Aazadi Ka Amrit Mahotsav:

Community Science Achievements, Opportunities and Challenges

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PREFACE

Community science is an equitable collaboration of science (with scientists and science- engagement) aimed at outcomes for the benefits of communities. It is very essential because the world faces critical challenges that are multi-disciplinary and exist at the intersection of science and society. Community science often involves using scientific methods, processes and tools to gather data analysis and collect observations. It might also incorporate data analysis and the application to understand current circumstances and advance community priorities including applying this knowledge to build self reliant, sustainable and self empowered community.

In present era, the field of community science is experiencing much more awareness, new information and new developments. Old information needs to be revised and some new information needs to be added, therefore, this book has been designed and structured to update the current developments in subject areas.

The edited book volume is primarily intended to be a collection of chapters written by experts of their respective fields. Chapters of this book entitled “Aazadi ka Amrit Mahotsav: Community Science Achievements, Opportunities and Challenges” particularly based on different disciplines of community science, i.e., food science and nutrition, food security, advancement in food preservation and processing, sustainable breeding and cultivation approaches in agriculture, importance of prebiotics, role of therapeutic diet, importance of nutrition for pregnant ladies and children, how cognitive development is affected by nutritional status of the children, spiritual development, skill based learning

system DEASA, effect of social media on community development.

I envisage the book to serve as a professional reference for researchers and practitioners in their relevant scientific field. This book will be very useful for students all over in India and Abroad, academicians, public health specialists, community science specialists, community development professionals, programmers of national and international agencies, entrepreneurs and aspirants of new start ups/ enterprises as well as libraries of relevant collages and institutions.

This book should be of interest to policy makers, bureaucrats, economists and community scientists and can be a reference material development industry.

This is my sixth book in the series of community upliftment. The first book titled as “Vridhopayogi Vyanjan: Vridhjano ke liye Upcharatmak Pak Vidhiyan (year 2016)” which contains more than 65 healthy food recipes developed, prepared and clinically verified by myself alone, tailored with the nutritional needs of the geriatric population.

Second book titled as “Community Science and Sustainable Community Development (Year 2021)” that provides excellent research data related to different aspects of community which will be helpful to strengthen the sustainability of a community in terms of health, nutrition, wellness and economy.

My next three books are the three distinct volumes of title “75 years of Indian Independence: Food and Nutritional Achievements, Opportunities and Challenges (Year 2022)” that provide enriched research data pertain to various aspects of health, lifestyle, tourism, agriculture, antenatal or

post natal diet, nutritional status, cognition and nutrition, etc., that will be extremely helpful to improve quality of life of the individuals ultimately making healthy and sustainable community.

With great pleasure, I would like to extend my sincere thanks to all the authors of the chapters for reporting their thoughts and experience related to their research and also for patiently addressing reviewer's comments and diligently adhering hectic deadlines to have the book published in timely manner. Their constant support and cooperation has made my task as editor a pleasure. I believe that this book is an important contribution to the community in addressing research work from numerous domains of community science.

It is my sincere hope that many more will join us in this time-critical endeavour and this book will stimulate discussions and generate helpful comments to improve future projects.

Happy reading and feedback awaited.

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It is indeed a great pleasure for me to express my profound gratitude to these eminent yet approachable personalities who helped me to bring this humble endeavour to its fruitful completion.

I am grateful to almighty God, who provided me an opportunity and ability to accomplish the great task, who in every moment of my life, always blessed me beyond my imagination, helped me in every difficult time and gave me strength and perseverance. Whatever I am today is just because of them.

I deeply recognize the efforts by all authors for their contribution without whom this book will not look like what it is today. They deserve a special round of applause.

Finally, I acknowledge the sincere efforts of my family which has been the nucleus around which all my efforts have crystallized. No one can conquer without a strong base. I bow my head with great respect to my grandparents and hope that this work makes you proud. Thanks for your blessings. Words would fail to express my heartfelt veneration and deep sense of admiration to my loving siblings Er. Surbhee Gupta and Er. Saurabh Gupta for their love, affection, moral support, encouragement and help in every possible way to complete my work. Their unwavering faith in me has always been a source of constant inspiration for me.

I express deep and heartfelt obligation to my parents Mrs. Archana Gupta and Dr. Lok Mani Gupta for their patience, cordial affection, will power, blessings, moral support and for being my driving force. Their love

provided inspiration and motivation, without which this work would not have been completed. They are the real architects of my life. They inspired me to build castles when all I had was a fistful of sand. They always stood by me during all thick and thin. Without their support, patience, sacrifice, forebearance and unalloyed love, this work would never have seen the light of the day.

I want to express feelings of utmost gratitude towards my parents-in-laws for their blessings. I owe Heartfelt thanks to a very special person my husband CA Dinesh Agrawal for being there for me at every step of this writing journey. My husband's good spirits, patience, constant support and encouragement made it possible to accomplish this task. I appreciate my kids, Hemakshee Agrawal and Devansh Agrawal for abiding my ignorance and the patience they showed during this endeavour. Their cute smile inspired me to go forward and their playful and naughty activities relaxed me during my tough times. Words would never say how grateful I am to both of you.

In the end, I want to express my sincere and deepest gratitude to everyone who, in their own way, directly or indirectly, have helped me to complete this book but could not have found separate names, so just in case: thank you to whom it may concern.

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Dr. Khushboo Gupta is a PhD Home Science (Food Science and Nutrition) from Banasthali Vidyapith, Newai, India. She has been teaching subject including food chemistry, food analysis, therapeutic nutrition, human nutrition, human physiology and community nutrition, etc. Presently she is working as Assistant Professor in Trilok Singh TT College, Laxmangarh, Sikar, Rajasthan.

She is MSc Gold medalist and had cleared UGC-NET and RPSC-SET examination. Dr Gupta holds Advance Diploma in French Language from Banasthali Vidyapith; Diploma in Naturopathy and Yoga (NDDY) from Gandhi Smarak Prakritik Chikitsa Samiti (Regd.), New Delhi; Certificate in Homeopathic Medicinal System conducted by Vardhman Mahaveer Open University, Kota and Certificate in Statistical Techniques and Applications. She has featured in several programs of All India Radio and Radio Banasthali (FM 90.4).

Dr. Khushboo is actively involved in community activities especially those concerned with self-employment, health and wellness, optimum nutrition and how to improve quality of life of a person and family. She is the keynote speaker and founder of her YouTube channel “Dietitian Ki Salah” through which she provides education related to optimum health, wellness and nutrition to masses. Dr. Gupta has published about more than 30 research papers in reputed national and international journals; 5 book chapters

in five different edited books, several news paper and magazine articles related to health, nutrition and new food product formulation. She authored one book related to elderly nutrition; edited a book related to community science and three books (edited books) related to food science for upliftment of the individuals of the society. She presented her research work in more than 25 national and international conferences. Her research is primarily in the area of food processing entrepreneurial skill Inculcation and geriatric nutrition and her research on food formulation using RSM has culminated into the successful filing of a patent that has been published.

In past she had worked as Assistant Professor (Food and Nutrition) in Modi University, Laxmangarh, Sikar; worked as Master Trainer in Agriculture University, Kota. During her PhD she had worked as UGC- SRF in Banasthali Vidyapith, Newai. One feather in her cap is that she had worked as regular trainee dietitian in dietetics department of Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh and got her short-term attachment certificate. She won many awards in different seminars and conferences for her contribution in scientific world. Apart from them, she is rewarded with Teacher Honour award by Lions Club Kota South (September, 2017) and 'Award of Honour' given by All Rajasthan Qualified Homoeopathic Doctors Association in Homoeopathic Scientific Seminar, 2017

She is the life member of many reputed institutes i.e. Nutrition Society of India, Indian Dietetic Association, The Indian Science Congress Association and Institute of Scholars and giving her services for upliftment of community.

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If readers have any query related to any chapter of the book, kindly contact with the corresponding author of the chapter. Authors of the chapters are responsible for their work.

1.

MICRONUTRIENT DEFICIENCY: OBSTACLES IN CHILD NOURISHMENT

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Abstract

Child malnutrition is a burning global issue and a public administration of our country is facing a lots of challenges to handle the situation. According to the National Family and Health Survey (NFHS)-I, 1992-1993, above half of the children under four years were underweight and stunted; and one in every six children was excessively thin (wasted). The data from the recent NFHS (2019-2021) shows only nine states of the twenty-two states surveyed a reduction in the number of the stunted children and ten in wasted children, and six in underweight children. In a report published by UNICEF, it is noted that malnutrition was one of the causes of 69% of deaths of children below five years of age. In this chapter we will discuss the four major micronutrients that are Vitamin A, Zinc, Iron, and Iodine which are closely associated with child malnutrition under the age of five years and linked to 12% of death

globally. Severely malnourished children seek medical attention when health issues such as infection initiates in the transition between marasmus and kwashiorkor, in which adaptation is no longer helpful.

This chapter will cover the deficiency symptoms of those particular micronutrients mentioned above in malnourished children and suggest the dietary guidelines and fortified food sources for the reduction of the symptoms in children below the age of five years.

Keywords: Child Malnutrition, Micronutrient Deficiency, Fortification, Dietary guidelines.

1. Introduction

Malnutrition is still a burning problem of the society and Micronutrient deficiency is a major health problem worldwide. There are so many advances and improvements in child health, but still malnutrition remains most critical public health challenge particularly in developing countries like India. Micronutrient malnutrition is a term that is usually refers to diseases caused by the diet deficient in vitamins and minerals. Sometimes many of the parents are concerned only with intakes of calorie, proteins and fats but less effort is given towards the lack of micronutrients like iodine, iron, zinc, vitamin A etc., this ignorance to micronutrient intake causes the child to suffer a lot even in future. Chronic deficiencies of these elements can lead to severity and often causes the faulty child growth. Childhood is the time when balances of all the nutrients are necessary for the proper functioning and activity of all the body part. Malnutrition due to micronutrients is a major obstacle to social and economic development and it has a greater effect on health, learning

ability and productivity. Micronutrient deficiency are widespread among 2 billion peoples including children in developing and developed country. The main reasons behind the micronutrient deficiency are poverty, lack of availability of sort of foods, inadequate dietary knowledge and high incidence of infectious diseases. Besides this, deficiencies of micronutrients can easily develop during an emergency or worsen if they are already present. Although there are a wide number of policies and programs to safe guard the situation but still availability is far behind the expected level. Vitamin A deficiency (VAD) affects the children globally and causes night blindness and if untreated can lead to complete blindness. Loss of blood during childbirth is very crucial to anemic mothers, and one of most important cause of maternal death and anaemia in during pregnancy causes growth retardation of the foetus, Low Birth Weight (LBW) and increased number of death in first week after birth. Iodine Deficiency diseases are a threat to those children who lives in areas where soils lack enough Iodine and causes severe mental retardation in children. Zinc deficiency also plays role in growth retardation and several associated symptoms. There are a number of effective methods exist to deal with the situation but there are requirements of comprehensive and cost-effective efforts by government to be successful. The sufferings of human especially the children can be cured in large numbers by only providing proper dietary care and by providing good nutrition education.

2. Trends in malnutrition

In the National Family Health Survey (NFHS-I) performed during 1992-93, India was performing very worst on child

health indicators. In the survey report it has shown that above half of the children below four years of age were underweight and stunted. One out of every six children was extremely thin.

Table 1 Showing some of the Indicators and their data from NFHS 5 Survey (2019-20):

Indicators	NFHS (2019-20)	NFHS (2015-16)
Children age 6-59 months old who are anemic (<11.0g/dl)	40%	49%
Prevalence of diarrhea in the 2weeks	5.6%	5.3%
Children with diarrhea in the two weeks participated in the survey who have received zinc	44.1%	8.3%
Infant Mortality Rate (IMR)	20.6%	9.8%
Under 5 Mortality Rate	24.5%	13.0%

The NFHS IV, conducted in the year 2015-16 found the prevalence of underweight, Stunted and wasted children under five were 21.6%, 23.3% and 18.9%.

Current data provided by NFHS conducted during 2019-20 shows the prevalence of stunted, wasted, and underweight were 22.5%, 16.0% and 23.7% where the data about severely wasted children was 4.8% [21]. Table 1

provides the data regarding prevalence of some childhood disease.

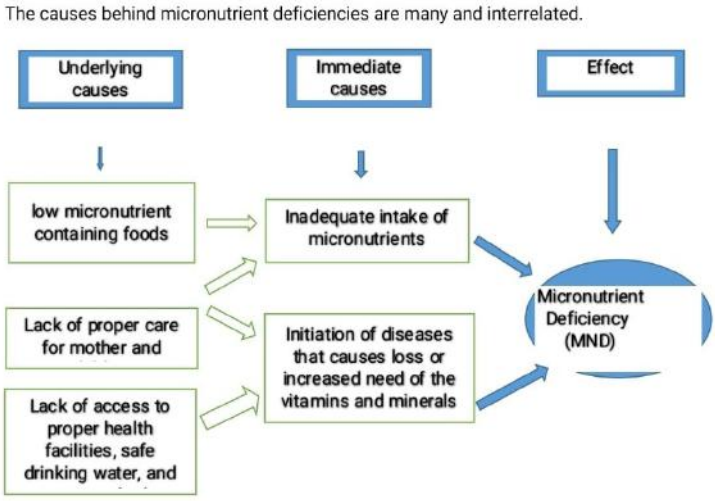

Fig.1 Causes of micronutrient deficiency

3. Reasons behind micronutrient deficiencies

3.1. Poverty

poverty is one of the leading causes of undernutrition in the developing countries that limits the availability of nutritionally rich food sources to the vulnerable groups. Poverty is multidimensional with three dimensions that includes Health, Education and standard of living. A household considered as nutritionally deprived if any child in the age group of 0-59 months, or women in the age group of 15-49 years, or man between 15-54 years' age for whom nutritional information is available – is found to be undernourished

3.2. Improper diet

The most important and modifiable cause of micronutrient deficiency is poor nutrient intake through. The principle dietary intake of Indians is Roti, Rice, breads, potato, pulses which provides the proteins and carbohydrates but due to poverty, lack of proper dietary knowledge, religious customs most of the people's skip eating fruits, chicken, egg, fish, milk, vegetables which are rich in essential micronutrients. Seasonal availability also a matter of concern in this aspect.

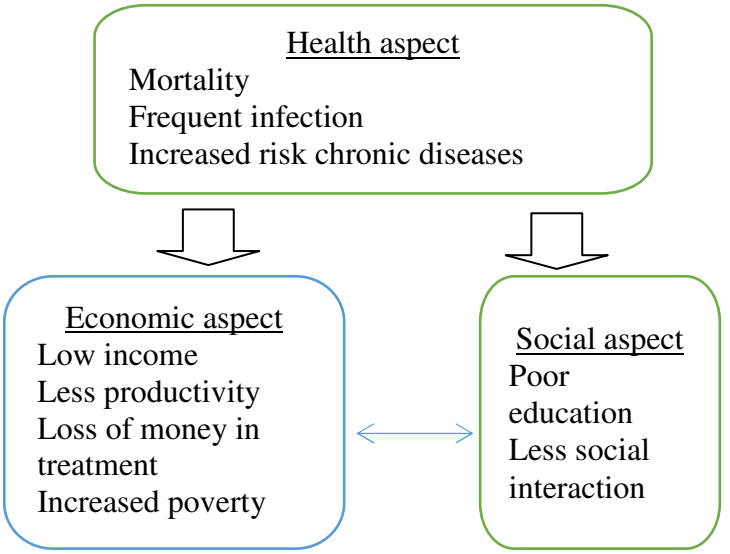

Fig: 2 Vicious cycle of Micronutrient Deficiency

3.3. Infectious diseases

The absorption and storage of the micronutrients decreases with diseases it can even leads loss of zinc, sodium and potassium during diarrhoeal infection.

Parasitic infection is also a causative factor in progression of anemia in children. The deficiencies caused by diseases make the individual more susceptible to the illness or less able to absorb micronutrients.

3.4. Other causes

The other causes that increases the progression of micronutrient deficiencies are lack of proper foods intake, inadequate health care facilities, less availability to safe drinking water and improper sanitary hygiene. Children from rural area suffers a lot from ineffective health care practices coupled lack of access to various food sources. Inadequate access to clean water and sanitation leads to gastrointestinal infection which in turn leads to loss of important minerals and disturbances of absorption of the same.

4. Deficiency symptoms of some important micronutrients

Micronutrients are vitamins and minerals needed by the body in very few amount. However, their role in various body function are many, and deficiency in any of them can cause severe and even risk to survival. There are a number of micronutrients such as Iron, manganese, copper, zinc, chlorine, vitamin A, Vitamin C. Among all these some of the important Micronutrients and their deficiencies are discussed below:

4.1. Vitamin A deficiency (VAD)

Vitamin A deficiency also known as Hypovitaminosis A is the immediate cause of blindness in children and increases the risk of death from common childhood infections such as diarrhea. Deficiency of vitamin A during infancy occurs

due to mothers' diet lacking in vitamin A or inadequate content of vitamin A in breast milk. Some common symptoms associated with vitamin A deficiency in children are eczema (itchy, dry skin), dry eyes that is inability to produce tears and ultimate drying of cornea, delayed growth, repeated infections of throat and chest.

4.2. Deficiency of iron

Iron is the major micronutrient that contributes to the movement of oxygen from the lungs to the other parts of the body and helps muscles to store and use oxygen besides this it promotes DNA synthesis and muscle metabolism. Iron is used by our body to make haemoglobin, a protein in the Red Blood Cells. Dietary deficiency of Iron leads to a clinical condition known as Iron Deficiency Anemia (IDA) in which the blood hemoglobin level ranges below the normal value. In very small infants the deficiency of this micronutrient is generally due to lack of iron in the mother's diet. Symptoms of Iron deficiency in children are pale skin, fatigue, cold hands and feet, slowed growth and development, rapid breathing, loss of appetite, unusual cravings for non-nutritive substances, such as ice, dirt, paint or starch. Diet lacking in iron containing foods, lack of vitamin C and parasitic infections or any gastrointestinal disturbances that interferes with iron absorption makes the children deficient in iron.

4.3. Deficiency of iodine

Deficiency of iodine is one of the leading causing of mental retardation and brain damage in the world. Iodine is the essential nutrient needed for the production of triiodothyronine and thyroxine. The absence or deficiency

any of these two hormones can lead to various developmental defects, including irreversible mental retardation in infants and a loss of up to thirteen Intelligent Quotient(IQ) points in children. Sufficient amount of these hormones have been proved to be important for normal growth and neuronal development in fetal life, infancy and childhood. Deficiency of iodine also associated with congenital anomalies, infant and neonatal mortality and growth impairment.

4.4. Deficiency of zinc

Zinc is the cofactor for many enzymes and essential for proper immune functioning. It is the most likely trace element that seems to be deficient after iron. Most of the zinc is likely to be stored during the third trimester of pregnancy, making susceptible the preterm infants at high risk of deficiency of this micronutrient. Acrodermatitis Enteropathica (AE) is the clinical disorder that results from zinc deficiency. It is a rare, autosomal recessive disorder but often results from nutritional or malabsorptive state. Other symptoms of zinc deficiency are alopacia, diarrhoea, loss of taste, and irritability. Zinc deficiency generally occurs in infants when its demand exceeds its supply.

5. Preventive measures for micronutrient deficiency

Micronutrient Deficiency is a result of combination of various factors such as poverty, lack of proper dietary knowledge, presence of gastrointestinal diseases and other underlying causes. Controlling or irradiating these factor can prevent the situation and reduce the burden of the diseases from children.

5.1. Adequate dietary Intake

Deficiencies of micronutrients can cause visible and serious health conditions, but they can also cause less clinically notable declining energy level, mental clarity and overall capacity. These deficiencies are preventable through nutrition knowledge and consumption of a balanced diet containing variety of foods such as fruits, vegetables, meat, poultry, eggs are essential. For the prevention of these deficiencies fortification and supplementation are helpful. Government initiatives are also there to reduce hunger and provide basic necessities of nutrition.

5.1.1. Food fortification

Fortification is a popular way used as food path that provides an opportunity for maximizing nutrient intake of the infants and known to be effective for improving growth. There are some common and easily accessible food items that can be Fortified with essential micronutrients such as staple foods like rice, some condiments like soy sauce and salt and sugar. Fortification of common salt with Iodine is available for all the socio economic classes. Researchers of IIT Bombay has provided an idea about fortified product, such as vitamin A or vitamin D fortified milk. Government of India also focused on the fortification of soya flour or gram flour with zinc, iron, calcium and vitamin A and C.

5.1.2. Supplementary feeding

Supplementary feeding is helpful for food insecure and vulnerable segment of the society by optimizing the nutritional values and adequacy of the diet and improving quality of life. Dietary supplements can be available in

variety of forms, including tablets, capsules, or powder as well as drinks and energy bars. Some common supplements are vitamin D and B12, minerals like calcium and iron, herbs such as garlic, products like probiotics and fish oils.

5.1.3. Government Initiative to combat malnutrition

For irradiation of malnutrition, Indian Government has declared mission Poshan 2.0 to strengthen the nutritional content, delivery, outreach and outcomes with focus on developing practices that deals with health, wellness and immunity to disease and malnutrition. One of the Umbrella scheme launched by GOI is Integrated Child Development Scheme in the year 1975. This scheme provides with betterment of nutritional and health status of children aged between 0-6 years and reduce the incidents of mortality. This scheme also provides nutrition to the pregnant and lactating mother and immunization with referral services.

5.1.4. Dietary Guidelines for children aged between 2-4 years

For girls:

- Calories: 1000-14000, based on growth and activity level
- Protein: 113.4 g.
- Fruits: 60 g
- Vegetables: 60 g
- Grains: 125 g
- Dairy: 150 ml.

For boys:

- Calories: 1000-1600, based on growth and activity level
- Protein: 125 g
- Fruits: 60 g
- Vegetables: 60 g
- Grains: 130 g
- Dairy: 200 ml.

