" of Mumbai. In fact, it was described as the second largest "Red-Light District" of Asia. The dark and narrow lanes and by lanes of Kamathipura were lined up with small buildings along with multi storied bungalows in close proximity. The red-light area begins from 'Kamathipura' to 'Falkland Road', 'Shuklaji Marg', and 'Foras Road' (Writer, 2017).

Our study started from Kamathipura but later shifted to Khetwadi, specifically Falkland Road. Falkland road is lined with old wooden buildings. On the ground floor there are cage like structures with girls inside them. Above these cages the buildings rise 3 or 4 storeys, and at every window there are more girls – combing their hair, sitting in clusters on the windowsills, beckoning to potential customers. At the same time, it is like any other busy lower-class street in Bombay. All day long there are enormous traffic jams, with horns constantly honking, hundreds of taxicabs, and unwieldy buses (Mark, Mary Ellen 1981). This description written in late 1970s holds true even today. We often do not realize that in the midst of widespread cultural assumptions about sex work which looks down upon sex work and sex workers we do not questions ourselves and our stereotypical assumptions and conditioning which produces a distorted view of reality. What must we interrogate? The sex workers and the work they do or our own stereotypical notions of culturally appropriate work.

REVIEW OF LITERATURE

Feminist debates on Sex Work

There is an increasingly sharp division among feminists as to the best approach to sex work. Prior to the 1980s, there was considerable agreement among feminists that sex work was harmful to women's equality and there was no suggestion that the industry of sex work should be legalized. However, post 1980s feminist positions on prostitution split into the "sex work" position, which argued for the decriminalization of sex work, and the abolitionist position, which argued for the suppression of the industry and the penalization of the male buyers.

Sex Work Position

Feminist scholars have supported the decriminalization of sex work on the grounds that it acknowledges the rights of a marginalized group of women to work and be free from police harassment, and to have protection from violence and harm to their health. Decriminalisation is based on the view that sex work may be a personal choice and a private matter between consenting adults. Distinguishing between trafficking and sex work, this approach seeks to decriminalise voluntary sex work and all related activities; forced sex work on the other hand is considered a separate issue for which existing laws related to trafficking are sought to be strengthened.

Abolitionist position

Abolitionists argue that sex work is inherently harmful and is a form of violence against women. Both prey on women and girls made vulnerable by poverty, discrimination and violence, and leave them traumatized, sick, and impoverished. Both reward predators sexually and financially, strengthening the demand and criminal operations that ensure the supply. Prostituted and trafficked women suffer identically: post-traumatic stress disorder, severe depression, damage to reproductive systems, damage from sexual assault and beatings, and sexually transmitted diseases. (George, Vindhya and Ray, 2010). They also feel excessive focus on women's agency has shifted the focus away from exploring a nexus between globalization, trafficking and poverty.

Legalization

Legalization is based on the notion that sex work should take place in legal brothels which will have to obey some state regulation to ensure the safety of the sex working women from health risks and violence, and the male buyers from sexually transmitted diseases (STDs). Legalisation advocates support measures to regulate sex work such as licensing, zoning (segregating sex workers into a separate place), mandatory check-ups and recognition of sex work as a lawful activity. Proponents of decriminalization do not support legalization because they believe it supports pimps and makes the state very powerful. Many oppose legalization because the intent is not to improve the lives or working conditions of sex workers. Nor is there any concern for the health of sex

workers, except in the one area where it would, in the perception of law-makers, affect the health of the 'public', i.e, sexual health (Gangoli, 1998)

Methodology

This was a qualitative feminist study that sought to interrogate common sense perceptions of sex work and gain an insight into voices from within the field. These voices include those of sex workers and their world view and the social workers who work tirelessly with them and around them to better their lives and their surroundings and those of their children.

Research Question

To gain access into the cultural categories/perceptions that informs the world view of sex workers.

The principal tool of data collection was in depth interviews held with social workers at the anti-trafficking cells, Prerana and Oasis. We interviewed three staff members at Prerana and two at Oasis and held in-depth discussions over several days with Farzeen who formerly worked at Apne Aap, a night shelter for the children of sex workers. The interviews were more in the nature of conversations that revolved around their work and their interface with the sex workers and their children. The study used two sets of interview guide one for the key informants and the other for the sex workers.

