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TRENDS IN INTERDISCIPLINARY RESEARCH VOLUME I



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PREFACE

In today's rapidly evolving world, the pursuit of knowledge knows no boundaries. The traditional confines of academic disciplines are becoming increasingly porous as researchers recognize the immense potential in collaboration and interdisciplinary exploration. This book, "Trends in Interdisciplinary Research," aims to shed light on the exciting developments and emerging frontiers in this dynamic field.

Interdisciplinary research, at its core, seeks to transcend the limitations of disciplinary boundaries and integrate diverse perspectives, methodologies, and expertise. By fostering cross-pollination of ideas, interdisciplinary research has the power to address complex challenges and generate innovative solutions that would otherwise be unattainable within a single discipline. It has the potential to revolutionize our understanding of the world and drive progress in areas such as science, technology, social sciences, arts, and humanities.

In this book, we have brought together a diverse group of experts and scholars who have been at the forefront of interdisciplinary research. Each chapter explores a unique area of inquiry and showcases the remarkable achievements and advancements in that field. From the exploration of the human brain to the intersection of art and technology, from the fusion of biology and engineering to the synthesis of social sciences and public policy, this book covers a wide range of interdisciplinary domains that reflect the diverse and multifaceted nature of contemporary research.

We hope that this book will serve as a valuable resource for researchers, academics, and students who are passionate about pushing the boundaries of knowledge. By exploring the trends in interdisciplinary research, we aim to inspire and encourage more individuals to embrace interdisciplinary approaches and foster a culture of collaboration, curiosity, and creativity.

We would like to express our gratitude to all the contributors who have generously shared their expertise and insights. Their dedication to interdisciplinary research has been instrumental in shaping this book.

Editors

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ATTITUDE OF U.G. STUDENTS TOWARDS YOUTUBE BASED LEARNING: AN EXPLORATION OF FACTORS AFFECTING ITS PERCEIVED UTILITY

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Abstract:

The use of social media in the field of education has become a trend among students as these social platforms are easily accessible, flexible and user-friendly. Moreover, YouTube serves as a learning tool for learners as it helps in learning general skills and completing tasks either at home or in classroom setting. Since, technological advancement and its implication in the field of education requires to be explored. It is interesting to see how the young learners have found innovative platform that provides wide range of content with flexibility in regard to time and modality. Therefore, the present study aims to examine the attitude of students towards YouTube based learning. Stratified random sampling method has been used for sample selection that includes 368 undergraduate students studying at Prayagraj city, Uttar Pradesh. It has been observed that both male and female students have favourable attitude towards YouTube based learning and do not differ significantly in terms of their attitude towards the same. Moreover, the attitude of students studying in different year of graduation was also examined which revealed that graduation third year students have significantly more favourable attitude than their counterparts of first year and second year graduation.

Keywords: YouTube based learning; attitude; social media; online learning, factors

Introduction:

The present era is the epoch of information technology. It has touched every sphere of our life. The key components of the present era are computers and the internet that has been emerging at a meteoric speed since the early 90s and it has become widespread in the world very swiftly. This proliferation has transformed the societies from all over the world, drastically. In concurrence with the speedy advancement of technology, the arena of education has also been experiencing significant developments in recent years (Akgunduz and Akinoglu, 2016). There is a need of assimilating these changes occurring in the various levels of society into the education system and therefore, it is the need of the hour to use technologies based on computers and the internet extensively and effectively in our current educational system.

Morris (2019) have mentioned in their study that students find the self-directed learning very satisfying and it also prepares them for their vocational life. Self-directed learning facilities addition in the students' existing knowledge and provides them with freedom to choose how and

what they want to learn. They have also emphasized that self-directed learning is student-centered and it allows them to decide how, what, when and where will be learned as opposed to traditional learning method which is teacher-centered. Self-directed learning makes the students responsible as they take decision regarding planning, learning, managing and controlling the content of learning. This learning technique instigates self-directed learning skills in students and also makes them aware of their responsibilities in learning from planning till evaluation of results. It enables them to act independently as they no longer need instruction from others for learning. Self-directed learning helps the students to grow into curious, enthusiastic, responsible, self-confident, organized and autonomous learners who can efficiently use their skills to learn new things and achieve their goals.

Human life has been tremendously affected by technology and it has also impacted education and learning in a positive way. In the twenty first century the learning-teaching paradigm has been changed and mediation of technology in this process has improved the experience of learning and also attracted various opportunities. Due to its availability and ease of usage internet have been utilized very frequently in the area of education and it has become a requirement for vivid teaching and learning experience. We are currently living in times where smart phones either provide assistance or give information directly to the techno-friendly young university students.

The use of online resources for teaching and learning process has been boosted up with the growth of the internet (Masiello Ramberg & Lonka, 2005). With the easy accessibility and convenience of usage the technology and the internet has raised a doubt about the significance of traditional face-to-face teaching-learning approach in the coming future. It has indicated towards the emerging trend of using web-based learning along with face-to-face learning which is called Blended learning (Akgunduz and Akinoglu, 2016). Barry *et al.* (2015) have also supported the notion that the blended learning approach has surpassed the conventional teaching-learning model. Blended approach of teaching and learning incorporates internet and computer technology for enriching both teaching and learning experience. Use of animation, graphics, sound and video clips helps in understanding and in turn facilitates learning.

In the present time, the students majorly who have born in early 90s, prefer viewing and exploring academic or non-academic content online as compared to any other sources. The students who belong to the generation of hyperconnected, digital native learners, they consider web-based technologies essential for searching, selecting and compiling the information with a specific preference for user generated content (Buzzetto-more, 2015). The content available on the internet renders approaches for blended learning and the portals of the internet provide content related to the education and the social media makes its use effective (Akgunduz and Akinoglu, 2016).

Students specially millennials are digital natives who look for online academic content on web than on any other medium. It has also been found that presently students as a generation of hyper-connected learners; they regard web-based technologies as integral to the information collection process with a specific inclination towards user generated content (Buzzetto-more, 2015).

The advancements in the digital world such as in the internet, web-based technologies, Information and Communication Technologies (ICT) in the past two decades have made the world a digital village (Babu H., Buddayya and Gujjarappa, 2019).

Social network sites are web-based platform with certain norms of the system itself. It allows individuals to create a public or semi-public profile within a system to explore the current happenings around the world, to connect with other users and observe their activities and to view and navigate their list of connections in the system. Social media is a tool for connection, socializing, communication and sharing (Akgunduz and Akinoglu, 2016). The current generation of students uses social media technologies for all the above-mentioned activities and also for learning purpose.

Use of social media in the field of education has become a trend among students as these sites are easily assessable, flexible and user-friendly. Therefore, as compared to other learning resources students are more attracted towards social media technologies and these are used more frequently. Social media technologies provide a platform for both teachers and researchers who can create content online, generate a community by following simple steps (bounded by some norms), they can share content within the community and can communicate with each other. Students can also communicate with the educator to resolve their queries for further explanation. These entire features attract users and facilitate this mode of learning. Social media web sites not only add blended learning process but can also enrich educational institutions by providing assistance in teaching and assessment process (Akgunduz and Akinoglu, 2016).

Today, social media offers enormous potential for students in their everyday activities in education, entertainment, socializing and so on (Baird and Parasnis, 2011).

YouTube is the most prominent host of user generated online video content provider. It is the world's largest video sharing service visited by more than one billion visitors per month. One can speculate its quantity and range of contents by the fact that every minute approximately 100 hours of video uploaded to the server (Buzzetto-more, 2015). Majority of the visitors on YouTube, for educational purposes, belong to 'Start generation connected' (Gen C.) or the 'YouTube generation'. Around 90% of this population has a social media profile and 65% of it updates it daily. YouTube generation does not characterize by specific age but by an attitude and outlook (Barry *et al.*, 2015). YouTube has a wide range of educational materials. Utility of its content has now been widely researched and studies in the social sciences (Chao, Chan and Chuang, 2014).

Maziriri *et al.* (2020) have discussed in their study YouTube as a new e-resource, can be utilized in contemporary tertiary or higher education pedagogy. Moreover, YouTube has been regarded as the most extensively used view hosting website. It has also been considered as a prominent contemporary e-resource which is greatly beneficial for the students at higher education level. YouTube serves as a learning tool for students because it helps in learning general skills and completing tasks either at home or in classroom setting. YouTube is also an effective resource for teachers as it assists them in their teaching work. YouTube has been proved to be useful for students in their affective, behavioural and cognitive classroom activities i.e., in overall learning.

Apart of this, students' engagement improves the learning experience on web through the course delivery, manner for deciding on their utility of videos and its services (Babu H., Buddayya and Gujjarappa, 2019). YouTube is no doubt the user generated content massive and is not only remarkably popular with but also familiar to the current generation of digital learners. Furthermore, it is the second most common place where people visit on the web to gather information (Buzzetto-more, 2015). Due to the high utility of YouTube as the major video sharing services its under consideration as part of the present study.

Main focus of the chapter

The main focus of this study is to determine the attitude of undergraduate students towards YouTube based learning, to investigate the factors (Gender, level of education and geographical demography) affecting attitude towards YouTube based learning.

Issues

Valtonen *et al.* (2014) has discussed in their study that web-based learning and teaching require a set of skills known as twenty-first century skills. These skills prepare students for practical life. These skills include creative thinking, problem solving, decision making, communication and ICT literacy. ICT plays an important role as it promotes collaborative thinking and also enhances learning experience. For blended teaching approach some of the changes are required in learning environment one of them is proper training of ICT skills. Social software applications provide various opportunities for building learning environment (Masiello, Ramberg and Lonka, 2005). On the basis of review of literature, hypothesis is as follows:

H₁- Gender of students will not have significant effect on their attitude towards YouTube based learning.

H₂- Level of education of students will not affect their attitude towards YouTube based learning.

Rationale of the study

YouTube has also been found to be user friendly for the digital learners with high acceptance levels. The use of online and hybrid courses such as YouTube has been found to enhance discourse, collaboration and engagement in the learning process. Besides this, YouTube

is cost-effective and there is no limit as to the memory, one can visit and watch online videos for free (Maziriri, Gapa and Chuchu, 2020). Barry *et al.* (2015) conducted a study in Dublin, Ireland and found that more than 86% of undergraduates owned three or more electronic devices (i.e. smartphones, laptops, i-pods etc.). They revealed in their study that more optimum utilization of blended learning approach is important to take into account the attitude of undergraduates of YouTube generation.

Technological advancement and its implication in the field of education is the subject matter of research for its fullest utilization for students as well as educators. Masiello, Ramberg and Lonka (2005) have stated that there is a need of study to assess the role of Information and Communication Technology (ICT) in the field of education, more specifically at the under-graduation level. Buzzetto-More (2015) emphasized that teaching and learning remain an area in which more in-depth exploration and research on the use and impact of YouTube is required. Moreover, the literature has indicated that learners taught by online and traditional method differ in terms of their personal learning styles. Students have individual preferences for their learning modalities. Incorporation of YouTube into the teaching and learning process in an area worthy of exploration. Barry *et al.* (2015) revealed in their study that for optimum utilization of blended learning approach, it is important to take into account the attitude of undergraduate students. Furthermore, undergraduate students' perception and attitude towards YouTube based learning has not been extensively researched in Indian context.

Even though researches on YouTube are available but it is important to keep in mind that there is still a scope of exploring the causal relationships between perceived utility of YouTube, students' attitudes and behavioural intention towards the use of YouTube. Consequently, further empirical investigations are required in order to consolidate the research area (Maziriri, Gapa and Chuchu, 2020).

Methodology

The research design used in this study is a cross-sectional survey design. The sample comprises of 396 under graduation students including B.A., B.Sc., B.Com. studying at Prayagraj city, Uttar Pradesh, India. Stratified random sampling technique has been used for sample selection so that the students of all three levels (3 years of graduation) have representativeness in the sample. In this study, attitude towards YouTube based learning is dependent variable that measured in terms of its three components- Affect, Behaviour and Cognition. Effect of demographic variables such as- gender, level of education, geographical demography, duration of site visit and the level of satisfaction are selected as independent variables. Researcher has developed a questionnaire on the basis of literature reviewed and previously used similar standardized tools. The questionnaire contained 16 items on 5-point rating scale to assess the attitude towards YouTube based learning along with demographic variables such as- gender, level of education, geographical demography, frequency of social media uses and possession of

electronic devices used for surfing social media. The response category ranges from completely disagree = 1, to completely agree = 5 with neutral = 3 in the middle. Higher scores on the scale reflect favourable attitude towards learning from YouTube.

Results:

The results computed on the basis of obtained data are as follows-

Table 1: Showing frequency of uses of social sites (particularly YouTube) for study purpose by the students.

How frequently do you use social sites for study?	Daily	2-3 times a week	2-3 times in fortnight	2-3 times a month
Frequency	137	106	78	47

Table 1 depicts that majority of the students use YouTube for study purpose on the daily basis.

Table 2: Showing means (gadgets) of using social sites (particularly YouTube) by the students.

Possession of electronic gadgets	Mobile (smart) phone	Tablet	Laptop
Frequency	210	56	92

Table 2 indicates that 98.83% of the students use YouTube through their smart phones for study purpose which signifies that the students access social sites whenever they wish to study.

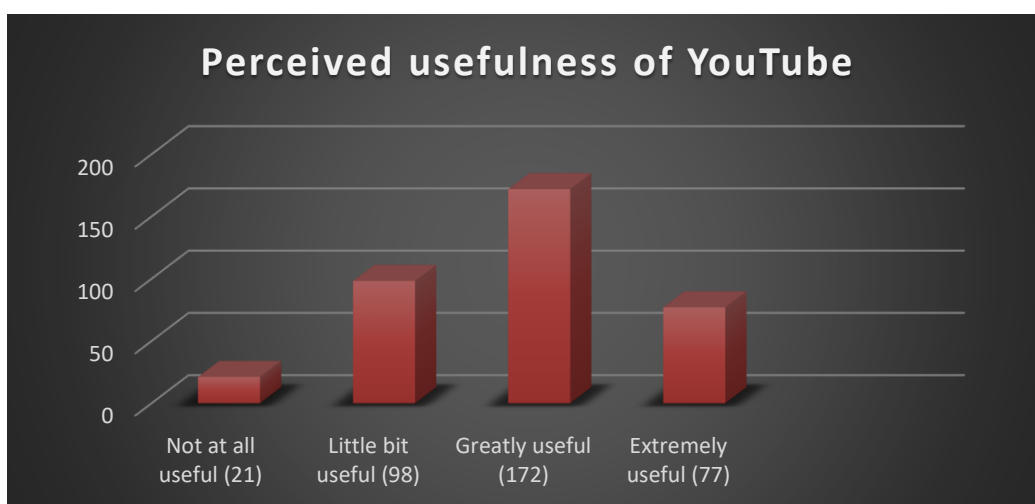


Figure 1: Showing perceived usefulness of YouTube for study purpose

The above diagram denotes that 75.92% of the students find YouTube greatly or extremely useful for study purpose while merely 0.08% of the students do not find it helpful in their study.

Table 3: Table showing mean, standard deviation and independent t-test on the scores of attitudes towards YouTube based learning between the groups based on gender of respondents.

Groups based on		Mean	S.D.	t	df	H ₀₁	Level of significance
Gender	Female	5.47	0.70	1.38	366	H ₀₁ accepted	p = 0.89
	Male	5.08	0.91				

The above table shows that both male and female students have favourable attitude towards YouTube based learning and do not differ significantly in terms of their attitude towards the same. So, it can be said that male and female students have almost similar and favourable attitude towards YouTube based learning.

Table 4: Table depicting mean scores and standard deviation of attitude of the respondents

Year of Graduation	N	Mean	S.D.
First	127	3.89	0.68
Second	123	4.12	0.57
Third	118	4.56	0.71

The above mean values in the table are indicative of the favourable attitude of respondents towards the YouTube based learning. Third year graduation students have comparatively more positive attitude as compared to both first year and second year students.

Table 5: Table depicting One-way ANOVA among the mean scores obtained by students of different level of education

Grouping variable		Sum of squares	df	F	H ₀₂ decision	Significance
Year of Graduation	Between groups	5.68	8	6.548	H ₀₂ rejected	P = 0.003
	Within groups	126.92	359			
	Total	138.60	367			

The above table shows that there is significant difference in the attitude towards YouTube based learning among the students studying in different year of graduation. This implies that graduation third year students have significantly more favourable attitude than their counterparts of first year and second year graduation.

Discussion:

The present study aimed at exploring the attitude of students of undergraduation towards YouTube based learning and also to find out the factors affecting perceived utility of the YouTube in academics. Results of this study revealed that 79.35% of the students visit online websites and platforms, primarily YouTube for educational purposes almost daily, using their

smartphones. Maziriri, Gapa and Chuchu (2020) discussed in their study that attitude has moderately strong relationship with behavioral intention which means that students will visit online websites for educational purposes if they feel positive about it. Findings of the present study depicts that majority of the students use YouTube for study purpose on the daily basis. It also indicates that 96.78% of the students use YouTube through their smartphones (mobile) for their study purpose which signifies that the students access social sites whenever they wish to study.

For students, the usages of YouTube are multifold and it makes the educational concepts comprehensible by providing the study material. Perhaps due to this reason almost 69% of the respondents find YouTube greatly or extremely useful for educational purposes. This finding is supported by Buzzetto-More (2015) that instead of teacher-lead approach, flexibility and self-directed approach of YouTube attracts students as it facilitates learning interests, learners' abilities and aspirations. Findings have shown that both male and female respondents have positive attitude towards YouTube based learning but do not differ in terms of their intensity of attitude. Therefore, H_{01} has been retained. This reveals that both male and female students have favourable attitude towards YouTube based learning and do not differ significantly in terms of their attitude towards the same. So, it can be said that male and female students have almost similar and favourable attitude towards YouTube based learning.

Similarly, Buzzatto-More (2015) found that there were minor attitudinal differences in terms of the use of YouTube in education among male and female students. Balbay and Kilis (2017) in their study discussed a further characteristic of YouTube that it is cost effective and there is no memory limit of viewing online content. Also, YouTube is a ubiquitous portal that can be accessed anytime and anywhere by the students. These are the contributing factors making YouTube as the first choice by the students for online learning.

Furthermore, results of the present study also demonstrated that with the advancement in their level of education, graduation third year students have significantly more favourable attitude towards YouTube based learning than their counterparts studying in the first year and second year of graduation. Therefore, H_{02} had been rejected. This is possibly due to the reason that as the horizon of knowledge of subject matter increases, students search for diverse and novel approaches of learning and YouTube provides immersive learning experience to the learners. Findings showed the significant difference in the attitude towards YouTube based learning among the students studying in different year of graduation. This implies that graduation third year students have significantly more favourable attitude than their counterparts of first year and second year graduation.

Conclusion:

Research findings exposed that the students are well aware of the significance and benefits of YouTube for educational purposes. Overall, this study revealed that students pursuing

graduation have favourable attitude towards YouTube based learning; although no significant difference was found between the attitude of male and female students regarding YouTube based learning. YouTube fosters engaging in flexible learning environment. Therefore, the teachers should encourage online teaching-learning practices to foster the problem-solving abilities of the students (Kaur, 2017). Social media has become part of our day-to-day life and the sphere of education is not untouched. Therefore, Blended learning environments and social media platforms are required for the students for assessing information without any difficulty from the web gateways. Students must be able to utilize educational websites with virtual libraries, from videos sharing sites and to develop the habit of using this information in their learning. Further researches can also focus on the effectiveness of online learning platforms to enrich the experience of self-directed learning of young learners using advanced technology. Users of YouTube channels in skill development and impact of modality of learning can be explored to a greater extent in upcoming researches.

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BEHAVIOR CHANGE TECHNIQUES (BCTS) AND SELF CARE

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Human behaviors including smoking, being physically inactive, and eating poorly are among the main causes of disease and mortality around the globe. For the sake of one's health and welfare as well as the economics of entire countries, interventions and policies aimed at altering these behaviors are essential because they can boost population and individual health for a relatively low cost.

Background:

Interventions for behavior modification are complicated since many elements are under influence. Many theories about behavior and behavior change attempt to explain and forecast when, why, and how behavior change takes place. A person must have the capacity, opportunity, and desire to change for a behavior to occur, according to the most fundamental model of behavior change, the COM-B (Fig. 1) (Michie *et al.*, 2014; Michie *et al.*, 2011).

The term "behavioral change techniques" (BCTs) refers to intricate, observable, and repeatable elements of an intervention that aim to influence behavior (3). BCTs are referred to as a part of an intervention that aims to change or refocus the causal mechanisms that control behavior in this way. BCT Taxonomy (v1), developed by Michie *et al.* in 2013, is a classification system for 93 hierarchically clustered techniques that are divided into 16 groups (4). The BCT Taxonomy aids in determining the efficacy of BCTs, particularly those created by fitness-related apps (5, 6). Digital behavior change interventions (DBCIs), according to Yardley *et al.* (7), use digital technologies to encourage behavior change and can be applied to improve health.

Standard Approach

BCT is a measurable and repeatable element intended to shift behavior in the direction of better self-care. It can be used alone or in conjunction with other BCTs and is the smallest component still able to keep the suggested active components. A BCT should be thoroughly stated so that interventions may be executed and evaluated in a way that results in the desired change in the target behavior (s).

The BCTs are descriptors, and they differ in how much they have been empirically researched and how much they alter behavior (or behaviors) in various contexts. The BCT definitions used for coding must be applicable, unique, and helpful for the accurate reporting of treatments.

A cross-domain taxonomy of 93 different BCTs with names, definitions, and examples is called the BCTT. Researchers and practitioners can use BCTT as a trustworthy method for

defining, understanding, and putting into practice the key components of interventions to alter behavior. The Medical Research Council provided financial support for its creation.

Through several mechanisms of action, behavior change strategies modify behavior. We can create more effective interventions and increase our understanding of how interventions work (and why they don't) by studying the processes via which behavior modification interventions have their effects. Researchers studying behavior change and intervention designers will benefit from having a more effective method for creating solid, theory-based interventions thanks to the outcomes of this program of work.

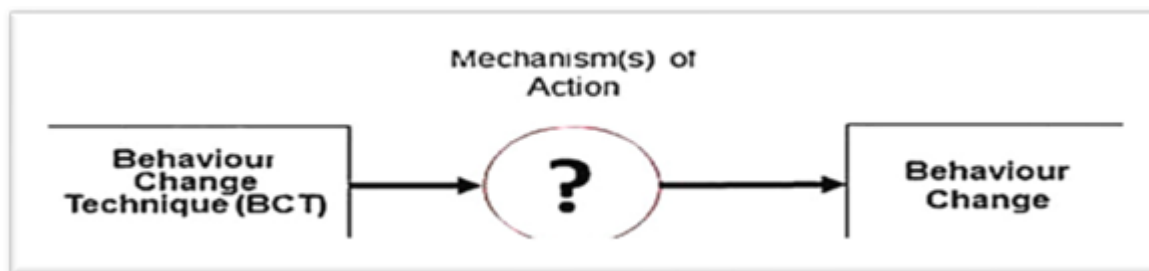


Figure 1: BCT Approach

Behaviour change techniques pros and cons

Benefits include:

Behavior change technique (BCT) is a strategy that helps an individual change their behavior to promote better health (e.g., setting goals, taking unhealthy foods out of the house, or packing your sports kit the evening before).

Drawbacks include:

- The classification is not always straightforward for digital products
- You may need additional expertise from someone familiar with behavior change science
- We lack understanding of:
- Which bcts are needed to change different behaviors, for whom, and when these are most effective
- How techniques interact with each other what is a sufficient delivery 'dose'

Definitions of self-care

There is no widely acknowledged definition of self-care behavior. Self-care is defined differently depending on

- (1) who practices it (e.g., an individual, a family, or a community),
- (2) what motivates it (e.g., practicing health promotion, preventing illness, limiting the effects of illness, or restoring health), and
- (3) the degree to which health care professionals are involved.

Self-care behavior - requisites for changes in persona

Self-care behavior, a crucial idea in health promotion, describes the choices and activities a person can make to deal with a health issue or to better their health. Examples of self-care practices include seeking information (e.g., reading books or pamphlets, searching the Internet, attending classes, or joining a self-help group), exercising, visiting the doctor frequently, getting more rest, changing one's lifestyle, adhering to dietary recommendations, monitoring one's vital signs, and seeking advice from lay and alternative care networks, evaluating this information, and then deciding whether or not to take action. For people with chronic health disorders, self-care is typically seen as an addition to professional medical care. Self-care behavior, however, encompasses more than merely adhering to a doctor's recommendations. It also includes a person's ability to draw lessons from past successes.

Theoretical approaches to self-care

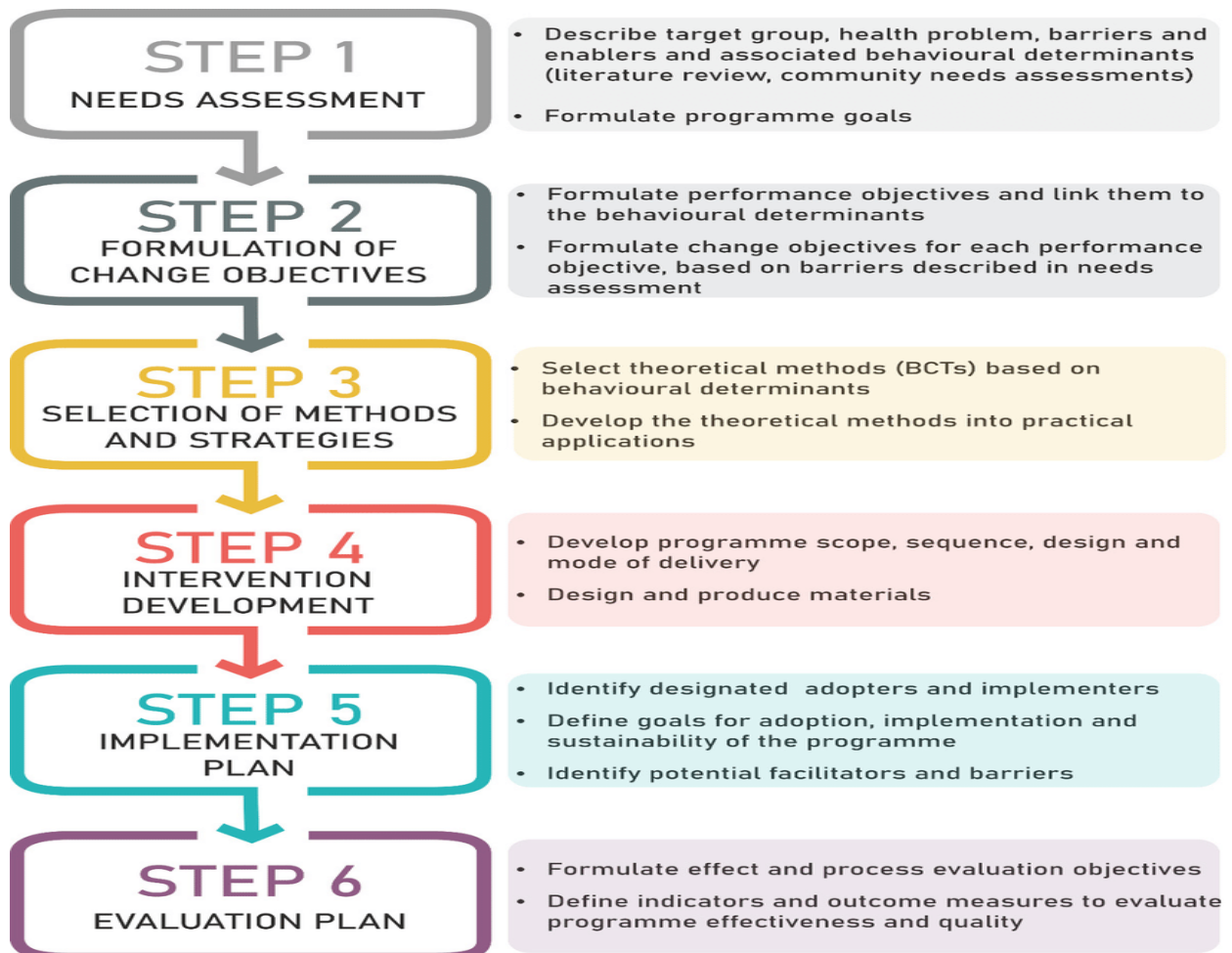


Figure 2: BCT Process

To explain self-care, researchers have typically used preexisting, broad theories of behavior change. The social learning theory, the health belief model, the theory of reasoned action, and the transtheoretical model of behavior change are some of these important theories.

Explaining self-care practices and the reasons why some people do or do not engage in these activities has met with various degrees of success.

The self-regulation model of self-care created by E. Leventhal, H. Leventhal, and C. Robitaille is one of two theories that are specifically related to self-care. D. E. Orem's theory of self-care (1991), which is a conceptual theory and not an empirically derived theory, is specific to managed-care environments in which nursing interventions occur. His second hypothesis has undergone some limited testing and shows promise in illuminating why people choose to practice self-care or not. It makes the argument that a person's unique characteristics and motivations are crucial in explaining decisions to start and maintain self-care behaviors. The fundamentals of this theory are depicted in the diagram below.

In this concept, an individual's reality and the emotional reactions to this reality interact. Concurrently, action plans and procedures for handling the symptoms are generated. The evaluation of expected and actual results follows last. This feedback may cause changes in emotional responses and reality perceptions, which may then result in revisions to action plans, among other things. In essence, this theory describes how people perceive and handle health concerns, as well as how this evolves with time in response to experiences and the evolution of danger.