5.2. Immunization

Generally, among the discussed micronutrients the only available immunization process is for vitamin A. In areas where vitamin A deficiency is a public health problem, routine Vitamin a supplementation is considered essential for infants and children aged between 6-59 months of age as a public health intervention and this immunization programme has been shown to reduce the risk of all-cause mortality by 12-24%. The National Programme for Prophylaxis against Blindness in children due to Vitamin A Deficiency, of GOI, has provided for administering mega doses of vitamin A. It recommends for at least nine doses of vitamin A to be given to all children aged 9-59 months. The first dose of 100,000 IU is given with measles vaccination at 9months and subsequent doses of 200,000 IU each, every six months.

5.3. Prevention of underlying causes

There are various underlying causes of micronutrient deficiency such as presence of some gastrointestinal diseases, lack of cleanliness, lack of availability to clean

water and proper sanitation. For example, Anaemia is often associated with parasitic disease such as malaria and hookworm infections. Hookworm infection results in anaemia by inducing iron deficiency by chronic intestinal blood loss. These should be prevented by use of medicines. Some malabsorption syndrome also deals with the absorption of the nutrients and leads to the deficiency. Adequate sanitation, hygiene, and availability to safe drinking water can help in reducing micronutrient deficiency and stunting in children by minimizing the risk of diarrheal and parasitic infections. WHO framed that diarrhea or gastrointestinal infections are related with nearly half of all malnutrition as a direct result of inadequate clean water, sanitation, and hygiene. This means, in addition to nutrient rich foods, a hygienic environment and proper sanitary and hygiene conditions are required for healthy nutritional status.

Recommended Dietary Intake for different kind of micronutrients mentioned below:

Table 2 RDA 2020 by ICMR NIN

Age group	Category	Vit. A (ug/d)	Iron (mg/d)	Iodine (ug/d)	Zinc (mg/d)
Infants	0-6 months	350	-	100	-
	6-12 months	350			
Children	1-3 y	390	8	90	3.0
	4-6 y	510	11	120	4.5

6. Conclusion

This chapter concludes that micronutrient malnutrition in children is a multifactorial clinical condition. Infancy and childhood is that phase of life which need proper attention for every aspect of growth and development and diet is the crucial factor for the sustenance of their lives. Mother's dietary pattern and health status is also a matter of concern in case of infants because mother's stored form of nutrient protects the child from various childhood diseases. Infants should be exclusively breastfeeding for the first six months of life and then proper dietary intake children attending Anganwadi centres should ensure the intake of the meals provided. An adequate dietary intake coupled with good hygiene, sanitation and a clean environment can reduce the burdens of micronutrient deficiency from the infant and children.

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2.

MECHANISMS OF COGNITIVE DEVELOPMENT AMONG SCHOOL GOING MALNOURISHED CHILDREN

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Abstract

Cognitive development plays a crucial role in a child's growth and development. There are wide ranges of cognitive abnormalities seen in children, as there is a connection between structural and functional abnormalities of various parts of the brain and deficiencies in cognitive, emotional and behavioural functioning. Children who are malnourished may also exhibit unusual patterns in the way that cognitive development processes. Study on Cognitive development, particularly in school-going children, has always been a point of discussion among researchers. This chapter aims to understand better the mechanisms underlying cognitive growth regarding school-going malnourished children. Cognitive

mechanism studies how the children's brain realizes the mental activities such as perception, learning, thinking, information processing, attention, decision making, planning and abstraction; therefore, school functioning of children is based on a wide range of elements, such as participation in school, academic success, interpersonal connections and co-curricular activities. This chapter also focuses on many factors that play a role in children's cognitive development, such as dietary supplementation, parents- teachers' role and the importance of play among children. Dietary supplementation is essential as nutrition is necessary for the brain, influencing mental function by directly affecting brain processes and indirectly affecting children's behaviour. The parents and teachers; both teach the child to interact with many talents and educate their children. Lastly, play enhances memory and stimulates the cerebral cortex's growth. This chapter will conclude with the crucial role of nutrition, play and parents among malnourished children if a balanced diet provided to malnourished children will improve their cognitive development, which is essential for proper growth and development of an individual and enhance one's academic performance. Understanding the appropriate cognitive development mechanism will help improve a child's overall development.

Keywords: Cognitive Development, Children, School, Nutrition, Brain

1. Introduction

Malnutrition affects children in every country. It is a silent epidemic that is associated with structural and functional brain disease. Malnourished children have been found to

have a wide range of cognitive abnormalities (Rao et.al, 2008). According to WHO estimates, 50 million children under the age of five are wasted, 159 million are stunted, and 41 million children under the age of five are overweight or obese (WHO, 2021). According to Global Nutrition Report 2021, an unacceptable proportion of people are still suffering from starvation. Low birth weight affects 20.5 million newborns worldwide (14.6 percent of all live births). Each fifth child below the age of five is stunted (149.2 million),45.4 million (6.7 percent) is wasting, and 38.9 million (5.7percent) is overweight. If the meet its global targets (Childhood wasting, childhood overweight, Anaemia, Low birth weight, Breastfeeding) of reducing the number of stunted children to 87 million by 2030 and 104 million by 2025, more aggressive measures will be required. In the meanwhile, meeting the overweight objective would necessitate reversing the existing trend (Global Nutrition Report 2021).All-India level child nutrition indicators show a minor improvement as stunting has decreased from 38 to 36 percent, wasting from 21 to 19 percent, and underweight between 36 to 32 percent (NFHS-5, 2019-2021).

The active stage of a child's growth occurs while they are in school. It is a crucial period of mental development as well as physical development. The current state of school-age children's health and nutrition in India is unacceptable. Nutritious food is essential for the child's proper growth. The problem of malnutrition is caused by a child not getting enough food with good nutrition, which is necessary for the children's growth and development because school-going children are affected by mental retardation, poor memory, and low academic performance (Chalmers, 2015).

According to UNICEF the majority of children in the globe with severe acute malnutrition. There is strong correlation has been established between inadequate nutrition and cognitive impairment. Several studies have shown that cognitive development rates poor in malnourished children (UNICEF, 2022).

Cognitive development is a stage of various mental activities such as thinking, reading, writing, arithmetic. In this chapter cognitive development focuses on how a child develops in terms of information processing, conceptual resources, perceptual ability, and language acquisition. There are mainly four stages of cognitive development. These are language, Intelligence, reasoning, and memory (Mischel, 1971). When a child reaches in these stages that captures anything like playing with toys, watching television or listening to their parents talk helps to improve their cognitive abilities. Piaget was a key figure in creating this field, developing what he called his “theory of cognitive growth”. In this theory of cognitive development, Piaget identified four phases: sensorimotor, preoperational, concrete operational and formal operational (Piaget, 1936).

2. Mechanisms of cognitive development

Malnourished children do poorly on the majority of neuropsychological tests, with the exception of the motor speed test, compared to appropriately nourished children, who were underweight, poorly on tests of higher cognitive abilities like, logical thinking, attention, working memory, perception of images, and verbal understanding, on the basis of neuropsychological tests revealed a broad

impairment affecting memory, attention, executive abilities, visuospatial functions (Janina et al. 2021).

2.1. Effects of malnutrition on children's cognitive development

Malnutrition affects motor activities, cognitive function, attention, language development, and physical work capacity, which has an impact on childhood performance and health. Memory issues, intellectual sluggishness, or learning problems in reading, writing, or arithmetic are all signs of cognitive abnormalities brought on by malnutrition. From many cognitive studies, It is discovered that the rate of cognitive development varies due to poor nutrition in children and showed low performance with respect to age as compared to healthy nourished children. There are several factors affecting school-going children and their academic performance (Janina, 2021).

2.1.1. Dietary supplementation

Dietary supplementation is an important factor that plays role in cognitive development. Nutrients rich diet is necessary for the brain that affects cognitive function by directly affecting brain processes or indirectly affecting children's behaviour. Inadequate availability of nutrients during school age negatively affects the structural and functional development of the brain. Nutrient intake is essential for many biological functions as well as cognitive development (Algarin, 2013). There are many dietary influences on cognitive development and the brain may be affect individually and in an interactive way by the macro and micronutrients that are consumed. Many researchers have examined the impact of undernutrition, most

frequently protein-energy malnutrition, on the cognitive development of children in underdeveloped countries. The effects of malnutrition on the brain include memory problems, intellectual slowness, especially in reading, writing and arithmetic, and other cognitive deficits (El Hioui, 2016).

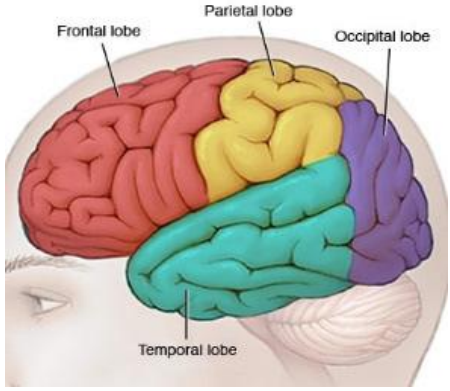
2.1.2. Role of parents and teachers

The role of parents and teachers plays a crucial role in cognitive development. Cognitive skills are taught by parents and teachers, Both are role models for children because they teach the child to interact with many skills as well as also educate them about critical thinking, problem-solving, and self-control. As a parent, it is crucial to encourage your child's cognitive growth from the moment of birth since doing so provides the foundation for your child's success in school and in later life.

2.1.3. Physical activity

The importance of play in the growth of cognitive development. The importance of physical activity in children, especially in late childhood, can always be overstated. Developmental abnormalities and limited perception might result from a lack of physical activity in childhood (Bidzan-B, 2018). It enhances memory and stimulates cerebral cortex growth. The term “cerebral mantle” also refers to the cerebral cortex. The outer layer of neural tissue of the cerebrum of the brain in humans (thefreedictionary.com). The cerebrum is a major part of the brain and regulates a wide range of functions, including personality, hearing, vision, and emotions. It manages all voluntary acts' accuracy (Bidzan,2018).

2.2. Lobes of the brain



The frontal lobes are part of the front of the brain. They are enormous and serve numerous purposes. The frontal lobes are crucial for controlling higher-order executive functions, expressive language, and voluntary movement. The ability to plan, organize, initiate, self-monitor, and manage responses in order to accomplish a goal is referred to as having executive functions. Situated in front of the temporal lobe and above the frontal lobes are **the parietal lobes**. The central sulcus divides the parietal lobe from the frontal lobe. Their main objectiveis to make it possible for us to understand the objects touch, such as whether they are firm or soft, smooth or sharp and the parietal lobe is where touch, temperature, pressure, and pain information is integrated. Other abilities such as math, spelling, hand-eye coordination, and fine motor actions like tying shoelaces depend on the parietal lobes.

The occipital lobe is the major visual area of the brain. Visual data from the eyes is sent to the main visual cortex, often known as V1. These secondary visual processing areas interpret depth, distance, position, and object identity using this information after it is sent along to them. **The temporal lobe**, which is divided from the frontal lobe by the lateral fissure, also has sensory information processing areas that are crucial for hearing, understanding language, and creating memories. The main

auditory cortex, located in the temporal lobe, interprets auditory information from the ears and other secondary areas so that may comprehend what we are hearing e.g.words, laughing, or crying (qbi.uq.edu.au).

3. Learning disability (LD)

Learning disabilities are considered to be a neurological disorders in the brain's capacity to send, receive, and absorb information. A youngster with a learning disability could struggle with comprehension in general as well as with reading, writing, speaking, listening, and mathematical ideas. A set of conditions known as learning impairments includes dyslexia, dyspraxia, dyscalculia, and dysgraphia. Disorders of different types can coexist. There are many factors that could resultsin learning disability: Heredity has been found that a child is more likely to experience the same disorder as their parents if they both have learning disabilities (kidsplus.com). Learning difficulties may result from a disease or injury sustained before, during, or after birth. Other potential contributing factors include drug or alcohol use during pregnancy, physical trauma, inadequate uterine growth, low birth weight, and stress-related early or accelerated labor. Stress during the sensory stage is a traumatic event that occurred after birth, such as high fever, head trauma, or inadequate nutrition. Environmental factors are More exposure to poisons like lead (in paint, ceramics, toys, etc.). Multifactorial diseases like; Attention disorders or disruptive behavior disorders are more likely to occur in children with learning difficulties than in typically developing children. ADHD can occur in up to 25% of kids with reading disorders(www.whiteswanfoundation.org).

3.1 Types of learning disabilities

A number of additional, more specialized learning impairments are collectively referred to as "learning disabilities" under this "umbrella" phrase. **Dyscalculia:** A particular form of learning impairment that impairs a person's capacity for understanding numbers and picking up math concepts. **Dysgraphia:** A particular learning issue that impairs one's fine motor and handwriting skills. **Dyslexia:** A particular learning deficit that has an impact on language-based processing abilities such as reading. **Non-Verbal Learning Disabilities** has difficulty reading nonverbal signs including body language or facial expressions and may be uncoordinated (ldaamerica.org).

4. Children who have learning disabilities and struggle in school

The National Center for Learning Disabilities defines a learning impairment as a neurological condition that impairs the brain's capacity to receive, process, store, and/or respond to information. Learning disabilities (LDs) are distinct from intellectual disabilities, and many people with LDs struggle in one or more specific learning domains despite having extremely strong general cognitive abilities (www.ncld.org).

4.1. Pre-school

The preschooler might experience some of these issues there. Acquiring speaking abilities between the ages of 15 and 18 months, when children's speech normally begins to develop. Pronunciation of basic words. Recognizing words and letters. Studying arithmetic, rhyming, or music.

Performing physical tasks while using fine and gross motor abilities.

4.2. Primary school

The child has difficulty in this stage Such as; connecting the sounds and letters, recognising differences between words with similar sounds or rhyming syllables, correct reading, spelling, or writing, and recognising right from left, such as mixing up the numbers 25 and 52, "b" and "d," "on" and "no," and "s" and "5",inability to judge distance or speed, poor hand-eye coordination, and accidents as a result of these issues.

4.3. Middle school

The child has difficulty in this stage such as; spelling variations (such as sea/see and weak/week), prefixes, and suffixes, solving math word problems, writing assignments, and reading aloud (www.whiteswanfoundation.org).

5. Psychological testing

A considerable discrepancy between a child's general cognitive functioning and his or her ability in particular subsets of work is required to make the diagnosis of learning difficulties. A battery of standardized tests that assess the children’s overall cognitive ability, academic success, and abilities in particular areas where the child is having difficulty is given by certified clinical psychologists. Which tests should be used depends on the child's age and the particular difficulties they are facing such as; the Pintner-Cunningham Primary Test, which has been used in several variants, is one of the most well-known group assessments for pre-schoolers.For the

elementary school level, Nelson Tests of Mental Capacity and School and College Ability Tests are used (Anastasi, 1961).

6. Conclusions

This chapter explains that cognitive development deficits have been observed in school–going malnourished children, which is attributable to various factors such as dietary supplementation, the role of parents and teachers, and physical activity. Along with this, various parts of the brain are also affected such as; the frontal lobe is responsible for expressive language, and voluntary movement. The parietal lobe is responsible for touch, temperature, pressure, and pain information is integrated. The occipital lobe is the major visual area of the brain such as; visual processing, color identification, balance, and coordination, and the temporal lobe is responsible for the auditory cortex. In the chapter, it has been also explained that school-going children have been found to have various learning disabilities due to poor brain development and inadequate nutrition intake. This disorder is treated by clinical psychologists for their prevention through various psychological tests.

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3.

SIGNIFICANCE OF NUTRITION FOR PREGNANT MOTHER

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Abstract

The period of pregnancy is a time when both the mother and the fetus undergo rapid growth and development. Nutrition during pregnancy is a well-known fact for maintaining maternal health. In order to fulfill nutritional requirements, expectant women should eat a diet that is rich in fruits, vegetables, and whole grains, and take daily vitamin and mineral supplements to ensure a satisfactory intake of iron and vitamin B_9.Malnutrition in mothers is more prevalent in pregnant women in India and the government is taking many initiatives for this purpose by introducing various schemes. Nutrients like energy, protein, iron, and vitamin are required in increased quantities to meet the needs of the mother as well as the fetus.

Keywords: Nutrition, placenta, health status, fetus

1. Introduction

Nutrition intake and way of living before and during the gestation period, have proved to make a long-lasting impact on the child's health during the later stages of life, including the increase in a high risk of noncommunicable diseases like obesity, diabetes, and hypertension. Thus, for the proper development of the fetus during pregnancy and the maintenance of the health of the mother, a woman should eat at least 3-4 proper meals every day.

The fetus, the placenta, the uterus, and mammary gland all need protein for proper growth, and this includes the intake of high-protein foods. Vitamins and mineral components are also needed to maintain a healthy pregnancy or woman as poorly provided vitamins or minerals can lead to serious health problems. (Maqbool, 1999)

2. Maternal malnutrition

As mothers, women are especially concerned about their nutritional and health status as it relates to carrying and fostering children, hence "maternal nutrition". Despite this, many women in the world suffer from a poor nutritional status that hinders their capacity to perform their responsibilities as mothers and fruitful workers.

It is clearly implicated as maternal malnutrition when there is insufficient food to eat or a lack of a particular nutrient, like iron. Thus, it is important to maintain the nutrition of the mother in a broader set of women's life situations. (McLean,2009)

3. Anemia during pregnancy

3.1. Introduction

Anemia results in many other pathological conditions. There is a reduction in the production of red blood cells (RBCs) and blood loss from external and internal bleeding as distinct characteristics of this condition. (Annamraju, 2016) (Percy, 2017)Deficiency of iron and genetic hemoglobinopathies are two of the most usual types of anemia seen in pregnancy, despite the fact that there are various types of anemia based on the underlying pathological aspects related to physiology. (Means, RT., 2020)It is, however, important to state the cause of anemia to treat it in the most efficient and appropriate manner possible. (Jimenez, K., et al., 2015)

3.2. Definition

It is difficult for regulatory bodies to agree on a precise definition of anemia during pregnancy. A healthy antenatal hemoglobin level is 110 g/L and a healthy hemoglobin level after delivery is 100 g/L, according to the World Health Organization (WHO).

During the first trimester, the hemoglobin level is 110/129, 105/129 during the second half of pregnancy, and 100/129 during the post-delivery period, according to the Committee of British people for Standards in Hematology guidelines. (McLean, E., et al., 2009)

3.3. Incidence of anemia

Lack of blood influences 1.62 billion people, constituting 22% of the total global population. (Gebreweld, A., et al. 2019) (Sadeghian M., et al., 2013)Preschoolers (47.4%)

and pregnant women (41.8%) have been shown to have the greatest anemia prevalence rates. (Gebereselassie, Y., et al., 2020). Even in affluent nations, the frequency of anemia during pregnancy is rather significant (about 30-40%). (Lebso, M., et al., 2017).

3.4. Causes

The most seen reason for anemia during the period of pregnancy is iron deficiency. Individuals' iron stores influence the presentation and progression of anemia. The development of anemia and the iron status of a person is also affected by age, dietary habits, absorption of iron, and its loss. (Annamraju, H., & Pavord, S., 2016)

4. Government initiatives to improve maternal nutritional status

4.1. Indira Gandhi Matritva Sahyog Yojna (IGMSY)

In addition to enabling breastfeeding exclusively for the first six months, IGMSY compensates mothers for lost wages during childbirth and child care. Consequently, it provides nutrition for pregnant and lactating women and their infants. (Ministry of Health & Family Welfare, 2013)Women aged 19 and above are eligible for benefits under the scheme except for Government/PSUs (Central & State).

Providing an excellent platform that includes antenatal and postnatal care, including immunization, breastfeeding support, counseling, and growth monitoring, the scheme has a cumulative direct impact on the 1000-day period.

4.2. Janani Suraksha Yojana (JSY)

JSY program, which began in 2005, has the most recipients of any provisional cash allocation program in the world. Pregnant women with poor institutional delivery rates are given special consideration in states such as Uttaranchal, Bihar, Uttar Pradesh, Jharkhand, Chhattisgarh, Assam, Rajasthan, Madhya Pradesh, Jammu & Kashmir, and Orissa.

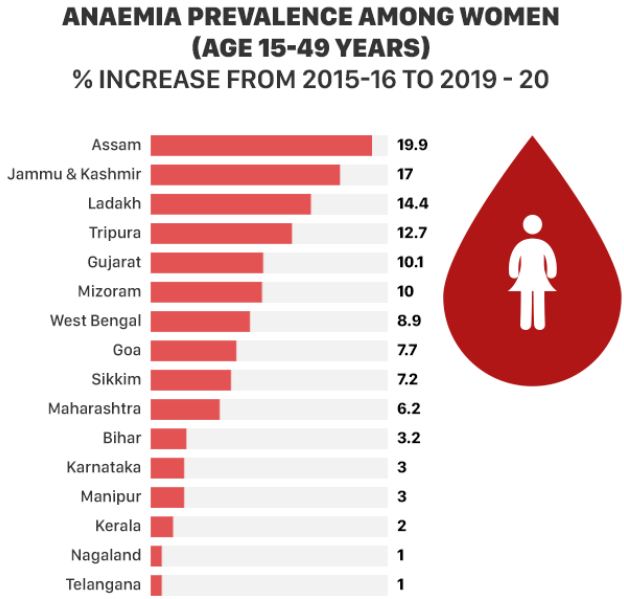

Fig.1 Anemia among women (Source: NFHS 5)

4.3. Mother and Child Protection Card (MCPC)

By integrating health and nutrition services, the MCPC can serve as a monitoring tool for early detection of pregnancy risks, growth faltering in children, and monitoring developmental milestones of children less than three years. (Ong, KK., 2015)This card contains messages and

pictures that provide guidance about care practices during pregnancy, danger signs, home delivery, newborn care and breastfeeding, immunization details, child growth, illness, feeding, and psychosocial care. Female frontline workers, including Anganwadi Workers (AWW), Accredited Social Health Activists (ASHA), and Auxiliary Nurse Midwives (ANM), play an important role in guaranteeing counseling and monitoring of the services they provide. (Lanigan, JA., 2001)

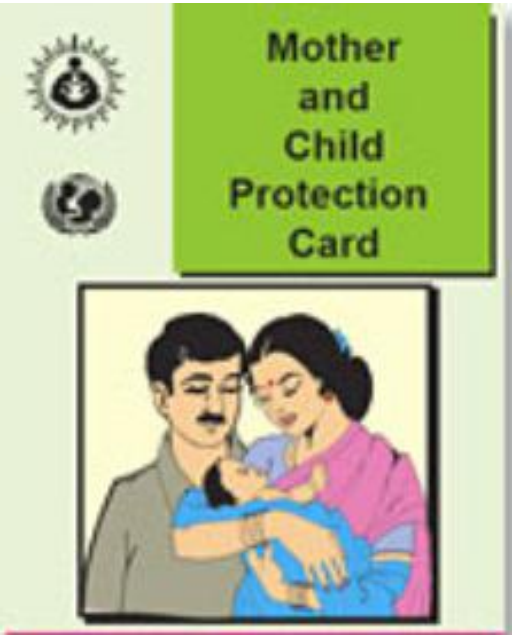

Fig. 2 Mother and child protection card (Source: MoHFW 2010)

5. Maternal nutrient and dietary consumption

Maternal diet is a critical aspect that influences not just the fetus health but also the baby's long-term growth.