Experiences in the field

Our initial efforts at building a rapport with them met with stiff resistance. We met Farzeen, a student of social work from TISS who had worked with sex workers. She explained everything about the research site, how to approach NGOs, where to go, how to dress up and how to negotiate the research site. Then we started contacting various NGOs, sent emails, called them and then ventured into Kamathipura.

When we first went to Kamathipura we only had mental representations of the place which we had formed while reading about our topic. We were at Grant Road station waiting for a taxi with only a few images and videos in our mind that we had seen. It took us quite long to get into a taxi because none of the taxi drivers were ready to take us. All we got were frowns, judgmental looks and a bunch of rejections. Finally, after a lot of struggles and convincing that "*main road pe chod do"* a taxi driver agreed and we went to Kamathipura and got down on the main road. What we encountered was something scary and disturbing. While

walking on the road, each and every man would look at us from top to bottom, scan us and scrutinize us. They would make us aware of the fact that they were watching us, it was that obvious! They would brush past us, looking over our shoulders and whisper*, "kitna legi?"* And this was the scenario on the very first day.

Still, we went further into the lanes to observe how they lived, their houses and their everyday activities. We saw a few women working in their houses, sex workers standing on the road probably waiting for customers. The road started narrowing as we moved further so we decided to return. We walked back till the main road, came into an open space, took a taxi to grant road station and went home. We knew we had to do this now on a regular basis so we were prepared for the next time. Luckily, if some driver was generous enough to drop us inside after a point, he too used to get irritated and say things like, *"idar hi utar jao" "aur aandar nahi jaunga."* They would tell us how the place is not nice and how *"tumhari jaisi ladkiya"* shouldn't be here. They would tell us *"Idar mat jao madam" "safe nahi hai*." Then there were questions like *"kaha ja rahi ho?"* as if we are going to some wrong place. There were many experiences each day showing us how this research was not going to be easy but we didn't give up. We also dressed in a certain way so we were not treated as outsiders. We wore kurtis, took dupattas and stoles. Inspite of all this we struggled a lot to get access to the sex workers.

Despite our repeated requests NGO's working in Kamathipura and Khetwadi refused to provide access to sex workers citing issues of confidentiality and ethics. We tried getting access from all the sources possible. We began contacting NGOs at other places in Mumbai, we kept sending them emails, we kept calling them but all in vain. Every day was marked by uncertainties, doubts and anxieties. But in retrospect we think this has been a rewarding and enriching experience because it gave us an insight into issues of access, ethics, gaining entry into the research site, all invaluable components of any piece of research. Things which generally get backgrounded because of the focus on findings.

We didn't want to give up so we thought we'll try one last time and go to the field directly on our own. We approached an NGO member who advised that it was a risky venture to wander about in the lanes. They asked us to approach another NGO that might help us. This was where we finally found some hope. They were very cordial, helpful and cooperative. We were asked to send a few emails to their head office and they promised us to enable an interface with sex workers. The centre

head was very cooperative and shared his experiences. Finally, a day before submission of our research paper we were taken on a field visit deep inside Falkland Road. We visited the homes of sex workers, interacted with them and had a wonderful interface. In fact, before we met them, we conducted an elaborate dress rehearsal of how we should interact with the sex workers. Peter the Centre Head at Oasis prepared us for the visit. He posed as a sex worker and asked us to shoot questions. We had to take care of small things like our body language, mannerisms and conduct while we interacted with them. We were apprehensive that they might not speak, would just clam up since this was our first visit. But much to our surprise they just opened up and poured their heart out. We were accompanied by an NGO worker Rita who had worked with the sex workers for 15 years. Her presence had a reassuring effect on the sex workers and even we became insiders. We met them in groups of three to four either at their homes or the lanes.

It was a very enriching experience. We learnt a lot of things and a prominent take away was that research is never easy and it's about passion and being persistent. There were moments when we felt like giving up but we didn't because we knew we could do this. We knew things wouldn't come easy but we kept trying and where we have reached is beyond our expectations and more than anything else it's satisfying to know that we could reach till here.

Limitations

Rapport building with sex workers is something that we are still trying to grapple with. Perhaps an internship or some voluntary work at the anti-trafficking centers could have helped develop a better rapport with the sex workers. But we hope to achieve this since this is a work in progress.