Conclusion:

Behavioral change is a key factor to take into account for attaining changes in health and preventing disease, according to the body of knowledge on what works in the field of health. This concept has gained popularity in recent years, and much research has been done to determine the most effective strategy. There is strong evidence that health promotion programs are more effective in promoting general health when theory is used in their development and implementation. Less research has been done on the best tactics to employ, though. Interventions need to help build communities and circumstances that support change in addition to directly addressing behaviors. To improve our understanding of health behavior change, a complete evaluation of such treatments is crucial. The successful reduction of health-risk behaviors in behavior change treatments has been linked to a variety of self-regulatory health behavior modification approaches.

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THE BASIC AND ADVANCED ASPECTS OF IMMUNOLOGY

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Abstract:

Immunology is an interdisciplinary subject encompassing a number of other fields like biochemistry, microbiology, biotechnology, pathology, clinical medicine. The immune system consists of complex network of cells and molecules and their interactions. It is specifically designed to eliminate infectious organisms from the body. It has developed profoundly than any other field. This article emphasizes on almost all the important areas of immunology and covers the basic and advanced aspects of immunology.

Keywords: interdisciplinary subject, immune system, infectious organisms.

Introduction:

History of immunology

It was in the 19th century that the gates of immunology opened with the discovery of Robert Koch who proved that the infectious diseases are caused by the microorganisms. The search for the mechanism of immunity started all over the world after the discovery of Koch and strategy of Louis Pasteur and Edward Jenner's vaccination. Another important breakthrough in immunology came in early 1900s with the discovery of blood groups by Karl Landsteiner found that reactions between substances present on the surface of antigens and other substances in plasma. Thus the transfusion of blood in man became possible. In 1934 it was found that sodium citrate would keep the blood from clotting when added to donor blood. This permitted donated blood to be stored in a bottle for later transfusion. In 1912 Roger Lee defined the terms Universal donor and Universal recipient. He demonstrated that O group blood could be transferred in patients having one of the four blood groups while persons having AB blood could receive blood having any one of the blood groups. This finding proved to be important not only in immunology but also in the field of medicine.

Immunology becomes a hot area of study in the mid 20th century. Increasing interest in the study after the first successful kidney transplantation. With the emergence of HIV public interest in immunology intensified.

Types of immunity

Immunity is resistance to disease based on prior exposure. There are two types of immunity, innate immunity i.e. inborn, provides immediate response to infections which includes first line of defense like saliva, skin, tears, hydrochloric acid in stomach. Innate immunity lacks immunological memory. Adaptive or acquired immunity developed with exposure to foreign

antigens and is highly specific, kicks in later than immune system. Adaptive immunity may be humoral which is antibody mediated and cell mediated immunity involves T cells which mature in thymus.

Cells of the immune system

The cells of immune system are so adapted that some of them mediate specific immunity and some can get involved in non specific immunity. The cells of immune system are derived from the pluripotent stem cells in the bone marrow. Monocytes, macrophages and granulocytes which mediate non specific immune response, mostly phagocytic in nature. On the other hand T-lymphocytes, B-lymphocytes and large granular lymphocytes are mostly involved in specific immune responses.

Organs of the immune system

The organs of the immune system are present in the form of organized tissues. The lymphoid organs are broadly classified as primary and secondary lymphoid organs. The primary lymphoid organs are involved only in the production of T and B cells. However in these organs the antigens are not normally encountered. Antigens are encountered in the secondary lymphoid organs. T and B cells leave the primary lymphoid organs and get organized into lymphoid follicles. Lymph nodes, spleen and mucosal associated lymphoid tissues are some of the important lymphoid organs.

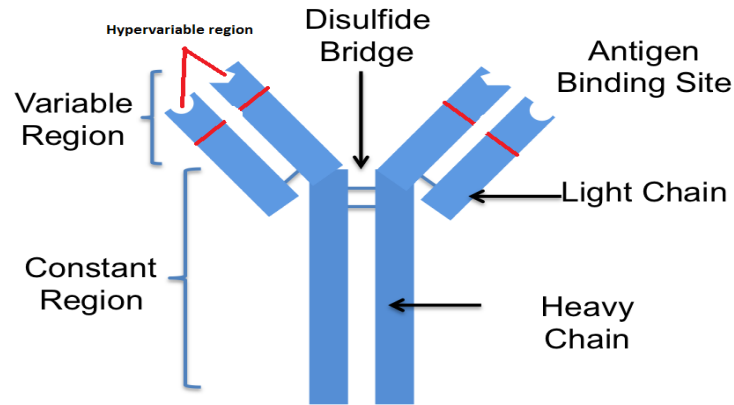
Antigenicity and haptens

Ability of a substance to bind to the product of immune response is known as antigenicity. Haptens are small molecules with lower molecular weight which when combine with larger carrier such as protein can elicit the production of antibodies. They are antigenic but not immunogenic. Therefore the moiety is chemically coupled to a highly immunogenic carrier protein that contains large number of epitopes, which are immunologically active region of immunogen that bind to specific antibodies.

Immunoglobulins

Rodney K Porter and Gerald M Edelman demonstrated through enzyme cleavage experiments that four polypeptide chains of antibody molecule can be cleaved into three parts i.e. two antibody fragments and one crystallisable fragment. For this contribution were awarded the Nobel Prize in 1972.

Immunoglobulins (Ig) or antibodies are glycoproteins composed of four polypeptide chains that are linked by disulphide linkages, produced by plasma cells. The proteins of immune system such as immunoglobins form an essential biological defense system of higher animals. Since antibodies are polypeptides they have carboxyl and amino terminal ends. Five major antibody classes have been identified in placental mammals: IgG, IgA, IgM, IgE, and IgD. This classification is based on differences in amino acid sequence in the constant region (Fc) of the antibody heavy chains.



IgG is the major class of immunoglobulin produced particularly during secondary immune responses, present in blood and tissue fluids. IgG is the only class of immunoglobulin capable of crossing the placenta consequently it provides some degree of immune protection to the developing fetus.

IgA is the second most abundant antibody found in many body secretions, including tears, saliva, colostrums. Very little IgA is present in the serum. Although IgG is the most common class of immunoglobulin, more IgA is synthesized by the body daily than any other class of antibody. However, IgA is not as stable as IgG, and therefore it is present in lower amounts at any given time.

IgM is pentamer largest in size, first to respond to infection, because of pentameric nature the strength of binding to antigen is enhanced.

IgE is heat labile immunoglobulin involved in allergic reactions. Antibody binds to allergen triggers mast cells to secrete histamine. In a highly allergic person abnormally a high concentration of IgE is found.

Apart from antigen binding the antibodies perform other functions like opsonisation, activation of complement, antibody dependent cell mediated cytotoxicity. The complement system composed of plasma proteins that complement the function of antibodies in depending the body from invading organisms.

Any disease that affects the development and function of B cells will cause a decrease in the amounts of antibodies produced. People with immunoglobulin deficiency become ill more often. These patients are more prone to infection caused by microorganisms

The major histocompatibility complex

The helper cells must first become activated before they can help other immune cells to respond to pathogenic organisms. This process occurs when an antigen presenting cell submits a fragment of a foreign protein bound to class II MHC molecule to the helper T cell.

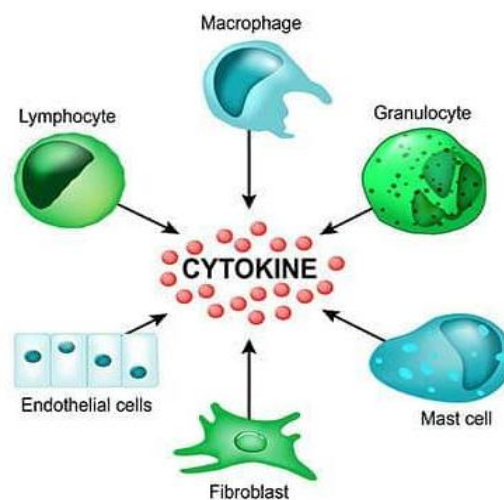
The ability of our immune system to recognize its own cells and distinguish those cells from foreign pathogens depends on proteins found on the cell membrane. B cell receptors can recognize antigens on their own whereas T cells can do so through mediation of MHC. The major histocompatibility complex in humans referred as human leukocyte antigen (HLA).

MHC class I, these protein markers are found on the membrane of most of the nucleated cells used to differentiate healthy cells from infected cells. MHC class II are found on only specific immune cells such as B-lymphocytes, macrophages, and some T lymphocytes. These protein complexes help immune cells to communicate with each other.

Organ transplantation is associated with the immunological complications and tissue rejection. MHC complexes are primarily involved in the allograft rejection. This is due to fact that MHC proteins are unique to each individual and the immune system responds promptly to foreign MHCs.

Cytokines

Secreted by various cell types. Cytokines are large group of proteins, peptides or glycoproteins that bind specific receptors on target cells. Cytokines are a category of signaling molecules that regulate immunity that brings about communication between different cell types involved in immunity. The main function is to amplify immune responses. Expression of cytokines and chemokines and their receptors is highly regulated. They direct the movement of WBC cells in the body. There are three functional aspects of cytokines they can act on the same cell from which they are produced (Autocrine), They can affect neighbouring cells (paracrine), and are able to affect distant target cells (endocrine). Cytokines family includes interleukins, interferons, tumor necrosis factor.



Therapeutic uses of cytokines

It is now possible to produce cytokines invitro. Some of the cytokines have potential applications in the practice of medicine. For instance IL-2 is used in cancer immunotherapy, increases the cytotoxic capacity of NK cells. A group of cytokines namely interferons can combat viral infection by inhibiting their replication.

Conclusion:

Innate immunity is the basic immunological, non-specific tool for combating contrary to infections. This immune response is expeditious, occurring in minutes or hours after invasion

and is intervened by various cells such as phagocytes, mast cells, basophils and eosinophils, besides the complement system. Adaptive immunity progress in conjunction with innate immunity to get rid of infectious agents; it depends on the substantially coordinated interaction between T cells, Antigen presenting or accessory cells and B cells. A captious aspect of adaptive immunity is the reinforcement of immunologic memory leading to effective and rapid immune responses upon consecutive exposure to the same pathogens. Human beings are born with some kind of immunity, but exposure to diseases and vaccinations can also help to boost the body's defenses. Approaches of boosting immunity include dietary and exercise choices having appropriate vaccinations.

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MATHEMATICAL ANALYSIS FOR ETHICAL ISSUES AND SOLUTIONS FOR CORPORATE SUSTAINABILITY

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Abstract:

The purpose of this paper is to analyse the Ethical issues and solutions for the corporate sustainability. By focussing on the above concepts, the paper highlights how companies can be ethical in corporate culture. Also, the companies can implement the solutions for corporate sustainability. Ethical issues in corporate are of major concern. Therefore, it is imperative to know the Ethical issues for corporate sustainability which affects the work culture and if it exists what may be the possible solution for the same. This gave rise to the objectives of study as 1) To study the Ethical issues for corporate sustainability. 2) To study the solution for Ethical issues for corporate sustainability. The scope of study was restricted to the employees working in Indian and International Companies. Thus, the methodology considered is as follows. The Research Design deployed for the research was Descriptive in nature. A sample of 250 respondents working in different Indian and International Companies was considered as the target audience. Using one way ANOVA different significant factors which were responsible for **Ethical issues and solution for corporate sustainability** was found. The researcher claimed that is P value for Discrimination and harassment, Workplace health and safety, Whistle-blowing or social media rants, Ethics in accounting practices and Nepotism or favouritism < 0.05 Thus, these are significant Ethical issues for corporate Sustainability. Also, p value for Be a good role model, promote your ethical behaviour, learn from your mistakes, Be Transparent and Unbiased Environment < 0.05 Thus, these are significant solution for Ethical issues for corporate Sustainability. Thus, Thus, from the implementation of the corporate ethics program that has been carried out by the company, it is proven that the company can maintain the company's going concern. This indicates that the implementation of the corporate ethics program carried out by the company can maintain the company's corporate sustainability.

Keywords: Ethical Issues, Corporate Sustainability, P Value, Descriptive Research, ANOVA

Introduction:

Human sources (HR) specialists and administration figures can also discover it difficult to control moral troubles effectively. Although there are legal guidelines to keep human beings accountable, unethical behaviour can nonetheless happen in the place of job and an enterprise can additionally act unethically. As an HR expert or a manager, gaining knowledge of about the moral problems a enterprise can face can assist you put together to control them efficaciously if

they occur. In this article, we reflect on consideration on what moral problems for company sustainability. Ethical troubles in enterprise show up when a decision, recreation or state of affairs conflicts with the organisation's or society's moral standards. Both corporations and people can end up worried in moral problems given that others can also query their movements from a ethical viewpoint. Complex moral problems consist of diversity, compliance, governance and empathetic decision-making that align with the organisation's core values. Ethical conflicts might also pose a chance for an organisation, as they may also suggest non-compliance with applicable legislation. In different instances, moral problems may additionally no longer have prison consequences. It may also be difficult to efficaciously control moral problems when no recommendations exist. For this reason, as an HR or administration professional, you can assist increase insurance policies to guide personnel to make the proper choice when confronted with ethical issues. It's quintessential to recognize what these troubles are to control them when they occur in the organization you work for. Knowing how to notice and deter these troubles earlier than they turn out to be complicated can assist you and your colleague's focal point on enterprise success and boom as a substitute of remediation. Corporate sustainability is an method aiming to create long-term stakeholder fee thru the implementation of a commercial enterprise method that focuses on the ethical, social, environmental, cultural, and financial dimensions of doing business.

Ethics applied to the 3 pillars of sustainability

Sustainability is oftentimes damaged up into three pillars: environmental, social, and economic. These three pillars incorporate subcategories that assist higher outline whether a sustainability venture is an environmental one, monetary and so on. Ethics can be utilized inside all three pillars of sustainability and need to be existing at some point of the collaborative decision-making processes. The want for ethics in sustainability is vital to reflect on consideration on at some point of these strategies and when all viable stakeholders in an issue. There is a want to preserve moral values when coming up with a answer and the enter from all stakeholders thinking about the sorts of challenges or implications that can also come out of a practicable solution. The inclusion of ethics in sustainable selection making creates a greater various technique in that it bridges the boundaries between stakeholders who would no longer in any other case talk with every other. This may additionally require some social, political, or even cultural sacrifices, however it is sooner or later recommended in the grand scheme of things.

Research methodology:

Research problem

Ethical issues in corporate are of major concern. Therefore, it is imperative to know the Ethical issues for corporate sustainability which affects the work culture and if it exist what may be the possible solution for the same.

Research objectives:

- 1) To study the Ethical issues for corporate sustainability.
- 2) To study the solution for Ethical issues for corporate sustainability.

3. Scope of the research

For the intension to complete the research project an attempt is made by the researcher to identify Ethical issues for corporate sustainability. Thus, for the same the scope of study was restricted to the employees working in Indian and International Companies.

4. Research Design

For the research purpose of research design undertaken is Exploratory and Descriptive in nature.

5. Sampling Design

The sampling design adopted by the researcher is simple random sampling with the sample size of 250 respondents.

6. Research Approach

The research approach adopted by the researcher is Deductive in nature where the hypothesis is considered and proved with the appropriate Mathematical and Statistical Techniques.

7. Mathematical and Statistical Techniques

Mathematical and Statistical techniques used for the data analysis is One way ANOVA.

8. Limitations of the Research

- 1) Limited sample size was considered
- 2) Limited scope of research was focused.
- 3) Respondent may have biased answers to the questions.
- 4) Limited variables for the study.
- 5) Limited Time for the study.

Data analysis and findings:

To Satisfy the objectives of the research an attempt was made by the researcher to analyse the data with appropriate tools.

To satisfy the first objective regarding Ethical issues for corporate sustainability, One way ANOVA was considered as the statistical tool for the data Analysis. This test was applied to find the significant factors which lead to Ethical issues for corporate sustainability.

Table 1: ANOVA

Significant factors for the Ethical issues for corporate Sustainability		Sum of Squares	df	Mean Square	F	Sig.
Discrimination and harassment	Between Groups	5.572	4	1.393	.759	.025
	Within Groups	451.656	246	1.836		
	Total	457.228	250			
Workplace health and safety	Between Groups	26.72	4	6.680	2.711	.029
	Within Groups	606.144	246	2.464		
	Total	632.864	250			
Whistle-blowing or social media rants	Between Groups	11.701	4	2.925	1.414	.027
	Within Groups	508.974	246	2.069		
	Total	520.675	250			
Corporate espionage and non-disclosure	Between Groups	.733	4	.183	.083	.988
	Within Groups	541.446	246	2.201		
	Total	542.179	250			
Ethics in accounting practices	Between Groups	18.388	4	4.597	2.281	.050
	Within Groups	140.41	246	2.016		
	Total	158.79	250			
Technology and privacy practices	Between Groups	4.187	4	1.047	.570	.684
	Within Groups	133.98	246	1.836		
	Total	138.17	250			
Nepotism or favouritism	Between Groups	43.502	4	10.875	4.181	.002
	Within Groups	94.579	246	2.601		
	Total	138.08	250			

Source: Trial SPSS

Findings:

From the above table p value for Discrimination and harassment, Workplace health and safety, Whistle-blowing or social media rants, Ethics in accounting practices and Nepotism or favouritism < 0.05 Thus, these are significant Ethical issues for corporate Sustainability.

To satisfy the Second objective regarding solution of Ethical issues for corporate sustainability, One way ANOVA was considered as the statistical tool for the data Analysis. This test was applied to find the significant factors which lead to solution of Ethical issues for corporate sustainability.

Table 2: ANOVA

Significant factors for the Ethical issues for corporate Sustainability		Sum of Squares	df	Mean Square	F	Sig.
Be a good role model	Between Groups	5.572	4	1.393	.759	.025
	Within Groups	451.656	246	1.836		
	Total	457.228	250			
Promote your ethical behaviour	Between Groups	26.72	4	6.680	2.711	.029
	Within Groups	606.144	246	2.464		
	Total	632.864	250			
Learn from your mistakes	Between Groups	11.701	4	2.925	1.414	.027
	Within Groups	508.974	246	2.069		
	Total	520.675	250			
Create a code	Between Groups	.733	4	.183	.083	.988
	Within Groups	541.446	246	2.201		
	Total	542.179	250			
Be Transparent	Between Groups	18.388	4	4.597	2.281	.050
	Within Groups	140.41	246	2.016		
	Total	158.79	250			
Move with the times	Between Groups	4.187	4	1.047	.570	.684
	Within Groups	133.98	246	1.836		
	Total	138.17	250			
Unbiased Environment	Between Groups	43.502	4	10.875	4.181	.002
	Within Groups	94.579	246	2.601		
	Total	138.08	250			

Source: Trial SPSS

Findings:

From the above table p value for Be a good role model, promote your ethical behaviour, Learn from your mistakes, Be Transparent and Unbiased Environment < 0.05 Thus, these are significant solution for Ethical issues for corporate Sustainability.

Conclusion:

Based on the results of the research mentioned in the chapter number 3, it is concluded that Discrimination and harassment, Workplace health and safety, Whistle-blowing or social media rants, Ethics in accounting practices and Nepotism or favouritism are significant Ethical issues for corporate Sustainability. Also, Be a good role model, Promote your ethical behaviour, Learn from your mistakes, Be Transparent and Unbiased Environment are significant solution

for Ethical issues for corporate Sustainability. Thus, from the implementation of the corporate ethics program that has been carried out by the company, it is proven that the company can maintain the company's going concern. This indicates that the implementation of the corporate ethics program carried out by the company can maintain the company's corporate sustainability.

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IS GOOD TEACHING CAUGHT OR TAUGHT? - RE-THINKING TEACHING AND LEARNING STRATEGIES FOR GENERATION Z

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Abstract:

As the world we live in changes to embrace tech futures, how and what we teach in our education system will also be reshaped to keep up to date with the growing demands of the 21st century. Curriculum teaching and learning already extends well beyond the classroom and will continue to do so, and as education changes to suit the future's needs, the role of a teacher must also adapt and grow. It is each teacher's responsibility to empower students to take risks, be innovative and seize any opportunity thrown their way. In light of a shift towards a more personalised learner experience, teachers of the future must be prepared to be data collectors, as well as analysts, planners, collaborators, curriculum experts, synthesizers, problem-solvers and researchers. The formal classroom should be replaced by learning areas that allow individuals, small groups or larger groups to collaborate face-to-face or virtually on learning projects. Classrooms of tomorrow need to focus on a combination of student engagement in learning, enquiry-based approaches, curiosity, imagination and design thinking. Teachers need to be constant and adaptive learners to meet the expectations of the youth. Knowledge should be blended with values and attitudes. Let's explore the techniques and the methodology to be adopted in future classrooms which is likely to be transformed over the next few years.

Keywords: Social and technological changes, future teachers, inclusive education, global well being.

Introduction:

Our world is changing fast. The pace of change, particularly when it comes to new technologies, means the half-life of skills is shrinking fast. The days of a "job for life" are gone forever. The education sector must adapt in line with this shift and reflect the fact that the essential, in-demand skills of the future will be very different from what has been taught in the past. In other words, what we teach has to change. Furthermore, how we teach must also change to reflect the rapid digitization that is taking place across all industries, not just education.

The 2019 Annual Teaching Professor Conference offered numerous tactics and strategies to implement in the classroom, but Ken Alford, PhD, Brigham Young University, took a different approach in his session for instructional vitality and divulged the best teaching advice he's received throughout his teaching career. Here's what he's gathered:

Let your students get to know you

On the very first day of class, share a family photo and let your students know there's life beyond the classroom. You can even tell the story of your family members to have a personal touch with the students. Make yourself real. Let them get to know you.

Help students get to know each other

Students most likely won't engage with one another unless you encourage them to do that. Start your courses with a *Get to Know You* form, and one of the questions on the form is, "What's something about yourself that you would never tell me unless I asked?" This type of question helps to understand the students in a better way.

Lighten up a little!

If you don't have fun with students in the classroom, you're doing it wrong. You've already got a captive audience.

Always be learning

Some hold the philosophy that once graduated with a degree, the door shuts, Alford says. "If there's no Eureka! moments for the teacher, there will be even fewer of these moments for the students." It's also okay to learn from the students. Sometimes you can even incorporate what you have learned from the students into your lessons.

Admit when you don't know something

It's a fact that you won't always know the answer. So, instead considering saying to a student, "If I knew the answer, I would sound smart, but I'm going to find the answer for you." Then, once you find the answer, teach the entire class how you found it. "I think that's just as valuable if the students can see the process."

Engage the entire student

You have to do some goofy things to keep students entertained. If you see students drifting, it is better to have random pictures ready at the end of your presentations. Pointing the picture you can ask the students, "How is this picture connected to what we're doing right now?" The picture, always outrageous, will absolutely have no connection to the content, but to our surprise students will *always* come up with a connection because our students are always clever.

Watch other teachers

Whether you learn something negative or positive from watching others teach, both are instrumental. "And it's okay to borrow as long as it's done with love and permission. If we're not sharing with each other, we're just doing more work—all of us."

There is power in examples

Too often we explain something and will assume our students get it right away. That's not always the case. Instead, identify what we call as "two canaries." One canary is the one who "may die of embarrassment from being called upon" and the other is the one who "thinks they know it all." If both of these individuals understand the lesson, then you're on the right track.

Right-size your course, your lessons, exams and assignments

Don't cram as much as you can into an exam, lesson, or assignment. Instead, if you end up adding five minutes of content to your lecture, you've also got to take five minutes out.

Tell more stories

Think of the power of stories. They illustrate so many concepts, and so often you can be teaching students with a story more effectively.

Fun with Mad Lib stories

Create interactive stories that allow the students to fill in the parts by their own imagination. Then, it becomes the student's story, and you can teach them a lesson based on their own creation. They'll be much more likely to retain this information in the future.

Help students see their potential

Many students don't see the potential in themselves, so it's important to remind students of their infinite potential. An innate passion to teach and the overall desire to keep learning fosters a great teacher. "Remember, it's an honor to teach," says Alford. "And, there's always room to improve as a teacher."

Four key ways education is set to change in the near future.

1. Connectedness, collaboration and co-creation

The concept of a teacher standing in front of a room full of students who listen and respond to direction is increasingly a thing of the past. While not an entirely new approach, student learning spaces will supercede the typical classroom that we know today. This will see students become partners or co-creators of their own learning. "Experiences that allow collaboration, communication and teamwork for all students often happen beyond classroom walls. We need to facilitate for these experiences in context, and our classrooms need to be a reflection of this," says McLaughlin. They should be set up to allow collaboration to occur on learning projects between individuals, small groups or larger groups. Classrooms will coexist as physical spaces and online, flipping the current learning model upside down so that students can learn at home and spend class time collaborating and applying their knowledge to real-life issues.

2. Anywhere, anytime learning

As we ride the wave of the digital era, it is becoming easier to get connected with a global reach. A world of information is at your fingertips with the click of a button or a simple voice command, and, as technology continues to advance, students need to grow their learning with it. Technology is no longer a motivating factor when it comes to learning – it is a must. It's something that needs to be incorporated in the future of education to ensure students are equipped with the skills to cope in a world dependent on technology. While some argue that technology in our classrooms creates lazy, disconnected students, McLaughlin believes this is a myth. She says technology has created endless boundaries of where learning can occur, with whom and why. "The reality is, classrooms can be anywhere anytime. Students can be working

on projects in virtual contexts with other students from around the world at any given moment,” she says. Technological advances have enabled interconnectedness of information and people with the touch of a button. Education in the future will need to demonstrate how technology can be used to students’ advantage, as well as teach future generations how to handle problems that arise from it. “Technology can change learning forever and we need to embrace it and manipulate it to our advantage,” says McLaughlin.

3. Customisation for a learner-first approach

Alongside our changing notions of what constitutes a classroom, our ideas about the way teaching is delivered must also be reshaped. “Most professions treat each individual’s case differently – each patient of a doctor has individualised treatment plans. Education should be no different,” McLaughlin says that the old model of teaching and learning is outdated and has no place in the agenda for future education. Teachers will become facilitators of learning and students will have more control of their own learning journey. “In the past, all children did the same work regardless of ability or skills. We now know that this contributes to disengagement, misbehaviour and poor outcomes,” she says. As a result, teachers should have individualised learning plans for students, which will enable each student to learn at a pace that best suits their abilities and to engage with content that is most beneficial to them. A combination of evidence-gathering and feedback from parents, students and other professions will enable these plans to be successfully integrated into the education system. To maximise the potential for individual progress, some elements of teacher-led learning will remain, which will augment traditional learning practices when combined with online digital media.

4. Putting testing to the test

McLaughlin poses the question “what are we testing for?”. Students today are heavily focused on the end result – achieving that high score, receiving a distinction in class, acing those tests. Education of the future will prove what you have been told many times before: results do not define you. McLaughlin believes that testing on its own can be a dangerous approach. “We too easily jump onto the test results in isolation of what we need to achieve. This can lead us off in the wrong direction to what’s really important,” she says, that grading is a waste of time if its purpose is solely to find out who is at the top and who is at the bottom. Assessments in the future should be evidence based, using measures that allow learning plans to be drawn up and personalised. “The big question is ‘why are we grading and for whom?’,” McLaughlin says. “Surely we want a society in which everyone is able to do the job and elements of it competently. Do exams really prepare us for this future?”

Educators of the future - Rethinking what we teach

Education – at all levels – must evolve to teach children the skills they need to thrive in our changing world. LinkedIn predicts 150 million new technology jobs in the next five years, and almost all of the roles in LinkedIn’s “Jobs on the Rise” report for 2022 can already be done

remotely. So, what sort of skills will be essential for success? In its Schools of the Future paper, the World Economic Forum outlined essential characteristics that will define high-quality learning in the future. Skills such as:

- Global citizenship skills (including awareness of the wider world, and sustainability).
- Innovation and creativity skills (including problem-solving and analytical thinking).
- Technology skills (including data science and programming, which I believe should be offered as a language option as standard).
- Interpersonal skills (including emotional intelligence, empathy, cooperation and social awareness).

Formal education originated around the time of the first industrial revolution, and it's telling that our general approach to education has changed little since then. In classrooms and lecture halls around the world, students still mostly sit facing the front, listening to the teacher deliver content that they're expected to memorize. This isn't to criticize teachers and lecturers. But in order to teach the skills that are necessary to thrive in the 21st century, and create the leaders that our world needs, the way in which education is delivered must adapt innovative strategies. In particular, I believe the teachers of the future will become facilitators rather than content deliverers. Some of the key enablers of this change are:

- More digitized content and online learning – a trend that has drastically been accelerated by the COVID-19 pandemic.
- More personalized, self-paced, and self-directed learning – in which learning becomes much more flexible and is paced to suit the needs of each student.
- More collaborative, project-based and problem-based learning – which better reflects the 21st century workplace.
- More bite-sized learning – because, according to a study by Microsoft, humans now have an attention span of around eight seconds. (That's less than a goldfish!) In the future, more education will have to be delivered as bite-sized, snackable content.
- More immersive learning – harnessing technologies like virtual reality and augmented reality to bring topics to life and immerse students in a subject.

Different generations of students have enrolled and graduated from higher education institutions for many decades. Throughout these decades, educators have been using the same strategies despite what generation is present in their classroom. Schwieger and Ladwig (2018) discuss a newer generation of students, Generation Z, who have unique characteristics and expectations. Individuals from this generation are born between 1996 and 2012. Like millennials, they were raised with technology. However, for Generation Z, technology is part of their everyday life activities. The question is, is it important for us as educators to evaluate our own teaching strategies year by year? Many may not think it is necessary, but educators must be conscious about these new generations who come into the classroom with unique characteristics.