(Khanna K., 1997)The mother must address her own demands as well as the requirements of the developing fetus. The nutritional requirements are also raised due to changes in maternal organs such as the uterus, the placenta, and the breast. As a result, the need for all nutrients increases during pregnancy. (Worthingston-Roberts, B. S., 2000). The additional requirements during pregnancy are as follows-

5.1. Energy

Calorie requirements during pregnancy are raised to facilitate the growth of the fetus, the placenta, and maternal tissues as well as the rise in basal metabolic rate. (Abu-Ouf NM and Jan MM., 2015).

5.2. Protein

Protein is critical because it serves as the structural foundation for the creation of new cells and tissues in both the fetus and the mother. As a result, the mother's protein intake must be increased to fulfill both of their needs. (Garrow, J.S., James, 2000)

5.3. Fats and essential fatty acids

Fatty acids are critical for the embryonic development, particularly for the membranes and brain of the baby. A food environment rich in lipids makes critical fatty acid deficiency improbable. (Scott, .1. & McNulty, 2004)

5.4. Calcium

Additional calcium is necessary during pregnancy for the development of fetal bones and teeth. It is thought that adequate calcium consumption may protect against high blood pressure levels during pregnancy.

5.5. Iron

Increased iron intake is required for fetal growth, and maternal tissue expansion, including red cell mass, placental iron content, and blood losses after parturition. Additional iron is also required to establish iron reserves in the fetal liver that will survive for around 4-6 months after delivery.

5.6. Vitamin B_9

As the pregnancy period proceed, folate plays an important role, but after the first few weeks, the focus shifts to avoiding vitamin B_9 deficit in pregnancy. The maternal folate shortage not only impacts the mother's health, but has also been linked to fetal growth retardation, low birth weight, and the neonatal folate deficit, all of which have serious consequences for the neonate and infant's health. (Institute of Economic Growth, 2013)

5.7. Zinc

Zinc is also important during pregnancy. Apart from being a component of insulin and enzyme systems (Carbonic anhydrase), it also contributes to the synthesis of proteins (like DNA and RNA), focusing its significance in the reproduction process. (Khanna K., 1997)

5.8. Vitamin A

The vitamin A requirement during pregnancy has been calculated using the vitamin A content of newborn livers. Typically, the needs are raised, and supplements may be taken. (Khanna K., 1997)

6. Conclusion

Pregnancy is a time of rapid growth and a rise in the number of cells for both the mother and the fetus. The period of feeding, growth, and development when the fetus is in the womb is one of the most vulnerable phases that affect the nutrition condition of the fetus. Proper maternal nutrition is critical for appropriate pregnancy development, healthy fetal growth, and normal infant birth weight.

SUMMARY OF RDA FOR INDIANS - 2020

Age Group	Category of work	Body Wt	Protein	Dietary Fibre*	Calcium	Magnesium	Iron	Zinc	Iodine	Thiamine	Riboflavin	Niacin	Vit B6	Folate	Vit B12	Vit C	Vit A	Vit D
		(kg)	(g/d)	(g/d)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/day)	(mg/d)	(mg/d)	(mg/d)	(mg/d)	(µg/d)	(µg/d)	(mg/d)	(µg/d)	(IU/d)
Men	Sedentary	65	54.0	32	1000	440	19	17	150	1.4	2.0	14	1.9	300	2.2	80	1000	600
	Moderate			41						1.8	2.5	18	2.4					
	Heavy			52						2.3	3.2	23	3.1					
Women	Sedentary	55	46.0	25	1000	370	29	13	150	1.4	1.9	11	1.9	220	2.2	65	840	600
	Moderate			32						1.7	2.4	14	1.9					
	Heavy			41						2.2	3.1	18	2.4					
	Pregnant woman	55 + 10	+9.5 (2nd trimester) +22.0 (3rd trimester)	-	1000	440	27	14.5	250	2.0	2.7	+2.5	2.3	570	+0.25	+15	900	600
	Lactation 0-6m		+17.0	-	1200	400	23	14	280	2.1	3.0	+5	+0.26	330	+1.0	+50	950	600
	7-12m		+13.0							2.1	2.9	+5	+0.17	330				
Infants	0-6 m*	5.8	8.0	-	300	30	-	-	100	0.2	0.4	2	0.1	25	1.2	20	350	400
	6-12m	8.5	10.5	-	300	75	3	2.5	130	0.4	0.6	5	0.6	85	1.2	30	350	400
Children	1-3y	12.9	12.5	15	500	90	8	3.3	90	0.7	1.1	7	0.9	120	1.2	30	390	600
	4-6y	18.3	16.0	20	550	125	11	4.5	120	0.9	1.3	9	1.2	135	1.2	35	510	
	7-9 y	25.3	23.0	26	650	175	15	5.9	120	1.1	1.6	11	1.5	170	2.2	45	630	
Boys	10-12y	34.9	32.0	33	850	240	16	8.5	150	1.5	2.1	15	2.0	220	2.2	55	770	600
Girls	10-12y	36.4	33.0	31	850	250	28	8.5	150	1.4	1.9	14	1.9	225	2.2	50	790	600
Boys	13-15y	50.5	45.0	43	1000	345	22	14.3	150	1.9	2.7	19	2.6	285	2.2	70	930	600
Girls	13-15y	49.6	43.0	36	1000	340	30	12.8	150	1.6	2.2	16	2.2	245	2.2	65	890	600
Boys	16-18y	64.4	55.0	50	1050	440	26	17.6	150	2.2	3.1	22	3.0	340	2.2	85	1000	600
Girls	16-18y	55.7	46.0	38	1050	380	32	14.2	150	1.7	2.3	17	2.3	270	2.2	70	860	600

* Adequate Intake (AI)

Note: For adequate intake of Biotin and Pantothenic acid, refer to the text on summary of recommendations.

Fig 3. Recommended dietary allowance (Source: ICMR 2020)

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4.

NUTRITION FOR ANTENATAL MOTHER

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Abstract

For the Health of a pregnant mother nutrition plays a vital role. To meet the extra nutritional need for the extra nutritional need for growth of fetus pregnant women are encouraged to some nutritional diet rich in vegetables, fruits, whole grain, vitamin and minerals supplement with the adequate intake of iron and folic acid. For weight gain of mother and rapid growth of the fetus, mothers' diet should be nutritious. Adequate in antenatal nutrition is essential for optimal growth and essential for optimal growth and maintenance of fetus. Micronutrient deficiency of mother predisposes mother to poor health infection, Pre-eclampsia, eclampsia, and adverse pregnancy outcomes like IUGR (Intrauterine growth retardation), Premature birth, low birth weight (LBW) baby.

1. Introduction

For sound health of pregnant mother, nutrition plays a vital role. It is very essential to take more healthy,

nutritious foods during pregnancy and child birth. When there is poor nutrition of mother nutritional reservoir are destination due to physical and physiological changes in pregnancy to increase in nutritional requirement of mother. To meet nutritional need pregnant woman must take must take nutritious diet with daily vitamin and mineral supplement with adequate intake of iron & folic acid. The energy relieves in pregnancy in maternal blood, representative tissue & fluid. The maternal health indicates the outcome of pregnancy: food habit different from region to region, culture to culture & custom to custom. Adequate intake of nourishing food can prevent so many complications like anemia, infection, eclampsia etc. Iron deficiency anemia has been considered as major public health issue & it is must prevalent in pregnancy due to ignorance of mother & family members.

During early pregnancy due to morning sickness. There is poor intake & fear of nausea and vomiting, mother can't consume sufficient amount. Constipation is common due to more intake of oily foods. Due to food aversion, reduce appetite women don't take sufficient amount of food & ultimately leads to poor outcome of pregnancy. Pica is also a major cause of poor maternal health. It is evident from research their direct relationship between maternal diet & pregnancy outcome & clinical problems. Inadequate intake of food results in high incidence of nutritional deficiency & disorders during pregnancy. Anemia is a major factor of maternal mortality & morbidity, abortion- miscarriage, stillbirth etc. We can't ignore factors like teenage pregnancy overage, short interval maternal dietary consumption & maternal health.

Maternal nutrition is an important factor for health of baby &future growth of baby & must meet the needs of herself & the fetus for development of uterus, placenta & heart tissue more enrich foods are must enhance.

2. Additional requirements are of nutrients

2.1. Energy

It is most important in pregnancy to provide adequate amount of calorie for the growth of fetus, placenta and maternal tissue and for the increased basal metabolic rate.

According to ICMR (Indian Council of Medical Research) for reference Indian women, whose body weight 50 kg, the total energy required approximately 73000 Kcal. (potassium chloride)The extra amount of energy required 120 Kcal per day is required during second and third trimester. It helps to meet the increased energy demand during lactation.

In Odisha, Balasore district energy consumption during pregnancy literally low 13.5% as compared to RDA (Recommended Dietary Allowances).

2.2. Protein

Protein is very essential during pregnancy because it helps in growth and maturation of tissue of mother as well as fetus.

Daily protein requirement during pregnancy depends upon body weight Nitrogen deposition during three trimesters are 0.1 gm, 0.5 gm and 0.9 gram. As Indian diet are largely based on vegetable protein, having an NPU of

nearly 65, the additional intake 15g/day in rest half of pregnancy(by ICMR).

2.3. Fat and essential fatty acids

Essential fatty acid is most important for fetal neural and brain development. Deficiency also seen in fat and fatty acid during pregnancy.

As it is most important ICMR recommended 30 gm of visible fat/day during pregnancy. The linolic acid requirement is 4.5% during pregnancy. Olsen et al. reported that the fish oil consumption increases birth weight.

2.4. Calcium

Additional calcium also important during pregnancy for growth and development of bone as well as teeth in fetus.

An inverse relationship was reported in 1980 that high calcium intake reduces the chance of eclampsia and pre-eclampsia.

Belizean et. al and Rapke and vi liar also suggest that calcium supplementation also reduce gestational hypertension and preterm infant. The correspond to an additional daily calcium used 250-300mg during the last 100 day of pregnancy.

2.5. Iron

Increased iron intake also important during pregnancy because it help in maturation of red cell mass and also blood loss during post state period. Additional iron also required for storing of iron in fetal, since baby's first food milk also deficit in iron. Iron also needs for female during menstrual blood loss.

ICMR recommended that Pregnant with 50kg, require iron 14mcg.g/kg body weight/day. Iron required need for extra need in pregnancy. The total iron required during pregnancy is 60mcg/kg body weight/day. Meheta et al (2004) Iron also impacts on maternal hemoglobin and Serum Ferritin.

2.6. Folic acid

Folic acid is important is more in later pregnancy then early age. Although folate deficiency has no impact on maternal health but affect fetus and cause growth retardation, LBW etc.

Folate deficiency cause increase of blood homocysteine, so presence of maternal homocysteine concentration causes many gestational complications, (Abruptio Placenta, Placenta Previa). So ICMR recommended additional intake of 300pg apart from requirement is most important.

2.7. Zinc

Although zinc is micronutrient but also it is important during pregnancy. Zinc help in nucleic acid DNA and RNA highlighting its significance in the process of reproduction. Severe zinc deficiency leads to prolonged laborand embryonic fetal death. Acrodermatitis enteropathy is an autosomal recessive defect also cause by inhibition of zinc metabolism. Several adverse effects seen due to decrease zinc status are congenital anomalies, reduced birth weight for gestational age and preterm delivery.

2.8. Vitamin

As vitamin A is content of liver in new born so it is also important in pregnancy additional Vitamin A required

25mcg throughout pregnancy. No additional amount needed during pregnancy suggested by ICMR(1990).

Vitamin A and 3 carotenes low at 3 trimester cause pre maturity and low birth weight.

3. Janani Sudarshan Yojana (JSY)

Janani Sudarshan Yojana is the intervention focused on maternal and neonatal health under the umbrella of National Health mission launched in 2005. The main objective is to reduce maternal and morality and neonatal mortality with the strategy of promotion of institutional delivery among the poor pregnant women. Benefits are cash assistance with delivery andpost-delivery care for pregnant women to public health institution for delivery, entire cash entitlement is to be disbursed to her in one go, at the health Institution.

4. Conclusions

Antenatal period is very susceptible for mother and fetus especially of nutrients under normal circumstances. The intrauterine period is most vulnerable period which status of fetus. Mother diet should be provided in adequate amount so that no gestational complication and fetal problem will arise.

Proper diet like essential nutrient Protein, Fat, Vitamin and Minerals should be provided in adequate amount for appropriate growth and development of fetus. More awareness Program should be conducted regarding improvement of maternal health status in pregnancy. JSY is one of the most important programs plays an important role in reducing MMR and IMR.

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5.

DECLINE IN MALNOURISHMENT AMONG CHILDREN OF AWCS IN SOUTH RAJASTHAN

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Abstract

This study was conducted as part of a project titled Khushi (CSR arm of Hindustan Zinc) . The project was carried out in a total of 5 blocks in Udaipur and its surrounding areas. The main purpose of the project was to work towards the decline in malnourishment of children attending the anganwadis (AWCs) in these blocks. The parameters used to assess the improvement in their nutrition status was mainly through 5 methods: Development of vegetable gardens (on/off site) and their daily usage percentage, recipe field trials and demonstration, THR analysis (take home ration), MUAC screening (mid upper arm circumference), Use of RUTF (ready-to use food), engagement and community participation. In the second phase of this project, CMAM camps were organized to assess the degree of malnourishment. Accordingly, RUTF packets were provided to the children coming in the

danger zone. An approximate period of 6-8 weeks was observed for the childrens' nutritional status. The results showed a gradual improvement in their nutritional status with indicators as: SAM- 77.2 % children shown improvement; MAM children were under observation. The time period (June 2018-March 2020)

Abbreviations: THR, SAM, MAM, RUTF, CMAM

Keywords: THR - Take home ration, SAM- severe acute malnutrition, MAM- Moderate acute malnutrition, RUTF- Ready-to use food, CMAM-Community management of acute malnutrition

1. Introduction

Hindustan Zinc, as a part of its CSR (Corporate Social Responsibility) arm, chose to work for the well- being of young children and signed an MOU with the government of Rajasthan in 2016, to work with the anganwadis located in 5 districts of Rajasthan i.e. Udaipur, Rajsamand, Chittorgarh, Bhilwara and Ajmer.

Seva Mandir was chosen as the implementing agency for Udaipur district. The major objective of this project is to strengthen the efficacy /functioning of the anganwadis in order to improve the nutritional status of the children visiting the centers, age group (0-6 years) The project was divided in two phases for Udaipur. Phase I included Girwa and Jhadol blocks including 575 AWCs. Seeing their success rate, 3 more blocks were added and was named as Phase II including Mavli, Sarada and Kotda blocks including 770 AWCs respectively.

The basic interventions of this project were :

1. Supplementary nutrition and need-based supplies
2. Preschool education
3. Health and hygiene
4. Community engagement

As per this year's MOU, focused nutrition interventions were planned at 100% AWCs i.e. 1345 of all the 5 blocks in comparison to 18'-19' where it was done at 50% AWCs.

The activities remained on the same parameters but their implementation was done in a different way.

1.1. Development of vegetable gardens

In this reporting period, a number of feasible centers have been selected for the development of vegetable gardens. The criteria for selection of AWCs are: adequate space, water supply and safety. A total of 7 seeds have been finalized for implanting in the rainy season for effective survival such as: bottle gourd, ridge gourd, tomato, coriander, cluster beans and guar beans.

BLOCK NAME	NUMBER OF AWCs
MAVLI	35
KOTDA	35
SARADA	28
Total	*97*

2. CMAM camp pilot trial study at Mavli and Jhadol blocks to assess the degree of malnourishment

A pilot study of CMAM camp was conducted in the month of April in the blocks of Jhadol and Mavli to help assess the effects of administering RUTF to combat malnourishment. ***Madri*** sector in Jhadol and ***Ghasa*** sector in Mavli were chosen according to the prevalence of malnourished children, location proximity, etc. A total number of 35 SAM children in Jhadol were selected. Similarly, 35 children in MAM category and 9 children under SAM were included in Mavli block. The children were brought to the camp on the basis of MUAC screening. In the camp, children were again checked for their anthropometric details with the help of a trained nurse.

A total of 17 children in Jhadol and 12 in Mavli were administered RUTF dosage. These children came under the SAM category. Within a week, home visits were done by field monitors of these 29 children to check on their proper dosage consumption and other problems faced by the child, if any.

After 15 days of the original camp, a follow up camp was organized for re assessment of the SAM children. Since the observation time frame was of a shorter duration, slight weight gain was observed in most children but only 2% showed overall improvement in both the blocks. For MAM children, 250 g packets of sattu was given for health improvement since sattu is a major source of protein and protein is known to improve lean body mass through cell regeneration and new tissue buildup. Recipe demonstration of ***simple laddoo*** was also conducted using some easily available materials. The proportion is for 1 kg demonstration:

1. Whole wheat-600g

2. Bengal gram-200g
3. Groundnuts-150g
4. Sugar/Jaggery-20g
5. Oil-10ml

All the major ingredients were roasted separately. After roasting, all the 3 ingredients were grinded to make flour. The flour was then mixed with jaggery/sugar and requisite oil. The mix was then shaped into laddoos and distributed among the beneficiaries.

RESULTS OF THE PILOT STUDY

RESULTS AND ANALYSIS (of Pilot CMAM)

- 898 children screened from Mavli and 395 Children were screened from Jhadol. 29 children in total were given RUTF (coming under the SAM category: 12 from Mavli and 17 from Jhadol)

Block Name	Number of children taken RUTF	MTC Referral	MAM	Normal/Green category
Jhadol	17	1		
Mavli	12	1	2	9
Total	29	2		

Table I: Pilot CMAM camps' trial

3. Annual training of staff on nutrition

Two days Khushi staff training on nutrition was conducted at Mohan Singh Mehta training center, Kaya, Udaipur in the month of June, 2019. A total of 85 staff members (from Girwa & Jhadol blocks) of Phase I and 85 staff

members (from Mavli, Kotda and Sarada blocks) of Phase II participated in this training.

The major objective of this training was to orient the staff on the conduction of CMAM camps. CMAM camps are organized on a worldwide basis to tackle malnourishment effectively. Recapitulation sessions on the importance of a balanced diet, basic food groups, important nutrients, identification of malnutrition, and effective measures for vegetable gardens were taken by Khushi nutritionists as well as the block team. The sessions were conducted using basic group discussions, presentation and demonstration.

Recreational activity like recipe competition was also organized in-between the participants. This helped them to get a fair idea about its effective implementation on the field further in the year. The teams were divided into different groups. Within a limited time frame using minimum ingredients, recipes like pakode and THR besan chakki were prepared.

Details of the participants from various blocks are tabulated below.

S.NO.	Block name	Date of training	No. of participants present	Total number expected
1.	Jhadol	28-29 June 2019	32	33
2.	Girwa	28-29 June 2019	32	34
Total			**64**	67

Phase II				
S.NO.	Block name	Date of training	No. Of participants present	Total number expected
1.	Kotda	10-11 June 2019	25	30
2.	Mavli	3-4 June 2019	21	25
3.	Sarada	3-4 June 2019	39	40
Total			**84**	95

II. The table above shows a comparison drawn between the staff who attended the sessional training

3.1. Feedback of participants

All staff members provided feedback that the training was very beneficial and useful for them. The members also admitted that the training enhanced their knowledge on combating malnourishment effectively through the extensive training conducted for CMAM camps. Everyone enjoyed the competition as that enhanced their competitive skills and increased their awareness on the usage of THR effectively.

3.2. Some snapshots of staff training

Recipe competition among Mavli and Sarada blocks

Group discussion among Kotda block

4. Recipe Demonstration

As per this year's MoU, recipe trials are to be conducted at 50% non focused AWCs and competitions at rest 50% focused intervention centers of all the five blocks biannually.

4.1. Recipe trials and competitions

Some dishes prepared during recipe trials. Prize distribution to the winning mother at Kotda block

(Kotda is an exception-75 % centers are listed for recipe trials and 25% have been engaged in competitions). In this reporting period, 4 recipes are being demonstrated such as: vegetable khichri, murmure ki kheer, THR pakodi and THR laddoo.