Method of data analysis

Our interviews and in-depth conversations with social workers attached to anti trafficking cells produced a voluminous amount of data, rich yet messy and disorganized. We spent hours sorting them, reading and re-reading them and identifying distinct patterns. The process of sorting began as soon as field data was obtained. Almost every night or at best the next day the whole interview would be refined and fared. Each complete write up comprised the following aspects. People met as well as events or situations experienced that day and the exact context in which they occurred

The main themes or issues discussed in each interview.

- Noting inconsistencies and gaps and how this could be avoided in the next set of interviews.
- Names of the research participants have been changed to ensure anonymity.

Findings

Our conversations with social workers at the Anti Trafficking Centres provided much need insights. The focus group discussions with sex workers added fresh and richer insights into our area of research. Following findings have been gleaned from the conversations.

Sex workers

Sex workers are generally trafficked and sold to brothel owners. They mostly come from Calcutta; some are from Nepal and some from Bangladesh. However, women from Bangladesh never say they belong to Bangladesh they always say they are from Calcutta. Some women exit the profession and engage in alternative work as maids, nurses, running parlours etc. Although the women have left, they and their children still remain beneficiaries of the NGO and so are followed up regularly. Sometimes those who exit find it difficult to survive in the work space and hence return to sex work. The Anti trafficking cells do follow up on this. Some women who are unable to pay the high rents in and around their work place move to suburban areas like Nallasopara/ Miraroad or to Panvel/New Bombay in groups of 4 or 5. They stay in these places but come to

Grantroad during night for work and leave in morning. These changing patterns seem to suggest that the number of women in the community is decreasing. However, a matter of concern is the spatial expansion of sex work whereby women are moving to newer areas with affordable rents and infrequent raids. In fact, traffickers and brothel owners keep moving minor girls from one place to another so that they are not found and they also cannot escape since they lose a sense of direction.

Children of sex workers

One of the Anti-Trafficking centres also offers a night shelter for children of sex workers so that children can stay safe while their mothers are at work. They go to school from there. However oftentimes they go back to their mothers during night and then roam outside on the streets

while their mothers are at work. Priti Patkar, the founder of Prerana found out during her field visits that children were administered sleeping pills so that they sleep for long hours without disturbing the mother so she started the night care centre. The NGO also provides a counsellor for the children as well as for their mothers. The counsellor explains to the children why their mothers do what they do and answer their questions using various techniques. Utmost care of the children is taken by the NGO and they build a good rapport with the community of sex workers. The NGO is home for children under the age of 18 and once the children are above 18 they go out, get jobs and study alongside. They are also put in group homes wherein 4 5 girls live together and they are given jobs by the NGO and they run their home from the earnings they get by doing jobs like working at a parlour or working as maids, etc. The boys from the NGO are also provided with similar group homes. The NGO organises a get together for their children who are now grown up and are settled in their lives. A lot of activities are organised for these children. Every month a cake is cut by the children whose birthday month that would be.

When we asked the sex workers about their future aspirations, they just had one thing to say. That they wanted a good future for their children and a good job. One (a sex worker from Calcutta with grown up children) of them mentioned about how her daughter wanted to be an airhostess.

Challenges and Difficulties

One of the biggest challenges that sex workers face is **procuring identity-based documents**. These centres also help the sex workers with procuring essential documents like aadhar, voting id's etc and in accessing medical aid. The spectre of abandonment also haunts them. Many of these sex workers are the sole bread earners of their families. For some who have been disowned and abandoned by the family it's a saga of suffering and loneliness. Their families have abandoned them, the society has abandoned them so they reconcile to what is given and move on. They are generally bought at a price by their' madams' and brothel owners. They have to repay this amount before they can exit the profession. This is a humongous task given the fact that they are paid a measly amount and a major part of their revenue is appropriated by the madams. So they gradually reconcile and adapt to the new profession. The reality of stigma and shame also haunts them and they are wary of finding new jobs.