Seemiller and Grace (2016) state that Generation Z consider themselves loyal, thoughtful, compassionate, open-minded, and responsible. Generation Z pursues to make changes in our society. And according to Seemiller and Grace (2016), this is a challenge because they prefer to work alone and occasionally lack creativity. What does this mean for us as higher education professors? We need to help and guide Generation Z students in their higher education endeavors.

First, as educators, we sometimes evaluate students through exams and research papers. This type of assessment solely tells us what students have memorized for a specific exam or what they know about a specific topic. Our new generation needs more than that. They need real-life knowledge that can be related to their job area. Generation Z is digital, and we, as professors, have access to the digital world. So, let us become more skilled in different types of devices, programs, and applications that can be integrated into our classes. We have to develop activities that are related to the course, and at the same time are meaningful to our students.

The following are a few ways of utilizing different technologies to help engage the students and foster motivation:

- Generation Z students are on their cellphones *a lot*, and most of them use their phones for everyday activities. In this case, students can use their cellphones to access their class textbooks or manuals online. Also create a blog where they can read articles related to class discussions, post comments, and at the same time, practice reading and writing in English. For example, they can start a discussion based on articles pertinent to class, such as why academic writing is important?
- Students also love social media. We can use Facebook Live with students. After listening to the conference, ask them to write a summary and give their opinion on the topic. This provides insight on life and work skills. Students will find this way of retaining information relevant to their everyday life and, at the same time, enjoy learning.
- YouTube is another application that helps our students in their learning and can be of great help to both students and professors. Generation Z is very visual and interested in using YouTube for their learning. These students prefer surfing the web and looking for answers before asking for help. Of course, when using YouTube videos, it is important to carefully select videos that are acceptable for students.
- The use of technology is not the only strategy we should re-think. We should also search for other ways of assessment and tools for how we present material to students of Generation Z.

The following are some ideas that you can start using right away:

- **Short online quizzes:** Generation Z students prefer to answer short, online exams. Upload quizzes and ask students to answer these short quizzes in the classroom—they can use their cellphones to do this.

- **Teams/small groups:** According to Rothman (2018), Generation Z prefers to work in small groups. When they work in small groups, they can foster more creativity. During the process, you can see how much they enjoy this exercise by their enthusiasm as they share their final product with their classmates.
- **Active learning activities:** Research has identified that Generation Z has a short attention span. One approach that we can use is writing a short summary in teams or individually. This activity helps to identify what needs to be reviewed. Also, “One Minute Papers” are very effective for this purpose.
- **Games:** Games are very effective to review material and allow students to share knowledge. Students can become very active and put forth a lot of concentration on the game. Generation Z students are virtual gamers, and they love game challenges.
- **Caring and feedback:** This is the most important strategy. When we care about what is happening to our students and their needs, students become more engaged in the classroom. Caring about their progress gives them constant and positive feedback. Although we may correct their papers, we give them feedback on how they can improve, and we motivate them by giving them encouragement. Positive words change people, and we need to do this with our students.

Conclusion:

Understanding Generation Z’s unique characteristics will help higher education educators re-think what they are doing in their classrooms. We need to become conscious about our students’ learning needs. Although it may not be possible to work individually with each and every student, we can try to understand their learning needs and implement new ideas. Students’ achievements are our greatest gift!

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UNLEASHING THE POWER OF NON-RESIDENT INDIANS (NRIS): A GAME-CHANGER IN THE ECONOMIC DEVELOPMENT OF INDIA

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Abstract:

Non-Resident Indians (NRIs) refer to Indian citizens who have migrated to other countries for employment, education, business, or any other purpose and hold an Indian passport. NRIs have made significant investments in various sectors such as real estate, stocks, mutual funds, and small businesses, providing a stable source of foreign exchange to the country. Additionally, NRIs have contributed to the growth of the Indian economy by providing remittances, creating job opportunities, transferring skills and knowledge, contributing to the start-up ecosystem, and investing in affordable housing projects. The Indian government has also been taking several initiatives to encourage NRIs to invest in India, which has further boosted the contribution of NRIs to the country's economy. Overall, NRIs have played a vital role in the growth and development of the Indian economy in recent years. The objective of this article is to present an overview of the role played by Non-Resident Indians (NRIs) in the economic development of India across different sectors, as well as to discuss the measures taken by the government to encourage NRIs to invest in India.

Keywords: NRIs, Indian Economy, Investments, Development

Introduction:

India is a land of diversity and has been the homeland of a large number of people who have emigrated to different parts of the world for various reasons. Non-Resident Indians (NRIs) refer to Indian citizens who have migrated to other countries for employment, education, business, or any other purpose and hold an Indian passport. They play a crucial role in the development of the Indian economy (Chandrasekhar, 2019). While they may not be the sole driving force behind the economy, they are an important component of it. In light of the economic slowdown currently facing India, with high inflation rates and widespread financial difficulties, the Indian government is looking to NRIs to invest in the country and help resolve the crisis (Zafar, 2019). The contributions of NRIs to the Indian economy cannot be overstated, with earnings estimated to be around \$250 billion, equivalent to one third of India's GDP (OECD, 2021). NRIs have been actively involved in various non-governmental organizations in India, helping with development, education, and social projects, as well as environmental and social issues (Government of India, 2021). To further bolster the Indian economy, the government should incentivize NRIs to invest in India and participate in other developmental

activities in the country (Singh, 2018). However, it's important to note that the development of India is not solely dependent on the growth of NRIs, but on the collective efforts of everyone to make India a better and more prosperous nation (Sainath, 2017). In this article, we will discuss the contribution of NRIs in various sectors of the Indian economy.

NRI'S-The backbone of Indian economy

Non-Residential Indians (NRIs) refer to Indians who reside outside India for various reasons. As per the Reserve Bank of India (RBI), the total amount of NRI deposits in Indian banks was approximately USD 130 billion in March 2020 (RBI, 2020). India possesses abundant natural resources, essential for its economic development, but lacks the required capital to harness them and advance its economy. As a result, India relies heavily on foreign investments, with NRIs playing a significant role in this area. Following the liberalization policies introduced in the 1990s, many NRIs invested in the Indian economy, considering its immense growth potential (Zafar, 2019). According to the World Bank, India received USD 83 billion in remittances in 2019, making it the highest recipient of remittances globally (World Bank, 2020). This investment has enabled the Indian economy to generate foreign currency funds, develop various industrial sectors, improve quality through competition, and create new opportunities within the country.

NRIs have contributed significantly to the growth of the Indian economy and development of its infrastructure, indirectly raising the standards of living for the people. The Reserve Bank of India has directed Indian banks to attract NRI deposits, with various short- and long-term investment plans available to them. Additionally, NRIs are encouraged to establish businesses and educational institutions, with reports suggesting that they are a significant source of direct foreign investment, market development (outsourcing), technology transfer, charity, tourism, political contributions, and knowledge flows in India (Singh, 2018).

Indians in Gulf:

Non-Residential Indians (NRIs) have been actively involved in various non-governmental organizations (NGOs) that cater to developmental, educational, and social projects in India. The presence of a large number of NRIs in such welfare programs has been noticed, with many of them registering NGOs to promote education, healthcare, and other developmental activities such as water management, rural development, and self-help programs. These efforts have contributed significantly to the overall development of India and have helped uplift the standards of living for many. Moreover, there has been an increasing trend of highly qualified and experienced NRIs returning to India. The combination of their professional knowledge and monetary resources could prove to be highly beneficial for the country's development. These individuals possess valuable skills and expertise that could help create new job opportunities, foster innovation, and spur economic growth. Additionally, their contributions to society in terms of funding for charitable causes and investments in various sectors could significantly impact

India's progress towards achieving its development goals (Zafar, 2019). Overall, the active involvement of NRIs in various developmental and social initiatives in India has been a positive trend. By leveraging their skills, expertise, and financial resources, NRIs can play a significant role in contributing towards India's growth and development. However, it is crucial to ensure that such efforts are well-coordinated and effectively implemented to maximize their impact on society.

NRI services in India

1. Investment in real estate

According to recent data, NRIs have shown a greater inclination towards investing in real estate in India, with an average return on investment of about 8-10% in 2021 (Sharma, 2021). This is lower compared to the average returns of 14-17% in the previous decade. On the other hand, the Sensex has delivered returns of about 20% in 2021 (Chatterjee, 2022). The top-performing diversified equity mutual funds have also given returns in the range of 15-20% in the current year (ET Bureau, 2021). While past performance is not always an accurate indicator of future performance, experts believe that if the Indian economy continues to grow at a rate of 8-9% in the upcoming decade, the pattern of real estate investment providing lower returns compared to equities may persist (Khurana, 2021).

2. Investment in mutual funds

Non-Resident Indians (NRIs) and Persons of Indian Origin (PIOs) are allowed to invest in mutual fund schemes in India without requiring any special approval from authorities like the Reserve Bank of India (RBI). NRIs can invest in mutual funds on a repatriable basis or non-repatriable basis, depending on their preference. To invest on a repatriable basis, they must have an NRE or FCNR account with a bank in India, and the investment money should be remitted through usual banking channels or from the NRE/FCNR account of the NRI investor. On the other hand, investment on a non-repatriable basis can be made with funds provided from the NRO account or NRE/FCNR account of the investor.

3. Investment opportunities in infrastructure sector

Foreign investors, including Non-Resident Indians (NRIs), can explore investment opportunities in India's infrastructure sector to achieve stable returns on investment. This sector has been attracting a significant amount of unlisted, close-ended funds, making it a highly preferred choice for investment. The Indian government has projected that the infrastructure sector will attract over US\$1.1 trillion in investments over the next five years, including projects like the National Highway Development Project (NHDP) (Government of India, 2021). NRIs and foreign investors can take advantage of investment opportunities offered by the National Highways Authority of India (NHAI) for the upcoming phases of NHDP, with contracts being offered to foreign companies. The industrial infrastructure sector, which is expected to generate more than 90 million jobs across different sectors in India over the next decade, creating a need

for more than 8 million square feet of office space, will also be an attractive option for foreign players seeking investment opportunities.

4. Investment opportunities in roads

The Indian Government has opened doors for private & NRI participation in the development of the road network in the country. Under this scheme, the Government will undertake all the preparatory work required for the projects identified for private investment. This includes the cost of the detailed feasibility study, acquiring land for right of way and en-route facilities, relocation of utility services, resettlement and rehabilitation of affected establishments, and obtaining environmental clearances, which are not required for existing routes. The initiative aims to encourage private participation in the road network development, which will not only improve the quality of the roads but also create more job opportunities in the country.

5. Investment opportunities in Indian railways

Recently, the Indian Cabinet has approved private investment in state-run Indian Railways for constructing new plants and lines with enhanced capacity. This decision will also open up doors for Non-Resident Indians (NRIs) to invest in the Indian infrastructure sector. The Indian Railways Vision 2020 has been projected by the Government of India to tackle infrastructure issues, which includes inviting foreign investment to make all the projects financially feasible. NRIs can take advantage of this reform by investing in the Indian Railways and contributing to the development of the country's infrastructure. This move is expected to provide foreign players with opportunities to connect railways with industrial plants, mines and ports by offering services at lower costs.

6. Investment opportunities in ports

Investment in India's port sector is needed to increase capacity and upgrade existing infrastructure using modern technology. Port Trusts, which are managed by the Central Government, oversee major ports in the country. The government has introduced guidelines to encourage private sector participation in major ports, with initiatives focused on enhancing port activities and modernizing equipment (Singh, 2018). This presents a promising opportunity for foreign investors, including NRIs, to invest in India's port sector and contribute to the country's economic growth.

7. Investment opportunities in power sector

The Indian government's policy to encourage private investment in the power sector allows 100% foreign-owned companies to set up power projects and repatriate profits without export obligations. The policy offers opportunities for private investors in power generation, distribution, renovation, modernization, and co-generation. The attractive return on investment and broad-based tariff structure provide flexibility for determining tariffs, making it a lucrative investment option for NRIs. With the high demand for power in India, the policy offers enormous

opportunities for investors looking for stable returns.

8. Private participation in the power sector - policies and incentives

The Indian government has amended the Indian Electricity Act, 1910 and the Electricity (Supply) Act, 1948 to create a new legal, administrative, and financial environment for private enterprises in the electricity sector. This opens up opportunities for NRIs to invest in the sector as private companies can now set up thermal projects, hydel projects, and wind/solar energy projects of any size. Additionally, the government has allowed private companies to have a debt-equity ratio of up to 4:1. Foreign investors can also participate in the sector as projects set up by foreign private investors can have up to 100% foreign equity participation. Furthermore, the rates for depreciation in respect of assets have been liberalized, and the government has allowed the import of equipment for power projects with concessional credit. The customs duty for import of power equipment has been reduced to 20%, and this rate has been extended to machinery required for renovation and modernization of power plants. In addition to this, the government has provided a five-year tax holiday for companies entering the electricity sector, and the excise duty on a large number of capital goods and instruments in the power sector has been reduced. All of these measures offer an attractive environment for NRIs seeking to invest in India's power sector, which has significant growth potential due to the high demand for power in the country.

The Indian government has provided a supportive structure to promote power projects in the country. State governments have been advised to explore the possibility of setting up barge mounted power plants. Additionally, to encourage captive power plants, including co-generation, guidelines have been issued to state governments for creating an institutional mechanism to ensure early clearance of proposals and effective measures such as purchasing or wheeling surplus power from such plants. These initiatives aim to provide more opportunities for private sector investment in the power sector and to improve the overall power supply in the country.

9. Investment in print media sector

Foreign Direct Investment (FDI) up to 100% is permitted in the publishing of scientific magazines, scientific journals, and periodicals, subject to approval from the Foreign Investment Promotion Board (FIPB). For publishing newspapers and periodicals dealing in news and current affairs, FDI up to 26% is allowed, with the condition that the antecedents of the foreign investor are verified and editorial and management control remains in the hands of resident Indians. Furthermore, there should be no dispersal of Indian equity. These regulations offer opportunities for NRIs to invest in the publishing sector in India, subject to the specified conditions.

The fig 1 illustrates the trend analysis of GDP, Total FDI inflows and Forex. As per the analysis, it has been observed that the trend line of GDP increases every year. In the commencing year of 2011-12, the GDP amount stood at ₹ 87,36,329 crores, and the highest amount of GDP was recorded in the year 2019-20 with ₹ 2,03,51,013 crores. However, there was no increment in the year 2020-21. Moreover, the trend line of Forex demonstrates a positive trend over the years

from 2011-12 to 2020-21, while the trend line of Total FDI Inflows shows a stagnant trend over the same period (Goyal *et al.*, 2022).

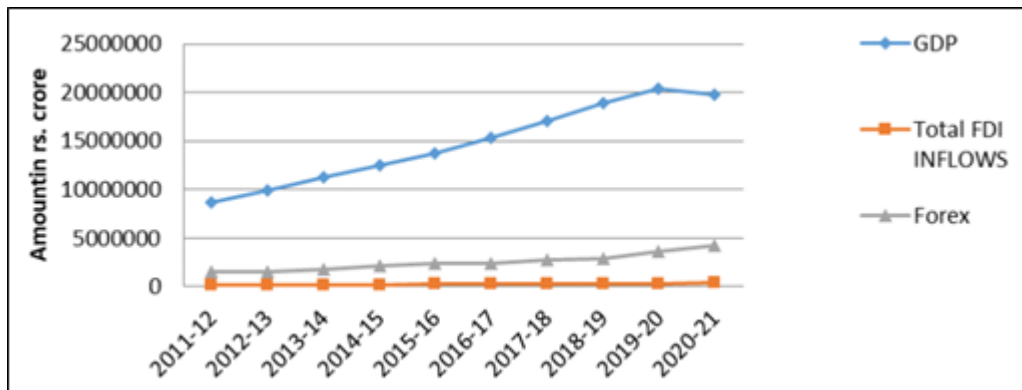


Figure 1: Foreign Direct Investment inflows in India (2011-12 to 2020-21)

10. Investment opportunities in software's

The STP (Software Technology Park) scheme presents an opportunity for NRIs to participate in the development and export of computer software, including the export of professional services. This 100% Export Oriented Unit (100% EoU) allows for the establishment of virtual software development units or the creation of infrastructural complexes to support STP units. NRIs can leverage data communication links or physical media to develop and export computer software as part of the STP scheme. By participating in this scheme, NRIs can contribute to the growth and development of the Indian software industry and take advantage of the benefits of the STP scheme.

11. Investment opportunities in tourism

Foreign technological agreements and 51% foreign equity holdings in the "Hotel and Tourism-related Industry" have been granted automatic approval by the Central Government, subject to certain norms. NRIs are permitted to hold up to 100% equity. The Reserve Bank of India, Bombay is responsible for granting these approvals. In cases where more than 51% equity is desired, clearance from the Foreign Investment Promotion Bank is required. The Tourism Finance Corporation of India and State Finance Corporations will also provide loan facilities.

Governing bodies of foreign investment in industrial sector

Secretarial for Industrial Assistance (SIA)

The Indian Government has established SIA (Secretariat for Industrial Assistance) under the Ministry of Industry's Department of Industrial Policy & Promotion. Its purpose is to provide a one-stop-shop for entrepreneurial support and investor facilitation, processing all applications that necessitate government approval. SIA also assists entrepreneurs and investors in setting up projects and monitors their implementation.

Foreign Investment Promotion Board (FIPB)

The Government of India has established a board chaired by the Secretary of the Department of Industrial Policy & Promotion, with the aim of promoting accelerated growth in the industrial sector, increasing inflows of Foreign Direct Investment into the country, and providing appropriate institutional arrangements, transparent procedures, and guidelines for investment promotion. The objective of the board is to promote foreign direct investment into India, by considering and recommending proposals for foreign investment, facilitating investment in the country by international companies, non-resident Indians (NRIs), and other foreign investors, and undertaking investment promotion activities. The board has the flexibility to negotiate purposefully with investors and considers project proposals in totality, free from parameters, with a view to maximizing foreign direct investment into the country.

The objective of the Board is to promote foreign direct investment into India:

1. By undertaking investment promotion activities;
2. Facilitating investment in the country by international companies, Non Resident Indians (NRIs) and other foreign investors.

The Board exercises the authority to evaluate investment proposals, whether or not they involve technical collaboration and/or industrial licensing. The Board is empowered to engage in purposeful negotiations with investors and assesses project proposals holistically, without being constrained by parameters, with the ultimate goal of maximizing foreign direct investment inflows into the country.

Foreign Investment Implementation Authority (FIIA)

The Foreign Investment Implementation Authority (FIIA) has been established with the aim of expediting the conversion of FDI approvals into actual implementation, and to offer foreign investors a convenient single-window service for obtaining necessary approvals, resolving operational difficulties, and engaging with government agencies to address issues. The FIIA is headed by the Secretary of the Department of Industrial Policy & Promotion and is supported by the SIA.

The Investment Promotion and Infrastructure Development Cell

The Investment Promotion and Infrastructure Development Cell is a specialized unit established to perform the following functions:

- ↻ Disseminate information on the investment climate in India.
- ↻ Facilitate investment by providing necessary support and guidance.
- ↻ Develop and distribute publicity material and information to attract potential investors.
- ↻ Organize meetings, symposiums, and seminars to promote investment.
- ↻ Provide match-making services to connect investors with suitable projects.
- ↻ Coordinate the progress of infrastructure projects in sectors such as power, telecom, ports, and roads.

- ✦ Develop industrial model towns, industrial parks, and other similar projects.
- ✦ Promote foreign direct investment in the infrastructure sector.
- ✦ Disseminate specific information on sectorial policies and guidelines pertaining to the infrastructure sector.

Conclusion:

NRI's have played an indispensable role in India's recent economic development. Their invaluable contributions across various sectors have generated countless employment opportunities, making a significant impact on the nation's economic trajectory. They have made decisive investments in India and facilitated the transfer of knowledge to help shape the country's economic future. The Indian government recognizes the crucial role NRI's play and is actively taking steps to incentivize and retain their investments. India's highly rated investment potential, political stability, and favorable foreign investment policies provide an ideal environment for investors. As global citizens, they have actively contributed to enhancing India's image worldwide and attracted foreign companies to invest in India. Given the right opportunities, NRI's could become long-term partners in India's development, as well as in other countries with large NRI populations. They can actively participate in shaping India's social and economic conditions, and the Indian government should encourage and engage them in developmental activities. The contribution of NRI's to India's development is crucial, and it is imperative to acknowledge their significant involvement. They have been instrumental in shaping India's economic landscape in recent years, creating employment opportunities and making noteworthy contributions. As the world moves towards greater globalization, NRI's can play a pivotal role in shaping the global economic and social environment. Therefore, it is vital that the Indian government continues to encourage and engage NRI's in the country's developmental activities.

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A STUDY ON CUSTOMER EXPECTATIONS TOWARDS SIDDHA MEDICINE IN TIRUNELVELI DISTRICT

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Abstract:

Siddha medicine is a system of traditional medicine originating in Tamilnadu. The siddha was prevalent in south and ayurvedha in the north, instead of giving the name of any of individual as the founder of these systems our ancestors attributed their origin to the creator. An analytical study is conducted based on customer expectations towards siddha medicine. Sources of data are primary and secondary data. Probability sampling techniques were used. Samples are collected in random method. Area of the samples is in Tirunelveli. The main objective of the study is to know the consumer satisfaction. Reviews are collected from various authors. In data analysis and interpretation in tabular form, and 200 respondents are there in data analysis. By the findings we may get know that the customer used siddha products because of good quality of siddha medicine. Different types of suggestions are given. By the analysing we conclude that all the consumers who are using siddha medicines look to recommend the siddha medicines because of its naturality and without any side effects.

Keywords: Siddha, Ayurvedic, Good quality, Consumer satisfaction, Probability sampling technique

Introduction:

Siddha medicine is a system of traditional medicine originating in Tamilnadu. The siddha system is based on a combination of ancient medicinal practices and spiritual disciplines as well as alchemy and mysticism. Siddha were spiritual adepts who possessed the asthma siddha, or the eight supernatural powers. Agastyar is considered the first siddha and the guru of all siddha; the ministry of ayurveda, yoga and naturopathy, unani, siddha and homeopathy of the government of India coordinates and promotes research in the fields of ayurvedic and siddha medicine. The Central Council of Indian Medicine (CCIM), a statutory body established in 1971 under ayush, monitors higher education in areas of Indian medicine, including siddha medicine.

According to tradition, the origin of siddha system of medicine is attributed to the great siddha 'Agastya'. Some of his works are still standard books of medicine and surgery being used among the siddha medical practitioners, siddha system consists of five elements that exist in nature; earth, water, fire, air, and ether all of which form the original basis of all corporeal things, It is believed that there is an intimate connection between the macrocosm of the external world and the microcosm of the corporeal being.

Origin of siddha

The siddha was prevalent in south and Ayurvedha in the north, instead of giving the name of any of individual as the founder of these systems our ancestors attributed their origin to the creator. According to the tradition it was Shiva who unfolded the knowledge of siddha system of medicine to his consort Parvathi who handed it down to Nandi Deva and the siddha. The siddha were great scientists in ancient times. In the siddha medicine system use of metals, minerals and chemical products is predominant. The use of metals started from the period of Vagbhata. The siddha treatment is aimed at restoring balance to the mind-body system. Diet and life style play a major role not only in maintaining health but also in curing diseases.

Statement of the problem

The success of siddha field depends mainly on customer satisfaction on siddha products. Siddha treatment consists of three distinct categories as divine method, rational method and surgical method. The siddha system of medicine emphasises that medical treatment is oriented not merely to disease but has to take into account the patient, environment, the meteorological consideration, age, sex, habits, mental frame, habitat, diet appetite, physical condition, physiological constitution in etc. This means the treatment has to be individualistic, which ensures that mistakes in diagnosis or treatment are minimal. So, an analytical study is conducted based on customer expectations towards siddha medicine.

Data sources

Types of research

In the present study, mainly descriptive research design had been adopted, as the main purpose of this study was to make fact finding study.

Primary data

The primary data was collected from the siddha medicine user, through the structured questionnaire and discussion with the siddha medicine users.

Secondary data

Apart from primary data the secondary data is being collected through the text books, journals, reports and websites.

Sampling design

Sampling technique

- **Probability sampling** - For selecting individuals for each member of the population has an equal chance of being selected to be added to the study.
- **Sampling method** - Sampling method of study used in simple random sampling used in this study.
- **Sample size** - People who use siddha medicines are taken as the samples 200 users in random were selected as the sample for the study.

- **Sampling area** - The primary data was collected for siddha users in Tirunelveli district. Therefore, simple random sampling is adopted for the purpose of collecting primary data.
- **Tools used for analysis** - The data analyse used in this research is percentage and tabulation.

Objectives of the study

- To study, the demographical profile of siddha medicine user in Tirunelveli district.
- To know about the customer opinion about siddha medicine.
- To identify, the expectations of siddha medicine users.
- To know about the customer satisfaction on siddha products.

Review of literature

Krishnan A, Bagyalakshimi P, Ramya *et al.*, (2008) states that, siddha is one of the oldest systems of medicine in India. Siddha holds close association with nature and been validated in the laboratory of life, even before the advent of formal modern western system of medicine.

Venkatachalam D, Kalaiselvi Selvaraj, Gomathi Ramaswamy *et al.*, (2018) states that socio-economic characteristics have significant impact on consumer's attitude towards the usage of traditional system of medicine.

Anup Krishnamurthy and Ramesh Kumar S, (2015) in his paper states that the consumer expectations are important because they influence decisions before purchase help determine satisfaction after purchase.

Rajani Puzhakal (2016) stated that ayurvedic means "knowledge of life" and is about 5000 years old traditional Indian system of medicine. Natural remedies have immense applications globally. Ayurvedic sees health and disease in holistic terms. It links the individuals with customs.

Krishnan A, Bagyalakshimi P, Ramya S *et al.*, (2008), in this study to review that traditional systems of medicine have made significant contributions towards fulfilling healthcare needs of the people in the past, impacts of modern medicine have been so large that traditional medicine witnessed a dark period in southern part of India. While such practices are common in the rural / remote areas, of late, change in the trend with respect to the usage of siddha medicine as complementary alternative therapy among urban population has been observed. The present study aims to evaluate the resurgence of interest in siddha medicine in Tamilnadu, India.

Data analysis and interpretation

Objectives 1: To study the demographical profile of siddha medicine user in Tirunelveli districts.

Table 1: Age wise classification of the respondents

Age	Number of Respondents	Percentage
Below 30	73	36.5
30-40	59	29.5
40-50	46	23.0
50 & above	22	11.0
Total	200	100.0

Source: Primary data

Interpretation

The above table indicates that the age wise classification 36.5 percent of the respondents belonging in the age group of below 30 year, 29.5 percent of them were between the age group of 30-40 years, 23 percent of them between 40-50 years and only 11 percent of them were in of 50 and above.

- Majority of the respondents (36.5%) belonged to the age group below 30 years.

Table 2: Gender wise classification of respondents

Gender	Number of Respondents	Percentage
Male	96	48.0
Female	104	52.0
Total	200	100.0

Source: Primary data

Interpretation

The above table shows that the gender wise groping of the respondents. Among them, 48 percent of the respondents were male and 52 percent of them were female of the study.

- Majority of the respondents (52%) were female.

Objectives 2: To know about customer opinions about siddha medicine.

Table 3: Consumption period of the respondents

Consumption Period	Number of respondents	Percentage
Below 1 year	27	13
1 - 3 year	87	44
3 - 6 year	47	23
More than 6 years	39	20
Total	200	100

Source: Primary data

Interpretation

The above table shows that consumption period of respondents 13.5% of the respondents were consume the siddha medicine below 1 year, 44% of the respondents were consume 1-3

years, 23% of the respondents were consume 3-6 years, and only 20% of the respondents were consume more than 6 years.

- Majority of the respondents (44%) were consuming siddha medicine for 1 to 6 years.

Objective 3: To know about customer expectations of siddha medicine users.

Table 4: Reason for usage

Reason for usage	Number of respondents	Percentage
Reasonable price	41	20.5
Good quality	89	44.5
Availability	48	24
No side effects	22	11
Total	200	100

Source: Primary data

Interpretation

The above table shows that the reasons for usage of the respondents 20.5% of the respondents were used for reasonable price 44.5% of the respondents were used for good quality, 24 percent of the respondents were used for availability and only 11 percent of the respondents were used because it has no side effects.

- Majority of the respondents (44.5%) used for the good quality of the medicine.

Table 5: Disease of the respondents

Disease	Number of respondents	Percentage
Asthma	40	20
Hair fall / skin disease	60	30
Ulcer	30	15
Back pain	70	35
Total	200	100

Source: Primary data

Interpretation

The above table shows that disease for which the medicine is used by the respondents. 40 percent of the respondents use siddha for asthma, 60 percent of the respondents use siddha medicine for hair fall, 30 percent of the respondents use siddha medicine for ulcer, 70 percent of the respondents used siddha medicine for back pain.

- Majority of the respondents (35%) use siddha medicine for back pain

Table 6: Medicinal type in siddha

Type	Number of respondents	Percentage
Tablet	80	40
Powder	70	35
Oil	50	25
Total	200	100

Source: Primary data

Interpretation

The above table shows that type of medicine used by respondents in siddha medicine. 80 percent of the respondents use it as tablet, 70 percent of the respondents use it as powder and 50 percent of the respondents use it as oil.