Table 3 shows recipe demonstration and field trials

Block	**Target (April-June' 18)**		**Achieved (April-June' 18)**		**Beneficiaries (April-June' 18)**	
	Recipe trials	Competitions	Recipe trials	competitions	Mothers	AWW/AWH
Total						
Mavli	89	89	89	0	1442	72/78
Sarada	164	164	92	1	1378+20 =1398	10/10
Kotda	187	63	0	63	132	66
Total	440	316	181	64	2972	

5. Tracking of malnourished children

Data of screened children through MUAC tape at all the 5 blocks with respect to prevalence of malnourished children

Table 4 shows improvement in nutritional status of undernourished children before the start of CMAM camps

BLOCK NAME	NUMBER OF AWCs COVERED	NUMBER OF TOTAL SCREENED CHILDREN	
		SAM	MAM
MAVLI	45	32	151
KOTDA	66	12	127
SARADA	80	23	428
TOTAL	***191***	***67***	***706***

6. THR tracking

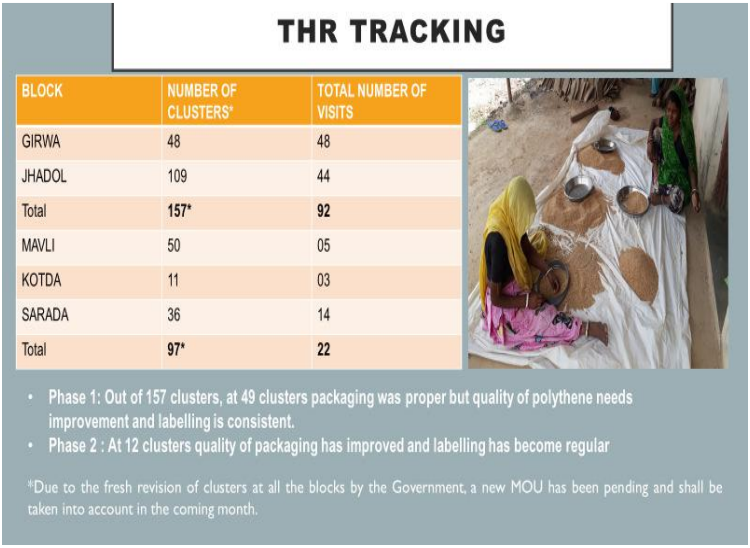

Table IV shows tracking of THR packets at anganwadis

6. Results and conclusions

The results and conclusion are as follows:

1. There is an urgent need for a proper dissemination of nutrition information.

2. Proper implementation needs to be taken care of.

3. RUTF was introduced in CMAM camps because local people are not aware of the resources needed to fulfill their nutritional demands.

4. A total of 17 children in Jhadol and 12 in Mavli were administered RUTF dosage. These children came under the SAM category. Within a week, home visits were done by field monitors of these 29 children to check on their proper dosage consumption and other problems faced by the child, if any.

5. After 15 days of the original camp, a follow up camp was organized for re assessment of the SAM children. Since the observation time frame was of a shorter duration, slight weight gain was observed in most children but only 2% showed overall improvement in both the blocks. For MAM children, 250 g packets of sattu was given for health improvement since sattu is a major source of protein and protein is known to improve their nutritional status.

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6.

Use of digital education

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Abstract

More and more things in today's world are becoming digital due to the development of the internet, mobile phones, mobile applications, tablets, laptops, and other modern devices. The education systems of India's metros and other cities have also been modernized to a great extent, paving the way for digitization. Digital education is making its way into the traditional education system of India along with many international schools and is replacing traditional classroom training. Gone are the days when classroom training was done through textbooks. Teachers used blackboards to explain their points and students used to write those words on their copies. Student pedagogy for learning and traditionally task-based methods were based on teachers for learning and focused more on writing and memorizing. However, now the use of chalk has become negligible in most schools. Nowadays, classroom teaching has become highly interactive with the use of digital teaching such as PPT, video presentations, e-learning methods, practice demos, online training, and other digital methods or platforms. The Covid-19

pandemic has disrupted the daily lives of children, has led to the suspension of all educational institutions and examinations, and has forced many children to drop out of the education system. Digital education has been chosen by many schools as an opportunity for children to continue their education. At present, when this pandemic has forced the process of teaching-learning to be taken in online mode, in such a situation the education sector is facing an unprecedented challenge. While many students spend most of their time in front of mobile or computer screens, many others are falling behind due to the unavailability of devices like the internet or smartphones or other challenges associated with it.

Keywords: Online, Digital, Education, Classroom, Child, Covid-19, School, Pandemic

1. Introduction

Classroom teaching has become more fun and interactive through digital education. Children are paying more attention to it, they are not only listening to it but also watching it on the screen, which is greatly increasing their learning ability. Children are easily learning through sounds and visuals. The instructional material in the practical sessions through interactive online presentations or interactive screens helps the students to pay more attention to details thereby enabling them to complete their activities on their own. Children can complete their tasks in less time with the help of the use of tabs, laptops, or notepads instead of pens and pencils. Active online screens allow students to improve their language skills. They learn new words and expand their vocabulary through content in e-books or online study. Many times, a

student hesitates to ask questions to his teacher during class training but through digital education even if he doesn't understand anything at once, he can still join the recording session to clear his dilemma. Technology helps a student to learn according to their ability. The best thing about digital education is that it is user-friendly, wherever you are, you can read your syllabus very easily. You can learn while traveling. Even if for some reason you have not been able to attend the class for a few days, you can still download the class material and files from the school website. In the online education system, the learning process of the student is self-motivated, nowadays online study material is easily available. Even if the entire education system is not in digital form, students can still take advantage of digital content based on their capabilities. Students can access sections of specialized online study of various subjects to enhance their knowledge even without a teacher. Along with online education, students can also get external guidance to build their careers.

Online learning enables both the student and the teacher to set the pace of learning, as well as facilitate a stipulated reading time to coordinate with everyone's daily routine. The vast and expansive world of the Internet offers opportunities to teach and learn infinite skills and subjects. Online education requires relatively less monetary investment and has shown better results. In online education, the fee spent on study material along with transportation, etc. is very less. Digital education is also not completely fault-free, it also has some disadvantages, and digital education is expensive. We see that most of the international schools in which education is digital are exorbitantly more expensive than the regular

schools. Digital education means that you need net not only in school but also at home especially. Online learning requires better management and rigorous planning whereas in traditional classroom training everything happens according to a fixed schedule. All the answers are easily available on the internet which reduces the creative ability of the children. Digital learning leads to poor study habits which can lead to the development of a lazy attitude in children. Digital education can make children forget the basic way of learning. Even for simple homework, children need net reading. Lack of online study follows disorientation in children. Being online does not mean that your child is just looking for study materials on the net. There are so many things in it that are not good for children, it can reach them.

In today's teaching-learning process, online quizzes like PPT, video presentations, experiential activities, online assemblies, methods of e-learning, Zoom, Google Classes, Google Meet, Google Forms, and Kahoot are making online training effective in these Classes have become more interactive due to digital methods. Through digital literacy, children are learning to use technology responsibly to interact with the world around them, while also exposing them to new areas of knowledge that are beneficial to them. Apart from this, there are many such online competitions, which are proving to be a great platform for children to gain knowledge, due to which their intellectual, logical, and technical development is taking place. Today's students are not only showcasing their amazing skills by creating their YouTube channels, websites, and portals, but also by learning new courses through online learning. Online education has now become a part of our life. If we want digital learning, we

need to equip our schools and teachers with internet resources appropriately. In today's world more and more things are becoming digital due to the development of the internet, mobile phones, mobile applications, tablets, laptops, and other modern devices teachers and students should know how to make proper use of them. The education systems of India's metros and other cities have also been modernized to a great extent, paving the way for digitization. Digital education is making its way into the traditional education system of India along with many international schools.

Online education or digital education is an effective way to introduce a large amount of study material to students. In this, more and more students get various useful information at the same time. Classroom teaching has become more fun and interactive through digital education. Children are paying more attention to it, they are not only listening to it but also watching it on the screen, which is greatly increasing their learning ability. Children are learning easily through sounds and audio-visuals and are also able to complete their activities given by the teachers. Using tabs, laptops, or notepads instead of pens and pencils allows children to complete their tasks in less time. With the help of online screens through Google search, students are improving their language skills. They learn new words and enhance their vocabulary through e-books or online study materials. The best part about digital education is that students can learn while traveling. Even if they are unable to attend the class for some days due to some reason, they are still able to complete their work by video recordings and downloading class material and files from the school website. Now the question arises that to take advantage of digital education, it is most important

not only in school but also at home, especially to have a proper arrangement of cheap broadband. We have to note that being online does not mean that your child is only looking for study materials on the net. Many things in it are not good for children, they can reach them. It is very important to say that if there are innumerable benefits of digital education, then at the same time it is also very important to take care that children do not see something that they should not see under the guise of the online system. The supervision of a parent or an elder is very important. It should also not be that children keep copying by searching the net and destroying their creativity.

It was a few years ago that the practice of online education systems and meetings was earlier only in computer-related areas, but nowadays we can do online education related to almost every field.Whether it is an online drawing class for children or a computer coaching class, learning a foreign language for adults, or a cooking class, you can learn everything online sitting at home. Barring some small villages, after the spread of video chatting, online meetings, chats, and interviews are known to almost every village in the city of India, but who knew that in the field of education from March 2020 Will there be such a big change? According to a report, in 2019 itself, India had become the second largest market in the field of e-learning i.e. online education, so suddenly making everything online due to the corona epidemic did not prove to be a big problem in front of the government. Now due to the corona epidemic in almost every country, online education is being done, the only difference is that the education system which was limited only to college-going students, now young children are also being taught with the same technology. Today, everywhere children

are studying at home and are also giving examinations. Keeping in mind the present era, we can bring better changes to our education system. Even today primary schools are available only in small and backward villages of India. To complete further education, children have to move to a nearby town or city, which is not possible for everyone. In such a situation, by using a digital education system in the evening in the primary school itself, we can educate more and more children at less cost and we just have to install a server with a computer there and computer knowledge. There will be no need to appoint anyone other than this. We know that now is the time of the digital age and we will make more progress in this direction in the future but it is equally true that this system cannot completely replace school physical education. Studying online right from the beginning can make it very difficult to teach children discipline and practical knowledge with people. We also cannot ignore the bad effects on health from online education. Everything has its advantages and disadvantages, so we have to keep in mind that we have to adopt both the education system at different times and build a better education system so that we can make a better future.

In this digital age, the method of learning and teaching has proved to be very effective. As the Covid19 created an uproar, children were barred from entering school, and everything seemed to have come to a standstill but due to the internet, mobile phones, tablets, computers, modern equipment, education, and other things all became digital. For the last few years, there was a debate among academicians and intellectuals, about whether in the future the traditional school education system can be replaced by online classes and see the law of nature our

schools have been locked for the last one year and the future that might be Once it was far away, today our face is staring at our door and is asking us many questions with itself. Whatever the reason, the reality is that at the time of Covid19, mobile phones and laptops, and computer screens are the schools of our children. Of course, in today's difficult times, digitalization and online classes have opened new dimensions of education. Today, our children's school is going on sitting at home and their homework is being updated on the parents' WhatsApp. If someone had said the same thing to you before Covid19, maybe you would have laughed at him or maybe said that if our children will have children, then maybe it will happen, but see today's truth is this. But how many parents can arrange a smooth mobile, computer for their children, how many villages have such internet where online classes can be taken, and are all the parents so capable and literate that they make all these available to their children? Can do it in the last few months, we have also heard reports of children committing suicide because their parents could not arrange online classes for them. It is thanks to online classes and digitization that our children are still connected with education. Just as there is a sunrise after every night, so the night of this calamity will surely have its dawn and when everything will be back as before, then perhaps this question will arise and ask, whether the compromise we are making with the centuries-old education system for online classes and digital education, how beneficial and how harmful is it.

The process of e-learning existed even before 2020 but was mostly used as an alternative to face-to-face classroom engagement. Teachers had to rapidly adjust to teaching only using digital platforms, modifying their

teaching style, curriculum design, assessment, and record-keeping. The transition from a controlled classroom setting to the use of digital devices and hardware was also overcome by the students. With the active support of his teachers, he has been inspired to pursue a new education. Irrespective of the method of teaching, students' approach to learning is always shaped by the effectiveness of their teachers in providing a supportive and conducive environment for learning. When pedagogical techniques develop at a rapid pace, they become helpful in facilitating the personal and professional development of teachers. To prepare students for the challenges of the 21st century globally, teachers are working on honing their analytical and problem-solving skills, critical thinking, reasoning, research and innovation skills, imagination, creativity, and effective communication. With the adoption of mandatory digitization, teachers have had to find more effective and efficient ways of communicating and interacting with their students using platforms like Zoom, Google Classroom, Microsoft Teams, etc. He has honed his skills in digital tools like slides. Document sharing, whiteboards, breakout rooms, and instant chat to make online classes more interactive and promote active learning. It has also inspired collaboration among teachers and inspired them to try different techniques such as developing original artworks such as stories and games, designing group activities, and creating worksheets to introduce key concepts.

Education is not limited to the conduct of classes but it aims at promoting dialogue, broadening of ideas and free discussion, etc. Which is not possible through online education? Classroom students learn more from each other during challenging group tasks and solving problems

together. Children staring at the screen of a mobile or laptop for a long time, children are not able to use their brains more freely and they are not able to give accurate feedback on the subjects being studied. It is not necessary that a student who can afford to go to school can also afford a phone, computer, or even a quality internet connection to attend online classes. Technology is not affordable for everyone, so completely shifting towards online education is like taking away the right to education of those who do not have suitable technical means or who cannot afford this cost. Due to the wrong sitting posture or lack of physical activities of students, while studying, there have been cases of neck and back pain in them along with many other health-related problems. Because of the above problems, it has become a topic of discussion among many experts and many measures have also been suggested by them such as giving priority to the disadvantaged class and such students with fewer facilities, who have the necessary resources for e-learning. do not have access to or who cannot afford it. Genuine efforts should be promoted to ensure the availability of good quality education equally as a fundamental right for every child. Priority should be given to short but quality discussions rather than lengthy, one-sided, and monotonous dialogues. The role of the teacher should be extended to a guide facilitating the transfer of knowledge, not limited to controlling the classroom. In such a situation, regardless of the quality, and knowledge acquired under the education system, students and teachers should not be pressured to complete the syllabus only, but under this special emphasis should be given to quality rather than quantity. Equality of opportunity is one of the fundamental principles of the Indian Constitution.

Without caring about the interests of the neediest people of the society, the attempt to transfer the entire education system for the benefit of only a particular section of the people destroys the basic concept of the said statement of the Constitution. Apart from these, digital education is an area where India has not achieved much success yet. At present, a lot of work has to be done in this area to ensure that meaningful educational course options for students and their rights are not being compromised.

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7.

FOOD SCIENCE AND NUTRITION

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Abstract

Food science is the application of basic scientific and technological principles to the production and upkeep of a sufficient, safe, and nutritious food supply. Food science is the study of the physical, chemical, and biological basics of food as well as the principles of food preparation. It is the application of fundamental sciences and engineering to these topics. Food technology is the use of information from food science in the selection, preservation, processing, packaging, and distribution of foods that are safe, wholesome, and healthy to consume. Food microbiology, food engineering, and food chemistry are just a few examples of the many specialized subfields that make up the broad discipline of food science. Since food and people directly interact, some food scientists are also interested in the psychology of food choice.

These individuals work with the sensory qualities of food. Unprocessed agricultural inputs like wheat are

transformed into more refined meals like flour or baked items by food technologists. Food processing uses many of the same elements found in chemical and mechanical engineering. Nearly all foods originate from living things. Since meals are mostly composed of "edible biochemicals," biochemists often research them to see how preparation or storage could affect food biochemistry. Nutritionists are also involved in the food manufacturing process to ensure that meals maintain the proper nutritional content. Other food scientists are employed by government organisations to ensure that the products we buy are wholesome, secure, and appropriately stated. The coming together of several important scientific and technical fields, especially in the last century, has shown how our knowledge of food and how to turn it into safe, useful, nutritious, healthy, and tasty products has grown. In the future, food science will be required to address a number of concerns that mankind is now grappling with, including sustainability, nutrition security, longevity, and health, as well as food safety and defence, and an expanding "farm-to-fork" continuum. Some of the issues in food science will be resolved when it evolves into a discipline of the twenty-first century by incorporating transformational and disruptive science and technology. To deal with these problems, a modern food scientist will need to be able to quickly look up information.

Keywords: edible biochemical, food scientists, nutrition security, fundamental sciences,

1. Introduction

Photosynthesis is the main method used to produce all food. Algae and plants employ chlorophyll to convert

solar energy into chemical energy. Initial forms of this energy are electron-rich carbohydrates, which are later converted into other organic substances like lipids, which are very energy-dense. According to every assessment, the planet can sustainably produce enough food for its people, both now and in the future. More than 9 billion people will live on Earth by the year 2050, up from the present approximately 7 billion (FAO, 2009)

Since 1/6 of the world's population lacks access to adequate food, there are still hungry people today. In addition, many people lack essential vitamins and minerals, which may slow down growth and make them feel lethargic. Despite the fact that the proportion seems to be beginning to decline, the quantity of individuals without access to food is steadily increasing (Pinstrup-Andersen & Herforth, 2008).

The disparity between the amount of food that is currently available to humans and the world's capacity for food production is due to both insufficient or inadequate agricultural methods and the enormous amount of waste produced by inefficient preservation, storage, processing, packing, transportation, and distribution.

Food science is crucial to ensuring that there is enough food for everyone on the planet to eat and have healthy, productive lives now and in the future. Food security and food safety are both topics covered by the field of food science, and they both rely on the microbiology, chemistry, and physics of food raw materials and produced foods. Food science is challenging because it requires the integration of several scientific fields in order to transform basic materials into food that is secure, delicious, healthy, and has a respectable shelf life. Recent

developments in the field of food science may be seen in the astonishing increase in the number of reports that have been published. These studies are often of high quality and draw on techniques and findings from more basic disciplines (McGorrin, 2009).

It may be argued that the top priorities for food scientists should be food security and safety. But there are still other challenges for the food industry to address today. A healthy diet that is well-balanced is essential for a happy life. In order to stop lifestyle illnesses and the obesity pandemic, food must be created and made to satisfy new standards based on our growing understanding of the human body's ideal function. A difficulty for the food sector in terms of promoting human welfare is providing food for various demographic groups with unique nutritional requirements. Material science is a big part of making food more enjoyable to eat and making sure nutrients are released in a controlled way (Palzer, 2009).

Food should be enjoyable as well since it is necessary for many social activities. Gastronomy has gained more worldwide recognition as a scientific study during the last ten years. The moment is now right to deepen the relationship between gastronomy and the traditional food science fields. Studies into why one meal is excellent and another is not centered on food chemistry and food physics (This, 2009).

2. Food science education, research, and professional development

Humans switched from being hunters and gatherers to cultivating crops and domesticating animals for

subsistence during the Neolithic Age (10 000–3000 BC). In order to prepare a variety of meals, some of which could be kept for a long time, humans adjusted some of their plant and animal exploitation practises as they advanced into the Bronze Age and acquired knowledge about food preparation from practical experience. Even though people didn't know much, artisanal ways of making food, like fermenting food, would develop and get better well into the 1600s. But early systematic, controlled studies that led to Nicolas Appert's discovery of canning and Pasteur's improvement of our scientific understanding of how microbes cause food (wine) to go bad showed by the 1800s how important food science was (Potter and Hotchkiss, 1986).

These initial scientific developments that enhanced food quality, safety, manufacturing, and shelf life are what define the field of food science as well as the contemporary food business that we utilise today. Large foodborne outbreaks remained in the late 1800s despite these advancements (Hardy, 1999). Qualified personnel were required to supervise food companies and carry out the essential product and process research and development as the food system grew increasingly industrialised. Education, research, and career growth in food science all advanced quickly in the 20th century. This article talks about the body of knowledge that affects food science and the series of reference books that show how knowledge is found, shared, and used in everyday life.

2.1. Education in food science and the discipline

In the 1800s, food science education was established using methodologies that were centred on commodities (e.g., dairy, fruits and vegetables, meats, etc.). However, at the

turn of the century, people were talking about food science and technology, and educators understood that the same methods could be used to preserve all types of food. As a consequence, from the middle of the 20th century until the end, several departments of food science and technology were established. (Livingston, 1972).

Significant educational that all meals could be preserved using the same methods in the early 1900s, when people started talking about food science and technology. As a consequence, from the middle of the 20th century until the end, several departments of food science and technology were established. (Iwaoka, 2011)

Food technology is defined as "the application of food science to the selection, preservation, processing, packaging, distribution, and consumption of food" despite the fact that the two terms are commonly used interchangeably. The definition of food science as it is practised today is "the subject in which engineering, biological, and physical sciences are employed to research the nature of foods, the reasons why they go bad, the principles of food processing, and how to improve meals for the general public" (Institute of Food Technologists, 2011). The popularity of television shows on the Food Network and other major network stations has significantly increased students' interest in food science. The number of students studying food science has lately increased in universities all around the world as a result.

2.2. Professional development and communication

Food scientists who wish to maintain their professional competence and stay competitive in the market must

engage in continual learning since change is the one constant in the field. Continuous learning investments may boost innovation, promote productive team relationships, guarantee best practices, and promote corporate success. Universities, for-profit companies, organisations, and consulting firms provide a wide range of opportunities for professional development via seminars, symposia, webinars, and short courses.Professionals in the field of food science have the chance to engage and network with like-minded peers by attending seminars and exhibits at the annual meetings of scientific societies.

Numerous universities offer programmes (on-site or online) with more flexible scheduling to enable people to complete further training or postgraduate degrees without interfering with their current employment responsibilities. The Certified Food Scientist certificate is the newest credential offered by the Institute of Food Technologists.

As was previously noted, a larger portion of the general population is now interested in food science due to the rising popularity of television programs that discuss the composition, preparation, and production of food. In order for these programs to be successful, food scientists will need to improve their communication skills so they can interpret and convey highly technical and difficult themes in food science into consumer-friendly English. Also, when it comes to food, nutrition, safety, and the environment, policymakers are turning to food scientists more and more for advice.

3. Discover more about our bridge to the future

Additional knowledge produced from research provides the basis for original future responses to problems. It is projected that global population expansion will continue, which will raise the demand for nutritious food while reducing the supply of resources like water and arable land. 795 million people, or about one in nine people on Earth, lack access to adequate food to lead active, healthy lives, according to the United Nations World Food Program. 1.3 billion tonnes of the food produced for humans each year are lost or squandered, according to FAO statistics from the United Nations (Gustavsson et al., 2011).