Police raids are another fear that looms over them. Once raided some find themselves behind bars and their release hinges upon the bail amount which is hard to pay. If not, court cases drag for years and they would rather pay up the police than be harassed by the legal processes. So, the madams locally known as *"ghar wali"* pay their bail amount which means more debt. Also during raids their work places are sealed and they cannot work sometimes for months on end. This pushes them to solicit on long distance trains. Days before we were supposed to meet the sex workers a police raid happened wherein the police took away their life earnings and jewellery that they had bought out of their meagre earnings. So we had to postpone our interaction with the sex workers since a raid meant a complete clam up and an atmosphere of distrust and a reluctance to share information. Since the threat of **HIV/AIDS** is real among them, sex workers insist on clients wearing a condom. However, where the clients refuse, the madams as well as their co sex workers step in. The madams are also interested in their revenues and profits and would not like the hassles of HIV/AIDS among the workers. Even though there is no unionism there is certain solidarity among them to fight for the rights of their coworkers. They face **harassment** on the streets when they go to drop their children to school especially by those who know their identity and this gives away their identity to those who are not aware. **Language** is another barrier. Because they are trafficked from different places like Calcutta, Nepal, Bangladesh they don't know Hindi and therefore cannot connect with anybody. Since they are frequently transported to different places in the city, they are unable to seek help. Some of them make good money and would not like to leave the work despite the stigma. Slightly older women whose services are rarely sought often suffer due to poverty and lack of work.

Housing was another issue with most of them. They wanted better living conditions. Most of them lived in the most unsafe and unhygienic conditions with filth and garbage all around them. There buildings were rickety structures with narrow staircases leading upto four to five rooms. We saw four to five beds in a room measuring 10 feet by 10 feet. There were tall beds with all belongings underneath the bed. Cooking also happened beneath the bed.

Exiting the profession

We met at least two sex workers who expressed a desire to quit the profession and we saw them pleading with the social worker to do something. She reassured them that if they so desire, they could take up

alternate jobs like sewing or work in the salons. However, the social worker later pointed out that though they express a desire to take up alternate sources of livelihood they desist from doing so since the returns are meagre in comparison to sex work.

Rescuing minor girls

These anti trafficking centres help rescue minor girls. The bond and trust are so much between the community and the NGO that they themselves tell the NGO workers when they are on field visit that they have spotted a small girl and she seems to be minor. The NGO then immediately finds out information and informs the police or childline agencies. There is a follow up on these tip offs before the police raids and rescues girls. The social workers have to be alert and careful when they are on field visits. They keep a check on whether any girl is new or seem to be minor; they find out details through their network and then take appropriate action.

Empowering sex workers

Representatives from anti trafficking centres help open bank accounts for sex workers underscoring the need to manage their own accounts and not leave everything to the pimps. Sex workers and the NGO workers share an excellent camaraderie and share and care for one another. Every woman's day a cake is cut of the sex workers to celebrate their birthdays. Every month a picnic is organised and they have their own celebrations. They also celebrate all the festivals and have a great time together.

One of the NGOs also provides the sex workers with classes to teach them various skills like tailoring and beauty parlour. They put up stalls of things made by them during festivals like Christmas. They encourage women to take up new skills. Slowly and gradually the NGO workers also create a rapport and bond with them. There general conversations revolve around food, cooking as these women love cooking. They are invited at the NGO's office for lunch or tea many times and that's how they build a bond. Whenever the NGO workers go on field one of the prominent questions that the sex workers ask is whether or not any doctor has come. They always need medical aid and keep asking for doctors.

However, this wasn't the case always. Initially the sex workers were quite wary of NGO workers and kept a distance. They would think of the pimps as their protectors and the pimps would ask them to stay away from social workers so much so that they would come to drop and pick sex workers' children from the night shelter rather than the women

themselves. The *'ghar wali'* and pimps controlled everything and would not want the sex worker's children to study. They wanted the daughters to come into the same profession and the sons to become pimps. But things changed gradually as an element of trust and empathy replaced the initial suspicion between the social workers and the sex workers.

Peter one of our key informants and head of an Anti-Trafficking Centre summed it up well.

'How we treat them depends on us as an individual. If we are good inside, we'll reflect that on the outside and if our intentions are wrong, we'll definitely do something wrong. There are a few policemen who ask for favors and others help them. There are doctors who refuse medical aid and there are also doctors who help for free. At the end, all that the women want is dignity.'

Interface with pimps and brothel owners

The fact that the NGOs rescue minor girls and take care of the women is something that the madams and brothel owners might worry about. So, when we asked Rahki one of the staff members at Prerana about their relations with the brothel owners, she simply said

'We share no relation. They don't know about our existence. We do things in a highly secretive manner. We never show them our faces; we walk around casually and make sure that they don't recognise us'.