- Majority of the respondents (47.5%) were given overall satisfaction for siddha medicine.

Objective 4: To identify the expectations of siddha medicine users.

Table 7: Overall satisfaction

Satisfaction level	Number of respondents	Percentage
Highly satisfied	53	26.5
Satisfied	95	47.5
Natural	32	16.0
Dissatisfied	20	10.0
Total	200	100.0

Source: Primary data

Interpretation

The above table shows that the overall satisfaction of the respondents. 26.5 percent of the respondents were highly satisfied, 47.5 percent of the respondents were satisfied, 16 percent of the respondents were neutral and only 10 percent of the respondents were dissatisfied with siddha medicine.

- Majority of the respondents (47.5%) were given overall satisfaction for siddha medicine.

Findings

- Majority of the respondents (36.5%) belonged to the age group below 30 years.
- Majority of the respondents (52%) were female
- Majority of the respondents (44%) were consuming siddha medicine for 1 to 6 years.
- Majority of the respondents (44.5%) used for the good quality of the medicine
- Majority of the respondents (35%) use siddha medicine for back pain
- Majority of the respondents (80%) use the medicine as tablet.
- Majority of the respondents (47.5%) were given overall satisfaction for siddha medicine.

- The main reason behind choosing the siddha products by the customers was the goodness of siddha. The quality of medication also motivates consumers to buy ayurvedic products.

Suggestions:

1. Out of 200 respondents, majority of the people using siddha medicines because of having no side effects and due to its naturality. So, the health care providers in siddha should concentrate on the customer expectations.
2. The siddha doctors can adopt advertisement techniques such as television advertisements, newspaper advertisements etc. To create awareness about the products among consumers.
3. The pharmacy may implant online shopping site to attract various customers.
4. Prospective consumers to make them a real consumer to make them a real consumer of the products.
5. The organisation in siddha can adopt web based promotional techniques to increase its area of operation and also to increase its commercial sales.
6. People must given awareness regarding the benefits of siddha and about having no side effects in curing the diseases.
7. Government should engage in every district in promoting siddha activities.

Conclusion:

It is concluded that a greater number of respondents those who fall within the age of 30 years meet their needs form siddha medical practitioners and siddha medical agencies. Further, it has to be stressed that siddha medical practitioners play a vital role in customizing need based treatment. Hence scientific validation of the safety and efficacy of the siddha drugs not individually as well as formulation has to be carried out in a systematic manner to compete in the international market and provide consumer satisfaction.

The high level of satisfaction reported from this study especially among the chronic visitors of these siddha hospitals indicates that this emerging system of alternate systems of medicine might become one of the preferred systems of medicine in this region. Though satisfaction is high in terms of attitude and behaviour of the providers, still there is a scope to improvise the amenities related to infrastructure. Untied funds sanctioned under National Health Mission can play a major role to improvise facilities in this regard. All the consumers who are using siddha medicines look to recommend the siddha medicines because of its naturality and without any side effects.

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RECALCITRANT BEHAVIOUR OF THE SEEDS OF *MYRISTICA MALABARICA* LAM.

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Abstract:

Myristica malabarica Lam. of the family Myristicaceae is categorised as vulnerable species as per the red data book of IUCN. (IUCN Threat Status: Vulnerable B1+2c) (IUCN, 2020-2). The vulnerability of this species is due to several reasons, including habitat loss and fragmentation, over-exploitation, competition with invasive species, climate change, recalcitrant nature of seeds etc. These factors, alone or in combination, are causing a decline in the population size and making them RET species. The seeds of *Myristica malabarica* are classified as recalcitrant because they are highly sensitive to desiccation and cannot tolerate drying. Recalcitrant feature of *M. malabarica* seeds in structural aspect include a thick, fleshy, and moisture-containing seed coat, larger seed size, a large endosperm, and a small embryo (Chin *et al.* 1989; Hamilton *et al.*, 2013). The weight of embryo of *M. malabarica*, w.e.t. seed is less than 1%, while that of orthodox seed like *V. unguiculata* is more than 3%. The presence of a thick seed coat (*M. malabarica* - 2.266 ± 0.08 g) compared to that of orthodox seeds (*V. unguiculata* - 0.027 ± 0.002 g) and large endosperm (*M. malabarica* - 14.39 ± 0.26 g, *V. unguiculata* - 0.18 ± 0.02 g) favour the retention of moisture, which is essential for seed viability (Daws *et al.*, 2004). The weight of embryo of *M. malabarica* with respect to endosperm is very less compared to that of orthodox seed (*M. malabarica* - 0.14 ± 0.003 g, *V. unguiculata* - 0.008 ± 0.00 g.).

Keywords: RET, Recalcitrant seed, Orthodox seed, PGR, ABA, Gibberellic Acids, DHA, TTZ, TDS, Leachate conductivity, Critical moisture content

Introduction:

Myristica malabarica Lam. is a species of plant in the Myristicaceae family that is native to India, Sri Lanka, and other parts of Southeast Asia. In India its distribution is restricted to swampy area of Western Ghats and many sacred grooves in Kerala at an elevation of 200 -1100 m A.S.L. (Roby *et al.*, 2014). This species of *Myristica* is categorised as vulnerable species as per the red data book of IUCN. (IUCN Threat Status: Vulnerable B1+2c) (IUCN, 2020-2). The seeds of this plant have been found to exhibit recalcitrant behaviour, which means they are

sensitive to desiccation and cannot be stored for long periods of time without losing their viability. Recalcitrant seeds are characterized by their high-water content and inability to survive drying and low temperatures. Unlike orthodox seeds, which can be dried and stored for long periods, recalcitrant seeds must be sown immediately after harvest to ensure germination. In the case of *Myristica malabarica*, the seeds have a high moisture content and a short lifespan, which makes them difficult to store and transport. This poses a challenge for conservation efforts, as the seeds must be sown immediately after harvest to ensure that they can be successfully propagated.

Materials and Methods:

Seed source and surface sterilization

The mature fruits of *Myristica malabarica* species were collected from Attappady, Palakkad (N 11°04'01" L, E 76°33'58"L. Altitude 672 m) and transported to the laboratory in sealed polythene bags. The seeds were extracted, dearillated, and inspected for physical damage or insect infestation. To sterilize the seed surface, they were treated with 1% sodium hypochlorite for 30 minutes and then washed with sterilized distilled water five times. The processed seeds were utilized for germination studies and PGR analysis.

Moisture content of the seeds

The moisture content of the seeds at different stages was determined by measuring the weight difference between fresh seeds and seeds stored under different conditions. Samples were cut into small pieces and dried at $130 \pm 2^\circ\text{C}$ for 1 hour, and the moisture content was calculated as the percentage of water on a fresh weight basis using ISTA (2008) guidelines.

Seed viability

The viability of the seeds at different stages were assessed by Dehydrogenase activity (DHA) test (ISTA, 2008). Each DHA test was conducted with five replicates. Each seed was preconditioned by soaking 4 hours (hrs.) in SDW. The embryos were taken out and incubated for 24 hrs in 3 ml of 1 % 2, 3, 5 - triphenyl tetrazolium chloride (TTZ). The stain intensity on the embryo was assessed visually and recorded the colour variations. Stained embryonic tissues were then soaked individually in 5ml of methyl cellosolve solution for 4 hrs. The extract was decanted and the colour intensity was assessed by using spectrophotometer (UV - VIS spectrophotometer, Shimadzu UV - 1800) at 480 nm.

To assess seed viability, the electrolyte conductivity and Total Dissolved Solutes (TDS) were measured as parameters. Electrolyte conductivity was determined by incubating one seed from each of the five replicates in 40 ml of deionized distilled water for 24 hours at $28 \pm 2^\circ\text{C}$, and then measuring the conductivity of the solution using a conductivity meter (Systronics, DDR, type 306) in micro-Siemens ($\mu\text{S}/\text{cm}$) as per the method of Bonner (1996). TDS of the seeds were also analyzed using the same method, and expressed as parts per million (ppm).

Seed germination test

Germination potential was evaluated by conducting a germination test under standardized conditions, and the percentage of seeds that germinated was used to determine seed viability. Seeds were considered germinated when the radicle emerged from the seed coat at a length of 5 mm (ISTA, 1993). The germination test was carried out in five replicates of 10 seeds each, and seeds were wrapped with wet acid-free germination paper and placed in a seed germinator (KEMI SEED GERMINATOR KSG-2) without light at $30 \pm 2^\circ\text{C}$ and $80 \pm 2\%$ RH.

Embryo seed ratio

The embryo seed ratio was determined as described by Daws *et al.* (2006). Fully matured fruits from selected plants were collected and packed in sealed polytene cover to avoid loss of moisture content. The fruit wall and aril of randomly selected fruits were removed smoothly and carefully. The seeds were washed thoroughly in distilled water and blotted gently with soft paper towel to remove any free surface moisture. Fresh weight of fully matured seed as whole and the fresh embryo, endosperm and seed coat were taken separately immediately after the removal of the fruit wall in the laboratory condition by using digital weighing balance (ANAMED Analytical Balance, Model No. AA - 2200 DS) and it was expressed in grams (g). Weight of embryo, endosperm and seed coat with respect to (w.r.t) the weight of whole seed and the endosperm were measured by using the following formulas.

$$1. \text{Weight of embryo w.r.t seed} = \frac{\text{Weight of embryo}}{\text{Weight of seeds}} \times 100$$

$$2. \text{Weight of endosperm w.r.t seed} = \frac{\text{Weight of endosperm}}{\text{Weight of seeds}} \times 100$$

$$3. \text{Weight of seed coat w.r.t seed} = \frac{\text{Weight of seed coat}}{\text{Weight of seeds}} \times 100$$

$$4. \text{Weight of embryo w.r.t endosperm} = \frac{\text{Weight of embryo}}{\text{Weight of endosperm}} \times 100$$

$$5. \text{Weight of seed coat w.r.t endosperm} = \frac{\text{Weight of seed coat}}{\text{Weight of endosperm}} \times 100$$

Hormone extraction and LC-MS/MS

The protocol for the extraction of various plant growth regulators was as followed by Pan *et al.* (2008). Initially, 100mg of dry tissue was frozen in liquid nitrogen, and then homogenized with a mixture of 1-propanol, water, and concentrated hydrochloric acid (2:1:0.002, v/v/v). The resulting mixture was sonicated for 30 minutes and incubated overnight at 40°C . For the liquid endosperm of tender nuts, the sample was first passed through a C18 column sep-pac cartridge to remove impurities. Subsequently, 5mL of the sample was homogenized with the same mixture of 1-propanol, water, and concentrated hydrochloric acid, sonicated for 30 minutes, and left overnight at 40°C . Then, dichloromethane was added to the homogenate, sonicated for 30 minutes, and centrifuged at 12,000rpm for 10 minutes. After centrifugation, the bottom layer was transferred to a conical flask containing sodium sulfate to remove any residual water traces. Finally, the sample was dried using a flash evaporator, and 1mL of mobile phase was added to

the dried sample. The solvent was filtered through a nylon filter paper and then injected into LC-MS/MS for hormone analysis.

The mobile phase used in the analysis consisted of two solvent systems, A and B. Solvent A was made up of a mixture of water, acetonitrile, and acetic acid in the ratio of 95:5:0.05 (v/v/v), while solvent B consisted of acetonitrile, water, and acetic acid in the ratio of 95:5:0.05 (v/v/v). A gradient program was employed during the analysis, starting with 85% solvent A and 15% solvent B for 1 minute, followed by 15% solvent A and 85% solvent B for 1 minute, and then a linear gradient leading to 85% solvent A and 15% solvent B for 4 minutes. The flow rate was set at 0.20 mL/min, and the total runtime was 20 minutes. The quantification of analytes was performed using the multiple reaction monitoring (MRM) detection method. The analytical column used was a 2.1 x 50 mm UPLC BEH C-18 column with 1.7 μ m particles, protected by a vanguard 2.1 x 5 mm BEH C-18 with 1.7 μ m, sourced from Waters (USA). The column temperature was maintained at 25°C. The samples were extracted three times, and calibration curves were generated using chemical standards of hormones purchased from Sigma-Aldrich (USA). The eluted hormones were quantified using a TQD-MS/MS chromatographic column (Waters – Acquity, USA).

Statistical analysis of data

Data presented correspond to means \pm standard error. DMRT was carried out with SPSS, version 13.0 software. All treatments consisted of five replicates.

Result and Discussion:

As the seed viability has been drastically declined after desiccation of the seeds to a certain limit, seeds of *Myristica malabarica* can be categorised as recalcitrant seeds (Bonner, 1996). Storage trials showed that seed viability was mainly determined by temperature and relative humidity of the storage system. Like the other recalcitrant seeds like *Saraca asoca* (Kittock *et al.*, 1968; Meryman, 1968) *Madhuca indica* (Parvathy *et al.*, 2020), *M. malabarica* seeds also showed sensitivity towards freezing temperature and desiccation.

The seeds stored at open laboratory condition have registered maximum germination (93.2 \pm 1.74%) when the seed moisture content was 31.48 \pm 0.16%. The seed germination rate was declined gradually and significantly ($p < 0.01$) as the seed desiccation proceeds. But sharp declination of seed germination from 67.2 \pm 0.49% to 19.2 \pm 0.49 % was registered when the seed moisture content was reduced from 14.32 \pm 0.15 % to 12.18 \pm 0.11 %. The seed viability has been lost fully at which the seed moisture level was 8.28 \pm 0.16 % (Table 1). The embryo of the viable seeds was stained deeply and observed as deep red in colour when incubated in tetrazolium chloride (TTZ) solution and the absorbance of formazan which is the indicator of the intensity of the TTZ absorbed by embryonic tissue was very high compared to that of nonviable seeds which were stained feebly or unstained. Leachate conductivity and TDS of the viable seeds were 5 and 3 times respectively lesser than that of nonviable seeds.

Table 1: Physiological behavior of *M. malabarica* seeds on desiccation.

Treatment	DoS	Seed Germination (%)	MC (%)	TTZ	DHA	LC (μ S)	TDS (ppm)
(28 \pm 2^oC and 65 % RH)	0	93.2 \pm 1.74 ^a	31.48 \pm 0.16 ^a	DR	1.18 \pm 0.004 ^a	10.05 \pm 0.35 ^a	5.25 \pm 0.30 ^a
	2	84.0 \pm 1.10 ^b	21.36 \pm 0.27 ^b	DR	1.15 \pm 0.005 ^a	15.58 \pm 0.79 ^b	9.27 \pm 0.25 ^b
	4	74.8 \pm 1.62 ^c	19.40 \pm 0.17 ^c	DR	0.90 \pm 0.006 ^b	21.39 \pm 0.51 ^c	12.27 \pm 0.43 ^c
	6	70.0 \pm 0.63 ^d	17.85 \pm 0.62 ^d	DR	0.72 \pm 0.008 ^c	25.22 \pm 0.77 ^d	15.77 \pm 0.50 ^d
	7	67.2 \pm 1.50 ^e	14.32 \pm 0.15^e	DR	0.61 \pm 0.007 ^c	29.52 \pm 0.68 ^e	18.08 \pm 0.43 ^e
	8	19.2 \pm 1.36 ^f	12.18 \pm 0.11 ^f	R	0.32 \pm 0.008 ^d	40.81 \pm 0.72 ^f	28.32 \pm 0.71 ^f
	9	3.6 \pm 1.17 ^g	9.38 \pm 0.16 ^g	P R	0.18 \pm 0.034 ^a	80.54 \pm 0.62 ^g	55.03 \pm 0.99 ^g
	10	00 ^{ns}	8.28 \pm 0.16 ^h	US	0.12 \pm 0.003 ^e	98.93 \pm 1.11 ^h	71.29 \pm 2.03 ^h
	11	00 ^{ns}	7.90 \pm 0.25 ⁱ	US	0.11 \pm 0.002 ^e	110.22 \pm 3.68 ⁱ	93.61 \pm 1.90 ⁱ

Values are Means of three replicates with Standard Error; Significant changes were indicated by letters in superscript DoS: Days of Storage, C: Control, RH: Relative Humidity, ^oC: Degree Centigrade, \pm : Standard Error, μ S: Micro Siemen, ppm: Parts Per Million, %: Percentage, LC: Leachate Conductivity, TDS: Total Dissolved Solids, MC: Moisture Content, TTZ: 2, 3, 5 Triphenyl Tetrazolium Chloride, DR: Dark Red, R: Red, PR: Pale Red, US: Unstained, R; Red,

The drastic decline of seed viability from 93.2 \pm 1.74 % to 19.2 \pm 1.36 % by 8 days after storage at open laboratory condition can be attributed to lowered moisture content in the embryo. Report are that lowered water contents for prolonged period may eventually leads to accumulation of aqueous based damages includes mechanical damage to cell membrane system (Oaikhena *et al.*, 2013) and macromolecular denaturation (Pammenter and BerjaK, 2000). A sharp declination seed germination when the seed moisture content is below 14.32 \pm 0.15 % implies that it is the critical moisture content (CMC) of *M. malabarica* seed. The detrimental effect of dehydration below the critical moisture content, on membrane system and biomolecules

in the cell has also been reported in many recalcitrant seeds (Pillai and Pandalai, 2015; Prajith and Anilkumar, 2017).

Table 2: Comparison of weight of endosperm, embryo and seed coat of *M. malabarica*

Name of plant	Wt. of Embryo g	Wt. of Endosp erm g	Wt. of Seed coat g	Wt. of whole seed g	Weight w.r.t seed			Weight w.r.t Endosperm	
					Embr yo %	Endosp erm %	seed coat %	Embr yo %	Seed coat %
<i>M. malabarica</i>	0.14 ± 0.003	14.39 ± 0.26	2.266 ± 0.08	16.79 ± 0.34	0.82 ± 0.01	85.69 ± 0.21	13.48 ± 0.21	0.96 ± 0.02	15.73 ± 0.29
<i>V. unguiculata</i>	0.008 ± 0.00	0.18 ± 0.02	0.027 ± 0.002	0.22 ± 0.02	3.87 ± 0.14	83.27 ± 1.23	12.86 ± 1.25	4.66 ± 0.20	15.55 ± 1.75

±: Standard Error, w.r.t: with respect to, %: Percentage, g: Grams

Recalcitrant feature of *M. malabarica* seeds in structural aspect include a thick, fleshy, and moisture-containing seed coat, larger seed size, a large endosperm, and a small embryo (Chin *et al.* 1989; Hamilton *et al.*, 2013) compared to *Vigna unguiculata* (L.) Walp. which comes under orthodox seeds (Table 2). The weight of embryo of *M. malabarica*, w.e.t. seed is less than 1%, while that of *V. unguiculata* is more than 3%. The presence of a thick seed coat (*M. malabarica* - 2.266 ± 0.08 g) compared to that of orthodox seeds (*V. unguiculata* - 0.027 ± 0.002 g) and large endosperm (*M. malabarica* - 14.39 ± 0.26 g, *V. unguiculata* - 0.18 ± 0.02 g) favour the retention of moisture, which is essential for seed viability (Daws *et al.*, 2004). . Additionally, the small size of the embryo limits its ability to store reserves, making the endosperm the primary storage tissue *M. malabarica* - 0.14 ± 0.003 g, *V. unguiculata* - 0.008 ± 0.00 g.). The weight of embryo of *M. malabarica* with respect to endosperm is very less compared to that of orthodox seed, *V. unguiculata* (Table 2).

Table 3: Dynamics of ABA and GA on seed germination.

Sl. No	Plant Growth Regulators		Fresh Seed n g g-1DW	Germinating seed ng g-1DW	Desiccated seed ng g-1DW
3	ABA	Absciscic Acid (ABA)	336.34±2.17a	30.11±2.75b	302.38±1.06a
4	Gibberellic Acids (GAs)	Gibberellic Acid 7 (GA7)	0.06±0.00a	0.07±0.00a	0.05±0.00a
5		Gibberellic Acid 4 (GA4)	61.56±0.70b	73.16±0.61a	30.24±0.16c
6		Gibberellic Acid 3 (GA3)	0.18±0.01a	0.40±0.02a	0.36±0.01a

±: Standard Error; ng: nanogram, g: gram, DW: Dry weight

The results regarding PGR shows that the seed maturation and seed germination are determined by the balance between gibberellins and ABA (Finkelstein *et al.*, 2008). From the results, it can be interpreted that whenever be the level of gibberellins are more than ABA seed germination will be initiated, otherwise seed germination will be suppressed. Initiation of seed dormancy and seed germination are two antagonistic processes determined mainly by ABA and gibberellins, respectively (Groot *et al.*, 1992).

Conclusion:

The seeds of *Myristica malabarica* Lam. exhibit a recalcitrant nature, which means that they cannot withstand desiccation and storage at low temperatures. This characteristic makes the storage and conservation of these seeds challenging, limiting their use in agricultural and forestry practices. Therefore, further research is needed to develop effective methods for the long-term storage and preservation of recalcitrant seeds, which would contribute to the conservation of important plant species like *Myristica malabarica*. Additionally, understanding the mechanisms behind the recalcitrant nature of these seeds could provide insights into plant physiology and evolution.

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NEW EDUCATION POLICY 2020 IMPACT ON HIGHER EDUCATION

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Abstract:

The year 2020 has been an exceptional year for countries across the globe. In India, apart from Covid-19, one of the important changes that took place was the development of the New Education Policy (NEP) 2020. Time by time,

The New Education Policy announced by Government of India (NEP 2020) was a welcoming change and fresh news amidst all the negativities surrounding the world due to the challenges posed by Covid-19 pandemic. The announcement of NEP 2020 was purely unexpected by many. The changes that NEP 2020 has recommended were something that many educationists never saw coming. Though the education policy has impacted school and college education equally, This paper initially depicts an overview of NEP-2020, distinguish the strengths & weakness of the policy at higher education & research part, evaluation of the implementation suggestions given in the policy, identifying and analyzing possible generic strategies for implementation of NEP-2020 to fulfill its objectives based on focus group discussion.

Introduction:

The National Education Policy-2020 envisions an India centered education system by incorporating its tradition, culture, values, and ethos to transform the country into an equitable, sustainable, and vibrant knowledge society. The NEP-2020 is developed by considering the wide and deep historical heritage of the country and the contributions of many scholars to different subjects as the founding stone to build high quality multi-disciplinary liberal education at both school and higher & professional education level. With the objective to increase the gross enrollment ratio (GER) of school education enrollment and higher & professional education enrollment to increase from 28% and 05% to 50% and 20% respectively by 2030, by means of radical changes in the existing education policies and governance systems by introducing accountability in each stakeholder.

Higher Education:

A significant change in NEP 2020 is the proposal to set up the Higher Education Commission of India (HECI), as an umbrella body for higher education, excluding medical and legal education. This will usually bring out a question that what will happen to the present UGC and AICTE? HECI is aiming at reforming the higher education sector; the Bill will separate the

Academic and Funding aspects of the sector. According to the new Bill, HECI will not have any financial powers. The funding processes which were handled by the University Grants Commission (UGC) will be taken care by the Ministry of Education, previously known as the Ministry of Human Resource Development (MHRD).

This change however is expected to clear the regulatory mess in India's Higher education system HECI is expected to have four independent verticals-National Higher Education Regulatory Council (NHERC)for regulation , General Education Council (GEC) for standard setting. Higher Education Grants Council (HEGC) for funding and National Accreditation Council (NAC) for accreditation.

The regulatory mess in India's Higher Education system. HECI is expected to have four independent verticals - National Higher Education Regulatory Council (NHERC) for regulation, General Education Council (GEC) for standard-setting, Higher Education Grants Council (HEGC) for funding, and National Accreditation Council (NAC) for accreditation. To have uniformity in education standards, a single umbrella body was always a requirement and this has been a vision of numerous educationists. This is considered as the right step in streamlining education policy. However, to ensure quality of higher education, institutes must be measured based on relevant parameters like research, industry linkages, placements and academic excellence, etc. If the HECI can manage this, the benefits to its biggest stakeholder, the youth of India, might be significant.

Graded accreditation and graded autonomy:

The concept of "empowerment and autonomy to innovate" is one of the key features in NEP 2020 which supports a "phasing out" strategy from Affiliated Colleges to Autonomous Institutions. The increased flexibility offered to autonomous institutions also gives hope in curriculum enrichment. It also says that with appropriate accreditations, Autonomous degree-granting Colleges could evolve into Research-intensive or Teaching-intensive Universities, if they so aspire. The announcement of setting up Multidisciplinary Education and Research Universities (MERUs) in the country gives more hope. These institutions will be at par with the existing IITs and IIMs and will aim to showcase multidisciplinary education for the Indian Students. Another important change the NEP 2020 suggests that the National Testing Agency will serve as a premier, expert, autonomous testing organization to conduct entrance examinations for undergraduate and graduate admissions and fellowships in Higher Education Institutions. The high quality, range, and flexibility of the NTA testing services will enable most universities to use these common entrance exams - rather than having hundreds of universities each devising their own entrance exams there by drastically reducing the burden on students, universities and colleges, and the entire education system. It will be left up to individual universities and colleges to use NTA assessments for their admissions. It also surely helps the students to easily transfer their degrees and credits to universities abroad.

Internationalization at home:

NEP 2020 also allows foreign universities and colleges to come to India and this brings out a challenge for the native institutions to improve the quality of education provided by them. The Indian higher education sector is buzzing all around as the opportunity of paving the way for foreign universities to set up campuses in the country. India has one of the largest networks of higher education systems in the world, with more than 900 universities and 40,000 colleges. But GER (Gross Enrolment Ratio) of India in higher education is 26.3%, which is significantly low when compared to other BRICS countries like Brazil (50%) or China (51%), and very much lower when compared with European and North American nations which would be more than 80%. India must achieve a significant growth in the area of global higher education for obtaining a sustainable economic growth, this should not be driven by natural resources, but by knowledge resources. As per the reports, India will need another more than 1,500 new higher education institutions by 2030 to accommodate a huge inflow of students, that's why the Indian government wants to promote FDIs (Foreign Direct Investment) and open up the ECB (External Commercial Borrowing) route to strengthen the capital investment for the education sector. than 7 Lakhs of Indian students

The ministry is also trying to boost India's image as an education center because already more are studying abroad. So, the intention of this policy is that, allowing foreign universities will enable world-class education available locally at a significantly lower cost without travelling and will considerably reduce the human capital migrating to other countries for study and job prospects. According to the different global surveys, cross-border education is beneficial for the economy and brings a wider level of global awareness, culturally perceptive, and competitiveness. Foreign collaborations enable local institutes to design their curriculum in alignment with international pedagogy and offer a diverse portfolio of subjects and specialization to students.

More holistic and multidisciplinary education:

The NEP 2020 claims that, a holistic and multidisciplinary education would aim to develop all capacities of human beings -intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner. Such an education will help develop well rounded individuals that possess critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, such as communication, discussion and debate; and rigorous specialization in a chosen field or fields. The NEP 2020 envisions one large multidisciplinary Higher Education Institution (HEI) in or near every district, by 2030.

Towards the attainment of such a holistic and multidisciplinary education, the flexible and innovative curricula of all HEIs shall include credit-based courses and projects in the areas of community engagement and service, environmental education, and value-based education.

Environment education will include areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living. Value-based education will include the development of humanistic, ethical, Constitutional, and universal human values of truth (satya), righteous conduct (dharma), peace (shanti), love (prem), nonviolence (ahimsa), scientific temper, citizenship values, and also life-skills; lessons in seva/service and participation in community service programmes will be considered an integral part of a holistic education.

As the world is becoming increasingly interconnected, Global Citizenship Education (GCED), a response to contemporary global challenges, will be provided to empower learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies. Finally, as part of a holistic education, students at all HEIs will be provided with opportunities for internships with local industry, businesses, artists, crafts persons, etc., as well as research internships with faculty and researchers at their own or other HEIs/research institutions, so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability.

The structure and lengths of degree programmes:

In the context of the National Education Policy 2020 scheme, any undergraduate degree in any institution will be of duration of three or four years. One can leave the degree within this period. Any educational institution will have to give to the student a diploma degree after the student completes two years of study, a degree after the student completes three years of study and a certificate to those students who complete one year of study in any professional or vocational course of their choice. The Government of India will also help in establishing an Academic Bank of Credit for storing the academic scores digitally. This will enable the institutions to count the credit at the end and put it in the degree of the student. This will be helpful for those individuals who might have to leave the course mid-way. They can start the course later on from where they left off and not start from the beginning once again. Even though NEP 2020 says that Higher education institutions will be given the freedom to start PG courses there may be some difficulty in designing One Year PG Degree for students who have completed 4 Year UG Degree and a Two Year PG Degree for students who have completed 3 Year UG Degree.

Conclusion:

The policy introduces a whole gamut of changes and reads largely as a very progressive document, with a firm grasp on the current socio-economic landscape and the prospect of future uncertainty. Education for a new generation of learners has to essentially engage with the increasing dematerialization and digitalization of economies, which requires a completely new set of capabilities in order to be able to keep up. This seems to be an even more vital requisite

now, with the trend towards digitalization and disruptive automation being quickened by the pandemic. Overall, the NEP 2020 addresses the need to develop professionals in a variety of fields ranging from Agriculture to Artificial Intelligence. India needs to be ready for the future. And the NEP 2020 paves the way ahead for many young aspiring students to be equipped with the right skill set.