Modern food must be healthier, safer, and more ecologically friendly due to shifting consumer habits.

Research on food products and processes may help us increase our ability to reliably manufacture foods with high product quality and longer shelf lives, decrease our capacity to utilise less waste and natural resources, and create new goods for a changing and demanding market. Partnerships between research funders and service providers are now more important than ever for maintaining the pipeline for innovation. Students often get advanced-level instruction that enables them to become the next generation of scientific leaders in addition to creating new scientific discoveries.Therefore, it is in the interest of government organizations, foundations, and commercial organizations to ensure that food research is ongoing. Food scientists will also have to think about how to use new research tools in the basic sciences as they are

made. This will help them answer more open-ended questions about the complexity of food and food systems.

Even though it may seem impossible to produce enough food to feed everyone, empowering food scientists via training, research, and professional advancement paves the way for a supply of food that is safe, healthy, and nutritious for everyone.

4. Consumer behavior and food science

Considering that food has historically been a rare resource for the duration of human history, it is surprising that it is now available, of high quality, and safe in many areas of the globe. The widespread accessibility of food is largely attributable to advancements in food production technologies, which are supported by research into food. Additionally, there have been some detrimental effects on customers' access to and safety with regard to food.Obesity results from eating too much cheap, easily accessible food with a high-calorie count. Food handling in the home has become less meticulous as a consequence of the excellent quality and safety of food. Food safety and spoilage risks brought on by customers' carelessness are still present.(Nauta et al., 2008). The consumer's house wastes a lot of food as a result of overbuying and irregular handling and storage. Due to the possibility that once-valuable resources might turn out to be trash or health risks, consumers may have mixed feelings about food in general.

Food science provides the foundation for the abundance and great quality of meals that are accessible today. But from the perspective of the consumer, food

should be healthy, natural, traditional, abundant, and safe (Saeed and Grunert, 2014).

Additionally, the price of this abundant, safe, flavorful, superior, nutritious, fresh, natural, and distinctive food should be fair. A industry where enormous quantities are sold at very low profit margins is the food marketing chain. There isn't much room for price hikes that would boost profit margins because of the amount of food eaten, which still makes up a large portion of family expenditures.The investment in land and equipment made by primary agricultural producers is quite large when compared to the meagre profit margins in the food business. Because of this, they are at grave risk in this situation. Food marketing may assist in increasing profit margins by providing the meals that clients want at the quality, location, and price they want (Bezawada and Pauwels, 2013). Food marketers are always telling people about their products in order to boost sales, especially of high-priced items.

Food manufacturers invest a lot of time and effort in positioning their products in ways that increase sales. Food science spends a lot of time trying to create products that are higher quality, healthier, and last longer. As a result, novel meals are constantly being created, ranging from completely new goods to product line and category expansions to enhanced iterations of already-existing products with cutting-edge packaging and more productive manufacturing methods. It's uncertain if buyers will constantly want these unique items.(Sassatelli and Scott, 2001) Even though there may be a market for unique items, stores now have so many options that it's almost impossible to look at each one. This means that

customers have to use shortcuts to make decisions. (Simonson, 1999) Every day, customers choose between a wide range of food alternatives, and the retail assortment choices made have a significant impact on the success or failure of the items.

The fact that not all customers have the same needs further complicates things, since solutions that work well for some consumers may not work at all for others. Food that is good for some individuals may be unhealthy for others at various stages of life or even dangerous for those who have allergies.(Schenk et al., 2011). As evidenced by the many regional delicacies found around the globe, some individuals like dishes that others detest or even consider to be inedible. (Tan et al., 2015). Depending on their lives and value systems, some customers may choose to eat differently.(van Dam and Fischer, 2015). Once assessing the market potential for novel meals, it is critical to identify and quantify these diverse client types. But even when we have identified customer categories, various eating situations lead to varied tastes. Customers may be health-conscious when choosing their main meal of the day, but they may have very different tastes when choosing snacks, drinks, or meals for special occasions or when socializing.

Of all the product categories, food has the highest concentration of social, cultural, and religious norms. There are numerous civilizations and faiths that have food taboos.(Meyer-Rochow, 2009) The ingestion of food and the precise things that are deemed food are the subjects of several cultural rituals. When confronted with a new situation, consumers respond differently. The difference

in how people eat at a formal dinner and a night out with friends is a good example of this (Honkanen et al., 2005).

Numerous such social and cultural factors have an impact on what a specific cuisine means to customers' social and self-identities. The social, cultural, and religious identities of consumers have a big impact on how food companies do in the market.

Consumers must choose what to eat in the face of a flurry of circumstances and expectations. They often do so while preoccupied or fatigued, such as at the conclusion of the workday, which makes deliberate thought challenging. As a result, a large portion of our everyday food selections are, at best, regular judgments based on habits, automatisms, or heuristic clues (Honkanen et al., 2005).

Consumer research reveals a wide range of variations in food-related behaviour. There are apparent conflicts in the area of consumer research on food due to the wide variety of various behaviours and situations. However, if we take into account that contradictory studies emphasise various consumer coping mechanisms for dealing with the many factors, circumstances, and settings of food choice in everyday life, many of these seeming discrepancies may be reconciled. The subject of consumer research, therefore, provides a kaleidoscope picture of how customers act, since various consumer science methodologies capture various components of this wide variety of behaviours.(Fischer and Reinders, 2016)

The analysis of consumer behaviour considers relevant differences across consumer groups and how this affects food preferences. Consumer science is to understand the differences between each individual consumer, whose

behaviours may change greatly and seem to be in conflict with one another based on a range of situational contexts, consuming intentions, reasons, and cognitive capacities. The study of consumer behaviour examines how social, cultural, and other factors influence behaviour in the very complex decision-making environment provided by most supermarkets.

5. Food science in the past and future

An adequate, healthy, and safe food supply is created and maintained via the use of fundamental scientific and technological concepts in the field of food science. As a consequence, we now have a better understanding of food and how to transform it into a variety of secure, beneficial, nutritive, healthy, and delicious commodities as a consequence of the intersection of several basic scientific and technical fields. This has been shown to be accurate, particularly during the last century. Future human issues including sustainability, nutrition security, longevity, and health will need the application of food science, as well as concerns with food safety and defence, and the ever-evolving "farm-to-fork" continuum. As food science develops into a 21st-century discipline, solutions will come from embracing transformative and disruptive science and technology. Modern food scientists will want quick access to reference materials to handle these issues.

6. Conclusions

Food science and technology advancements have led to developments and improvements in the analytical methods or procedures used to guarantee food safety, quality, and nutrition-related research and practical applications across the food supply chain. In addition to

covering basic topics, including detailed reviews of well-known traditional chemical, physical, and microbiological procedures, this article also discusses new developments in sensorial, bioanalytical, and instrumental analysis techniques as well as how they might be used. Applications of these revolutionary technologies in the examination of food additives and components, such as carbohydrates, proteins, lipids, trace elements, vitamins, toxins, pollutants, and residues, have been reviewed, along with their benefits and drawbacks. Technologies for food-related research and development should also include its physical and chemical features, such as texture, rheology, and colour. It is thought that exposure to cutting-edge methodologies and technology, such as noninvasive and destructive techniques like NMR, ultrasound, biosensors, and e-nose and e-tongue, would provide light on future trends in food analysis.

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8.

RECENT ADVANCED TECHNIQUES FOR FOOD PRESERVATION AND PROCESSING

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Abstract

Food preservation entails a variety of food processing operations to maintain the appropriate degree of food quality so that maximum benefits and nutritional values can be achieved. Growing, harvesting, processing, packaging, and distribution of food are all examples of food preservation techniques. Innovative preservation techniques are being developed to meet consumer needs

for safety, nutrition, and sensory characteristics while maintaining economic preservation. Increasing variety in diet, developing goods with added value, and combating seasonality are some of the goals of food processing and preservation. Numerous chemical and biological interactions could result in food deterioration. Drying, chilling, freezing, and pasteurization are common and basic methods of food preservation that help prevent microbiological and chemical deterioration and the methods used to prevent these spoilages have evolved into a highly interdisciplinary discipline in recent years, becoming more sophisticated. Food goods are preserved using highly sophisticated technologies like irradiation, high-pressure technology, and hurdle technology. This chapter provides overviews of recent advanced techniques, identifying the changing demands of food quality, food safety, food preservation and processing.

Keywords: Food Preservation, Food Quality, Processing, Nutrition, Techniques, Food safety

1. Introduction

Foods are intricate substances made of different combinations of proteins, vitamins, carbs, fats, minerals, and water (Ercan and Soysal, 2013). Different techniques and safeguards are needed for food processing and preservation. The necessity for non-thermal new techniques to food processing was prompted by increasing consumer demand for high quality food items that are natural, flavourful, and do not contain any preservatives (Ulusoy *et al.,* 2007). Historically, safe food products including juice, milk, beer, and wine have been produced using thermal treatments (pasteurization and

sterilization), however the end product has a limited storage life. Thermal treatments, however, cause a reduction in vitamins, taste, color, and other sensory qualities.

High temperatures have the unfavorable consequence of causing food to lose nutritional components and change in sensory characteristics. It frequently results in the requirement for additives to enhance the products. The food industry has become interested in non-thermal food processing techniques that provide the highest levels of product quality and safety while processing techniques include high pressure, pulsed electric fields, cold plasma, ozonization, and oscillating magnetic fields (Adekunte *et al.,* 2010).The increased industrialization and adoption of lean practices allowed for the development of methods like heat treatment, canning, and freezing that extended shelf life by reducing microorganisms. However, due to the expanding population and rising consumer expectations for good and nourishing food, food safety and food security have become a significant concern (Saravanan *et al.* 2020).

Therefore, Food preservation grew rapidly as people sought to feed everyone. In order to preserve food, harmful biochemical processes must be prevented and harmful bacteria and molds should not be allowed to multiply. The method enables increased shelf life extension while minimizing waste. Large industries have adopted some of the well-liked traditional preservation methods, such as heating, drying, and freezing (Pereira *et al.,* 2018; Biakowska *et al.,* 2020; Said, 2020). Heat treatment and freezing are responsible for a number of problems including shrinkage, texture, nutritional loss,

and even organic loss to food products (Jayasena *et al.,* 2015). During the recent, additives, coatings, and various polyphenolic plant extracts have been subjected to chemical and microbiological treatments, offering a practical remedy for food preservation. Food preservation methods are not being researched enough to bridge the gap between food waste and food preservation methods. A comprehensive discussion of all new techniques for food preservation and processing is presented in this chapter, which are likely to play a dominant role in preserving or extending the shelf life of food products.

2. Recent food preservation technologies

2.1. Ultrasonic processing technique

As a food processing technique, ultrasonic processing is significant due to its potential for large-scale commercial scale-up and strong return on capital investment. The cavitation is the fundamental tenet on which ultrasonic can operate. A kind of energy known as ultrasound is produced by sound waves whose frequency is unheard by human ears. It's because the particles in the medium have been squeezed and rarefied and there will be a considerable quantity of energy produced when sound waves travel through any product. Therefore, cavitation is the development, expansion, and collapse of bubbles which produce a concentrated amount of mechanical and chemical energy (Gogate*et al.,* 2009). Cavitation, which happens when ultrasonic waves flow through a liquid medium, causes gas bubbles to develop inside the liquid (Kentish and Ashok, 2011).

In fruit-juice processing, ultrasound is more effective because it inactivates bacteria, inactivates enzymes,

prevents juice sedimentation, produces a degassing effect, and improves juice quality. Many beverages and concentrated juices are vital food products due to their massive demand in the global market (Cares *et al.,* 2010). Fruit juice's microbial load can be effectively reduced by thermo sonication treatment. Numerous factors, including the intensity of the ultrasonic waves, the processing duration, the treatment temperature, the amount of juice to be processed, and the juice's composition, including its acidity, pH, water activity, and nutritional content, might affect how effectively bacteria are inactivated. As not all bacteria respond to ultrasound treatment in the same way, process improvement is necessary (Alabdali*et al.,* 2020).

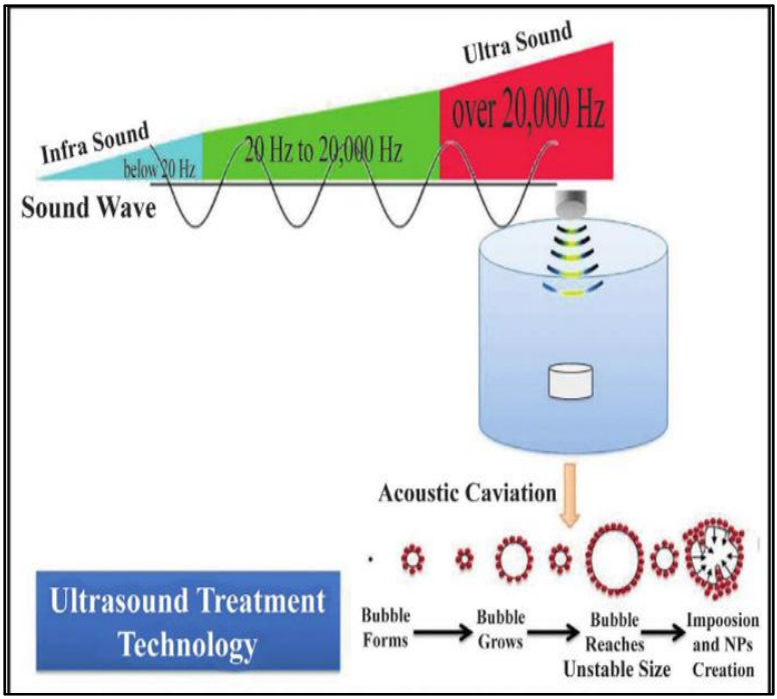

Fig.1 Ultrasonic waves and cavitation process (Cares *et al.,* 2010)

2.2. Pulse electric field technique

The pulse electric field technique is a pre-drying treatment that treats food with a shorter residence time than traditional methods. The approach gained a lot of popularity because it could be carried out in a continuous manner and only required a modest level of electric fields (1–5 kV/cm). Due to the fact that it operates at a temperature as low as 40°C, this technique can be viewed as an alternative to thermal drying and has the potential to speed up the drying process for food (Barba *et al.,* 2015; Wiktor *et al.,* 2016).Pulsed electric fields involve inserting the food (fruit, vegetables, milk, or juices) between two electrodes and then applying a high voltage for a short period of time (50 kV/cm).After this, the food is treated with the electric field. The method utilises both electroporation and electropermeabilization as its underlying principles (Barba *et al.,* 2015). Foods with disrupted cell membranes are more nutritious, safe, and shelf-stable as a result of their electric field exposure. The field intensity, pulse breadth, frequency, treatment time, polarity, and temperature employed are the factors that influence the pulse electric field "Odriozola-Serrano *et al.,* 2013 and Wiktor *et al.,* 2016".

Generally, pulse electric fields are applied to liquid foods and pastes. This method involves pulsing electricity into food materials in order to preserve it non-thermally. As a result of the treatment, the food maintains its original taste and texture with almost no change in quality or texture.

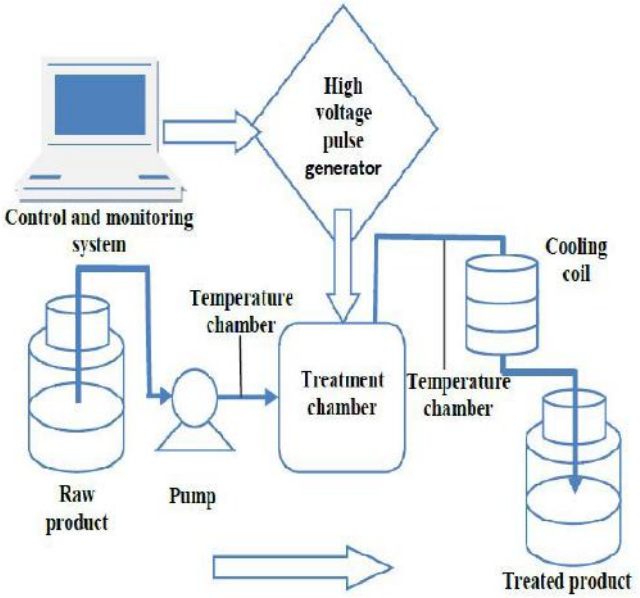

Fig. 2 Pulsed electric field processing (Barba *et al.,* 2015)

2.3. Nanotechnology for food preservation

The development of nanotechnology is a major step forward with enormous promise for environmental improvement. Physicists, biologists, food technologists, environmental engineers, physicians, and materials engineers all use this technology in their fields of study. Any material or nanoparticle with dimensions on the order of 100 nm or smaller is considered to fall under the purview of nanotechnology "Auffan *et al.,* 2009 and He *et al.,* 2019". Nanotechnology's success can be attributed to its promising outcomes, lack of pollutant emission, energy efficiency, and little space needs. In addition to these success elements, nanotechnology has demonstrated a wide range of applications for risk assessment in the domains of agriculture, food, and the environment

(Kaphle *et al.,* 2018).The use of nanotechnology has expanded into processing and formulating colorants, sensors, tastes, additives, preservatives, and food supplements (nano-encapsulation and nano-emulsion) (He *et al.,* 2019).

As nanotechnology is used in various fields, food processing industries have introduced nano-sensors. Many types of sauces, beverages, oils and juices contain nanomaterials that have electrochemical and optical properties. Unique traits have proven to be excellent as ingredients and supplements in the field of food preparation. Oxide chemicals such as silicon dioxide and magnesium oxide can be used as a culinary flavouring, food colour, and a baking ingredient. Adding titanium dioxide to foods including gum, sauce, and cake has also been approved (Weir *et al.,* 2012).

2.3.1. Nanotechnology in food packaging to ensure the food safety

Food quality often declines when fresh fruits and vegetables are exposed to ethylene, oxygen, and water permeability (Gaikwad *et al.,* 2018). As a result, food packaging is essential in resolving this problem. The most effective treatments have been found to be nanoparticles and polymer-based composites (Auffan *et al.,* 2009 and Joshi *et al.,* 2019). Recent research has indicated that covering food surfaces with natural or biopolymers could help preserve food (Luo *et al.,* 2020). Despite being in its early stages, the use of nanoparticles in smart packaging has advanced quickly since it provides a secure and sustainable method (Rai *et al.,* 2019).

Recently, several functionalities of chitosan and chitosan-based additives and films have been investigated, and the results have been promising. In general, chitosan-based films have antioxidant, antibacterial, and antifungal qualities that make them an excellent alternative to synthetic chemicals "Yuan *et al.*, 2016 and Yousuf*et al.*, 2018"s. Using derivatives based on chitosan to preserve foods without impairing their sensory quality is an effective method for extending shelf life (Kulawik *et al.*, 2020).

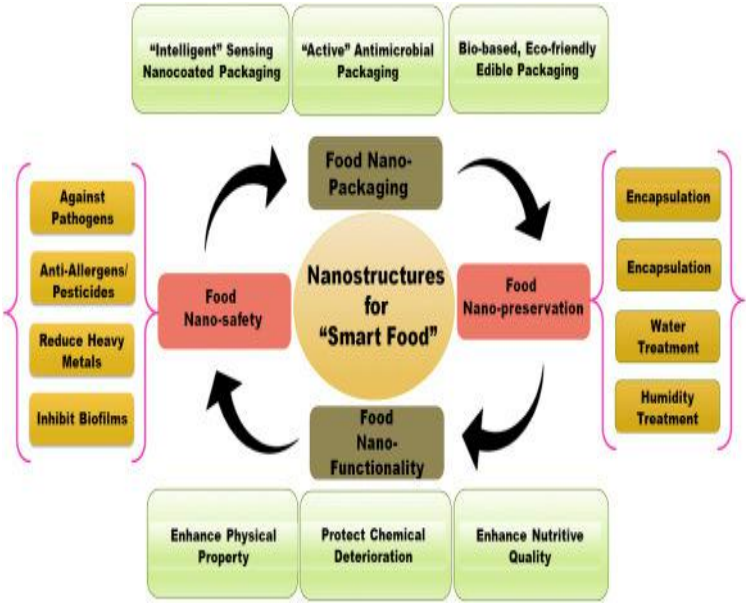

Fig. 3 Nanotechnology for food preservation, processing and food safety (Kulawik *et al.*, 2020)

2.4. High pressure processing

High hydrostatic pressure processing, ultra-high pressure processing, pascalization, and cold pasteurisation are other names for high pressure processing (HPP). It is possible to

improve the safety, quality, and organoleptic qualities of solid or liquid foods by applying a high level of pressure to them (Okpala*et al.,* 2010). Using HPP technology extends the shelf life of products, while maintaining taste and nutritional value.

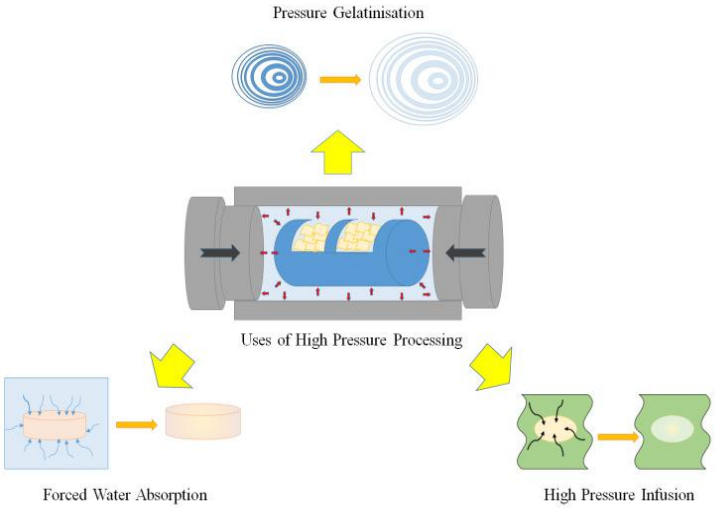

Fig. 4 High pressure processing phenomenon (Okpala *et al.,* 2010)

Additionally, it increases the product's target markets and increases the shelf life while lowering the failure rate. Due to its non-thermal processing characteristics, HPP is a popular option for protecting food quality. Some enzymes will be rendered inactive by the high pressure used in standard HPP procedures, which range from 400 to 600 MPa for two minutes or longer. and a reduction in the number of most vegetative bacteria by up to four log units or more, with only a minor alteration in the food's organoleptic properties. Despite HPP's highly effective antimicrobial properties, some gram-positive bacteria can still show resistance, such as Listeria monocytogenes.