Aspirations for children

"The children sometimes grow up and earn well, so good that they buy houses and live there with their mothers" said Rakhi[i]. They get their mothers out of the profession and help her live her old age without making her sell her body. These women have great aspirations for their children. They don't want their children to remain in the field after them; they want them to get out and do something on their own and achieve great things. They don't think badly of themselves or their job but they don't wish that their children continue in the same field. Rahki mentioned how once a daughter of the sex worker wore lipstick just out of curiosity and her mother scolded her very much, she was so furious that she couldn't control her anger. Their children have become teachers, professors, nurses and they often come to the NGO when a get together is planned.

Views

When asked about their views on legalising sex work or abolishing it the key informants said just one thing *'let them be'*. If at all, we need to decriminalise sex work and see it as a legitimate form of labour. What is required are more constructive interventions like medical aid, access to education and procuring identity documents and dignity of labour rather than greater regulation at the hands of the government.

Peter from Oasis spoke about how the sex workers perceive men. He said that they have absolutely no trust in men and that they look at men only as machines. When we further questioned him that how do the NGO people then talk to them, he said that they have built a rapport over the years and they too get rude answers at times if the women are not in a good mood. But they also share a brother-sister relationship too with them as these NGO workers become their family over time. He then told us how they come and buy clothes and grocery from the local market and that their interactions with the shopkeepers are as normal as any other person could have. Shopkeepers look at them just like any other person, they only want to sell their product and earn money.

One of the significant takeaways from this insightful piece of research was to shed presumptions about sex work, accord dignity of labour and not look at it through a moral lens. It is after all a struggle for livelihood and the need to gain recognition. We must respect the agency of women and question our privileges.

CONCLUSION

There were significant takeaways for us, first time and budding researchers, from a study of this nature. Our interest in sex work was triggered off by a number of factors, one among them being a session on sex work in college by someone who spoke from her lived experiences of working with sex workers. That set us off on this path even as we were fully aware of the challenges that lay ahead. We knew that access to the sex workers had to be mediated through the social workers and the anti-trafficking cells working in the area. However, we never anticipated that it would take almost six months of regular visits to the research site to be able to access the gatekeepers and key informants and a month later the sex workers. Finally, when we did, we were happy but also came back with a tinge of sadness and poignant memories. There were some questions which troubled us. Much as we saw the resilience and strength of the sex workers, we also witnessed the impoverished conditions under

which they lived and the deprivations and denials that characterised their lives.

It made us question our privileges and whether we could theorise and comment from a position of privilege. It also drew our attention to the ethics of doing research. In our quest for data and information did we in any way impinge on their privacy and personal space. Were we intrusive? We were not because we were trained to be non-intrusive and be empathetic listeners.

Still, we experienced a sense of unease. We got some data but what did we give them in return. How does one feel when you have small children of sex workers showing us their drawings and asking us *'Didi aap kal bhi aaoge na?'* Did we have any answers? If feminist research is about transformations, how could we possibly do that? How could we encourage other researchers to shed their inhibitions about doing a similar project and have a nuanced and multilayered understanding of sex work? These are preliminary findings from a work that we hope to build upon. Surely there is a caste, class, gender and regional basis to sex work. This of course is yet to be explored. These questions led us to some introspection and we decided to continue our research to gain a deeper understanding of the world view of sex workers so to shatter stereotypes associated with sex work. We have also volunteered to teach the children at the anti-trafficking cells and contributed our little bit in enriching their lives.

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[i]Rakhi is a social worker with Prerana

Acknowledgements

We owe our deep gratitude to our inspiration Ms. Farzeen Khambatta who took a keen interest in our project and guided us all along, till the completion of our project work by providing all the necessary information and important details that helped us in our field work.

We heartily thank Mrs. Aruna, Ms. Vaishali and Ms. Mamta for their time and motivation. We would also love to thank Mr. Michael for his constant support and deep insights on our topic and Shobha didi for accompanying us to the field and making us feel comfortable. Without them our research would have been incomplete.

We would not forget to remember our parents and friends for their encouragement and more over for their timely support till the completion of our project work.

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