The new education policy has a laudable vision, but its strength will depend on whether it is able to effectively integrate with the other policy initiatives of government like Digital India, Skill India and the New Industrial Policy to name a few, in order to effect a coherent structural transformation. Hence, policy linkages can ensure that education policy addresses to and learns vocational from Skill India's experience in engaging more dynamically with the corporate sector to shape education curriculum in order to make it a success. There is also a necessity for more evidence-based decision-making, to adapt to rapidly evolving transmutations and disruptions. NEP has reassuringly provisioned for real-time evaluation systems and a consultative monitoring and review framework. This shall empower the education system to constantly reform itself, instead of expecting for a new education policy every decade for a shift in curriculum. This, in itself, will be a remarkable achievement. The NEP 2020 is a defining moment for higher education. Effective and time-bound implementation is what will make it truly path-breaking.

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REVIEW OF ECONOMIC POLICIES IN INDIA

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Abstract:

India has been one of the fastest-growing economies globally, and economic policies have played a significant role in shaping its growth trajectory. This chapter presents a review of India's economic policies, starting from the pre-independence era to the present day. It covers a wide range of measures, such as monetary policy, taxation, budget, and job creation, and how they have impacted the country's economic development. The article also sheds light on some of the challenges that India faces in the current economic scenario. Overall, this review provides valuable insights into India's economic policies and their impact on the country's growth and development

Introduction:

India is a developing country that has made significant progress in the economic and social spheres over the last few decades. Being one of the largest and fastest-growing economies in the world, the country has undergone several economic policies over the years to boost growth and development. Economic policy covers a wide range of measures which governments use to manage their economy. These include monetary policy (money supply and demand), taxation, budget, job creation, etc. These policies have played a crucial role in shaping the Indian economy and bringing about significant changes in the standard of living of its people. In this chapter, we review the economic policies in India, starting from the pre-independence era to the present day. We also highlight some of India's challenges in the current economic scenario.

Pre-Independence Era

Before India gained independence in 1947, the economy was primarily agricultural-based. The British colonial government implemented several policies that were detrimental to the growth of the Indian economy. One such policy was the imposition of high tariffs on Indian goods, which hindered the growth of Indian industries. Another policy was the exploitation of India's natural resources, such as the extraction of raw materials for industries in Britain.

Post-Independence Era

After independence, India adopted a mixed economy model emphasizing state intervention in economic activities. The government introduced the Industrial Policy Resolution in 1948, which aimed to promote the growth of industries in India. The policy emphasized the development of infrastructure and the creation of public sector enterprises. The government also implemented several agricultural policies to improve productivity and increase farm incomes. In

the 1990s, India adopted a new economic policy emphasizing liberalization, privatization, and globalization.

Liberalization, Privatization, and Globalization

In 1991, India faced a balance of payments crisis, which led to a severe economic downturn. The government was forced to implement a new economic policy emphasizing liberalization, privatization, and globalization. The policy aimed to open the Indian economy to foreign investment and reduce state control over economic activities. The government introduced several reforms, such as the reduction of import tariffs, the devaluation of the Indian rupee, and the deregulation of industries.

Major economic policies which followed in India have played a major role in the growth of the Indian economy

1. Monetary Policy
2. Fiscal Policy
3. Agricultural Policies
4. Industrial Policies
5. Trade Policies

1. Monetary policy:

Monetary policy, sometimes called credit policy, concerns the cost (i.e., interest rate) and credit availability to influence the overall money supply.

Instruments of monetary policy:

The monetary authority directly and/or indirectly controls the money supply by changing the monetary base or the reserve-deposit ratio. There are various instruments under the monetary policy and are discussed as follows:

- a) Open-market operations,
- b) Reserve requirements
- c) Discount rate

a) Open-market operations: It is the sales or purchase of government bonds by the Central Bank (i.e., the monetary authority). When it purchases bonds from the general public, the money it pays for the bonds increases the monetary base and, thus, the money supply. When it sells bonds to the public, the proceeds reduce the monetary base and, therefore, the money supply. Open-market operations are the most commonly employed policy instrument of the Central Bank.

b) Reserve requirements: These are Central Bank regulations requiring banks to maintain a minimum reserve-deposit ratio. A rise in the reserve requirement raises the reserve-deposit ratio, lowering the money multiplier and money supply. This is the least commonly used tool.

c) Discount rate: It is the interest rate that the Central Bank charges when it makes loans to banks. When banks have insufficient reserves to meet reserve requirements, they borrow from

the Central Bank (CB). The lower the discount rate, the cheaper the cost of borrowed reserves, and the greater the number of banks borrowing at the CB's discount window. As a result, lowering the discount rate increases the monetary base and the money supply.

2. Fiscal policy

Fiscal policy is involved with taxing, spending, and borrowing. Fiscal policy evolution has resulted in a tax structure heavily reliant on indirect taxing. As it has failed to control non-plan expenses, re-investible surpluses could not be generated/produced. The government then relied on deficit finance and public borrowing. All of these contributed to an increase in the fiscal deficit. Fiscal policy measures were implemented initially in mid-1991. Since then, fiscal policy has aimed to promote market-led economic development. For example, efforts are still being undertaken to simplify both the tax laws and the tax structure. The government has taken steps to tighten expenditure management systems in its new fiscal strategy. Above all, the new fiscal policy seeks to improve resource allocation per market principles. It seeks to stimulate demand on the one hand while constraining supply on the other by calibrating tax rates. There is much overlap between these diverse economic policies and their effects on macroeconomic variables.

3. Agricultural policy:

Immediately after independence, the country faced two main challenges: a food crisis and a shortage of raw industrial resources. Agriculture, along with irrigational power, was accordingly given top priority. Technological measures were introduced in the middle 1960s. High priority was given to technology as a major input. Focus shifted to broadening the base of agricultural growth and modernization through infrastructure development: irrigation, roads, drainage, markets and credit institutions, appropriate price, extension of new technology, and procurement policies, and so forth. During 1951-1990, important policy measures were introduced in the agricultural sector. During the first three Five Year Plans (1950-65), public investment packages and institutional reforms were the dominant policies.

(i) Land reforms: Land reforms contribute to higher productivity and bring social justice. It comprises redistributing land ownership and/or use rights away from large growers and towards small cultivators with minimal or no landholdings. After independence, India implemented the following land reform measures:

- ✓ Abolition of the intermediary system.
- ✓ Rent regulation, security of tenure, and the conferment of ownership rights to tenants are all part of tenancy reforms.
- ✓ Landholding ceilings and redistribution of acquired landholdings by the state among landless workers and small farmers are also part of tenancy reforms.

(ii) New agricultural strategy encompassing new technology: The Indian government implemented a new agrarian strategy known by several titles such as seed-fertilizer-water technology, modern agricultural technology, green revolution, etc.

It refers to breeding high-yielding wheat and rice varieties and implementing modern technologies to achieve a sustained breakthrough in agricultural production.

(iii) Institutional credit: Commercial banks were nationalized in 1969 to ensure a smooth flow of credit to agriculturists. Regional rural banks have also been established to address credit needs. In 1982, the National Bank for Agriculture and Rural Development (NABARD) was established as an apex credit organization. Given the creation of financial institutions, the village moneylender's monopoly position in providing agricultural finance has been broken.

(iv) Agricultural price policy: There are two distinct phases of India's agricultural price policy—one covering the period up to 1965 since independence and the other covering the period from 1965 till date. Every season, minimum support prices, procurement prices, etc., are announced in a bid to provide incentives to the farmers to increase production as well as marketable surplus.

(v) Food security—Public Distribution System (PDS): An elaborate food security system known as the Public Distribution System (PDS) has been established. The PDS aims to control prices, reduce price fluctuations, and achieve equitable distribution of some basic consumer items. It is also an important component of the government's anti-poverty programmes. As a result, the PDS provides food subsidies.

(vi) Input subsidies: In addition to food subsidies for consumers, significant input subsidies were offered to farmers with the goal of raising both production and productivity. Subsidies were mostly given to inputs like irrigation, power and fertilizers, etc.

(vii) Provisioning of non-farm services: Non-farm services, such as marketing and credit, are an important component of agricultural policy. Agricultural marketing policy measures can be grouped as follows:

- (a) Setting up of marketing organization,
- (b) Establishment of regulated markets,
- (c) Provision of storage and warehousing facilities, and
- (d) Crop insurance scheme.

viii) National agricultural policy: In response to the problems encountered in the agricultural sector during the 1990s, the National Agricultural Policy was launched in July 2000.

The Policy Document aimed to attain the following objectives:

- i. An annual growth rate of over 4% in the agricultural sector
- ii. Growth that is based on the efficient use of resources and conserves our soil, water and biodiversity
- iii. Growth with equity, i.e., growth which is widespread across regions and farmers

- iv. Growth that is demand-driven and caters to domestic markets, and maximizes benefits from exports of agricultural products
- v. Growth that is sustainable technologically, environmentally and economically

In order to attain these objectives, the NAP-2000 envisages measures in the areas of sustainable agriculture; generation and transfer of technology; food and nutritional security; incentives for agriculture; investment in agriculture, institutional structures, and risk management. Above all, the NAP-2000 recognizes the significance of institutional reforms. Land reform measures embrace:

- ✓ Consolidation of small and fragmented holdings,
- ✓ Redistribution of ceiling surplus lands,
- ✓ Tenancy reforms,
- ✓ Updating of land records,
- ✓ Development of land-lease markets, and
- ✓ Recognition of women's rights in land.

This concept envisages the National Agriculture Insurance Scheme providing a set of insurance policies to all farmers and crops to protect them against natural calamities.

4. Industrial policies:

In 1948, the first Industrial Policy based on the mixed economy principle was established, precisely delineating the spheres of operation of the public and private sectors. This policy was revised in 1956 to emphasize the rising role of the public sector. This was in keeping with the Mahalanobis strategy of industrialization embodied in the Second Five-Year Plan (1956-1961). In 1991, India reached a crossroads when enormous economic challenges necessitated unprecedented reforms in economic policies. On July 24, 1991, the Government of India declared liberalized Industrial Policy, a major change from the 1956 Industrial Policy. The new policy prioritized market-led development over state-sponsored development. Indeed, this new policy took a bolder step towards deregulating the economy and making the Indian industry more competitive domestically and internationally. This approach is a significant step towards privatization and liberalization. It calls for the disinvestment of government equity. Foreign direct investment has been welcomed with open arms under the new strategy.

5. Trade policies:

In terms of commercial policy, the world was divided into two camps: developed and developing. Developed countries increasingly moved towards free trade policies and currency convertibility during the 1950s and 1960s. International organizations such as the IMF and GATT (General Agreement on Tariffs and Trade) promoted free trade policies. Since the Five Year Plans (1951) began, India has followed the Import Substituting Industrialization (ISI) strategy. Significant protection was granted to domestic industries in India for development. This was the period when it was believed that the "government" or the "state" was superior. It

followed a restrictive or protective trade policy until June 1991, when a liberal free trade environment was established. India now transitioned from 'inward' to 'outward' trade policies, gradually removing various trade restrictions.

Recent reforms to boost the Indian economy

Performance of the Indian Economy post demonetization, implementation of GST, Make in India, and other key reforms brought about to propel economic development faster.

a. Corporate tax cuts: boost to economic development: After five consecutive quarters of slowing growth saw, India in 2019 lost its status as the fastest-expanding major economy to China. To take India out of its economic slowdown on September 20, 2019, the Finance Minister of India, Ms Nirmala Sitharaman announced Corporate Tax Rate cuts to boost the Indian Economy. The government slashed the basic corporate tax rate to 22% from 30%, while for new manufacturing companies, it was cut down to 15% from 25%.

b. Make in India: manufacturing sector GDP contribution up: The Make in India Campaign launched by the Government of India in September 2014 permitted 100% FDI in 25 sectors of the economy except for the space, defence and media industries of India. The movement further led to local state movements like "Make in Odisha", "Happening Haryana" and "Magnetic Maharashtra". With this campaign, the government aimed to raise the manufacturing sector's contribution to 25% of GDP.

c. Goods and Services Tax (GST): Single taxation system across the country: GST, a unified consumption tax on all goods and services except electricity, petroleum products and alcoholic drinks, was implemented by the government in July 2017. This tax eradicated the disparity of taxes among different state governments and the multilayer tax system. It has pooled the resources of the centre and state government under a single tax, which can benefit both. GST has caused an increase in the tax base, easier movement of goods across state borders and reduction in tax rate from 28% to 18% for several products

d. Foreign Direct Investment (FDI): FDI rose to around \$61.96 billion in 2017-2018, further increasing an all-time high of \$60.1 billion in 2016-2017 which is certainly an indicator that even the foreign countries are banking on India as a growing economy and that is a step in the right direction. FDI is as good an indicator of a growing economy as any, and an increase at such a scale is quite good for the economy. The new tax policies on FDI have led to this increase with a permit of 100% FDI in 25 sectors, with 74% in aerospace, 49% in defence and 26% in media.

Impact of economic policies:

The economic policies implemented in India have positively and negatively impacted the economy. The policies implemented in the post-independence era led to the growth of industries and the creation of public-sector enterprises. However, the policies also led to inefficiencies and corruption in the public sector. The liberalization policies implemented in the 1990s led to an

increase in foreign investment and the growth of the service sector. However, the policies also led to widening income inequality and the marginalization of certain sectors of the economy.

Future of Indian economy: The road ahead

Higher farm sector productions, higher contribution to GDP by the manufacturing sector, making India stand up with the concepts of Start-up India and Stand-up India, the introduction of water transport, creating better road and rail network, higher FDIs are expected to make Indian economy grow faster in future.

Conclusion:

India has implemented several economic policies to boost growth and development over the years. The policies have had both positive and negative impacts on the economy. The pre-independence era was characterized by British colonial policies that hindered the growth of the Indian economy. However, the post-independence era saw the adoption of a mixed economy model with an emphasis on state intervention in economic activities. The liberalization, privatization, and globalization policies implemented in the 1990s led to an increase in foreign investment and the growth of the service sector. Despite the progress made, India still faces several challenges in the economic sphere, including unemployment, inflation, and corruption. The government must continue to implement policies that promote growth while addressing these challenges. Furthermore, the policies must be designed to promote inclusive growth, reduce income inequality, and improve all citizens' living standards. Overall, India has come a long way economically, and its future looks promising. However, much work must be done to ensure sustained growth and development. By continuing to implement sound economic policies and addressing the challenges, India can achieve its full potential as a global economic powerhouse.

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IMPACT OF COVID 19 IN INDIA WITH SPECIAL FOCUS ON BIHAR

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Abstract:

The pandemic COVID disrupted the whole globe and was declared health emergency by World Health Organization thereby stop the spread of disease through following norms and social distancing. Here, we discuss about the global scenario, Indian scenario with special focus on Bihar as case study in order to study the impacts on the various aspects. Bihar is taken as a case study as it has the maximum number of migrants working in the informal sector and were impacted the worst during the COVID 19.

Keywords: COVID 19, Bihar, India, Reverse Migration, Economy

Global scenario:

An eruption of the new pandemic in the Chinese city of Wuhan took place in December 2019 (Sarfranz, Shehzad, 2020). A health emergency was declared by World Health organization (WHO) all around the world due to COVID 19. World Health Organization (WHO) recommended as well as advised countries across the globe to stop spread of disease by following social distancing and restricting social interaction. Therefore, countries across the globe had observed strict measures of lock down as well as social isolation measures (Sarfranz, Shehzad, 2020). Also, various sectors of economy were complete shut down as well as blocked like airlines, trade, educational institutions as well as transportation activities across the globe (Sarfranz, Shehzad, *et al.*, 2020). Coronavirus had reached everywhere across the globe and has led to stagnation of global economy with production intervention and the workings of global supply chains have been disrupted (Jachak *et al.*, 2020). Companies across the globe, whether big or small, have taken to reduction in production (Jachak *et al.*, 2020). Transport has been restricted and even confined between countries has further slowed down the functioning of the economy (Jachak *et al.*, 2020). A strong market inconsistency can be seen in the disfigured pattern of consumption and global financial market as well as stock exchange indicators have also reacted as well as jumped (Jachak *et al.*, 2020). COVID 19 was declared as a pandemic by World Health Organization (WHO) and India was also impacted severely thereby drastically impacting its economy as well.

Indian scenario:

COVID 19 crisis which is first of its sort for India in quite a while, as the country had not gone up against any such pandemic beforehand and thus it has attempted to test the status of the

preparedness of medical services structure, and the overall methodology of the Governments at the Centre and the State (ADRI, Patna, 2020). It had impact on India as well where by 30 March 2020 COVID 19 pandemic had grown to 1251 cases and 32 deaths (Chatterjee *et al.*, 2020). Government of India declared it as a National disaster and adopted a complete lockdown from 23rd March to April 4th 2020 which was extended three times with progressive relaxations, first up to 3rd May, second up to 17th May and third up to 31st May 2020 (Sinha, 2020). There after procedure of measured unlock started with authorization of State and local authorities to take procedures and safety protocols as per local situations to contain the disease (Sinha, 2020). To hold increment of cases there were various types of social distancing measures as far as lock down were applied like closing down of schools, colleges, workplaces, trying not to pack just as mass get-togethers, parades, network wide regulation and so forth were applied to everybody and contact following, reconnaissance just as quarantine were applied (Chatterjee *et al.*, 2020). There were various impacts on various sectors in India which have been discussed in brief below:

Impact of COVID 19 on healthcare

Scarcity of healthcare resources is a major challenge in Indian context. The Indian Council of Medical Research (ICMR) estimated that India has about 70,000 ICU beds and even fewer ventilators (Chatterjee *et al.*, 2020). India is home to 1.37 billion people, nearly one fifth of the world's population (United Nations, 2019). In such situation, will 70,000 ICU beds sufficient in the huge country like India is a question to ponder on. Insufficient infrastructure of health care in India made the scenario even worse especially in case of Government hospitals.

Psychological effects among health care workers

The coronavirus disease (2019) pandemic has caused an excessive financial and psychological chaos. Medical services Professionals are among the numerous groups of individuals who are in the cutting edge and confronting a danger of direct exposure to the infection of virus (Wilson *et al.*, 2020). It has put medical care authorities under tremendous burden and pressures as they contract with numerous factors some of which are painful working man hours, absence of PPE (Personal Protective Equipment) i.e. individual defensive gear, absence of explicit medicines, therapies and protocols, and being endlessly away from family (Wilson *et al.*, 2020).

Impact on child and maternal health

In vulnerable or poor families, there has been substantial rise in stress levels during the lockdown imposed (Dakshinamurthy *et al.*, 2020). There has been no access to routine health check-up for pregnant women as well as new born infants due to strict lockdown measure (Dakshinamurthy *et al.*, 2020). There has been an increase of domestic violence or abuse as well as gender-based violence against children and woman (Dakshinamurthy *et al.*, 2020).

Economic impact

Economic impact is huge enough to take away the current jobs of thousands of workers in India, furthermore attracting to more vulnerability of joblessness (Jachak *et al.*, 2020). The previous approximations of job data show that the coronavirus impact may have prompted influence the economy drastically accordingly making joblessness rise to 30.9% (Jachak *et al.*, 2020). The rising unemployment has led to the vicious cycle of poverty and debt trap among the vulnerable groups.

Impact on migrant workers

Migrant workers who run the major part of the economy through informal sector as well as construction labourers. These are considered as the back bone of Indian economy were impacted drastically due to pandemic. According to Kumar *et al.*, (2020), when lockdown was declared in India on 24th March, 2020 at 8 pm, the situation of these laborers turned into the subject of global consideration. There was no centre and state support at that exact second when the Government declared the 21 days lockdown despite the fact that the relief package was announced much later.

Kumar *et al.*, (2020) cites a survey conducted between 8 and 13th April, 2020, 90% of migrant workers in different states didn't get their wages by their employers in various states did not get paid by their employers, 96% didn't get ration from the public authority and 70% didn't get cooked food (Hindu 2020 cited by Kumar *et al.*, 2020). A large number of laborers across the nation began to walk hundreds and thousands of kilometres to their local places (Kumar *et al.*, 2020). (Hindu 2020 cited by Kumar *et al.*, 2020). New reports began coming in that few transient workers, their relatives, including youngsters lost their lives on their way back, either because of starvation or because of road accidents (Kumar *et al.*, 2020 cites Rawal, *et al.*, 2020).

Implications of COVID 19 on Bihar – case study

Bihar is taken as a case study as stated by Sarkar (2020) it is one state with massive amount poverty rate, hardship and underdevelopment (Sarkar, 2020). According to World Bank (2016), Bihar is the 3rd most populous state in India. It is home to 100 million people, 36 million of whom are underprivileged (World Bank, 2016). The state also observes most high movement of interstate out migration and relocation to the subsequent prosperous states (Sarkar, 2020). The unforeseen lockdown due to pandemic have brought about arrival of masses of migrant laborers to that State that have made grave monetary difficulties to the weak economy of Bihar (Sarkar, 2020). Sarkar, (2020) states that most of the migrant laborers from Bihar as a rule worked in the messy sloppy areas in progress, creating, minor private undertakings and projects and furthermore as domestic help etc. (Sarkar *et al.*, 2020). It is presently the concern of metropolitan states regarding how to hold back the migrant laborers or to re-pull in them to address the issues related with the lack of work as well as deficiency of labour (Sarkar *et al.*, 2020).

Public health care in Bihar

The existing state of well-being as well as public health care in Bihar has been moulded by bequest of continuous neglect (thewire.in, 2020). On account of numerous parameters of precautionary and promotional healthcare services, the record of the last state government in the last 15 years has continued to remain far from acceptable (Kumar *et al.*, 2020). According to Kapoor *et al.*, (2020), research conducted by Princeton University in the state of Bihar there were 292 ventilators in public sector and 480 ventilators in the private sector making it a total of 771 ventilators in both private and public sectors.

Kumar *et al.*, 2020 states that on 23rd March 2020, it was informed that most of the junior subordinate resident doctors employed in the Nalanda Medical College, Patna – the nominated hospital by the Government of Bihar as the state's principal hospital to treat cases of COVID -19 were displaying some symptoms due to coronavirus patients. Rather than following a home isolation for 15 days as advised, without any tests and reaction from the state government, all resident doctors and specialists kept on treating the patients for next a few days (Kumar *et al.*, cites Ray, 2020). Kumar *et al.*, 2020 further states that with no convention with respect to counteraction and control of COVID 19 until first passing was accounted for, the bungle of the state organization constrained Bihar into the phase of neighbourhood transmission at the absolute starting point. The density of testing centres testing focuses per populace in Bihar is most noticeably awful in the whole nation with one centre, Rajendra Memorial Research Institute of Medical Sciences, in Patna to tests its more than 110 million populaces (Kumar *et al.*, 2020).

Impact on informal sector

As indicated by Acharya *et al.*, 2020 in India about 80% of the labour force is utilized and employed in the casual informal sector and around 33% are used as day workers or labourers, the lockdown strategy may worsen current wellbeing, healthcare and lead to monetary imbalances (Acharya *et al.*, 2020 cites Lancet, 2020). Uttar Pradesh and Bihar are two of the least fortunate states in India, subsequently are at specific high danger of unfavourable wellbeing and monetary impacts of a COVID 19 flare-up and continuous lockdown, since the vast majority from these two satisfies work in the informal sector (Acharya *et al.*, 2020).

ADRI, Patna, (2020) in their report published states that the lockdown forced after the episode of Covid-19 has influenced the informal labour force, which is around 94 percent of the labour force in Bihar. Likewise, there was an immense inflow of the migrant during the underlying period of lockdown (ADRI, Patna, 2020). MGNREGA, an interest-based government program, end up being a powerful transient help measure for giving business, particularly for the rural and unskilled labour force (ADRI, Patna, 2020). The state government took some momentary measures to deal with the emergency anyhow, substantially more should be done to relieve the effect in the medium to long term (ADRI, Patna, 2020).

Reverse migration

According to Sarkar *et al.*, (2020), the return of millions of transient specialists' laborers will put huge burden on the rural labour market which has been in helpless situation, and was one of the very purposes behind high migration rate from Bihar. The contracting GDP levels will additionally add to the fuel, and will make it extremely hard for the employment in sectors like, development, industry, construction, manufacturing area and so on to restore (Sarkar, *et al.*, 2020).

Impact on the economy

The difficulties before the economy are additionally one of a kind this time as a financial emergency is brought about by the health emergency (ADRI, Patna, 2020). All things considered, the disturbance of the production and manufacturing activities in Bihar for a sensibly significant stretch may prompt the eradication of some small-scale production activities and industries, which represent an enormous number of creation units in a helpless economy like Bihar (ADRI, Patna, 2020). The difficulties before the economy are likewise one of a kind this time as a monetary emergency is brought about by the wellbeing emergency(ADRI, Patna, 2020).

According to website (ruralmarketing.in), as a result and outcome of COVID 19 lockdown, a study through survey was directed by Human Liberty Network discovered most important encounters and issues related to living, income, employment, healthcare, nourishment and elementary needs in rural Bihar the survey was done in 15 districts of Bihar with crucial results where strong social humiliation or stigma is predominant against reverse migrant workers. Bad presentation as well as performance of MNREGA creating people weaker was seen in case of Bihar(ruralmarketing.in).

Mushahar group is one of the most backward and neglected community in Bihar. Since they are normally landless subsequently huge number of individuals from this network need to go to different states looking for occupations and employments (ruralmarketing.in). They comprise enormous level of populace of transient laborers who returned in Bihar during the lockdown. After getting back to Bihar, they are confronting challenges in discovering work under MNREGA (ruralmarketing.in). Since a large portion of them have not worked under MNREGA before, they haven't been given occupation cards (ruralmarketing.in). Besides, MNREGA staff have not been helping them with documentation and enlistment (ruralmarketing.in). This has placed them in a weak position, where they have lost their wages and reserve funds with no substitute wellsprings of work (ruralmarketing.in). Hence in terms of social, public health as well as economic impact, Bihar is one of the state that has been affected the most in these hard times of pandemic.

Conclusion:

There are many ways in which economy in Bihar post COVID 19 can be revived. There can be various schemes which the Government can revive by giving benefit through Government Schemes at both Central and State level. The first focus is to improve the public health infrastructure at both Public Health and Private sectors. Special facilities for children and pregnant women. The second focus can be to bring and revive the livelihood mission, MGNREGA schemes and the packages announced by Government like Central Gareeb Kalyan Yojana should be reaching the poor people. These all packages will help the people of Bihar to uplift them in terms of social as well economic needs.

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EFFECT OF HEAT ON FOOD

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Introduction:

Heat processing is one of the most important methods for extending the storage life of the foodstuffs. Cooking also changes the appearance of the food. During the heating process or the cooking of food, a series of physical and chemical changes are taking place. And these changes are varied according to the heating method and time exposed, but there is also a changes in nutrient composition, fat content, flavour moisture, smell, colour and texture. The longer the food is heated and the higher the temperature, the greater the nutrient loss. Heat breaks down the cellulose and the starch present, changes the flavour within the food and it destroy the bacteria to make food digestible. When we look at home cooking as preparation, the heat applied during the extrusion process, Microwaving or grilling contribute to the reduction in the nutritional value. (How heat affects food - Jennifer Carter on Jul 9th 2019)

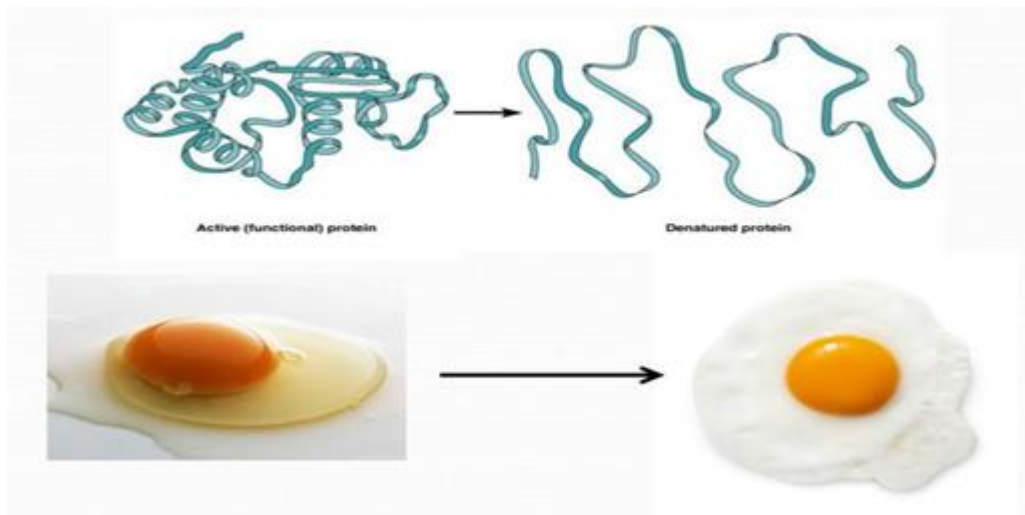
Foods are composed of protein, fats, carbohydrates and water plus trace elements like minerals, vitamins, pigments and flavor elements. It is most important to understand how these elements react when heated and when mixed with each other. We must understand the why foods behave as they do and then we can get them to behave, as you want them to. (<https://www.hotelierlifestyle.com/2020/12/what-are-effects-of-heat-on-food.html?m=1>)

Here are some of the basic reactions that occur when heat is applied to different foods.

1. Proteins:

Proteins are essential macromolecules made up of amino acids these are connected by peptide bonds. And perform a variety of functions in our body, including building and repairing tissues, transporting molecules, and catalyzing chemical reactions. Proteins are present in plant and animal-based food.