There is a wide range of resistance to HPP among bacteria and other microbes (Boukil *et al.,* 2020).

Mold and bacterial spores are both generally resistant to HPP's ability to kill them. Viruses can withstand a variety of pressures, depending on the diversity of their structural makeup. The target organism, the type of food matrix, the temperature, and the pressure exerted will all affect how well HPP treatments work (Zacconi *et al.,* 2015).

2.5. Ultraviolet radiation technique

Recently, a non-heat method of decontamination called UV radiation (therapy) has been utilized to extend the shelf life and increasing the food safety (Bahrami *et al.,* 2020). UV radiation, which has wavelengths between 200 and 280 nm, is a type of energy that is generally regarded as non-ionizing radiation and possessing germicidal effects (usually termed UV-C). In addition to UV-A, UV-B, UV-C, and UV-Vacuum, UV light typically has a wavelength range between 100 and 400 nm; UV-Vacuum is between 100 and 200 nm. In theory, UV radiation works by eradicating the pathogen's genetic material in order to stop it from dividing, multiplying, and consequently spreading (Xuan *et al.,* 2017; Vasuja and Kumar, 2018).

According to research, fruit juices (like watermelon juice), when processed with UV light, retain their nutritional value better. The levels of phenolic compounds, Vitamin C, lycopene, and antioxidant capacities are only slightly affected (Bhattacharjee *et al.,* 2019). In addition, UV light has greater mortality effects on bacteria than typical chemical agents like hydrogen peroxide and chlorine (Miks-krajnik *et al.,* 2017).

Additionally, UV radiation is user-friendly and economical to employ (Gayan *et al.*, 2012).

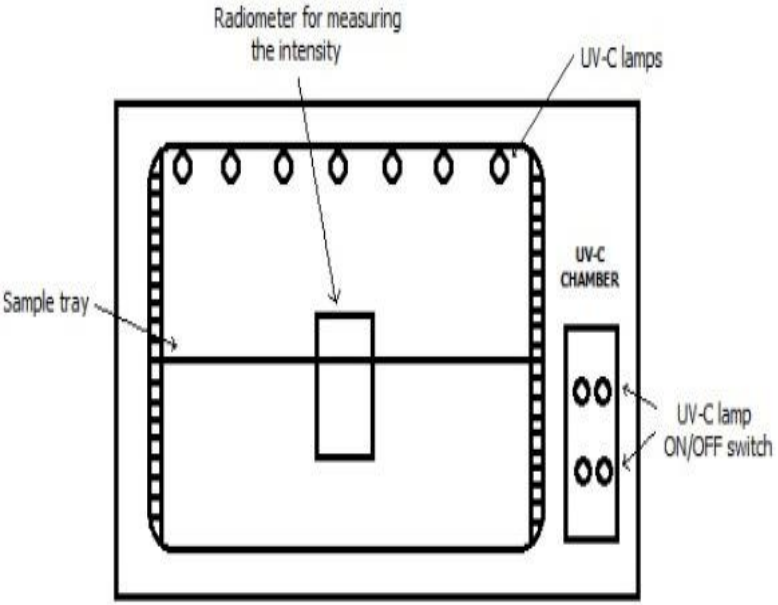

Fig. 5 Ultraviolet radiation process (Bhattacharjee *et al.*, 2019)

3. Conclusions

There is a growing need to find ways to extend the shelf life of food and preserve it so that it can be used to nourish people in developing countries. While many innovative tools have been created, there is still a long way to go before we have a truly sustainable food system. To appreciate the significance of food security, one must strike a balance between food supply, access, and appropriate utilization. The selected non-thermal technologies we have evaluated here appear to have a

variety of energy sources driving their activity, including electrical fields, light, and hydrostatic pressure. It has been demonstrated that these methods can maintain foods close to their original fresh state, as opposed to many of the traditional heat application methods, which can negatively affect the quality of the food. Certain non-thermal technologies improve the bioavailability of specific bioactive food components while having little effects on the nutritional makeup of foodstuffs. Consumers will continue to seek nutrient-dense, fresh meals, so the food industry must continue to advocate for complete adoption of non-thermal food processing technologies, particularly those covered in this analysis.

A variety of traditional methods, including drying, chilling, freezing, and fermenting, have been developed over time to preserve food while preserving its nutritional content and texture. As time and demand have evolved, preservation methods have become more contemporary. Irradiation, pulsed electric field effect, and high pressure food preservation are among the most recent developments in food preservation. Additionally, other chemical agents have been developed as food additives and preservatives. The recent techniques are more efficient in inhibiting or eliminating dangerous enzymes and bacteria while leaving the helpful ones alone. These techniques might not be able to completely replace the conventional techniques of food preservation, but it can most definitely complement or be merged with them.

4. Future prospects

The food industry must move forward and into the future by learning all it can about the action mechanisms,

benefits, and drawbacks of non-thermal food technologies before and even as they are being implemented. It may be beneficial to streamline the process mechanisms of each technique in order to increase cost-effectiveness and scale-up capability for industrial-level applications before considering ways to modify their designs. Consumers should also be educated about non-thermal technologies and their strengths.

As a general rule, the food processing line should be thoroughly evaluated using hazard analysis and critical control points (HACCP) methodology before any revolutionary non-thermal technologies are implemented or selected. HACCP and QACP, when used together, can improve and maintain the food industry's cleanliness, quality, and safety standards, thus their joint efforts are necessary for a thorough review. Additional research should focus on comparing prices among the preferred non-thermal food processing methods. Food producers and anyone with a stake in the industry might benefit from cost comparisons like these when deciding which non-thermal technology is best suited to fulfil their specific needs and capacity constraints.

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9.

AN INTEGRATED AND SUSTAINABLE APPROACH TO PAPAYA BREEDING AND CULTIVATION

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Abstract

In the tropical world, *Carica papaya*is a productive and nutritional fruit crop grown commercially. In papaya, sex form is an important symptom that affects its production and genetic improvement. High fruit production may increase profitability due to the identification of desired sex form in papaya at an early stage. Slow germination, increase in the mortality rate of seedlings, susceptibility to many diseases, and dependence on sexual propagation are some limitations in quality papaya production. However, germplasm conservation, hybridization, heterosis, mutation breeding, and molecular markers for sex determination and disease resistance are some advanced strategies for papaya quality enhancement. In some studies, gene transformation techniques and genetic engineering results improved disease resistance. Papaya regeneration has been refined by organogenesis and

somatic embryogenesis in the last 3 decades. Perfecting *in vitro* protocol integration in future papaya research to cope with the currently existing ecological phenomena will boost crop development. There have been promotional studies on the papaya by raising the axillary buds. In this chapter, papaya research achievements in breeding, molecular breeding, and breeding methods are discussed and they have shaped papaya into an ideal model species for genetic studies that will help teach papaya and other tropical crops.

Keywords: Papaya breeding, molecular makers, sex determination, propagation.

1. Introduction

Papaya (*Carica papaya* L) is a tropical plant and a member of the Caricaceae family (Ming and Aryal, 2014). It is the third-ranked international fruit crop which is also known for processing worldwide and occupies 16% of fresh produce (Ramos *et al.,* 2013). In the world, India is a leading country for papaya cultivation. Papaya spread in 1,29,130 ha which gives 51,60,390 M. tones yield in India. Uttar Pradesh, Bihar, Assam, Karnataka, Gujarat, Maharashtra, and West Bengal are major states for its production. Currently, it is additionally grown in Andhra Pradesh, Telangana, Madhya Pradesh, Manipur, and Meghalaya (FAOSTAT, 2020). Among these states Andhra Pradesh accounts for maximum production with 20.65 M. tones, Gujarat in production with 1,189,11 M. tones and Tamil Nadu performs superior productivity with 1,91,917 t/ha of papaya (NHB, 2020).

The adorable aroma, sweetness, and creamy-like consistency make papaya more popular. The fruit is

widely consumed in India and it holds high value as an export item due to its high carbohydrate, mineral, vitamin A and ascorbic acid content.100g of fresh papaya contain 11 g of carbohydrate, 1.7 g of fiber, 6 g of sugar, 152 mg of Vitamin A, 60 mg of Vitamin C, 37 mg of Folate, 7 mg of Sodium, 140 mg of Potassium, 4 mg of Magnesium, 240 mg of Beta carotene, 1 350 mg of Cryptoxanthin 1828 mg of Lycopene and 89 mg Lutein (USDA, 2020). Normally a ripened papaya has a significant amount of minerals. Ascorbic acid, vitamin A and Carotenoids (β-carotene and β-cryptoxanthin) are important compounds in papaya fruits. Papaya ranks 2nd out of all other fruits and vegetables for the amount of vitamin A that can be found after the fruit has ripened which is a water-soluble antioxidant (Franke *et al*., 2004).Papayas are used for the preparation of jam, jelly, marmalade, nectar, tutti frutti, syrup, and baby foods. Papaya has been described as the 'fruit of angels' because of its nutritional and health benefits, including promoting healthy blood circulation and preventing cancer (Ara *et al.,* 2016).The milky latex from this plant is known as papain, which can hydrolyze beer peptides, tenderize meats, and be used as a medicinal ingredient (Ming *et al.,* 2007).

Papaya plants grow faster and may give yield in one year. However, for the growing of papaya, there are some problems like incomplete germination, slow-growing, and high initial seedling mortality (Chavez-Pesquera and Nunez-Farfan, 2016). To increase the germination percentage, it is mainly propagated through seeds. Healthy and strong plant growth depend on seedling vigor, which can be maintained by breading approaches (Setargie *et al.,* 2015).For the breeding of papaya, the scientists concentrated mainly on heterosis breeding but backcross

breeding was recently known as helpful for research findings in molecular diversity. Papaya is the first crop for research in the manipulation of sex determination (Yang*et al.*, 2008). This chapter provides a comprehensive knowledge of the success and scope of the research area on papaya. This chapter has two main objectives which are to know the breeding progress of papaya and future papaya breeding scopes.

2. Floral biology of papaya

A cultivar of papaya has three forms, male, female, and hermaphrodite, which are cross-pollinated (Carvalho and Renner, 2012). Dioecious papaya cultivars bear their male and female flowers separately on separate plants in a 1:1 ratio, while gynodioecious papaya bears both female and andromonoecious flowers in a 1:2 ratio. Generally, a female flower will typically develop 32 days after bud formation, while a male flower will develop 42 days after bud formation (Kumar *et al.,* 2020).The phase from bud formation to anthesis is longer for females than for male flower buds. In the hermaphrodite flowers, stamen development occurred before the ovary (Sondur*et al.,* 2006). In most cases, anthers dehisce between 18 and 36 hours before the flower opens and this depends on the weather conditions. Meanwhile, stigma becomes receptive a day before the flower opens, and remains receptive during the 6 days following. The active anthesis was observed in most papaya cultivars between 5.00-6.00 a.m. and these cultivars also displayed maximum stigma receptivity on the day of anthesis (Goswami and Singh, 2020). Several dioecious papaya cultivars (e.g., CO1, CO2, CO4, CO5, CO6, Pusa Giant, Pusa Dwarf, and Pusa Nanha) are capable of producing high fruit set when the ratio of

female to male flowers remains 20:1.While there are mainly andromonoecious trees in gynodioecious varieties (e.g., CO3, CO7, Coorg Honey Dew, Sun Rise Solo, Sun Set Solo, etc.), pollination is primarily accomplished by insects in papayas (Kumar *et al*., 2020).

Table 1 Types of papaya varieties grown up in India

States	Varieties
Andhra Pradesh	Taiwanese lines, Arka Surya and Arks Prabhath
Bihar	Pusa Dwarf, Pusa Majesty, Pusa Nanha, Pusa Giant, Pusa delicious, and Ranchi
Karnataka	Coorg Honey Dew, Sunrise Solo, CO 3, CO 4, Arka Surya, Arka Prabhath and Taiwanese lines
Maharashtra	Taiwanese lines
Odisha	Coorg Honey Dew, Surya, Washington, Ranchi, Pusa Dwarf, and Pusa Delicious
Tamil Nadu	CO 5, CO 6, CO 7, CO 8, Arka Surya, Arka Prabhath, Coorg Honey Dew, and Taiwanese lines
Uttar Pradesh	Coorg Honey Dew, Pusa Dwarf, Pusa Delicious, CO 1, CO 3, and Barwani Red

(Source: National Horticulture Board, 2020)

Dioecious and gynodioecious forms of papaya are the two main sex forms (Storey, 2008).There are dioecious cultivars of papaya that have male and female trees, while gynodioecious cultivars are composed of females and andromonoecious trees in a ratio of 1:2. When bisexual flowers are selfed, they produce pure seeds (Ming *et al*.,

2007b).In most cases, sex determination is determined by the pairing of sex chromosomes in papaya (Carvalho and Renner, 2015).The Y-chromosome is the sole determinant of sex in both male and hermaphrodite flowers (Lam *et al.,* 2012). For a lot of yield production, a lot of female flowers are needed in tropical regions. In the subtropical region if there is continuous flowering occurs then additionally the fruit set is reduced (Gonsalves,2008).Cultivars of papaya show diverse performance in different climatic conditions. The suitability of variety cultivation is preferred in all areas according to their performance. India has diverse climatic conditions, so for instance some varieties are being cultivated in different states of India (Table 1).

3. Advances discovered in papaya propagation

3.1. Vegetative propagation

In papaya, cutting and grafting are the two major vegetative propagation methods practiced. Vegetative propagation promotes the chance to produce 100% hermaphrodite plants (Shara *et al*., 2020). The characteristics of mother plants, such as high yields, low maturity, and high cultivation, are maintained when using vegetative propagation (Chan, 2008). Papaya has no significant infectious agent problem (Allan, 2013). But for commercial plantations, seeds are the most likely to give seedlings to increase yields (Caple and Cheah, 2016). It is possible for Honey Gold propagated by cuttings for 50 years to bear fruit within 15 years (Giampan *et al*., 2005). This method of propagation increases sugar content in Hortus Gold papayas and maintains their genotype in

phenotypic characteristics (Singh *et al*., 2001). Cuttings can be rooted and survived reliably by adding plant growth regulators to the perlite and vermiculite media (1:1) (Nieto-Soriano *et al*., 2021).

Grafting is the technique of joining two plant parts, such as a scion and a rootstock, to provide vegetative growth and rooted development (Hartmann *et al*., 2011). Within the Caricaceae family, grafting between distinct genera and species is also conceivable (Richelle *et al*., 2019).

Despite the need to graft seedlings in the early stages of their development, sprouts should be kept at controlled temperatures and relative humidity for graft union callose production (Nguyen and Yen, 2018).Solo line 8 has been shown in studies to be grafted to reduce the flowering height and predict fruit output (Clarindo*et al*., 2008). The two most prevalent grafting procedures in papaya are splice grafting and V grafting (Airi*et al*., 2008).

3.2. *In Vitro* techniques

In Vitro techniques like somatic embryogenesis, organogenesis and micropropagation are the most strategies utilized in the regeneration of many species (David and Choi, 2021). By using these strategies, one can facilitate classical genetic improvement by crossing between members of the Caricaceae family and propagating clones (Drew, 2008).Maintenance of *in vitro* germplasm and transgenic plants may help in growing especially for virus resistance (Sergany and Bakry, 2012). The major problems of the papaya tissue culture are an increase in a slow rate, the poor establishment of axenic

cultures, and excessive deaths during an epidemic (Rimberia *et al.*, 2018).

Plants may be produced via micropropagation instead of seed propagation, resulting in increased homogeneity. Clonal propagation is commonly used in micropropagation to achieve high genetic purity at a low cost (Caple and Cheah, 2016). It is more efficient to use NAA and BAP for most micropropagation because they assist with increasing the induction times, frequency, and size of the shoots (Drew, 2008; Costa *et al.,* 2019). Whereas, gibberellin is commonly used to restore adventitious shoot during apical dominance and for the elongation phase. To avoid immature zygotic embryos in greenhouses and the field, micropropagation is essential for obtaining papaya lineage from several species (Chiang and Yeh, 2017).

Plant tissue culture involves the cultivation of different cell varieties, tissues, and organs using axenic cultivation techniques for the regeneration of a complete organism (Ming *et al.*, 2007a). The cultivation of tissue plays an essential role in controlling plants, assisting in traditional genetic improvement, plant health, germplasm, biotechnology, as well as the discovery and analysis of metabolomics, genomics, and proteomics(Yu *et al.,* 2010).

A process of generating roots, shoots, and flowers either directly from an explant or through a callus culture is known as organogenesis (Clarindo*et al.,* 2008). An embryo does not qualify as an organ because there is no vascular tissue and it exists independently (Drew, 2008).The main protocol for organogenesis is the use of MS medium as organic and inorganic compounds (Fitch,2008). Cytokinin, BAP, and kinetin are the main plant regulators for organogenesis (Mumo*et al.,* 2013).

Axillary and apical buds are the main source of explants in papaya (Traas and Teng, 2019).

Plants or embryos are derived artificially from a single somatic cell through a process called somatic embryogenesis, which is induced by specific conditions (Quiroz-Figueroa *et al*., 2006; Anandan *et al.,* 2012). It is made from plant cells that are not normally involved in embryonic development (Bhattacharya *et al.,* 2002). Somatic embryology can be used to increase plant production by promoting the highest economical fruit-producing fruits (Heringer *et al*, 2012).Explants that are used in embryogenesis are viz., hypocotyls, immature zygotic embryos, anthers, and cotyledons (Fitch, 2008).A papaya somatic embryo's efficiency is influenced by its carbohydrate content and concentration (Malabadi *et al.,* 2019). In order for somatic embryos to develop and mature, it is important to use growth factors like abscisic acid and osmotic agents like polyethylene glycol and phloroglucinol (Perez *et al.,* 2013).

4. Breeding methods and achievements

4.1. Inbreeding and selection

A plant that carries both male and female flowers is considered inbred if it crosses closely related plants (Heringer *et al.,* 2012).Selecting plants with desirable characteristics and destroying those with less desirable characteristics is the process of selection (Kumar *et al.,* 2018).From a dioecious line, suitable male plants are selected which are similar to female plants in vegetative characteristics, including stem and leaf color, stem thickness, and bloom height. Plants raised from S_1inbreeds are screened and desired male and female plants are

selected for further sib mating, that is, crossing between the female plant and male plant of the same cultivar.

To establish consistency in a collection of characters, the technique must be repeated for 7-8 generations. In this procedure, the progeny will have an equal number of males and females. This strategy has produced a large number of dioecious varieties. Due to the intensive breeding program, four cultivars were developed, namely CO1, CO2, CO5, and CO6 due to inbreeding selection. Which is dioecious Through sib-mating with CO2 variety, which is a red-fleshed variety, CO8 papaya was developed in the dioecious group, which is unique for the red pulp color that no other dioecious papaya variety has. As a result of inbreeding and selection for 8 generations, uniform lines of Pusa Delicious, Pusa Majesty, Pusa Giant, and Pusa Dwarf process desirable traits. Some of the most important papaya varieties have developed as fallow through inbreeding and selection.

Table 2 Important cultivars of papaya developed through selection are as under

Varieties	Characteristics
CO1	A dwarf selection of Ranchi cultivars produces round fruits.
CO2	Dual-purpose variety for dessert fruit as well as papain production, based on a local selection, which is suitable for papain production due to its high enzyme activity.
CO3	The plant is vigorous and produces medium-sized fruits with excellent keeping quality. It is a cross between CO2 and Sun Rise Solo.

CO4	It is a CO1 × Washington hybrid. The fruit grows big, keeps well and the flesh is yellow.
CO5	The variety comes from Washington. It is also good for papain production, as it yields a high amount of latex.
CO6	This product is a selection from an assortment called 'Giant' which are bigger and heavier than normal fruits weighing 2.5 to 3.0 kg. It is suitable for papain extraction and desserts.
CO7	The fruit of this hybrid has red flesh and a round cavity. It is a gynodioecious variety of CP75 × Coorg Honey Dew.
CO8	This is a red-fleshed dioecious variety developed at CO2 through selective sib mating. It is ideal for desserts, handling, and producing papain.
Coorg Honey Dew	Honey Dew in Coorg has a gynodioecious selection.
Pusa Majesty	It is a gynodioecious variety suitable for high papain levels that is a selection of cv. Ranchi.

(Source; Aiyappa and Nanjappa, 2016).

4.2. Hybridization

Crossing genetically dissimilar parents to produce a hybrid is called hybridization. Polyploid offspring are commonly produced (Dinesh and Yadav, 2008).By inter-varietal or intergeneric hybridization, the hybrid HPSC-3 (Tripura local × Honey Dew) and a few hybrid varieties have been established, but there is still sufficient space for the production of superior cultivars with greater quality and yield (Singh *et al.,* 2010). A research team at TNAU,

Coimbatore has developed three varieties to achieve quality and higher yield, viz., CO3 (CO2 × Sunrise Solo), CO4 (CO1 × Washington), and CO7 (CP.75 × Coorg Honey Dew) (Dinesh and Yadav,2008).

Two hybrids named IIHR-39 (Sun Rise Solo × Pink Flesh Sweet) and IIHR-54 (Waimanalo × Pink Flesh Sweet) were developed at IIHR Bangalore to achieve higher yields (Singh *et al*., 2010). Hybridization was also attempted within species of the genus *Carica*. It was not possible to germinate and grow immature embryos from the cross between *Carica papaya* and *Carica cauliflora* but they could be cultivated from immature embryos (Zaidi *et al*., 2016). There are no large, rapid-growing *Carica papaya* and *Carica cauliflora* F1 progenies. Their apical necrosis develops before maturity in the case of the *Carica papaya* (Bussabakornkul and Somsri, 2008).Without additional treatment, Sunrise Solo Line 72/12" and Tainung 01 exhibited better vegetative growth, vigor, and dwarfing, as well as early flowering (Nguyen and Yen, 2018).

4.3. Heterosis

When two different varieties of a species are crossed, the resulting progeny has greater biomass, speed of development, and fertility than either of the parents is known as heterosis. It was observed that there was heterosis up to 111.4% in Solo yellow × Washington for yield and yield traits, while there was high heterosis for potential economic competitiveness in Thailand × Washington (Mitra and Dinesh, 2017).Three dwarf plants were isolated for the first time from the M2 population. Repeated submission of dwarf line Pusa Nanha helped in establishing a homozygous and improved yield up to 600-800g and the red flesh, firm and sweet with a TSS of 14

degrees Brix (Dinesh and Mitra, 2017).

4.4. Mutation breeding

By exposing seeds to chemicals or radiation, mutation breeding produces mutants with desirable traits that may be used to breed with other cultivars. Mutagenic plants or mutagenic seeds are plants that develop by mutagenesis. By treating papaya seeds with 15K gamma rays, a dwarf mutant line was isolated. Pusa Nanha was a homozygous dwarf line developed by repeating sib mating among dwarf plants. Recently, papaya seeds have been irradiated in an attempt to flatten and/or develop disease-resistant varieties (Husselman *et al.*, 2019).

4.5. A recent breeding scheme of papaya

The developed segregation population for future breeding will work for future research and increase new commercial varieties.

4.5.1. Strategies to improve the breeding of papaya are

1. For the maturity of papaya grow several lines of plants
2. Identified important traits for the papaya breeding program
3. Evaluate traits of interest in all the lines
4. On the first harvest, we should collect data from the selected tree which bear fruits having the best-consuming quality
5. On the second harvest, collect the data on the correlation
6. On the third harvest, select two trees with the highest difference and finally cross-pollinate those trees to establish segregating populations for

marker analysis (Nickel and Gonsalves, 2005).

5. Biotechnology in papaya

Biotechnology involves the industrial exploitation of biological processes, especially the genetic manipulation of microorganisms to produce antibiotics, hormones, and other products.By using *in-vitro* propagation and genetic engineering techniques, it is possible to overcome some of the major constraints in the *Carica papaya.* The papaya is now considered to be a model fruit crop for biotechnology applications (Drew, 2008).In Thailand, papaya has been hybridized with six other species of *Carica* and some hybrids contain helpful disease resistance genes; however, serious fertility barriers retard breeding activities (Salinas *et al.,* 2018). While Genetic Engineering is somewhat controversial, it can play an important role in papaya improvement by modifying one or more characteristics of elite cultivars without changing the existing characteristics altogether (David and Choi, 2021). Advances in genetic engineering of the genome of papaya are facilitated by extensive efforts to develop and transfer the essential characteristics of papaya reproductive systems for efficient gene insertion techniques (Bergy *et al.,* 2016).

5.1. Embryo culture

A failure in the formation of the endosperm is a primary cause of papaya incompatibility. During 30 days of incubation on White's medium, the hybrid embryo resulting from an inter specific cross between *C. papaya* and *C. cauliflora* has been successfully protected (Kavitha *et al.*, 2017). However, the female is unproduced and after fertilization obstruction, due to a fetal miscarriage of homozygous dominant andromonoecious forms. Thus,

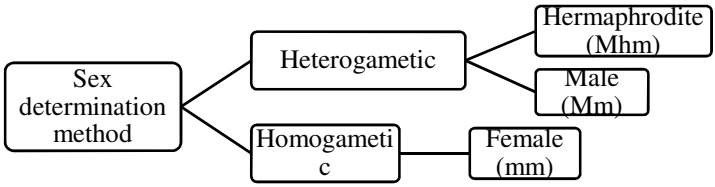
papaya is impregnated in pollination after 50, 60, and 70 days of mother embryo to produce high-yieldin ggynodioecious lines and fertilizing in a nutrient medium and inducing growth (Jayavalli *et al*., 2019). During the 60 days of embryonic heart-shaped pollination, it was very weak. When pollinated, the embryos were necrotic and deformed, and the number of embryos decreased for each fruit 120 days later. The fetus was not found within 150 days after pollination (Malabadi *et al*, 2019).

5.2. Transgenic papaya

University of Hawaii researchers have produced transgenic papaya resistant to Papaya Ring Spot Virus (PRSV) via coat protein-mediated resistance. To provide immune resistance against the severe strain of PRSV, a coat protein gene from the virus was isolated, cloned, and integrated into papaya (Botella *et al.,* 2008). Red fleshed and Sun Set Solo papayas, as well as Yellow, fleshed Kapono Solo, were the cultivars targeted in the transformation. Microprojectile bombardment was used for transformation in papaya embryogenic tissues with the coat protein gene (Laurena *et al.,* 2008).

5.3. Papaya sex determination using molecular markers

Papaya is characterized by a single dominant gene with three alleles for determining its gender (Chae *et al.,* 2021). They expand in advance the genotypes of male, female and hermaphrodite plants are Mm, mm, and Mhm and described those homozygous dominant alleles are lethal (Kanchana-udomkan *et al.,* 2014).



There are numerous crop species for which Molecular markers are being used for genetic improvement (Eusticeet *al.,* 2007). First PCR-based markers of papaya were the randomly amplified polymorphic DNA (RAPD) markers, used to determine the sex of papayas before flowering (Aryaland Ming, 2014).

Table 3 Different types of sex-determining markers of papaya

Type of markers	Name of marker	Sex detection	References
RAPD	PSDM	Hermaphrodite and male	Urasaki *et al.,* 2002
RAPD	BC210 438	Hermaphrodite	Lemos *et al.,* 2002
RAPD	OP-Y7 900	Male	Chaves-Bedoya, 2011
RAPD	OPF2- 0.8	Male	Parasnis *et al.,* 2000
SCAR	T1	All sex	Deputy *et al.,* 2002
SCAR	C09/20	Hermaphrodite and male	
SCAR	SCARpm	Hermaphrodite	
DAF			

RFLP	OPA06 (GATA) 4	and male Hermaphrodite and Male Hermaphrodite and Male	Niroshini *et al.,* 2008 Urasaki *et al.,* 2002 Somsri *et al.,* 2008 Parasnis *et al.,* 2000

5.4. Disease resistance breeding in papaya

The most serious problem with papaya production worldwide is the papaya ringspot virus (PRSV) (Chan and Ong, 2003). Many researchers took interspecific hybridization steps to cross papaya with PRSV – P resistance related to *Carica* species. The four lines were found to be most tolerant to PRSV, that is, L248, L41, L90, and L13. These lines showed that the greatest tolerance occurred when both pistillate and staminate resistant lines were used. The plant L248 exhibited the best resistance to plant disease symptoms and the highest yield of all four lines (Kavitha *et al.*, 2010).

5.5. Improvement of disease-resistant breeding

Several illness resistances are found in *Vasconcellea* species (Peter van Esseand Lynn Reuber,2020). Tocharacterize their genetic diversity, this species is classified into three taxonomic groups: 1) *V. stipulate* and *V. parviflora*, 2) *V. chilensis* and 3) *V. glandulosa*. All alternative species of the genus are grouped in this biological category (Dillon *et al.,* 2006). A survey was

conducted from 2006 to 2008 at the plantation of papaya in various states in India. It states that most leaf curl (23.5%) was recorded in Lucknow (Chowdhury and Hasan, 2013).The utmost leaf curl incidences are found in vascular plants of CO-4 (80% to 86.67%) and MF-1 (80% to 83.33%). However, the Harichap cultivar has the lowest leaf curl incidence (23% and 20%). Hence CO2, CO3, CO6, Coorg Honey Dew, Pusa Delicious, and Pusa dwarf, these six varieties were found to be moderately resistant (Singhand Awasthi, 2017). Through natural resistance in hosts, either directly or indirectly, the virus is resisted either directly by the host plant through its mechanisms or indirectly through resistance to insect disease vectors. Although a genetic diversity analysis of papaya cultivars has been conducted in India (Saxena *et al.,* 2007).Researchers in India are working on developing transgenic papaya that is relevantly resistant to PaLCuV's victimization coat super molecule factor and antisense replicase factor (Mishra*et al.,* 2007). CRISPR technology allows papaya to develop resistance against viruses by decoding its complete order, which makes it a suitable food crop for CRISPR technology (Ming*et al.,* 2012).

5.6. Analysis of molecular diversity

There are 31 genotypes utilized in papaya which were collected from totally different regions like India, Taiwan, China, Brazil, Spain, and a few localities in Bangladesh to check their molecular diversity together with SSR markers (Eustice *et al.,* 2007). SSR markers are used for the determination of sex (Parasnis *et al.,* 2000). They found a total of 11% and 89% of entire genetic diversity among and at intervals of the populations. Their findings in the analysis of papaya genetic resources are essential for

parental lines at intervals of any hybrid breeding programs (Hasibuzzaman *et al.,* 2020).

6. Conclusions

In conclusion, there are many edges with the propagation of papaya that are promising to be used on a business scale. Cutting and affixation procedures have been demonstrated to be less financially effective than *in vitro* propagation in agamogenetic propagation and their application is limited. In papaya culture, embryogenesis, *in vitro* propagation and organogenesis are the most difficult aspects of the *in vitro* propagation technique. However, the ultimate objective of papaya breeding is to enhance the standard and amount of the merchandise. It's finished that to improvement techniques to urge, illness resistant selection, manipulating the sex determination genes to search out a static protocol for faithful sort hermaphrodite, variable germplasm by utilizing molecular diversity analysis. Papaya breeding has achieved excellent advancement. Several advanced technologies are created for papaya breeding and additionally, totally different advanced breeding approaches are taken to enhance the quality of papaya. In addition, many alternative experiments are done to create a crop acceptable to the patron. The advancing breeding techniques in papaya, from individual choice to cross and advanced molecular breeding can profit the present and future papaya breeding programs within the world.

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10.

PREBIOTICS IN MAINTAINING A HEALTHY COMMUNITY

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Abstract

A transition from high-fibre foods to processed foods has made the community vulnerable to many diseases. Prebiotics are specialized plant fibres which the human body couldn't digest. The bacteria present in the gut can however digest this fibre. Prebiotics serves as fuel and helps nourish gut bacteria and support a healthy digestive system and immunity through the growth of beneficial microorganisms. Inulin, Fructo-oligosaccharides, Galacto-oligosaccharides, Pectic-oligosaccharides and Resistant starch are some of the types of prebiotics that are naturally found in whole grains, legumes, fruits and vegetables. When the microorganisms present in the gut metabolize these, they bring out short-chain fatty acids like acetate, propionate and butyrate. These short-chain fatty acids nurture the colonocytes and help to lessen the threat of cancers like colon cancer, support the immune system and regulate inflammation and certain digestive ailments like ulcerative colitis, crohn's disease, diarrhoea

and constipation. Short-chain fatty acids also establish two-way communication with the central nervous system by gaining entry into the bloodstream. They also suppress hunger signals and contribute to weight loss. Eating plenty of prebiotics encourages the growth of bacteria with an ability to make more short-chain fatty acids that may provide health benefits. The core objective of this review is to explain the effect of prebiotics on health and diseases.

Keywords: Prebiotics, Gut bacteria, Short-chain fatty acids, Butyrate

1. Introduction

Prebiotics are specialized plant fibres which are non-digestible and non-absorbable in the digestive tract and are put through fermentation in the colon by bacteria (Gibson GR et al., 2010). These dietary fibres are a source of food for beneficial microorganisms (Glenn G and Roberfroid M, 1995; Gibson GR et al., 2004). They influence the bacterial microbiota, microbial metabolic activity and development of fermentative end products giving way to benefit host health.

The fermentative end products are Short-Chain Fatty Acids, specifically butyrate, propionate and acetate. These bioactive compounds are termed postbiotics. The congregation of Short-Chain Fatty Acids changes all through the gastrointestinal system, where most elevated levels are found in the cecum and reduced levels in the descending colon (Cummings JH et al., 1987).

The majority of Short-Chain Fatty Acids are utilized by the microbiota in the gut. A small quantity of Short-Chain Fatty Acids namely propionate and acetate are seen in the

blood and tissues. Propionate is mainly involved in reducing cholesterol levels and also producing glucose in the liver and small intestine. Acetate is actively involved in energy expenditure and appetite regulation. Butyrate supplies energy for colonocytes and enterocytes and help in maintaining colon health. Short-Chain Fatty Acids impact glucose homeostasis, gastrointestinal epithelial cell integrity, lipid metabolism and immunity (Koh A et al., 2016). This review talks about the effect of the utilization of prebiotics on the well-being of the community.

2. Prebiotics and their types

There is a great variety of prebiotics. Most of them are oligosaccharides namely Inulin, Fructo-oligosaccharides (FOS), Galactooligosaccharides (GOS), Resistant starch, Pectic oligosaccharides and non-carbohydrate prebiotics.

2.1. Fructans

This classification comprises inulin and fructo-oligosaccharide or oligofructose. Inulin is an oligosaccharide with fructose units having terminal glucose units. Inulin is found in natural substances such as vegetables, spices, wheat, onions, bananas, leeks, artichokes, and asparagus. Fructooligosaccharides (FOS) are formed by the breakdown of inulin.

They are found in grains, onion, garlic, chicory, artichokes, asparagus, tomatoes, fruits and vegetables. Dietary Fructooligosaccharides oppose the action of digestive enzymes and on finally reaching the colon they are acted upon by anaerobic bacteria such as Clostridium butyricum, Bacteroides fragilis and Enterobacter cloacae.

2.2. Galacto-oligosaccharides

Galactooligosaccharides (GOS) is a short-chain galactose with a terminal glucose particle. They are tracked down in dairy items, beans, and certain root vegetables. Galacto-oligosaccharides can enormously invigorate Bifidobacteria and Lactobacilli.

2.3. Resistant starch

There is a sort of starch that is impervious to dissolution in the gastrointestinal tract. It is found in barley, oats, rice, legumes, beans, potatoes and unripe bananas. It is also formed when starchy foods like rice and potatoes are cooked and cooled. The Resistant starches which function like soluble fibre are acted upon by the bacteria and can advance health by delivering an elevated degree of butyrate.

2.4. Pectic oligosaccharides

Oligosaccharides derived from the hydrolysis of pectin are known as pectic oligosaccharides (POS). Pectin is treated as a prebiotic as it is resistant to degradation by gastric juices. Pectin from various sources such as apples, apricots, peaches, tomatoes, carrots and citrus fruits serve as the carbon source for gut bacteria.

Bacteroidetes present in the colon can utilize more pectin compared to Firmicutes (Wing Sun Faith Chung et al., 2017).

2.5. Non-Carbohydrate prebiotics

There are a few substances other than carbohydrates which have a prebiotic effect. When microbes consume flavonoids secondary bioactive metabolites are produced.

3. Prebiotics in maintaining health

3.1. Prebiotics and digestive health

Prebiotics can strengthen the digestive system by increasing the growth of good bacteria that help ward off pathogens. Prebiotics helps in relieving constipation and diarrhoea. The persistent inflammation related to ulcerative colitis and crohn's disease can also be treated with prebiotics (Daniela Parada Venegas et al., 2019). Studies indicate that butyrate and acetate supplementation reduced bowel inflammation (Edda Russo et al., 2019; Sara Deleu et al., 2021). However lower levels of butyrate and acetate worsened ulcerative colitis.

In a study with 25 persons having ulcerative colitis, it was found that consuming 15 grams of inulin every day for nine weeks significantly improved symptoms by increasing butyrate production (Rosica Valcheva et al., 2019). In another in vitro study of the faecal microbial communities of 10 people with crohn's disease, supplementing with butyrate-producing bacteria significantly enhanced the production of butyrate and improved epithelial barrier integrity (Annelies Geirnaert et al., 2017).

3.2. Prebiotics and cancer

Prebiotics take a part in the treatment and prevention of particular types of cancers, mainly colon cancer. Butyrate keeps the cells of the colon healthy by increasing the expression of epithelial barrier-forming molecules and influencing the production of certain immune cells in the colon.

Studies indicate a convincing association between fibre-rich diets and lowered chance of colon cancer (Stephen J D O Keefe, 2016; Soeren Ocvirk et al., 2019). In a study, mice fed with fibre-rich diets showed 75% fewer tumors compared to the one that was not given. This is because mice fed on a fibre-rich diet contained butyrate-producing bacteria in the gut (Dallas R. Donohoe et al., 2014).

3.3. Prebiotics and diabetes

Butyrate helps in maintaining blood glucose by reducing insulin resistance in diabetic patients (Alessandra Puddu et al., 2014). It enhances insulin production and diminishes glucagon synthesis in the pancreas and enhances enzyme activity in the muscle tissue and liver cells, resulting in healthier blood glucose management.

In a study, obese adults having normal blood glucose were given 20 grams of inulin propionate ester daily for 42 days. Their insulin resistance significantly improved, and pro- inflammatory interleukin-8 levels decreased in the experimental group (Edward S Chambers et al., 2019).

Another study found that propionate may improve beta-cell function and stimulate the production of insulin (Attilio Pingitore et al., 2017).

3.4. Prebiotics and obesity

The microbiome of the gut can regulate fat metabolism by decreasing fat storage and increasing fat burning. Butyrate, the end product of bacterial fermentation reduces appetite and increases energy expenditure. This was evident in many animal studies.

In a study, when obese mice were fed with butyrate for five weeks body weight and body fat reduced to 10.2 and 10 percent respectively to their original weight (Sean M McNabney and Tara M Henagan, 2017).

3.5. Prebiotics and heart diseases

A reduction in the quantity of butyrate produced was reported to be the cause of atherosclerosis in many studies (Chen W et al., 2020). The size of the atherosclerotic lesion was found to be reduced when diets rich in fibre were given to mice (Kasahara K et al., 2018). Many animal studies showed lower cholesterol levels when supplemented with butyrate. Mice fed with 200 and 400mg/kg butyrate showed a reduction in total cholesterol and low-density lipoproteins (Du Y et al., 2020). Butyrate stops the absorption of cholesterol and down-regulates the genes responsible for the formation of cholesterol. The results of several studies have shown that fibre-rich foods had reduced the effect of heart problems. Nevertheless, it is based on the type of fibre. Depletion in butyrate-producing microorganisms was correlated with severe heart disease, inflammation and death (Kummen M et al., 2018).

4. Conclusions

The fermentative end products formed after the breakdown of fibre in the colon enhance the growth of beneficial microorganisms which helps keep off pathogens. Prebiotics also help in amelioration of cardiovascular diseases, diabetes and digestive diseases as mentioned in the article. Apart from that, the bioactive compounds were also found to protect the individuals and community from rheumatoid arthritis, neurological,

pulmonary and skin diseases. Hence the best way of increasing the beneficial microbes is by consuming a lot of fermentable fibre.

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11.

A STUDY ON ROLE OF DIET IN CANCER PATIENTS

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Abstract

A healthy diet is critical intended for proper health and nourishment. It safeguards against a lot of chronic non-communicable disease such as heart illness, diabetes and cancer. Intake of a different type of food and consumption of less salt, sugar, saturated and transfer are required for a balanced diet. Cancer patients have improved protein need owing to anti-tumour treatment modalities, particularly chemotherapy regimen that consist of steroids or radiation therapies. The most recent practice guidelines recommend a protein intake of 1 to 1.5 gram per kg every day but patients may require as much as 2 gram per day. A healthy diet is important in every step of cancer journey. The present study was to assess knowledge on role of diet in cancer patients. Structured questionnaire was designed to collect the data which includes demographic information, food habits like food frequency, dietary intake, number of meals per day, foods to be consumed during and avoided after cancer treatment. The sample comprised of total 100cancer patients who falls under

inclusion criteria were selected at SVIMS Hospital, Tirupati. The collected data was comprehensively analysed by using statistical methods. The knowledge on role of diet among cancer patients were assessed among them only 15(15%)had adequate knowledge. Sum of the particular demographic variables important at $p<0.01$ level. Cancer patients need continuous education on type of diet to be consumed during cancer treatment and diet to be modified after treatment.

Key words: Assess, knowledge, diet, cancer patients.

1. Introduction

The World Health Organization (WHO) states that dietary status is a form of the body ensuing from intake, inclusion and use of nutrient which persuade over physiological and pathological status of the body (Boyle P, Ferlay J 2004). Cancer is one of the most important cause of morbidity and mortality all over the world (WHO report 2020).The moment for the most part of common cause death in Europe and cause of fatality in old age (European Communities, 2002).Weight loss and dietary struggle are often related with cancer (Khaling Rai Dipa 2019).

The World Cancer Research Fund/American Institute for Cancer Research decided that fruits and vegetables may be care for contrary to gastric cancer, while salt, salt potted foods as well as smoke, process and roasted meats are perhaps cause of gastric cancer. Red meat has been revealed to encourage the structure of N-nitroso complexes through response among nitric oxide and haemoglobin (Report on NIH 2020).

Cancer treatment programs help to cure or prolong the life of patients. Many cases can be prohibited by not smoking, maintain a strong weight, not drinking to boot alcohol, eating a lot of fruits, vegetables and entire grain, immunization beside firm communicable disease, not consumption excessively handled red meat along with escaping too much sun light exposure (Soeters PB, Reuven 2008).

Nourishment treatment is used to continue a well body weight, preserve potency, reduce side effects during and after treatment. A healthy diet includes eating and drinking sufficient foods and liquid that have important nutrients (vitamins, minerals, protein, carbohydrates, overweight and hose) (WHO report on diet 2003).

2. Methodology

The study was to assess knowledge on role of diet in cancer patients. Cross-sectional descriptive research design was selected. A sample consists of 100cancer patients were identified by using non - probability convenient sampling technique included under inclusion criteria. A prearranged survey was designed to collect the information, which includes demographic data of patients, frequency of food habits, type of foods and foods to be avoided during and after treatment. Formal approval was taken from Head of the Department of medical oncology, SVIMS Hospital. Consent was taken from the patients and collected the data. Finally distributed booklet on foods to be consumed during and after therapy to the cancer patients. The consistency of tool was validated by interrater reliability by using Cronbach's alpha r=0.84. The

results of the study was analysed by using statistical method of SPSS software.