When proteins are exposed to heat, the energy causes the weak bonds between amino acids to break, and leading to a change in the protein's structure. This process is known as denaturation. The denaturation of proteins depending on the type of protein and the conditions of the heating process. denaturation can lead to coagulation, where the protein becomes insoluble and forms a gel-like substance. This process occurs when the proteins are heated in the presence of other ingredients, such as acid, or salt, water. Egg proteins coagulate on heating. Milk proteins coagulate on addition of acids.



Example: Boiled egg

The denaturation and coagulation of proteins can impact the flavor and texture of foods. When proteins coagulate, they trap water and other ingredients, leading to solid texture (semi-solid). That’s why the boiled egg is more solid than a raw egg.

Coagulation at 160-185°F (71- 85°C).

Non- enzymatic browning (Maillard Browning):

This reaction is of importance because it is responsible for many of the specific tastes, aromas and colours of food. Maillard reaction occurs when protein in foods, such as meats, are heated. The Maillard reaction involves destroying some of the food enzymes that were active prior to heating. This causes a browning in the color of the food and can be seen most often in the browning of beef and steak when they are cooked. e.g. Browning of biscuits etc.

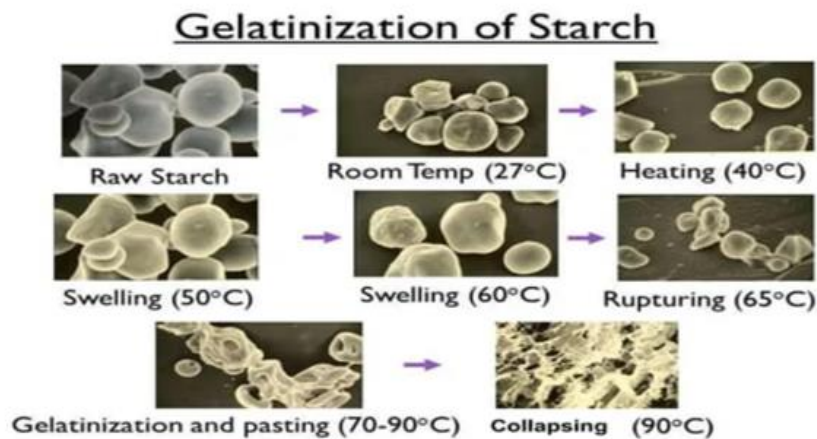
Effect of Heat	Example
Coagulation	Hard Boiling eggs
Colour change	Myoglobin in meat (red- brown)
Maillard reaction	Bread crust
Tenderising	Collagen in meat changes to gelatin and fibers fall apart
Indigestible	Over cooked meat or cheese become tough and hard to digestible

The Effects of Heat on Protein in Foods By Sandi Busch Updated September 30, 2017
 Effect on Milk Proteins Milk contains two groups of proteins – casein and whey – which react with one another at high heat. This is beneficial for some purposes, such as making cheese, because it prevents curds from forming. Casein and whey have different physical characteristics that make whey proteins more sensitive to heat. Whey withstands pasteurization but denatures at higher temperatures. Denatured whey can bind with more water, which improves the consistency of products such as yogurt, reports Milk Facts.

Starches:

Gelatinization occurs when starches absorb water and swell. This is a major principle in the making of sauces and the production of bread and pastries. Acids inhibit gelatinization. Starch is the most common carbohydrate in human diets. As heat is applied to starch it absorbs moisture from its surroundings and becomes softer. This process is called gelatinization. It is a process in which the solid starch granules turn into a gelated starch when dissolved in water, by heating the suspension. Starch granules primarily swell as the intermolecular bonding between the starch molecules breaks under high heat (50 degrees Celsius or above), resulting in more water absorption. Eventually, the starch granules burst, and they start leaching the crystalline layers as gelatinous sheets into the surrounding water. And is the reason pasta and rice double in size and soften when cooked.

Gelatinization begins at 150° F.



Sugars:

Caramelization is the browning of sugars. When sugar is heated, whether it's added or naturally in foods, it becomes brown and changes dramatically in flavor. This popular process is called caramelization, and it's responsible for flavors we associate with cooking and baking. Caramelization is a type of non-enzymatic browning reaction process used extensively in cooking for the resulting nutty flavor and brown color. The reaction involves the removal of water (as steam) and the break down of the sugar. Caramelization occurs at higher temperatures which is why foods only brown when using dry heat methods. The browning of seared meats and the golden crusts of bread loaves are forms of caramelization.

The caramelization reaction depends on the type of sugar.

- Caramelization begins at 338° F
- Sucrose and glucose caramelize around 160C (320F)
- Fructose caramelizes at 110C (230F)

Caramels are the chewy candies made by cooking sugar, cream, corn syrup, and butter to 245° F. Their brown color comes from a reaction between the sugar and the protein in the cream.

This reaction is called the Maillard Reaction. Caramelization is what happens to pure sugar when it reaches 338° F.



Water:

Dried food too contains some percentage of water 01%. Fresh vegetables, meat, dairy products, and fruits contain the most water. Water exists in three states solid, liquid, and gas. Water can also turn from liquid to gas at lower temperatures. When water turns to gas at any temperature, the process is called evaporation. Evaporation occurs more slowly the lower the temperature is. Evaporation is responsible for the drying of foods. The drying of food surfaces as they are cooked enables them to be browned. Many minerals and other compounds dissolve in water, so water can be a carrier of flavor and of nutritional value. When water carries dissolved compounds, such as salt or sugar, its freezing point is lowered and its boiling point is raised. The evaporation of water is one of the most common, yet most underrated processes in cooking. When water molecules within the food are brought to a boil, they begin to move faster and faster until they change to gas (steam) and evaporate. Since water is present in many foods, evaporation that occurs as food is cooked or heated causes the food to dry out.

Evaporation begins at 212° F.

Fat:

When oils are heated, they undergo chemical changes that affect their taste, color, and nutritional value. As the temperature rises, the oil begins to break down and release volatile compounds, some are harmful to health, the heat can cause the oil to oxidize, leading to rancidity and off-flavors.

When heat is applied to fats, they melt, rather than evaporate or solidify. Fats can take the form of a solid, liquid, or a variation of both. However, they all become liquid when heated. Fats are used as a medium for cooking and baking because they are less likely to burn than other substances.



Melting temperature depends on the fat.

Vitamins and minerals:

Water-soluble vitamins: vitamin C and the B vitamins — thiamine (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), folic acid (B9), and cobalamin (B12)

Fat soluble vitamins like (A, D, E, K) have a relatively stable structure with the cooking temperature, in the process of cooking and cooking, often this group of vitamins will be lost by 15-20% .

Minerals like potassium and magnesium.

These Minerals and vitamins are important to the nutritional quality of the food.

- Pigments are important to a food's appearance.
- All these components may be leached out, or dissolved away from foods during cooking.
- Vitamins and pigments may also be destroyed by heat, by long cooking and by other elements present during cooking.

Vitamins and minerals are lost primarily by leaching, oxidation of water soluble nutrients and thermal destruction. Changes in vitamins The loss of water soluble vitamins ranges from 0-60% as a result of leaching (drain away) , thermal destruction and oxidation. Frying and roasting can cause the loss of fat soluble vitamins ranging from 40- 60 % Vitamin A and Carotene do not leach out in water because these are insoluble in water. There is slight destruction of these vitamins during cooking in water due to oxidation by air.

Vegetables are generally a great source of vitamin C, but a large amount of it is lost when they're cooked in water.

In fact, boiling reduces vitamin C content more than any other cooking method. Broccoli, spinach, and lettuce may lose up to 50% or more of their vitamin C when boiled. Because vitamin C is water-soluble and sensitive to heat, it can leach out of vegetables when they're immersed in hot water.

B vitamins are similarly heat sensitive. Up to 60% of thiamine, niacin, and other B vitamins may be lost when meat is simmered and its juices run off.

Loss of Vitamins during cooking

Thiamine (vit. B1)

- Its destruction by heat during cooking
- Its leaching out in cooking water
- If cooking soda is used, most of this Vitamin. Is lost.

Riboflavin

- Exposure of food to strong light during cooking
- Due to heat
- Due to solubility in water
- Due to soda

Niacin

- It is lost in cooking water

Pyridoxine

- It is lost by leaching out in cooking water

Ascorbic Acid (Vitamin C)

- It is lost in two ways:
- By oxidation due to exposure to air during cooking
- By leaching out in excess cooking water

Minerals:

Minerals are also lost on account of leaching and their losses are smaller i.e. 0-35 %

Caicium and Phosphorus - These minerals are lost in excess of cooking water.

Iron - Iron is lost in excess cooking water. Iron content of the foods can be increased. When vegetables are cut with iron knives or cooked in iron pans, an appreciable amount of iron is incorporated in the foods.

Sodium, Potassium and Magnesium - These minerals are loss by leaching out in water. NaCl is added to foods as salt which increases the Sodium content of the cooked food.

Conclusion:

We know that heat affects food and we have seen it too while cooking. foods are composed of proteins, fats, carbohydrates, and water, plus small amounts of other compounds such as minerals (including salt), vitamins, pigments (coloring agents), and flavor elements. Physical and chemical reactions that affect the components of food. Heat is one of the most crucial scientific reactions that occur while cooking, and it can greatly affect the taste, texture, and consistency of food. Because most foods are composed of a variety of these substances, multiple variations of these reactions can occur simultaneously, making the ability to monitor and adjust applied heat crucial to food quality.

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INTERACTION OF DRUGS ON NUTRIENTS: REVIEW STUDY

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Introduction:

A drug is a chemical that interacts with proteins in the body to affect a physiological function. This is the general idea behind all medicine. Once these chemicals are absorbed into the systemic circulation they bind with certain proteins and this changes the functioning of the cell slightly. For example, anticancer drugs bind to proteins on the surface of cancer cells this stimulates the cells to die. In this case cell death is the physiological action of the drug. No drugs are specific to interacting with just one type of cell or one type of protein and this is what causes side effects. Again using an anticancer drug as an example, the medication works by binding to very rapidly dividing cells, such as cancer cells, however hair cells are also rapidly dividing and that is why one of the side effects of anticancer drugs is hair loss.

How do drugs work

Our bodies are largely controlled by proteins. Proteins exist in many different forms in the body and have many different functions. Each protein has a specific function and is quite specific to the cell type that it acts on. For example, there are specific types of proteins called receptors. Receptors are embedded on the cell surfaces, there are different receptors for different types of cells. A liver cell will have different receptors than a cardiac cell. The receptor binds to other proteins and chemicals on the outside of the cell and this in turn creates a change in the functioning of the cell.

Absorption

Many factors affect absorption. The principal factors are the route of administration, the dosage form, the chemical nature of the drug, and the local at the site of absorption (i.e., pH, blood flow, physiological changes of tissue, etc.). One general principle to remember is that drugs are generally absorbed in an unionized form. Weakly acidic drugs are, therefore, generally absorbed in the stomach, while weakly basic drugs are absorbed in the small intestine. Most drugs are weakly basic. Binding to other chemicals in the gastrointestinal tract may interfere with absorption. Distribution Once the drug enters the body, it travels within the bloodstream. Depending on its chemical nature, the drug may preferentially concentrate in a particular tissue. Many water-soluble drugs remain in the fluid compartment. Other drugs may preferentially accumulate in adipose tissue or muscle. This affects the serum levels of the drug. Theoretically, the concentration of a drug put in a solvent should be equal to the amount of the drug divided by the volume of the solvent. If you think of the organism as the solvent for a drug, then the amount

of the drug absorbed divided by the volume of the organism should equal the measured drug concentration. Since the organism is not a single solvent, this does not work. A theoretical construct called volume of distribution (Vd) is used to reconcile the measured serum level and the amount of drug absorbed. A volume of distribution of 0.6 L/kg indicates that the drug is distributed principally in the fluid compartment that accounts for about 60% of our body weight. A lower Vd would indicate that the drug is preferentially found in the bloodstream. Higher Vds indicate that the drug is sequestered in tissues other than the bloodstream (i.e., muscle, bone, CNS, etc.).

Metabolism

When a drug enters the body, it will encounter metabolic processes that may alter its chemistry. As a general rule, the metabolic processes in the body tend to decrease toxicity and enhance the elimination of foreign chemicals. These paired processes are achieved by three principal mechanisms: (1) increasing the water solubility of these chemicals, (2) decreasing the size of the foreign molecules, and (3) binding the drugs to larger molecules (conjugation). The end products of these processes are referred to as metabolites. Metabolism can happen in the peripheral tissue of the body or in a specific organ. The liver is frequently the organ involved in this process. Many enzymes participate in drug metabolism; one group of liver enzymes responsible for much of this activity is the cytochrome P450 enzymes. Furthermore, many subgroups of enzymes exist in this class. One drug or nutrient may alter the action of these enzymes on a second drug or nutrient by binding to or having a greater affinity for the enzymes than the other substance. This may result in drug–drug or drug–nutrient interactions. Changes in liver function may also affect drug metabolism. Age alone, in the absence of liver pathology, will affect drug metabolism. This will be elaborated in later chapters of the text.

Elimination

Several organs are involved in eliminating drugs from the body. The kidneys are the most important organs in this regard. These organs of homeostasis remove drugs and drug by-products from circulation by both passive action (filtration) and by active processes involving secretion and resorption of substances from the plasma. The lungs, the liver, the skin, and various glands may also help in the elimination of chemicals from the body. Once again, age will be a factor because renal function declines as a function of normal aging. Substances processed by the kidney may be actively or passively secreted into the urine as it traverses the nephron, which is the functional unit of the kidney. Substances can also be actively or passively reabsorbed into the bloodstream before leaving the nephron. This process can be affected by the pH of the urine and can be enhanced or inhibited by the presence of other substances in the urine or the blood. Drugs that alter urine production, such as diuretics, may also affect the urinary excretion of drug and drug metabolites, and this may result in interactions.

Types of the drugs

Dosage forms

In order to take advantage of this multitude of medication administration routes, a similarly diverse number of dosage forms have been devised. Some, such as urethral bougies, are no longer in common use, while others, such as the transcutaneous patch and metered dose inhalers (MDI), are becoming increasingly popular.

Pills and powders

When the general public thinks of an oral dosage form, the word pill is commonly used. The pill is actually an archaic dosage form. Pills consist of medication combined with inactive ingredients to form a gelatinous (doughy) mass. This mass is then divided, rolled into cylinders on a pill tile, and then cut into individual pills. The pills are then dried prior to use. Currently, few medications are truly pills. Carter's Little Liver Pills® and Lydia Pinkham's Pills® are among the last of a once popular dosage form for both manufactured and extemporaneously prepared medications. Powder papers (a small, precisely measured quantity of medication and diluent inside a folded piece of paper) were once a popular method of drug delivery. Two over-the-counter (OTC) popular medications are available in this form: BC Powders and Goody's Powders.

Tablets, capsules, and high tech

The most common dosage form is the tablet. It is prepared from a dry mixture of active and inactive ingredients (excipients). The excipients include binders, lubricants, diluents, and coloring agents. This mixture is mechanically compressed into solid tablets in various shapes. The excipients are considered inert ingredients, but can occasionally cause difficulty in individual patients. Lactose is commonly used as a diluent. The quantity is usually too small to cause adverse effects, even in a lactose intolerant individual. Tartrazine, commonly called FD&C yellow dye No. 5, is a coloring agent. Serious allergic reactions are possible to this agent and to medications colored with it. Capsules are the other most common oral dosing form. Active ingredients, diluents, and lubricants (to improve the flow of the powder through the equipment) are put into preformed, hard gelatin shells that are then mated with a second gelatin shell. Liquid medication can also be sealed into a capsular shell. Several variations on the manufacturing of tablets and capsules can result in delayed or extended medication release into the gastrointestinal tract. The absorption of the drug into the bloodstream and the pharmacological effect of the drug will be affected by this alteration in the release of the medicine. The most advanced oral dosage forms use semipermeable membranes or laser technology to produce dosage forms that release medication into the gastrointestinal tract at a controlled rate. Some drugs may be absorbed from the capillary beds in the mouth. Nitroglycerin tablets are designed to dissolve under the tongue and will be absorbed sublingually. Recently, rapid dissolving tablets have been developed to deliver medications into the gastrointestinal tract. The medication is released in the oral cavity

but is absorbed at numerous locations in the gastrointestinal tract. This results in a quicker onset of action. Rapid disintegration (RD) is frequently associated with this type of dosage form. Other medications may be designed for absorption from the inner aspect of the cheek. These are referred to as buccal dosage forms. Lozenges may be used to deliver medication into the oral cavity for both local and systemic action. Local anesthetics for treating a sore throat can be put into a lozenge. A powerful pain medication, fentanyl, is available in a lozenge on a stick form for transmucosal absorption. Cough suppressants are also available as lozenges.

Liquids

Oral liquids remain a popular dosage form. This category includes solutions such as teas (infusions and decoctions), fluid extracts, syrups, drops, and tinctures, as well as emulsions and powders ready for reconstitution with water. With the popularity of “natural remedies,” the use of teas and homemade preparations has increased. All oral liquids are relatively simple in comparison to oral liquid nutritional supplements. The supplements are generally oil-based solutions emulsified within water-based solutions with some of their ingredients suspended in a colloidal form. Recently, the introduction of foods having desirable pharmacological properties has further blurred the distinction among drugs, nutritional supplements, and foods. Benecol (contains plant stanol esters) and Take Control® (plant sterol-enriched spread) are the best examples of this, but even the marketing of oatmeal and oat bran ventures into this newly grayed area separating drugs and foods.

Rectal dosage forms

Other enteral dosage forms are designed for absorption in the sigmoid colon and may be solid dosage forms (suppositories), liquids (enemas), or aerosols (foams). Again, both local and systemically acting medications may be given via this route. Hemorrhoid treatments, antiemetics, laxatives, and antipyretics (medications used to treat fever) are all commonly given in these forms.

Topical Agents

Topical dosage forms are similarly diverse. Ointments (oil base) may deliver topical medications. Creams (water-soluble base), gels, and mustards (pasty substance spread on a cloth and wrapped around a body part) also do so. Shampoos, soaps, solutions, and topical patches may also deliver medication in a useful manner. Nasal, ophthalmic, and otic (for the ear) solutions and suspensions are available. Aerosols, sprays, nebulized medications, metered dose inhalers, and powders for inhalation are used to deliver medication to the respiratory tract. Intravaginal suppositories (also called vaginal tablets), creams, douches, and sponges are used to deliver medications.

Injections

Parenteral dosage forms are mainly water-based solutions, but a few novel approaches are used. These include solutions in solvents other than water, oil-in-water emulsions, and even

drug-impregnated solids used as subdermal implants. Recently, drugs have even been delivered inside liposomes in a parenteral liquid.

Proteins also act as drug targets. In order for a drug to exert an effect it needs to be bound to a protein. This can be thought of as a lock and key system; where the drugs are the key and the protein is the lock. Once the drug is bound in this lock and key mechanism it can have one of two main influences over the cell. It can produce a change in response or it can stop a normal response of the cell. Drugs that produce a change in the cell functioning are called agonists. Drugs that stop a normal function of the cell are called antagonists.

Nutrient

Nutrient intake is consuming a substance that provides nourishment essential for the maintenance of life and growth. Nutrients are the compounds in foods essential to life and health, providing us with energy, the buildings for repair and growth and substances necessary to regulate chemical processes.

There are 6 major nutrients: carbohydrates (CHO), Lipids (fats), Proteins, Vitamins, Minerals, Water.

Primary sources of nutrients are

Proteins: meat, dairy, legumes, nuts, seafood, and eggs

Carbohydrates: pasta, rice, cereals, breads, potatoes, milk, fruit, sugar.

Lipids (most commonly called fats): oils, butter, margarine, nuts, seeds, avocados and olives, meat and seafood.

Vitamins: common vitamins include the water soluble B group vitamins and vitamin C and the fat soluble vitamins A, D, E, and K. fruits, vegetables, grains, cereals, egg yolk, dairy products and oils containing the vitamins.

- Fruits and vegetables are generally good sources of vitamin C and A and folic acid. Grains and cereals are generally good sources of the B group vitamins and fiber.
- Full fat dairy and egg yolks are generally sources of the fat soluble vitamins A, D and E. milk and vegetable or soya bean oil are generally good sources of vitamin K, which also be synthesized by gut bacteria.

Minerals: (sodium, calcium, iron, iodine, magnesium, etc): all foods contain some form of minerals. There are 16 different which are necessary for the body, they can be found in abundance in fruit, vegetables, seaweed, and milk/dairy products.

- Milk and dairy products are good source of calcium and magnesium.
- Red meat is a good source of iron and zinc.
- Seafood and vegetables (depending on the soil which they are produced) are generally good source if iodine.

Water: as a beverage and a component of many foods, especially vegetables and fruits.

Drug interaction

A drug-nutrient interaction is the effect of a medication on food or a nutrient in food. Medications interact with foods and nutrients in several ways. Medications can decrease appetite or change the way a nutrient is absorbed, metabolized, or excreted. A food-drug interaction is the effect of food or a nutrient in food on a medication. Dietary nutrients can affect medications by altering their absorption or metabolism. The food you eat could make the medications you take work faster, slower, or even prevent them from working at all.

Such interactions raise concerns that medications may lead to nutritional deficiencies or that your diet may change how a medication works. This does not mean that if you are taking a medication you need to use a vitamin and or mineral supplement. There is little chance that taking a medication for a short time, such as a ten-day treatment, will affect your nutritional status. However, use of some medications for months or years may affect your nutritional health. Children, older adults, pregnant women, people who are poorly nourished, and people with a chronic disease are at greater risk of medications affecting their nutritional health. Changing the diet to include more foods rich in vitamins and minerals is preferred to taking vitamin or mineral supplements. In fact, vitamin and/or mineral supplements taken in excess can affect how a medication works.

Effects of food on drug intake

Drug absorption: Food or nutrients in the stomach or intestine may act to reduce the absorption of a drug by delaying digestion, binding to minerals found in the food, or adhering to food particles. In other cases, the food may promote drug absorption.

Drug breakdown: Food may act to enhance or inhibit the metabolism of certain drugs in the body.

Drug excretion: Food and nutrients may act to alter the reabsorption and excretion of drugs from the kidney.

Other actions: Certain food components can lead to the enhancement or opposition of the effects of some drugs. Some examples of food and constituents found in food include: vitamins, minerals, fat, proteins, caffeine, or alcohol.

Effects of drugs on food and nutrition

Nutrient absorption: Certain drugs may increase, decrease, or prevent nutrient absorption in the gut.

Nutrient breakdown: Drugs may speed up the metabolism of certain nutrients, resulting in higher dietary requirements of that particular nutrient.

Nutrient excretion: Drugs can increase or decrease the urinary excretion of nutrients. (Nutrient-Drug Interactions and Food by L. Bellows and R. Moore)

Types of Drug-Nutrient Interactions

1. Drug – drug interaction
2. Drug – nutrient interaction

1. Drug – drug interaction

Drug-drug interaction refers to the reactions which may develop between two or more drugs that may result in altered structure of the parent compound and development of new compound(s). This may in turn elicit unexpected side effect. which may cause sever morbidities and even mortality in isolated cases. Some examples of drug-drug interaction include: antiemetics may interact with sedatives and tranquilizers, aspirin can interact with alcohol to cause stomach bleeding. Sometimes, the effect of one drug may be increased or decreased. For example, tricyclic antidepressants can decrease the ability of a hypotensive to lower blood pressure. In other cases, the effects of a drug can increase the risk of serious side effects. For example, some antifungal medications can interfere with the way some cholesterol-lowering medications are broken down by the body. This can increase the risk of a serious side effect.

2. Drug nutrient interaction

Drug nutrient interaction refers to specific changes in the process by which a drug is absorbed, distributed, metabolized and eliminated by the body due to the presence of nutrient . The study of the effect of drugs on various nutrient and vice-versa help us in understanding and minimizing these interactions which can help in gaining maximum benefit from particular drug dosage without disturbing the nutritional homeostasis in the body/deteriorating the existing nutritional status. This would also help in minimizing the expenditure on health care services and the incidence of various disease complications or side effects. For example,

1. Vitamin K found in green leafy vegetables, tomatoes, coffee, beef liver, green tea etc., and some non prescription vitamin-mineral products can antagonize the anticoagulant effect of warfarin, resulting in decreased anticoagulant activity and lowered prothrombin time (PT); laboratory blood tests.
2. Vitamin B6 (pyridoxine) found in avocados, beans, peas, sweet potatoes, bacon, pork, tuna, and some non prescription vitamin-mineral products, increases the metabolism of levodopa, producing decreased blood levels of dopamine and antiparkinsonism effects.
3. Calcium, magnesium and aluminium found in food supplements or antacid compounds bind (chelate) with ciprofloxacin and tetracycline to form an insoluble complex resulting in significantly decreased absorption of these antibiotics and decreased antibiotic effect.
4. Calcium in vitamin-mineral products and liquid enteral nutritional supplements interact with some fluoroquinolone antibiotics and with phenytoin, reducing their bioavailability and resulting in decreased antibiotic activity and loss of seizure control, respectively. (Nutrient and drug interaction by ignou, the people's university)

Fruit juices

Among all fruit juices, grape fruit juice (GFJ) possesses high interaction with almost all types of drugs. The juice modifies the body's way of metabolizing the medication, affecting the liver's ability to work the drug through a person's system. Taniguchi in 2007 reported a case of purpura associated with concomitant ingestion of cilostazol, aspirin and grapefruit juice in 79 years old man. His purpura disappeared upon cessation of grapefruit juice, although his medication was not altered. The most probable cause of his purpura is an increase in the blood level of cilostazol because of the inhibition of cilostazol metabolism by components of grapefruit juice; Taniguch.⁹ Numerous reports have documented drug interactions with GFJ that occur via inhibition of CYP3A enzymes.

Furanocoumarins present in GFJ inhibit the intestinal CYP 3A4 and have been shown to increase the oral bioavailability of medications that are CYP 3A4 substrates like Felodipine, midazolam, cyclosporine and raise their concentrations above toxic levels. GFJ is generally contraindicated to patients taking psychotropics and it is advised to inform patients about described interaction. The in vitro data suggest that compounds present in grapefruit juice are able to inhibit the P-gp activity modifying the disposition of drugs that are P-gp substrates such as talinolol. The overall exposure of some drugs can be increased by more than fivefold when taken with GFJ and increase the risk of adverse effects. With new anticonvulsants, serum iron and sodium need to be monitored. Additionally, users are advised to avoid drinking grape fruit juice within 1-2 hr(s) of taking these anticonvulsants.

Furanocoumarines and active bioflavonoids present in GFJ are also inhibitors of OATP and when ingested concomitantly, can reduce the oral bioavailability of the OATP substrate, fexofenadine. Overall, a series of flavonoids present in GFJ are identified as esterase inhibitors, of which kaempferol and naringenin are shown to mediate pharmacokinetic drug interaction with most of the calcium channel antagonist and the statin groups of drugs such as enalapril and lovastatin due to their capability of esterase inhibition. Cholesterol-lowering agent lovastatin should be taken with food to enhance gastrointestinal absorption and bioavailability. The absorption of rosuvastatin, another anti-hyper lipidemic agent, was significantly decreased in the fed state compared with the fasting state, which suggests that rosuvastatin should be administered on an empty stomach. Simvastatin, Ezetimibe, pravastatin and fluvastatin may be taken without regards to food. However, high fiber diets may lower the efficacy of these drugs. Concomitant administration of statins with food may alter statin pharmacokinetics or pharmacodynamics, increasing the risk of adverse reactions such as myopathy or rhabdomyolysis or reducing their pharmacological action. Consumption of pectin or oat bran together with Lovastatin reduces absorption of the drug, while alcohol intake does not appear to affect the efficacy and safety of Fluvastatin treatment.

Warfarin

Warfarin is commonly used to treat or prevent thromboembolic events. Patients taking warfarin are at particular risk of interactions with dietary supplements, yet approximately 30% use herbal or natural product supplements on a regular basis. There is a possible interaction between warfarin and a highprotein diet. The potential for increased dietary protein intake to raise serum albumin levels and/or cytochrome P450 activity has been postulated as mechanisms for the resulting decrease in international normalized ratio (INRs). Some vegetables (broccoli, Brussels sprouts, kale, parsley, spinach, and others) are high in vitamin K. Eating large quantities or making sudden changes in the amounts eaten of these vegetables, interferes with the effectiveness and safety of warfarin therapy.

Eating charbroiled food may decrease warfarin activity, while eating cooked onions may increase warfarin activity. Soy foods have been reported both to increase and to decrease warfarin activity. The significance of these last three interactions remains unclear. The combination of warfarin administration and cranberry juice ingestion appeared to be associated with an elevated INR without bleeding in elderly patient. A number of studies have been documented on the interaction of warfarin and cranberry juice. Cranberry juice is a flavonoid, which has been shown to induce, inhibit, or act as a substrate for the biosynthesis of several cytochrome P-450 (CYP) isoenzymes. Specifically, cranberry juice may inhibit the activity of CYP2C9, the primary isoenzyme involved in the metabolism of S-warfarin. It was suggested that cranberry juice increased the International Normalized Ratio (INR) of patients taking warfarin, but neither clearly identified cranberry juice as the sole cause of INR elevation. If warfarin sodium is ingested with leafy green vegetables, the hypoprothrombinemic effect of warfarin may be decreased and thromboembolic complications may develop.

Monoamine Oxidases

Antidepressant activity of monoamine oxidase inhibitors (MAOIs) was initially noted in the 1950s. Although older monoamine oxidase inhibitors (MAOIs) are effective in the treatment of depressive disorders, they are under-utilized in clinical practice due to main concerns about interaction with tyramine-containing food (matured cheese, red wine, ripened bananas, yogurt, shrimp paste and salami) or so called cheese reaction, since they are capable of producing hypertensive crisis in patients taking MAOIs. The first-generation MAOIs such as phenelzine and isocarboxazid were largely nonselective inhibitors of both subtypes of MAO, MAO (A) and MAO (B). These medications carried with them dietary restrictions. Tyramine is an indirectly acting sympathomimetic agent, is degraded by MAO but in the presence of MAOIs, it escapes degradation and reaches the systemic circulation where it is taken up by the adrenergic neuron, leading to a hypertensive crisis. However, MAOIs have been well established as an effective intervention for people with treatment-resistant depression, and transdermal formulations may provide a valuable therapeutic option and eliminate the drug-food interaction.

Antihypertensive drugs

Patients placed on anti hypertensive drugs will benefit from concomitant moderate sodium restricted diets. Propranolol serum levels may be increased if taken with rich protein food. A change in diet from high carbohydrates/low protein to low carbohydrate/ high protein may result in increased oral clearance. Smoking may decrease its plasma levels of by increasing its metabolism. The intestinal absorption of celiprolol (beta-blocker) is inhibited when it is taken with orange juice. Hesperidin, present in orange juice, is responsible for the decreased absorption of celiprolol. The absorption of ACEs inhibitors is increased when taken on an empty stomach. While GFJ increases the bioavailability of felodipine (Ca² channel blocker). Licorice extract, a common ingredient of dietary supplement contains glycyrrhizin and glycyrrhetic acid. It is a potent inhibitor of 11- bet- hydroxyl steroid dehydrogenase, it increases excess of cortisol to mineralocorticoid receptors causing sodium retention and potassium depletion, so it may interfere with various medicines including antihypertensive and antiarrhythmic agents. A high intake of liquorice can cause hypermineralocorticoidism with sodium retention and potassium loss, oedema, increased blood pressure and depression of the renin-angiotensin-aldosterone system. Studies showed that a daily consumption of glycyrrhizic acid of 95 mg or more caused an increase in blood pressure. A practical guideline for an acceptable daily intake of glycyrrhizic acid seems to be 9.5 mg a day. This means no more than 10-30g liquorice and no more than half a cup of liquorice tea a day.

Antibiotics

Antibiotics are widely prescribed in medical practice. Many of them induce or are subject to interactions that may diminish their anti-infectious efficiency or elicit toxic effects. Food intake can influence the effectiveness of an antibiotic. Avoid coadministration of antibiotics with milk products which are rich sources of divalent ions, such as calcium and magnesium that complex with some antibiotics and prevent their absorption. The intake of dairy products, however, needs to be monitored and encouraged with appropriate consideration of specific antibiotics involved.⁴⁵ A number of studies give evidence that fluoroquinolones forming slightly soluble complex with metal ions of food show reduced bioavailability. Casein and calcium present in milk decrease the absorption of ciprofloxacin.

The effect of interaction of five fruit juices on the dissolution and absorption profiles of ciprofloxacin tablets were determined. It was found that the absorption of ciprofloxacin (500 mg) tablets can be reduced by concomitant ingestion of the GFJ.⁴⁸ Therefore, to avoid drug therapeutic failures and subsequent bacterial resistance as a result of sub-therapeutic level of the drug in the systemic circulation, ingestion of the juice with ciprofloxacin should be discouraged. Azithromycin absorption is decreased when taken with food, resulting in a 43% reduction in bioavailability. Tetracycline should be taken one hour before or two hours after meals, and not taken with milk because it binds calcium and iron, forming insoluble chelates, and influencing its

bioavailability. The effect of milk added to coffee or black tea on the bioavailability of tetracycline was evaluated in healthy individuals. Results showed that even a little quantity of milk containing extremely small amounts of calcium severely impair the absorption of the drug, so that the presence of this metal ion should be carefully controlled in order to avoid decreasing the available tetracycline. Food-drug interactions may reduce the bioavailability of drugs taken after meals (negative food effects). However, enteric-coated tablets that start to disintegrate when they reach the middle-to-lower region of the small intestine could reduce negative food effects. Results indicated that food-drug interactions were avoided by separating the main absorption site of drugs from that of food components.

Analgesics and Antipyretics

Analgesics and antipyretics are used to treat mild to moderate pain and fever. For rapid relief, acetaminophen should be taken in an empty stomach because food may slow the body absorption of acetaminophen. Co-administration of acetaminophen with pectin delays its absorption and onset. NSAIDs like ibuprofen, naproxen, ketoprofen and others can cause stomach irritation and thus they should be taken with food or milk. Avoid or limit the use of alcohol because chronic alcohol use can increase the risk of liver damage or stomach bleeding. The absorption of ibuprofen and oxycodone when given in the combination tablet was affected by the concomitant ingestion of food. The C_{max} and $AUC_{0-\alpha}$ of ibuprofen were significantly increased after single and multiple doses of Coca-Cola, thereby indicating increased extent of absorption of ibuprofen. The daily dosage and frequency of ibuprofen must be reduced when administered with Coca-Cola. Food intake did not appear to affect the extent of absorption (ie, total exposure) of oral Diclofenac potassium soft gelatin capsule at doses.

Bronchodilators

Bronchodilators like theophylline, albuterol, and epinephrine possess different effects with food. The effect of food on theophylline medications can vary widely. High-fat meals may increase the amount of theophylline in the body, while high-carbohydrate meals may decrease it. Avoid alcohol if taking theophylline medications because it can increase the risk of side effects such as nausea, vomiting, headache and irritability. Avoid eating or drinking large amounts of foods and beverages that contain caffeine (e.g., chocolate, colas, coffee, and tea) since theophylline is a xanthine derivative and these substances also contain xanthine. Hence consuming large amounts of these substances while taking theophylline, increases the risk of drug toxicity. Additionally, both oral bronchodilators and caffeine stimulate the central nervous system. Patients may be advised not to consume GFJ when taking theophylline, since it increases the bioavailability,⁵⁸ and monitoring of plasma theophylline levels in patients consuming GFJ might be helpful in better management of patient care.

Antihistamines

Fexofenadine, loratadine, rupatadine, cimetidine cetirizine, are all antihistamines. It is best to take prescription antihistamines on an empty stomach to increase their effectiveness. Rupatadine is commonly used for the management of diseases with allergic inflammatory conditions. A study indicates that concomitant intake of food with a single 20 mg oral dose of rupatadine exhibits a significant increase in rupatadine bioavailability. Cimetidine is given with food to assist the maintenance of a therapeutic blood concentration. A fraction of cimetidine is absorbed in the presence of food, allowing the remaining drug to be dissolved once the gut is cleared. Thus, therapeutic levels are maintained throughout the dosing interval. A study was conducted on a latest molecule esomeprazole (acid-reducer), and it was observe that its bioavailability was reduced when taken within 15 min before eating a high-fat meal vs. that while fasting.

Antitubercular Drugs

Anti-tubercular drugs like isoniazid have been associated with tyramine and histamine interactions. Inhibition of monoamine oxidase and histaminase by isoniazid can cause significant drugfood interactions. Food greatly decreases isoniazid bioavailability. Oleanolic acid, a triterpenoid exists widely in food, medicinal herbs and other plants, has antimycobacterial activity against the *Mycobacterium tuberculosis*, when administered with isoniazid, it exerts synergistic effect. High fat meals decrease the serum concentration of cycloserine, a bacteriostatic anti-tubercular drug and results in incomplete eradication of bacteria.

Antidiabetics

Glimepiride is an antidiabetic and a new generation sulfonylurea derivative should be administered with breakfast or the first main meal of the day. It has absolute bioavailability and the absence of food interaction guarantee highly reproducible pharmacokinetics. Immediate release glipizide should be taken 30 minutes before meals. However, extended release tablets should be taken with breakfast. The maximum effectiveness of acarbose, an alpha-glucosidase inhibitor is attained when the drug is taken immediately at the start of each meal (not half an hour before or after), because it delays the carbohydrate absorption by inhibiting the enzyme alpha-glucosidase. Thyroxine Recent evidence pointed out the role of gastric acid secretion on the subsequent intestinal absorption of thyroxine in relation with the timing of food ingestion as well as with pH impairment associated to frequent gastric disorders like *Helicobacter pylori* infection and gastric atrophy. Levothyroxine is a derivative of thyroxine. Grapefruit juice may slightly delay the absorption of levothyroxine, but it seems to have only a minor effect on its bioavailability. Accordingly, the clinical relevance of the grapefruit juice-levothyroxine interaction is likely to be small. Drug interactions may be theoretical or clinically relevant. A summary table is given to highlight some significant food-drug interactions. Some may be taken advantage of, to the benefit of patients, but more commonly drug interactions result in

unnecessary adverse events. Fortunately, undesirable drug interactions can be prevented. Becoming more familiar with potential drug interactions can help clinicians predict and explain a patient's response to medications. Significant food effects complicate development of new drugs, especially when clinical plans require control and/or monitoring of food intake in relation to dosing. The prediction of whether a drug or drug product will show human food effect is challenging.

Drug	Food	Drug-food interaction
Warfarin	High-protein diet	raise serum albumin levels, decrease in international normalized ratio (INR)
	Vegetables containing vitamin k	interferes with the effectiveness and safety of warfarin therapy decrease warfarin activity increase warfarin activity
	Charbroiled	elevated INR without bleeding in elderly patient
	Cooked onions	thromboembolic complications may develop
	Cranberry juice	decrease warfarin activity
	Leafy green vegetables	hypertensive crisis serum level may be increased
Monoamine Oxidases	Charbroiled	the intestinal absorption is inhibited
Propranolol	Tyramine-containing	absorption is increased
Celiprolol	food	increases the bioavailability
Aces Inhibitors	Rich protein food	that complex with some antibiotics and
Ca ²⁺ Channel	Orange juice	prevent their absorption. reduced
Antibiotics	Empty stomach	bioavailability
	Grape fruit juice	delays its absorption and onset
	with milk products	can increase risk of liver damage or stomach bleeding
Acetaminophen	Pectin	the c max and auc _{0-alpha} significantly increased
Nsaids	Alcohol	increase bioavailability
Theophylline	Beverages	increases the risk of drug toxicity bioavailability was reduced
	High-fat meal and	increase bioavailability
Esomeprazole	grape fruit juice	exerts synergistic effect
Cimetidine,Rupatadine	Caffeine	

Isoniazide	High-fat meal with food(any type)	decrease the serum concentration bioavailability was reduced
Cycloserine	Plants medicinal	increase bioavailability
Esomeprazol	herbsoleanoic acid	exerts synergistic effect
Cimetidine,Rupatadine	High fat meals	
Isoniazide	High-fat meal with food(any type)	decrease the serum concentration absolute bioavailability
Cycloserine	Plants medicinal	maximum effectiveness
Glimepiride	herbsoleanoic acid	reduce bioavailability
Acarbose	High fat meals	delay the absorption
Mercaptopurine	with breakfast	absolute bioavailability
Levothyroxine	at start of each meal	
Glimepiride	Cow's milk Grapefruit juice with breakfast	

Conclusion:

Drugs and nutrients share several pharmacokinetic and pharmacodynamic characteristics and can interact according to a variety of mechanisms. Drugs can affect the bioavailability of nutrients, whereas nutrients and supplements can influence the bioavailability of drug. Interaction between foods and drugs can have profound influence on the success of drug treatment and on the side effect profiles of many drugs. The clinical significance of drug-food interactions can be variable. Some foods greatly affect drug therapy, resulting in serious side effects, toxicity or therapeutic failure. In some instances, the interaction may have a beneficial effect by increasing drug efficacy or diminishing potential side effects. The interactions are not always detrimental to therapy, but can in some cases be used to improve drug absorption or to minimize adverse effects. These interactions have received more attention recently, especially drug interactions with grapefruit juice. As new drug approvals occur with ever increasing speed, there is less information available about their adverse effects and interactions when the drugs reach the market. Pharmacists in every practice setting need to be vigilant in monitoring for potential drug-food interactions and advising patients regarding foods or beverages to avoid when taking certain medications. It is imperative for pharmacists to keep up-to date on potential drug-food interactions of medications, especially today’s new drugs, so that they may counsel properly to the patients.

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योग का हमारे स्वास्थ्य पर प्रभाव

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प्रस्तावना:

योग के अंतर्गत योगासनो, प्राणायाम और ध्यान आदि को भी शामिल किया जाता है। योगासनो, प्राणायाम और ध्यान सेहत के लिए किसी वरदान से कम नहीं हैं। विभिन्न आसनो से हड्डी, मांस-मज्जा और शरीर के भीतरी अंग सशक्त होते हैं। वहीं प्राणायाम से शरीर के भीतर की नाडियां सुचारु रूप से कार्य करती हैं। योग डिप्रेशन और एंजाइटी जैसे मनोरोगो के इलाज में सहायक है। यह आपके हृदय को भी स्वस्थ रखने, रक्त शुगर को कम रखने, बैड या खराब कोलेस्ट्रॉल को कम रखने और अच्छे या गुड कोलेस्ट्रॉल के स्तर को बढ़ाने में भी मदद करता है। नियमित रूप से योग करने से पुराने कमर दर्द से राहत मिलती है और योग हमारी हड्डियो और जोडो को लचीला बनाए रखता है। यह पुराने दर्द को नियंत्रित रखने में भी सहायक है। योगासन, ध्यान और प्राणायाम आदि के रूप में नियमित योग करने से आपके संपूर्ण स्वास्थ्य को फायदा पहुंचता है।

तनाव को करे नियंत्रित

योग करने से तनाव के दौरान एड्रीनेलीन नामक न्यूरो केमिकल कम निकलता है, जिससे मानसिक तनाव नियंत्रण में रहता है। योग हमारे मस्तिष्क को तनावमुक्त और शांतचित्त रखने में मदद करता है। योग से हाई ब्लड प्रेशर को सामान्य रखने में मदद मिलती है, तनाव कम होता है और मोटापा नियंत्रित होता है। इसके साथ ही व्यक्ति का रक्तसंचार सुचारु रूप से संचालित होता है, जिसका प्रभाव तन ही नहीं बल्कि मन पर भी पड़ता है।

जीवन-शैली और बीमारियां

आज जीवन शैली से संबंधित रोग जैसे कोरोनरी धमनी(आर्टरी) रोग, मोटापा और हाई ब्लड प्रेशर तेजी से बढ़ रहे हैं। ऐसी स्थिति में योग आधारित जीवन-शैली की मदद से इन रोगो पर काबू पाया जा सकता है। कुछ शोधो से पता चला है कि श्वासन हाई ब्लड प्रेशर के इलाज में सहायक है। एक और अध्ययन के अनुसार योग पर आधारित जीवन-शैली पर अमल कर केवल दो महीने में ब्लडप्रेशर में कमी आ सकती है। मोटापा अपने आप में कोरोनरी धमनी रोग के लिए खतरे का कारण है, लेकिन अध्ययनों से पता चला है कि योग अभ्यास के एक वर्ष के बाद शरीर के वजन को घटाने और हृदय की क्षमता बढ़ाने में मदद मिलती है। योग की मदद से एचडीएल को छोड़कर सभी लिपिड मापदंडों में कमी लाई जा सकती है। इस प्रकार योग पर आधारित जीवन शैली से कोरोनरी धमनी की बीमारी से बचाव संभव है।

डायबिटीज से बचाव

मौजूदा समय में मधुमेह या डायबिटीज एक स्वास्थ्य समस्या बन चुका है। दुनिया भर में सबसे ज्यादा मधुमेह रोगी भारत में ही हैं। कई अध्ययनों से पता चला है कि योग मधुमेह के रोगियों के लिए भी लाभकारी है। योग शरीर की हर कोशिका को प्रभावित करता है। योग अभ्यास करने वाले व्यक्ति का दृष्टिकोण सकारात्मक होता है और वह उद्देश्यपूर्ण और स्वस्थ जीवन व्यतीत करता है। निष्कर्ष के तौर पर कहा जा सकता है कि योग के कई मानसिक लाभ हैं। जैसे स्वास्थ्य में सुधार, एकाग्रता का बढ़ना, आत्मविश्वास में वृद्धि और जीवन के प्रति आशावादी दृष्टिकोण आदि। योग के साथ व्यायाम करें या नहीं

अमेरिकन हार्ट एसोसिएशन ने सुझाया है कि नियमित व्यायाम करने के साथ-साथ योग भी करना चाहिए। इसे नियमित व्यायाम का पूरक नहीं समझा जाना चाहिए बल्कि तेजी से चलने और दौड़ने जैसे कार्डियोवैस्कुलर व्यायामों के साथ रोजाना करना चाहिए।

कितनी देर योग करना चाहिए

ज्यादातर विशेषज्ञों का सुझाव है कि हर दिन कम से कम 10 से 15 मिनट तक योग अवश्य करें। अगर आपको कोई स्वास्थ्य संबंधी दिक्कत है या आप दिल के मरीज हैं तो आप योग शुरू करने के पहले अपने डॉक्टर से संपर्क करें। स्वस्थ लोगों के लिए कम से कम 30 मिनट से 45 मिनट तक योग पर्याप्त माना जाता है। विभिन्न योगासनों के अलावा अनुलोम विलोम और कपालभाति आदि प्राणायाम शामिल हैं, लेकिन गर्भवती महिलाओं को कपाल भाति नहीं करना चाहिए।

इस बात का भी दें विशेष ध्यान

अगर आप हृदय से संबंधित किसी समस्या से पीड़ित हैं तो इस मौसम में सुबह की सैर और व्यायाम के दौरान अपने आप को पूरा ढक कर जाना चाहिए। इस मौसम में सर्दी के कारण धमनियां सिकुड़ जाती हैं और खून गाढ़ा हो जाता है। इस वजह से ब्लमड क्लॉट बढ़ने की संभावना बढ़ जाती है। ऐसी स्थिति में हार्ट अटैक और स्ट्रोक होने की आशंकाएं बढ़ जाती हैं। ब्लड प्रेशर के मरीज अपनी दवाएं लगातार लें।

निष्कर्ष:

योग अभ्यास करने वाले व्यक्ति का दृष्टिकोण सकारात्मक होता है और वह उद्देश्यपूर्ण और स्वस्थ जीवन व्यतीत करता है। निष्कर्ष के तौर पर कहा जा सकता है कि योग के कई मानसिक लाभ हैं। जैसे स्वास्थ्य में सुधार, एकाग्रता का बढ़ना, आत्मविश्वास में वृद्धि और जीवन के प्रति आशावादी दृष्टिकोण आदि।

योग और आधुनिक उपकरणों का जीवन शैली से सम्बन्ध

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प्रस्तावना:

आधुनिक जीवन शैली ने मन-शरीर के संबंधों में सामंजस्य खो दिया है जिससे उच्च रक्तचाप, कोरोनरी हृदय रोग और कैंसर जैसी कई तनाव-आधारित बीमारियां हो गई हैं। इन बीमारियों को रोकने और उनका इलाज करने के प्रयास ने बेहतर जीवन शैली और बेहतर रणनीतियों की खोज को गति दी, जो कि योग जैसे प्राचीन विषयों की पनुर्खोज में परिवर्तित हो गए, जीवन शैली को स्थायी मानसिक शांति के लिए शक्तिशाली अचकू नुस्खे के साथ जोड़ना जैसा कि नैदानिक अध्ययनों द्वारा पुष्टि की गई है। योग आधुनिक जीवन जीने का, सही जीवन जीने का विज्ञान है और इसे हमारे दैनिक जीवन में शामिल किया जाना चाहिए। योग में दिमाग को शांत करने, लचीलापन बनाए रखने, शारीरिक और मानसिक ऊर्जा का दोहन करने और एक एकीकृत व्यक्तित्व विकसित करने में मदद करने के लिए तकनीकी प्रणालियां हैं। यह भावनाओं को संतुलित करने और मन और शरीर के बीच सामंजस्य स्थापित करने का एक तरीका है।

योग का अर्थ

योग का शाब्दिक अर्थ होता है जोड़ना। योग शब्द संस्कृत की युज धातु से मिलकर बना है जिसका अर्थ है- जोड़ना। अर्थात् स्वयं को उस परम शक्ति से जोड़ना जिससे यह संसार चल रहा है। योग आदि काल से भारत भूमि पर अनवरत चल रहा है। यह भारतीय संस्कृति की अनुपम देन है। योग से मनुष्य में स्थिरता, धीरता और अनुशासन का जन्म होता है और अनुशासन से व्यक्तित्व का विकास होता है। व्यक्तित्व से चरित्र का विकास होता है और चरित्र से एक नए समाज का निर्माण होता है।

योग और आधुनिक जीवन शैली का सम्बन्ध

दुनिया भर में योग का अभ्यास किया जा रहा है मूल रूप से योग ना केवल व्यायाम का एक रूप है। बल्कि स्वास्थ्य, खुशहाल और शांतिपूर्ण तरीके से जीने का प्राचीन ज्ञान है। यदि हम नियमित रूप से योग का अभ्यास करेंगे तो शरीर में सकारात्मक बदलाव हो सकेंगे जिससे कुछ ऐसी बीमारियां जो आज हमारे जीवन शैली में सामान्य है। उन से भी छुटकारा पाने में योग हमारी मदद करता है। एक सर्वे के मुताबिक विश्व में 2 अरब से भी ज्यादा लोग रोजाना योगाभ्यास कर रहे हैं और स्वस्थ भी हो रहे है योग तो 5000 साल पुराना भारतीय दर्शनशास्त्र है। वैदिक ग्रंथों में योग का विशेष रूप से वर्णन है। शरीर साधना का सर्वश्रेष्ठी साधन है। किसी ने ठीक ही कहा है- 'जान है तो जहां है' योग के संदर्भ के एक स्वयं सिद्ध कथन है-

‘करें योग, भगाये रोग’

योग में उपकरण की उपयोगिता

योगा उपकरण एक ऐसी वस्तु है जो आपको शरीर के विभिन्न कोणों को आसनों के दौरान सहायता प्रदान करते हैं। इनकी सहायता से आप आसन को लंबे समय तक कर सकते हैं और आपकी ऊर्जा भी संरक्षित रहती है। ये आसनों को आराम दायक तरीके से पूरा करने में आपकी सहायता करते हैं। यह प्रत्यक्ष और अप्रत्यक्ष दोनों तरह से आपके शरीर और दिमाग को संतुलित करते हैं।

ये उपकरण मुख्य आसनों और मुश्किल कोणों को अधिक ऊंचाई, ताकत, वजन और सहारा देकर आसान बना देते हैं। इसके आलावा इन उपकरणों के इस्तेमाल से रक्तप्रवाह और श्वास प्रणाली में भी सुधार आता है। उपकरणों के साथ योग आसनों का अभ्यास तभी अद्वितीय कहा जा सकता है, जब यह आपको क्रिया के साथ आराम भी दे। यह संपूर्ण शरीर को बिना थकाए नया जीवन प्रदान करते हैं। उपकरण आपको अभ्यास की सही दिशा प्रदान करता है और आसन के साथ आपकी समझ को विकसित और विस्तृत करता है। ये एक मूक अध्यापक की तरह आपको निर्देश प्रदान करते रहते हैं।

घर में मिल जाने वाले उपकरण

इस प्रकार के उपकरण आपको घर में ही आसानी से उपलब्ध हो जाएंगे। इनके साथ इस तरह अभ्यास करें कि आसन करते समय इनकी मदद से आपको पूरी सुविधा प्राप्त हो।

1. कुर्सी
2. लकड़ी कि बेंच
3. अर्ध हलासन स्टूल
4. कम ऊंचाई वाली खुली स्टूल
5. ऊंचा स्टूल

कुर्सी

यह उपकरण आपको बैठे हुए अपने धड़ को घुमाने में सहायता प्रदान करेगा। भारद्वाज आसन में इसके पिछले हिस्से को मजबूती से पकड़ सकते हैं और आसन आसान बना सकते हैं। यह कुर्सी सलम्ब सर्वांग आसन और हलासन के दौरान आपकी सहायता कर सकती है। कुर्सी पीछे की ओर झुकने के दौरान आपके धड़ को सहारा देती है। विपरीत दंडासन में भी कुर्सी का इस्तेमाल किया जा सकता है। इससे पहले यह निश्चित कर लें कि कुर्सी मजबूत और जमीन पर एकदम बराबर तरीके से रखी हुई हो।

लकड़ी का बेंच

हृदयरोगियों, माइग्रेन ओर श्वास प्रणाली के रोगों से ग्रस्त लोगों के लिए यह उपकरण ज्यादा फायदेमंद होता है अगर वे इसका प्रयोग सेतुबंध सर्वांग आसन के दौरान करते हैं।

अर्धहलासन स्टूल

यह स्टूल 30 से 45 से.मी. ऊंचा होना चाहिए। यह पैरों और पीठ को सहारा प्रदान करता है। इसकी सहायता से आप परिपूर्ण आसन, उस्तरासन कर सकते हैं। इसकी वजह से आसनों में लचीलापन आता है और पीठ, पेट, बांहों और पैरों को ताकत का अनुभव होता है।

कम ऊंचाई वाली खुली स्टूल

इसकी सहायता से आप उस्तरासन कर सकते हैं। साथ ही आप शरीर को बड़ी आसानी से आगे और पीछे झुका पाएंगे। इसकी ऊंचाई कम से कम दो फिट की होनी चाहिए। साथ ही यह जमीन पर बराबर और मजबूती से रखा हुआ होना चाहिए।

ऊंचा स्टूल

इसकी सहायता से आप उत्थित मरीचासन कर सकते हैं। यह रीढ़ और पूरा शरीर घुमाने में मदद करता है और थकान भी नहीं होती है। इसको उपयोग में लाने से पहले यह सुनिश्चित कर लें कि यह जमीन पर बराबर और मजबूती से रखा हुआ है और यह पर्याप्त चौड़ा है।

विशेष प्रकार के उपकरण

ये उपकरण ऐसे उपकरण हैं जो विशेष प्रकार से योग को ध्यान में रखकर नाये गए हैं ऐसे उपकरण योग में बहुत मदद गार साबित होते हैं।

1. मसनद
2. फोम का टुकड़ा
3. लकड़ी के क्यूब
4. लकड़ी का बेलना कार क्यूब
5. मोड़ा हुआ कंबल
6. गोल मोड़ा हुआ कंबल
7. योग बेल्ट
8. क्रेप बैंडेज

मसनद (गोल तकिया)

मसनद उस समय आपकी सहायता करता है जब आप अपने शरीर को खींच या आराम दे रहे होते हैं। इस मसनद का वजन कम से कम तीन किलो और इसमें अच्छी मात्रा में रूई होनी चाहिए। ये कम से कम दो फीट लंबा और 23 से.मी. व्यास का हो तो बेहतर होगा।

फोम का टुकड़ा

फोम के टुकड़े का प्रयोग प्राणायाम के दौरान सिर के नीचे और पीठ के नीचे इस्तेमाल करना होता है। इसका आकार 30 से.मी. ग् 18 से.मी. ग् 5 से.मी. होना चाहिए।

लकड़ी के क्यूब

उज्जयी प्राणायाम के दौरान लकड़ी के घन पीठ को सहारा प्रदान करते हैं और छाती को प्रसारित करने में मदद करते हैं। आगे झुक कर किए जाने वाले आसनों में जैसे उत्तान आसन में यह कारगर तरीके से हाथों और सिर को सहारा प्रदान करते हैं। इसका आकार 23 से.मी.गु 12 से.मी.गु 7 से.मी. होना चाहिए।

लकड़ी का बेलनाकार क्यूब

एक लकड़ी का छोटा गोल टुकड़ा खड़े होकर घूमने में आपकी पर्याप्त सहायता कर सकता है। उत्तिठ मरिचासन में आप बिना थके अपने शरीर को आसानी से घुमा पाएंगे। इसकी ऊंचाई 5 से.मी. और लंबाई 10 से.मी. होनी चाहिए।

मोड़ा हुआ कम्बल

यह प्राणायाम, सलम्ब सर्वांग आसन के दौरान काम आता है। बैठकर किए जाने वाले आसनों में यह पर्याप्त ऊंचाई प्रदान करता है। यह शरीर को रगड़ से बचाता है और आसन की स्थिति में भी सुधार करता है। आसन के दौरान सूती कम्बल का इस्तेमाल करना चाहिए और यह पर्याप्त आकार का होना चाहिए। इसका आकार 2मी.गु 1.2मी. होना चाहिए।

गोल मोड़ा हुआ कम्बल

कम्बल को मोड़कर गर्दन के नीचे सहारे के तौर पर इस्तेमाल किया जा सकता है। पीछे की ओर झुककर किए जाने वाले आसनों में भी यह पीठ को सहारा प्रदान करता है। विपरीत दंडासन, वीरासन और अधोमुख वीरासन में चार बार गोल मोड़कर इस्तेमाल में लाया जा सकता है। यह सीने, जंघा और पसलियों में होने वाले दर्द से बचाता है।

योग मैट (चटाई)

योग मैट लेट कर या बैठ कर योग करने में सहायता करती है, इसकी कम से कम लम्बाई 6 फिट और चौड़ाई 2 फिट होनी चाहिए।

योगा बेल्ट

योग बेल्ट पेशियों और जोड़ों के दर्द से बचाता है और खिंचाव को बेहतर बनाता है। सुप्तपादांग उस्तासन उर्ध्व मुख जानु शीर्षासन और परिपूर्ण नवासन में बेल्ट सहायता प्रदान कर सकती है। यह कम से कम दो फीट लंबा और पर्याप्त मजबूत होना चाहिए।

क्रेप बैंडेज

क्रेप बैंडेज का इस्तेमाल शवासन और प्राणायाम में किया जाता है। ये ढाई से तीन मीटर लंबी और कम से कम दस से.मी. चौड़ी होनी चाहिए। यह मस्तिष्क को ठंडक प्रदान करता है और चेहरे की मांसपेशियों व तंत्रिका तंत्र को सुदृढ़ बनाता है।

निष्कर्ष

आधुनिक जीवन शैली को सन्तुलित एवं सामंजस्य पूर्ण बनाने में योग की भूमिका महत्वपूर्ण है। योग भारतीय संस्कृति की अनुपम देन है जिससे मानव में स्थिरता, धीरता एवं अनुशासन के साथ चारित्रिक व सामाजिक विषय होता है। घर परिवार में ही हय योग की क्रियाओं द्वारा जीवन को सरल व सुगम नमाकर अपना शारीरिक, मानसिक व अध्यात्मिक विकास कर सकते है। जीवन में कर्मयोगी बनकर स्वास्थ्य को ठीक रख कर अपनी स्वयं की जीवन शैली को आदर्श बना सकते है। अतः

’करो योग रहो निरोग’

BEHAVIOURAL FINANCE - A STUDY WITH REFERENCE TO THE PRE AND POST BEHAVIOURAL FACTORS IN SMALL INDIVIDUAL INVESTOR IN TIRUNELVELI DISTRICT

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Abstract:

Behavioural finance attempts to explain and increase understanding of the reasoning patterns of investor, including the emotional processes involved and the degree to which they influence the decision making process. Essentially, it explains the what, why, and how of finance and investing. The research in behavioural finance is comparatively less in India, when compared to other developed countries. It is assumed that information structure and the characteristics of market participants systematically influence small individual investor investment decisions as well as market outcomes. The globalization of financial markets has been increasing the number of small individual investors over the past decades by providing a wide variety of investment options. The small individual investors are more or less confused lot, as to the relation of preferred. This makes the investment decisions process more complex. Generally, they consider: objectives, investment strategy, risk, returns and so on while making investment decision. But it is not possible for them to make a successful investment decision at all times and. The influences of behavioural factors when it was relating to one investment avenues is less influences than when it was relating to choosing from among many investment avenues. It is also to be noted that, many studies conducted on small individual investor preferred only one investment avenues. Thus, the present research study will investigate mainly the pre as well as past investment behaviours of small individual investors, in relation to investment in more than one investment avenues.

Keywords: Behavioural finance, Small individual investors, Investment avenues, Investment decisions, Pre and post behavioural factor

Introduction:

Behavioural finance attempts to explain and increase understanding of the reasoning patterns of investor, including the emotional processes involved and the degree to which they influence the decision making process. Essentially, it explains the what, why, and how of finance and investing. It endeavors to bridge the gap between neo-classical finance and cognitive psychology. It takes into account the individual investor's decision making formula as well as their behaviour, which, in turn, sheds light on the observed departures from the traditional

finance theory. Thus, behavioural finance is the application of scientific research on the psychological, social, and emotional contributions to market participants and market price trends.

Statement of the problem:

The research in behavioural finance is comparatively less in India, when compared to other developed countries. It is assumed that information structure and the characteristics of market participants systematically influence small individual investor investment decisions as well as market outcomes. The globalization of financial markets has been increasing the number of small individual investors over the past decades by providing a wide variety of investment options. The small individual investors are more or less confused lot, as to the relation of preferred. This makes the investment decisions process more complex. Generally, they consider: objectives, investment strategy, risk, returns and so on while making investment decision. But it is not possible for them to make a successful investment decision at all times and. The influences of behavioural factors when it was relating to one investment avenues is less influences than when it was relating to choosing from among many investment avenues. It is also to be noted that many studies conducted on small individual investor preferred only one investment avenues. Thus, the present research study will investigate mainly the pre as well as past investment behaviours of small individual investors, in relation to investment in more than one investment avenues.

Review of literature:

Anli Suresh (2013), this paper on understanding behavioural finance through biases and traits of trader vis-à-vis investor attempts to fill the void and explore the relationship among these factors. The concluding observation is that understanding various behavioural key biases and traits can help individual take sound financial decisions and in turn make him a better trader / investor.

Babaraju, K. Bhatt., and MS. Apurva, A. Chauhan (2014), this paper only analyzed by the conceptual oriented not that empirical study. The objectives of the study were to understand behavioural finance new paradigm of finance and know the difference between traditional finance and behavioural finance, to identify various behavioural factors influencing the decision of investor in stock market in conceptual wise investigated. The final result of the study can be drawn that investors not always rational manner.

Charu Thakral, Babita Dosajh, and Vimal Aggaral (2013), this paper provides an overview of theories of behavioural finance that seed to explain the non-financial indicators, the main analyze of this study is based on personality of investor affect its financial decision making. This study covered the personality characteristics of individual as well as the social environments. The result of this study there is a strong relation between theories personality and financial decision making. Five types of personality traits were discovered which shows that is very strong association between the personalities of investors.

Egidijus Bikas, Daiva Jureviciene, Petras Dubinskas and Lina Novickyte (2013), the article aims to analyze the research of non-professional investors' financial behaviour in a historical-theoretical perspective. This article reveals the aims of recognition and emotional factors on market movement focusing on a limited number of investor rationality and explains the psychological effects of investing activities. The methods of analysis and synthesis, description and comparison were applied in the article. The result of this study behavioural finance is based on research of human and social recognition and emotional tolerance studies to identify and understand incoming economic decisions.

Edward Khisa Kisaka (2015), this study investigated the behavioural finance factors influencing investment decisions in the Kenyan NSE with a particular interest in Machakos county. This study was aimed at better reflecting the way NSE investors think and behave by use of behavioural finance. It intended to verify the extent to which these behavioural factors contribute to the success or failure of the investments made by these investors. Finally, the study focused on establishing the frequency at which these factors are utilized in informing investment decisions making by NSE investors. The result of this study is not an end in itself as it suggests further studies and research in this field with a view of identifying the most influential factors on stock market investors' behaviour on how they base their future investment strategies and they are likely to affect their investment decisions.

Nicholas Barberis and Richard Thaler (2002), representativeness also leads to the so-called "sample size neglect" which occurs when people try to infer from too few samples. In stock market, when investors seek to buy "hot" stocks instead of poorly performed ones, this means that representativeness is applied.

Erner F. M. De Bondt and Richard Thaler (1985), representativeness refers to the degree of similarity that an event has with its parent population or the degree to which an event resembles its population. Representativeness may result in some biases such as people put too much weight on recent experience and ignore the average long-term rate. A typical example for this bias is that investors often infer a company's high long-term growth rate after some quarters of increasing.

Vasileios Kallinterakis, Nomana Munir and Mirjana Radovic-Markovic (2010), herding effect in financial market is identified as tendency of investors' behaviours to follow the others' actions. Practitioners usually consider carefully the existence of herding, due to the fact that investors rely on collective information more than private information can result the price deviation of the securities from fundamental value; therefore, many good chances for investment at the present can be impacted. Academic researchers also pay their attention to herding; because its impacts on stock price changes can influence the attributes of risk and return models and this has impacts on the viewpoints of asset pricing theories. In the perspective of behavior, herding can cause some emotional biases, including conformity, congruity and cognitive conflict, the

home bias and gossip. Investors may prefer herding if they believe that herding can help them to extract useful and reliable information. Whereas, the performances of financial professionals, for example, fund managers, or financial analysts, are usually evaluated by subjectively periodic assessment on a relative base and the comparison to their peers. In this case, herding can contribute to the evaluation of professional performance because low-ability ones may mimic the behaviour of their high-ability peers in order to develop their professional reputation. Therefore, this research will explore the influences of herding on individual investment decision making.

Objectives and hypothesis of the study:

Objectives

1. To study the demographical profile of the small individual investor in Tirunelveli district.
2. To analyze the pre as well as post behavioural factors of the small individual investors in relation to the preferred more than investment avenues.
3. To identify and analyze the impact levels of behavioural factors on the investment decisions and performance of small individual investors in relation to the pre as well as post preferred investment avenues.
4. To give some recommendations for small individual investors to adjust their behaviours to achieve good investment results.

Research hypotheses:

- a) H₀ - Sources of information do not affect the pre and post preferred investment avenues.
- b) H₀ - There is a no significant relationship between investment experience and preferred investment avenues.
- c) H₀ - There is no relationship between investment experience and investment performance.
- d) H₀ - Behavioural factors do not influence small individual investor' pre and post investment performance.

Research methodology:

Research Design - Exploratory and experimental research design.

Sample Design

Sample size determination - Finite population ($n = \frac{Z^2 pqN}{(N-1) e^2 + Z^2 PQ}$), the sample size required for the main study is 384 (99% confidence level) and pilot study sample size determine in the total = $384 * 1/6$ (64) of the respondents were determined in the pilot study.

Sampling Technique - Proportionate stratified random sampling technique.

Data Collection Method - Primary data was collected by structured interview schedule method to the small individual investor in Tirunelveli district. The secondary data was collected from the journals, articles, internet, books, thesis and the lie.

Tools for Analysis - The collected data are analyzed using the SPSS software package. The following statistical techniques were also used in this study frequency distribution, descriptive statistics, factor analysis, cluster analysis, one way ANOVA, MANOVA test.

Major findings:

Objective 1: To study the demographical profile of small individual investor in Tirunelveli district

- 234 (60.9%) are males and 150 (39.1%) are females. Thus it depicts a higher proportion of male respondents.
- 126 (32.8%) respondents belong to age group of 26 – 35 years and 53 (13.8%) respondents belong to age group of above 56. Thus it depicts a higher proportion of 26 – 35 years age of the respondents.
- 126 (32.8%) of the respondents had completed their school level / diploma / ITI, 29 (7.6%) of the respondents had completed their professional degree, 79 (20.6%) of the respondents are in illiterate level. Thus it depicts a higher proportion of school level / diploma / ITI had completed of the respondents.
- 171 (44.5%) are living in rural and 213 (55.5%) of the respondents are living in urban areas. Majority of the respondents living in urban areas.
- 132 (34.4%) of the respondents are government employees, 186 (48.4%) of the respondents are private employee and 66 (17.2%) of the respondents are own business. Thus it depicts a higher proportion of private employee.
- 36 (9.4%) of the respondents monthly income belongs to below 20000, 130 (33.9%) of the respondents monthly income belongs to 30001 – 40000, Thus it depicts a higher proportion of monthly income in 30001 – 40000.

Objectives 2: To analyze the pre as well as past behavioural factors of the small individual investors in relation to the preferred more than investment avenues.

- To find the most of the small individual investor have pre preferred in their investment avenues for bank deposit 337 (87.8%), other investment avenues 200 (52.1%) and most of the small individual investor have not preferred investment avenues in national savings securities (80.5%), government securities (89.8%), debt (91.7%), bond (94.5%), mutual fund (87.5%), share market (66.7%).
- To find the most of the small individual investor have post preferred in their investment avenues for mutual funds 199 (51.8%), 261 of 384 (68.0%) of the respondents had their invested money in life insurances , share market 282 of 384 (73.4), other investment avenues 282 of 384 (73.3%) and most of the small individual investor have not preferred investment avenues in national savings securities (57.6%), government securities (76.0%), debt (75.8%), bond (89.3.5%).
- Small individual investor due invested in their own fund preferred various investment avenues in the 322 (83.9%) of the respondents and 62 (16.1%) of the small individual investor' due to invested in their borrowed fund in pre period. Most of the small individual investor invested in their investment avenues in pre period of own funds used in the

investment activity.

- Small individual investor due invested in their own fund preferred various investment avenues in the 339 (88.3%) and 39 (11.7%) of the small individual investor' due to invested in their borrowed fund. Most of the small individual investor invested in their investment avenues in post period our own fund used in the investment activity.
- 171 (44.5%) of the respondents look before invested in return based on invested in particular investment avenues and 103 (26.8%) of the respondents look before invested is risk based. Most of the small individual investor 171 (44.5%) look before invested in return based in pre investment period.
- 126 (32.8%) of the respondents look before invested in risk based in invested in particular investment avenues and 113 (29.4%) small individual investor look before invested in investment based. 126 (32.8%) of the respondents look before invested in return based on pre investment period. This research suggest that do you look before in returns of the various investment avenues, investment period and various investment options also look in future investment period.
- 151 (39.3%) of the small individual investor have the investment amount invested in selected investment avenues for pre period below 10% and 119 (31.0%) of the small individual investor are investment amount to invested in selected investment avenues in pre period. Thus it depicts a higher proportion 151 (39.3%) of small individual investor' investment amount below 10% invested in pre selected investment avenues.
- 126 (32.8%) of the small individual investor have the investment amount invested in post selected investment avenues in 31-40% and 79 (30.6%) of the small individual investor are having the investment amount to invested in post selected investment avenues in above 40%. Thus it depicts a higher proportion at 126 (32.8%) of small individual investor' investment amount 31-40% invested in pre selected investment avenues.
- 150 (39.1%) of the respondents frequently invested in daily basis selected investment avenues. 129 (33.6%) of the small individual investor monthly invested in the selected investment avenues. Thus it depicts a higher proportion at 150 (39.1%) of the small individual investor daily basis invested in pre investment period.
- 186 (48.4%) of the respondents frequently invested in daily basis selected investment avenues and 79 (20.6%) of the small individual investor monthly invested in the selected investment avenues. Thus it depicts that higher proportion at 186 (48.4%) of the small individual investor daily basis invested in post investment period.
- Small individual investor pre preferred investment horizon about short term investment and 129 (33.6%) of the small individual investor investment horizon about pre preferred in long term investment. Thus it depicts that higher proportion of small individual investor's pre preferred investment horizon in short term based.

- Small individual investor pre preferred investment horizon about short term investment and 119 (31.0%) of the small individual investor investment horizon about pre preferred in long term investment. Thus it depicts that higher proportion of small individual investor's pre preferred investment horizon in short term based.
- 261 (68.0%) of small individual investor have no experience in pre investment period and 123 (32.0%) of small individual investor have below one year experience in pre investment period. Thus it depicts that a higher proportion of small individual investor have no experienced investor in pre period.
- 261 (68.0%) of small individual investor' below one year experienced in post investment period and 123 (32.0%) of small individual investor have more than one year experienced in the post investment post period. Thus it depicts that higher proportion of small individual investor have below one year experienced investor in post period.
- Majority 95 (24.7) of small individual investor before making an investment decided with friends advice had to invested in pre investment period and lower priority to 10 (2.6%) of the small individual investor through magazines and journals. Thus it depicts in higher proportion of 95 (24.7) of small individual investor before making an investment decisions at friends advice.
- Majority 81 (22.4%) of small individual investor before making an investment decisions broker advice to invested in selected investment avenues and lower priority to 5 (1.3%) the small individual investor through magazines and journals. Thus it depicts in higher proportion of 81 (22.4%) of small individual investor before making an investment decisions broker advice to invested in selected investment avenue.
- 159 (41.4%) of small individual investor pre investment strategy rely on other tips and 98 (25.5%) of small individual investor pre investment strategy in just select particular investment that catch the attention in the media of financial market. Thus it depicts a higher proportion in 159 (41.1%) of small individual investor's pre investment strategy that rely on other tips.
- 92 (24.0%) of small individual investor pre investment strategy rely on other tips and 20 (5.2%) of small individual investor post investment strategy is just select particular investment of companies with establish reputations. Thus it depicts a higher proportion in 92 (24.0%) of small individual investor's pre investment strategy that rely on other tips.
- 130 (33.9%) of small individual investor are to invest their money in necessity purpose only to invest in pre investment period and 10 (2.6%) of the small individual investor invest their money in family purpose to invested in selected investment avenues. Thus it depicts that higher proportion in 130 (33.9%) of small individual investor are to invest their money in necessity purpose only to invest in post investment period
- 86 (22.4%) of small individual investor are to invest their money in to have tax shelter

purpose, and 36 (9.4%) of the small individual investor invest their money in family purpose to invest in selected investment avenues. Thus it depicts that higher proportion in 86 (22.4%) of small individual investor are to invest their money in necessity purpose only to invested in post investment period

- According to the respondents the investment options high risk is the bank deposit 351 of 384 (91.4%) , public provident fund 66 of 384 (17.2%), government securities 350 of 384 (91.1%), mutual fund 346 of 384 (90.1%), debt 363 of 384 (94.5), bond 362 of 384 (94.3%), share market 339 of 384 (88.3%), real estate 49 of 384 (12.8%). According to the respondents the investment options moderate risk is the life insurance 152 of 384 (39.6%), debt 21 of 384 (5.5%).
- Higher risk investment avenues, according to the respondents the investment option is of high risk is the national savings securities 349 of 384 (90.9%), government securities 384 of 384 (100%), life insurance 208 of 384 (54.2%), debt 384 (100%), bond 362 of 384 (94.3%), share market 207 of 384 (53.9%). Moderate risk, according to the respondents the investment option is having moderate risk is the bank deposit 26 of 384 (6.8%) and other investment avenues 139 of 384 (29.2%). Low risk avenues, according to the respondents the investment option is of moderate risk is the post office 216 of 384 (56.3%), bank deposit 4 of 384 (1.0%), mutual fund 97 of 384 (25.3%).
- Small individual investor have the investment options that gives more return in bank deposit 49.5%, post office (31%), PPF (1.6%), mutual fund (3.4%), life insurance (6.8%), share market (7.8%) and remaining investment avenues are given to low return. Thus it depicts that higher proportion of bank deposit has high returns given to small individual investor.
- Small individual investor have the investment option that gives more return in life insurance (19.8%), share market (4.9), bank deposit (16.4), post office (12.0%), mutual fund (8.6%) and remaining investment avenues given to low return. Thus it depict that higher proportion of bank deposit has high returns given to small individual investor and low return to investment avenues for debt and bond.
- The exploratory factor analysis (EFA) is used for the behavioural variables (X1 to X76) and investment performance (Y1 to Y3) to identify the factors to which these variables belong. The requirements of factor analysis, which are mentioned in chapter 4, are satisfied to reduce the variables. After some rounds of removing the unsuitable variables, the analysis results that the remaining variables are grouped into six factors (five factors of behavioural variables and one factor of investment performance), at the Eigen value = 1.007, KMO = 0.881 (sig. = 0.000), % of total variance explained = 68.32%, and all factors loadings are more than 0.5 and cronbach's alpha value is .959 accepted pre behavioural variables. These indexes prove that factor analysis for these variables is totally

suitable and accepted.

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Objectives 3: To identify and analyze the impact levels of behavioural factors on the investment decisions and performance of small individual investors in relation to the pre as well as post preferred investment avenues.

- **Pre behavioural factor impact on Heuristic variable mean value is 2 to 3 (moderate impact):** Behavioural variables of heuristic dimension that influencing the investment decisions consists of representativeness, overconfidence, gambler's fallacy, anchoring, and ability bias have moderate impact on the small individual investor investment decision making in pre period.
- **Pre behavioural factor impact on heuristic variable mean value is 1 to 2 (low impact):**
The variables of overconfidence are having low impact on the pre period.
- **Post behavioural factor impact on Heuristic variable mean value is more than 3 (high impact):** In post period behavioural variables of heuristic dimensions that impact level of all the variables (X1 to X41) have highly influencing on small individual investor investment decision making at post period in this mean value more than 3. In post period the small individual investor want to preferred new investment avenues and highly risky investment avenues that new investment has more return, company performance, our own representativeness, overconfidence about the that new investments avenues, ever tempered person, do not manage the new investment avenues, too much of gambling activity these kind of heuristic variables has its impact on the post period. This research suggests the respondents to rectify this problem at present and in future.
- **Pre behavioural factor impact on prospect variable mean value is 1 to 2 (low impact):**
In the dimensions of prospect, all its three kinds of behaviour: loss aversions, regret aversions, and mental accounting have their representative variable influencing the decision making of small individual investor preferred investment avenues. Small individual investor towards preferred investment avenues in pre period have loss aversion,

regret aversion, mental accounting all the variables low impact level of the small individual investor' investment decision making. In pre period the components of prospect variable is having mutual relations to each other and positively impact on the investment performance.

- **Post behavioural factor impact on heuristic variable mean value is more than 3 (high impact):** The behaviour of small individual investor investment decision making at preferred investment avenues in post period have loss aversion, regret aversion, mental accounting all the variables high level impact on the small individual investor investment decisions making at preferred investment avenues. The components of investment avenues have the mutual relations to each other, and together impact the investor' investment decisions so that treating these elements unconnectedly may impact negatively their investment performance.
- **Pre behavioural factor impact on market variable mean value is 1 to 2 (low impact):** Market factor low impact on the investment making of small individual investor in pre period due to the means carefully select the investment, past experience of investment, correct to changes of investment, company analysis report, sources of information, market fundamental activities in before making an investment variables have moderate impact on the small investor investment decision making in pre period.
- **Post behavioural factor impact on heuristic variable mean value is more than 3 (high impact):** In post period above all the variables have highly impact on the small individual investor' investment decision making at post preferred more than investment avenues. The standardized deviations of these variables, which are relatively high in comparison to the mean values, show that there may be some investor strongly focusing on the market variables whenever they decide to invest in investment avenues.
- **Pre behavioural factor impact on Herding variable mean value is 2 to 3 (moderate impact):** herding pre investment decisions all behavioural variables have moderately impact on the small individual investor however, the herding pre investment decision behaviour effect does not seen to impact quickly on their avenues.
- **Post behavioural factor impact on herding variable mean value is more than 3 (high impact):** If herding post investment decisions all behavioural variables have highly impact on the small individual investor. This research suggests the small individual investor to make investment decisions do not follow their other investor' opinion and other investor preferred investment avenues.

- **Pre behavioural factor impact on emotional self expressions variable mean value is 2 to 3 (moderate impact):** In pre investment decision of small individual investor' self-expressions variable is to follow their other investor reactions, emotions basis selecting investment another person view point, motivated person, tend to investment change the mind frequently and have moderate impact on the small individual investor investment decisions and to new investment avenue is having low impact on the emotions self expressions of the mean value is.
- **Post behavioural factor impact on emotional self expressions variable mean value is more than 3 (highly impact):** In post investment decision of small individual investor' self- expressions variable follows their other investor reactions, emotions basis selecting investment on another person view point, motivated person, tend to investment change the mind frequently and have moderate impact on the small individual investor investment decisions having highly impact on the small individual investor'.
- **Post behavioural factor impact on emotional self expressions variable mean value is 2 to 3 (moderate impact):** Moderate impact on the emotions self expressions. In total, cluster analysis of the behavioural variables of five factors Heuristic (divided into 5 factor), prospect (divided into 3 factor), market, herding, emotional (only one factor is self-expressions), have most of them moderate impact on pre investment decisions of small investor' pre preferred investment avenues. In post period all the behavioural factors have highly impact on the small individual investor post investment decisions towards post preferred investment avenues.
- **Pre investment performance moderately impact (mean value 2 to 3):** Pre investment results satisfy fairly small individual investor' expectations. They have the relatively low investment return in both comparisons to their expectations (y1, mean value 2.87), the rate of return is equal to or higher than the rate of return of the investment (y2, mean value 3.00), and feel satisfied with the investment decisions in the loss choosing investment and deciding the investment amount (y3, mean value 3.31) all three variables moderately impact investment performance of small individual investor'.
- **Post investment performance highly impact (mean value more than 3):** Post investment results satisfy fairly small individual investor' expectations. They have the relatively low investment return in both comparisons to their expectations (y1, mean value 4.01), the rate of return is equal to or higher than the rate of return of the investment (y2, mean value 3.86), and feel satisfied with the investment decisions in the loss choosing investment and deciding the investment amount (y3, mean value 3.85) all three variables highly impact on investment performance of small individual investor'.

Hypothesis test result:

a) **H0 - Sources of information's do not affect to the pre and post preferred investment avenues**

- **Pre sources of information wise pre preferred investment avenues:** The above analysis is computed that the, calculated value (F) value is greater than the all the tabulated value of at 5% level of significance, so the null hypothesis rejected and alternative hypothesis was accepted and is concluded that there is a significant relationship between investment experience and preferred investment avenues for public provident fund, mutual fund, bond, gold silver. Except the post office, bank deposit, national savings securities, life insurance, real estate, chit funds and other investment avenues F values is lesser than the tabulated value of at 5% level of significance, so the null hypothesis is accepted and alternatives hypothesis is rejected and it is concluded that there is a significant relationship between investment experience and pre preferred investment avenues.
- **Post sources of information wise pre preferred investment avenues:** Elaborated that all the calculated value (F) is greater than the all tabulated value of F at 5% level of significance, the null hypothesis is rejected and alternative hypothesis will be accepted and is concluded that there is a significant relationship between post preferred investment avenues. It is concluded that sources of information affects all preferred investment avenues in small individual investor.

b) **H0 - Investment experience is does not affect to the pre & post preferred investment avenues.**

- **Pre investment experience wise pre preferred investment avenues:** The above analysis is computed that the, calculated value (F) is greater than all the tabulated values of at 5% level of significance, so the null hypothesis rejected and alternative hypothesis was accepted and is concluded that there is a significant relationship between investment experience and preferred investment avenues.
- **Post investment experience wise pre preferred investment avenues:** Above analysis elaborated that all the calculated value (F) is greater than the all tabulated value of F at 5% level of significance, the null hypothesis rejected and alternative hypothesis will be accepted and is concluded that there is a significant relationship between post preferred investment avenues. It is concluded that sources of information affects to all preferred investment avenues in small individual investor.

c) **H0 - There is no relationship between investor experience and investment performance.**

- **Pre investment experience on relationship between the investment performance of small individual investor:** The above analysis is computed that, calculated value

(F) is greater than all the tabulated values of at 5% level of significance, so the null hypothesis is rejected and alternative hypothesis was accepted and it is concluded that there is a significant relationship between investment experience and it depends on the investment performance. It is concluded that sources of information affect investment performance in small individual investor.

- **Post investment experience on relationship between the investment performances of small individual investor:** The above analysis computed that the, calculated value (F) is greater than all tabulated values at 5% level of significance, so the null hypothesis is rejected and alternative hypothesis was accepted and it is concluded that there is a significant relationship between investment experience and investment performance. It is concluded that sources of information is affect to all investment performance in small individual investor.

d) H0 - The heuristic, prospect, market information, herding, emotional self intelligence behavioural factors do not influence small individual investor' investment performance.

- **Pre behavioural factors wise investment performance:** There are five effective factors on the investor' investment pre investment performance. These include Heuristic, prospect, market, herding and emotional factor. The result revealed that the Heuristic methods have the most effect on the investor' investment pre performance and its F value (16.588) is greater than the table value 5% significant level (0.000) so the null hypothesis is rejected alternative hypothesis will be accepted. The heuristic behaviour is highly influenced in the pre investment performance. Also prospect, market, herding, emotional factors do not influence the investor' pre investment performance of small individual investor' because F value is lower than the calculated value 5% significant level. Based on the result of hypothesis analysis it can be said that the first hypothesis is supported and second, third, fourth, fifth hypothesis are not supported.
- **Post behavioural factors wise investment performance:** There are five effective factors on the investor' investment pre investment performance. These include heuristic, prospect, market, herding and emotional factor. The result revealed that the heuristic, prospect, market, herding, emotional factors methods have the most effect on the investor' investment pre performance and its F value is greater than the table value at 5% significant level (0.000) so the null hypothesis is rejected. Alternative hypothesis will be accepted and the heuristic behaviour is highly influenced in the post investment performance. Based on the result of hypothesis analysis it can be said that the first second, third, fourth, fifth hypothesis are supported.

Conclusions:

The research study area is “behavioural finance - a study with reference to the small individual investor in Tirunelveli district”. Male respondents want to preferred more than one investment avenues and educated people participated in investment activities; own fund are also used in the investment activities. The present study has two ways analyzed in the preferred investment avenues one is pre preferred investment avenues as well as post preferred investment avenues. In this research finding the in pre period the small individual investor only preferred in low risk investment avenues and also in post period the small individual investor preferred investment avenues medium and high risk investment avenues. The small individual investor look before investment decisions at in pre period only necessity basis, returns, friends opinion to follow their pre period but to total different in post period the small individual investor look before investment decisions at risk, returns, company investment strategy, company performance also to look in before investment decisions at post period. Behavioural factors also influenced in the before and after investment decisions in small individual investor and to find this research behavioural variables influencing individual investor’ decisions towards more than investment avenues in pre and post period: heuristic, prospect, market information, and herding, emotional self expressions. The heuristic factors include five behavioural variables (representativeness, overconfidence, anchoring, gamblers fallacy, ability bias), in prospect factor include three behavioural variables: regret aversion, loss aversion, mental accounting; herding factors include decisions of other investor, followed by other investor, volume of investing, speed of herding; the market factor consist of three variables: price changes, market information, and past trend of the company performance; emotional self expressions on our own expressions in investment decisions. These are all the variables moderately impacted on the pre preferred investment decisions period and also highly impacted on the post investment decisions period and those behavioural factors are highly impacted on the investment performance.

Future recommendations:

- Small individual investor prefers in future investment avenues in national savings securities, government savings securities, debt and bond.
- Small individual investor to look before in returns of the various investment avenues, investment period, and various investment options also loot in future investment activities.
- Behavioural factors of heuristic, prospect, market, and herding, emotional self-expression also highly impact on post investment decisions of small individual investor preferred investment avenues and investment performance low return into post period. The recommendation given to small individual investor is that they should consider carefully before making investment decisions.

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