3. Results

The findings of the study revealed that 45(45%) had inadequate knowledge, 40(40%) had restrained knowledge and only 15(15%) had sufficient knowledge on role of diet among cancer patients. The table1 indicates the level of knowledge on diet among cancer patients.

Table 1 Level of knowledge on role of diet among cancer patients

(N=100)

S. No	Level of Knowledge	Frequency (f)	Percentage (%)
1.	Inadequate	45	45
2.	Moderate	40	40
3.	Adequate	15	15

The findings of association on role of diet among cancer patients and selected socio demographic variables were shown that age through a chi-square value of 30.608, gender with a chi-square value of 11.874,educational status through a chi-square value of 30.122, occupation with a chi-square value of 36.941, monthly income through a chi-square value of 16.894, residence through a chi-square value of 18.383, family history of cancer with a chi-square value of 21.121 were shown significant at the level of $p<0.01$.This was shown in table 2.

Table 2 Distribution of mean and standard deviation on role of diet

S.No	Demographic varlables	Level of knowledge								Chi square (f)	P' Value
		Inadequate (0-50%)		Moderate (51-75%)		Adequate (>75-100%)		Total			
		(f)	%	(f)	%	(f)	%	(f)	%		
1.	Age (in years)	28	28	19	19	3	3	50	50	30.608	0.000**
	a. 20-30 years	9	9	12	12	3	3	24	24		
	b. 31-40 years	3	3	8	8	1	1	12	12		
	c. 41-50 years	5	5	1	1	8	8	14	14		
	d. >51 years										
2.	Gender									11.874	0.003**
	a. Male	19	19	22	22	14	14	55	55		
	b. Female	26	26	18	18	1	1	45	45		
3.	Educational Status									30.122	0.001**
	a. Illiterate	11	11	2	2	0	0	13	13		
	b. Primary education	9	9	6	6	1	1	16	16		
	c. Secondry education	8	8	3	3	1	1	12	12		
	d. Higher education	12	12	7	7	2	2	21	21		
	e. Graduate	4	4	19	19	9	9	32	32		
	f. Post graduate	1	1	3	3	2	2	6	6		

4.	Occupation									36.941	0.000**
	a. Government employee	0	0	0	0	4	4	4	4		
	b. Private employee	11	11	12	12	3	3	26	26		
	c. Unemployee	13	13	12	12	3	3	28	28		
	d. Cooli	15	15	7	7	4	4	26	26		
	e. Cultivation	0	0	0	0	1	1	1	1		
	f. Home mark	5	5	9	9	0	0	14	14		
	g. Retired	1	1	0	0	0	0	1	1		
5.	Monthly income									16.894	0.002**
	a. Below 10,000/-	13	13	10	10	5	5	28	28		
	b. 10001-20,000/-	14	14	9	9	3	3	26	26		
	c. Above 20,001/-	0	0	0	0	4	4	4	4		
6.	Residence									18.383	0.001**
	a. Rural	31	31	30	30	5	5	66	66		
	b. Urban sium	8	8	1	1	1	1	10	10		
	c. Urban	6	6	9	9	9	9	24	24		
7.	Family history of cacer									21.121	0.000**
	a. Yes	15	15	28	28	14	14	57	57		
	b. No	30	30	12	12	1	1	43	43		

Table 3 Mean and Standard Deviation on role of diet among cancer patients.

(N=100)

S. No	Variables	Mean	Standard Deviation
1.	General information	2.52	1.28
2.	24 Hours Food Recall	4.26	1.35
3.	Foods to be used during Treatment	2.62	0.94
4.	Foods to be avoided after Treatment	4.31	1.50
5.	Information on special diets	3.30	1.72
	Total	17.01	4.46

4. Discussion

The study objective was to evaluate patients knowledge on role of diet and the results shows that 45(45%) of patients were had inadequate knowledge, 40(40%) had modest knowledge and only 15(15%) were had sufficient knowledge. Khaling Rai Dipaet.al (2017); conducted a study to estimate the successful of self-instructional section on information concerning cancer along with 60 professional students by using simple random technique.

The study results revealed that in pre-test 43(71.67%) had insufficient knowledge, 17(28.33%) had moderate knowledge and none of them had adequate knowledge, whereas in post-test 40 (66.67%) were had adequate knowledge, 20(33.33%) were had moderate knowledge and not any of them had not enough knowledge regarding cancer. Dilip kumar Pal, et.al conducted a study on dietary-induced cancer prevention and recently published that usual carotenoids in the diet lead to normalization of body epithelial cells in oesophageal cancer and improves the immune system response.

5. Conclusion

As there was inadequate level of knowledge on diet, so the cancer patients may need continuous education on type of diet to be consumed during and after therapy. Counselling on diet changes are useful to improve the patient's nutrition.

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12.

NUTRITION AND PSYCHOLOGICAL HEALTH DURING THE PANDEMIC

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Abstract

Millions of individuals worldwide are now impacted by the coronavirus (COVID-19) epidemic. Even though the majority of those who get COVID-19 recover from the illness, there may still be serious health effects (such as organ damage) after recovery. Future illness burden, the use of healthcare services, and cost are all pretentious by this. The COVID-19 pandemic's consequences on socioeconomic level, way of life, and mental health are additional factors that merit consideration. These effects could be a direct result of the virus or existing controls to stop its spread. The virus also negatively affects diet, one of the "pillars" of health that is strongly connected with behaviour and modifiable. Physical and mental health are directly and significantly predicted by dietary behaviour.

Furthermore, research indicates that nutrition plays a significant predictive role in individuals with viral infections, particularly COVID-19. Therefore, nutrition and hydration are crucial components of COVID-19treatment. The virus-related loss of jobs may increase the consumption of low-quality food and cause food insecurity on a local level. As a result of the rising incidence of chronic diseases and mental health issues they are associated with these eventually become a public health hazard. Thus, a thorough examination into the management of nutritional and psychological health, as well as the predictive impact of diet, and related impacts on physical and mental health, may serve to direct present and future clinical and public health initiatives.

Keywords: Nutritional management, COVID-19, Psychological health, Balanced Diet

1. Preface

A good diet before, during and after infection is very important. Infections affect us physically, causing fever; the requirements of additional nutrients and energy are needed by the body. The preservation of the balanced meal/diet at the interim of COVID-19 therefore is very necessary. Although COVID-19 infection cannot be avoided from any food or dietary supplement, maintaining a balanced diet is an essential factor for promoting a good immune system. Countries that have imposed stringent legislation for locking and physically apportionment and also adopted safeguards to maintain food access, and there haven't been any significant food disruptions to date. The United Nations Food and Agriculture Organization (FAO)

and UN organizations contribute best practice to help policymakers maintain secure food supply.

Despite these tough times it is still possible to shop and consume a balanced diet. Diets vary significantly, depending on many factors, including dietary patterns and history. However, with respect to food, we learn a lot about the best balance to maintain a balanced diet anywhere we live. To sustain a balanced diet, FAO urges all in every food class and in every food category to eat a range of foods to ensure that essential nutrients are properly consumed(FAO, 2020).

2. FAO has developed food-based nutritional recommendations and guidance on what constitutes a balanced diet

- Consume fruits and vegetables in abundance. New fruits and vegetables contain a number of vitamins, minerals and fiber for a healthy diet. You may also purchase frozen or dried fruits and vegetables to shorten your excursions to the pharmacy or market in addition to purchasing fresh produce. Vitamins and nutrients are also found in this fruit and vegetable. Nevertheless, other additives, including sugar, salt or preservatives, are also used in the canning and packaging of these products. Read the marks so that you can select the right choices for you and your family to restrict your intake.
- Consume a food that is high in whole grains, nuts or balanced fats like olives, sesame, peanuts or

other fatty acid-containing oils. These diets will help and reduce the immune system.

- Note the oils, sugar and salt you drink. Most people use diet as a safe form of overconsumption in periods of high tension. In comparison, foods that are convenient are also very sweet, because they have a high amount of carbohydrates, fats, salts, and sugars. Seek not to eat excessively many of these ingredients as convenience meals, although whatever you consume. Again, product packaging is important here in order for customers to restrict the pick-up and intake of certain products in a balanced diet in small amounts.
- Keep on practicing good hygiene of food. You may be more worried about the health of food because of COVID-19, but COVID-19 does not have a food-borne illness but is the respiratory virus. Contact with the acquired food cannot reveal the disease.
- To increase food safety, however, it's always a good idea to put the five food safety keys into action:
    - ✓ Maintain cleanliness
    - ✓ Segregation of raw and cooked foods
    - ✓ Efficient cooking
    - ✓ Preservation of food at safe temperatures
    - ✓ Use of safe raw materials and water
- Staying properly hydrated, primarily by drinking lots of regular water (for most adults' 6-8 glasses a day) always supports our defence mechanism. Intake of pure water rather than beverages with added sugar often decreases the likelihood that too

many calories may be eaten in order to sustain a healthier weight.

- Restricted alcohol intake. Alcoholic alcohol is another way that other people want to deal with pain. The nutritional content of these beverages is small, calories are also high and excessive use is connected to several health issues. Many people fear that food will run out of store shelves when keeping a healthy diet throughout the COVID-19 epidemic.
- Supermarkets and significant internet shops make it possible to do this in many locations. It can also be done through community-supported production initiatives, in which small producers are sent to homes in food boxes and directly given to customers. This is also a way to support nearby farms. The Food and Agriculture Organization of the United Nations indicates that the chance of excessive food waste will not lessen by consuming more than your family wants**(FAO, 2020)**.

3. Nutrition management for health workers and patients

To improve the immunological defences against RNA virus infections in afflicted individuals, diet management / treating is very important. There is enough evidence to demonstrate that an inadequate diet will impair the immune response. Therefore, it is important to test for general care the nutritional status of COVID-19 infected patients, also to make adequate dietary and dietetic therapies available before and during and after the administration. It is recommended to use a standard

balanced diet as the basis for the maintenance of every diet. COVID-19 poses signs involving various kinds of treatment of diet. The Diet Treatment recommended below is based on COVID-19 symptoms. Note: These key messages are generic recommendations in diet handling during COVID-19. For individualized treatment, working with a certified and qualified nutritionist is recommended. COVID-19 symptoms with Dietary Implications COVID-19 symptoms vary from moderate to extreme, advanced symptoms. The signs include: Uncomplicated illness: stuffy nose, fever, congestion, headache, and hoarseness; respiratory issues and lung inflammation; Acute respiratory distress syndrome, extreme pneumonia kidney failure and septic shock (Khaled & Benajiba, 2020).

4. Dietary modification for mild signs and symptoms

The signs and symptoms are a runny nose, fever, congestion, headache, and sore throat, and the advice is:

- Make sure to be hydrated by consuming enough water (2 litres minimum per day) especially when suffering from fever.
- The need for more calories increases during a fever: Increase the frequency of your meals to increase the quantity of healthy food you consume. A range of foods, such as those high in energy, fruits, vegetables, milk, legumes and other pulses should be consumed.
- If you're not receiving enough from your food, consider supplementing with supplements of Vitamin A, Vitamin C, Vitamin B6, Vitamin D, Vitamin E, Zinc, Folate, Iron and fiber.

- Get enough rest, manage your stress, exercise, and abstain from alcohol and cigarette use.
- A combination of honey with pineapple or eating chicken soup could be taken to treat cough and congestion; one should gargle to relieve symptoms and wash hands to avoid spreading of bacteria.
- Tea, honey, ginger, turmeric, and sage can all be used to treat sore throats.
- To raise the body's antioxidant levels, it is advised to employ sage, cinnamon, cardamom, oregano or any culinary herb along with consumption of more fruits and well-cooked vegetables.
- Limit consumption of foods high in trans fats and saturated fats. Consuming processed carbohydrates in moderation, avoiding sugar, confectionery, cake, soft drinks, and other liquids with added sugar e.g., shortening, fried meals, fatty meat products, cookies, and pastries, as well as vegetable oils with hydrogenated additives.
- Fluid intake should be based on weight, with an average of 1.5 to 2.0 litres for 40 kg to 60 kg of weight, 2.0 to 2.5 litres for 60 kg to 80 kg, and 2.5 to 3.0 litres for above 80 kgs or 30-35 ml/kg with allowances for additional drain losses(Omar et al., 2020).

5. Management of nutrition in pulmonary disease

Mild, chronic, or acute pneumonia can all be signs of lung disease.

The following are suggestions for nutrition during pulmonary disease

- When you have a sore throat, drink warm water or drinks with honey and lemon
- Keep taking your prescription medication.
- Eat nutrient-dense meals often in little portions.
- Indulge in favourite wholesome meals or snacks. Increase your fruit intake. Supplemental vitamins and minerals may stimulate the appetite and enhance food intake.
- Make sure you consume enough food from each food category.
- The key to preventing muscle atrophy is consuming enough protein.
- 1.2 to 1.7 gms/kg/day of protein should be consumed.
- 30-35 gms of energy/kg/day in cases of dyspnea (shortness of breath).
- Reduce your carbohydrate intake and increase your intake of liquid, room-temperature healthy fats like sunflower, safflower, canola, avocado, and maize oil to meet your energy demands during the difficult breathing period.
- Eat lean meat and eggs as well as a balanced diet to get your protein from a reliable source.
- Provide enough nutrients without going overboard, and refrain from overfeeding. If necessary, cut down on the feeds to 50% of what is

needed, then gradually raise the amount as the patient stabilizes.

- To maintain the energy from food that is released at each meal, include a supply of protein.
- Restrict sugary foods and sweets
- Restrict sugary foods and sweets
- Eat small meals frequently
- Exercise cautiously while keeping the severity of the sickness in mind.
- Individuals who may be deficient in vitamins and minerals or their consumption is insufficient may want to think about taking a multi-micronutrient supplement. Other disorders that are connected to pulmonary illness may impede proper nutrition as the disease advances.
- Increase fruit and vegetable consumption, especially citrus fruits, and leafy greens.
- Drink more warm beverages, such as warm decaffeinated tea and soups with clear broth and those without cream or dairy.
- If you have an allergy or intolerance to a certain meal, this could result in more mucus being produced. Common dietary allergies include eggs, milk, fish, peanuts, almonds, shellfish, wheat, and soy.
- If any of these foods make you sick, stay away from them.

- Histamine is a naturally occurring substance in some meals and eating those foods may increase histamine production. Mucus production may increase if histamine levels in the body rise.
- Vinegar, spinach, dried fruits, tomatoes, mushrooms, avocados, eggplant, cheese, yoghurt, sour cream, smoked fish, buttermilk, sardines, and processed meats like bacon and hot dogs are examples of foods that contain histamine.
- Eat modest, wholesome meals frequently.
- Consider your intake of snacks and dry foods.
- Do not consume food and liquids at the same time. Drink your liquids separately.
- Sit between 45 and 90 degrees to eat, then take a rest before returning to lying down.
- Increase consumption Vitamin C rich fruits and vegetables, such as citrus fruits, and foods high in iron, such as meat and green leafy vegetables.
- Depending on the degree and origin of the anaemia, think about taking supplements.
- Some people with fluid retention need to limit their salt intake and fluid intake. Potassium consumption needs may increase depending on the kind of diuretics administered.
- Parenteral lipids or calorie-dense enteral feedings may be used to help meet energy requirements. Additional Comorbidities When managing a condition, take into account the presence of any additional illnesses including cancer, diabetes mellitus, cardiovascular or renal disease, or cancer.
- Patient complaints of early satiety, anorexia, malaise, bloating, constipation or diarrhoea may be present in those with low oxygen levels.

- Patients who are incubated typically need parenteral or enteral nutrition.
- Reduced mechanical breathing time improves the chance of proper enteral nutrition, which improves clinical outcomes.
- Although aspiration and bacterial overgrowth are worries, the stomach route is recommended.
- Feeding methods that reduce aspiration include continuous feeding as opposed to large bolus feedings, employing smallbore nasogastric tubes instead of stomach-based ones, large bolus feedings, raising the chest to a minimum 45 degrees, routinely checking for gastric residuals, and inflating the cuff of endotracheal tubes are all examples of supportive care. Depending on the severity of the illness, reduce catabolism by making sure you're getting the right amount of nourishment through a healthy diet, parenteral feeding, or enteral feeding.
- Don't overfeed, but make sure you get enough energy of 30–35 kcal/kg/day for patients with normal body weight. For obese patients: 18-20 kcal/kg/day.
- satiate your demands for vitamins, minerals, and protein.
- Determine your hydration needs and keep your electrolyte balance in check. Your oral, enteral, and/or parental nourishment regimen should be planned.
- Immune modifying medications may be hazardous in people with mild and severe sepsis and are therefore not advised.

- After hemodynamic stabilization, in septic patients, early and progressive enteral feeding should be administered. Progressive Parenteral Nutrition should be used in place of Enteral Nutrition if necessary(*Coronavirus*, n.d.WHO, 2020).

6. COVID-19 pandemic heavy toll on psychological health as well

At the end of 2019, the novel corona virus disease emerged and started endangering the health and lives of millions of people. This severe respiratory ailment that spread quickly became pandemic. Dry cough, sore throat, fever, malaise, and exhaustion are the primary symptoms at the moderate stage. Pneumonia can cause acute respiratory distress syndrome (ARDS), multi-organ failure, and even death, although only in extreme situations. The severity of COVID-19 has been directly linked to age and immune-compromised state of the body. The World Health Organization has already released recommendations for treating the issue from both a biological and psychological standpoint. It strongly advises social isolation(*Mental Health*, n.d.WHO, 2022).

Experts advised people to remain self-isolated and un integrated. However, these restrictions would probably have a future impact on mental state. Belonging to a socialized culture that is extremely addicted to social support and social connectedness, it's very difficult to make people understand the importance of such isolation as they are emotionally reluctant. People are not geared for this. They are just at home. It's a perfect storm as we have people in isolation, and this creates a big problem

like loneliness. In that age group, those who experience loneliness had a 29% increased risk of developing coronary artery disease, a 32% increased risk of having a stroke or passing away, and a 40% increased risk of developing dementia. There is a paradoxical consequence, so it's not only psychological; their bodies also start to degrade (Brooks et al., 2020).

Nations all across the world are still taking action to stop the spread of this terrible virus. According to mental health professionals, we must not ignore a problem that is just as serious. The long-term effects that this pandemic will have on society's mental health. A highly traumatic event is coming up. Trauma is something we are aware of, and we know that when it occurs, we will do anything to survive. Our neurological system has a rapid reaction that causes us to quickly enter survival mode when faced with trauma, which may be quite taxing on a person's mental health. In fact, it prevents you from processing what is occurring to you or thinking through Its primary concern is keeping you secure and alive. Many other feelings, such as concern, anxiety, and dread, have been brought on by it.

Nobody can demonstrate an x-ray of anxiety or despair. But the truth is that as this lockdown continues, more people who are already vulnerable become affected, and it seems as though a tipping point will eventually be reached. There will come a day when the lockdown causes so many issues for people that it will eventually result in more destruction and fatalities than the virus itself.People every year die from poverty and this group will be filled up fast as because the economy is collapsing all around us, more and more individuals will eventually sink below it.

The worst conceivable impact on people's life means that this fallout will linger for years. It's true that certain stress can also be beneficial.

A continual and high level of stress can have a detrimental effect on our mental and physical health, but it can also be a motivator that discourages us from washing our hands or practicing self-isolation. While maintaining our mental health is always vital, doing so during a pandemic can be extremely challenging. With all the changes occurring as we fight this pandemic, we shouldn't neglect our mental health. It's simple to feel excessive stress and anxiety. It is true that social withdrawal can result in fewer interpersonal encounters, which makes it more challenging to manage stress, emotions, and anxiety. It is difficult to avoid worrying because doing so is nearly impossible, especially for those who are already afflicted with anxiety and despair. The epidemic can make their symptoms worse. Perplexity, frustration, and post-traumatic stress disorder are among psychological side effects of quarantine (Brooks et al., 2020).

Anxiety arising from the perception of uncontrollable events to some extent could be contained by some controlled actions like -:

- Rising personal hygiene
- Healthy diet
- Exercising (Physical and Mental)
- Have adequate sleep
- Meditation
- Painting
- Composing
- Performing arts

- Learning instruments
- Learning languages
- Knitting
- Gardening
- Cooking
- Reading any books
- Listening to songs
- Watching movies/serials
- Enjoying indoor/outdoor games

or any issue that might be helpful and aids in protecting from stress, anxiety, and panic (Banerjee, 2020).

A big pandemic event would be detrimental to society's and individuals' physical and mental health, for instance:

- Psychological issues
- Sadness and grief
- Loss and grief
- Injury to family members, whether deliberate or not
- Loss of family or family separation
- Guilt
- Self-injury
- Helplessness
- Signs of posttraumatic stress
- Substance abuse or dependence
- A tendency to believe uncontrolled conspiracies and a lack of faith in medicine
- Panic attacks
- Anxiety
- Stress
- Depression
- Shame
- Self-injury

- Self-destructive thoughts
- Mood swings
- Sleep disorders
- Denial
- Boredom
- Feeling of uncertainty
- Frustration
- Anger
- Fear of degradation of socio-economic standings

and many other such physical and mental issues. Resources for management's successful intervention and protective actions for impacted persons would need to be mobilized by a pre-existing coalition. In order to support mental health efforts and provide psychological support to patients, their families, socially isolated persons, and healthcare workers in hospitals, labs, the field, and in quarantine, psychiatric and psychological institutions should be established, supported, and operational (Banerjee, 2020). Concerns have also been raised about the trauma phase of this pandemic, which is what occurs after the physical barriers are removed. what happens when the pandemic is over, and people may resume their regular activities. These are precisely the kinds of risk factors that increase rates of melancholy, anxiety, and even suicide. There may be some lingering stress and depression and learning how to re-engage with the world in this new way will be challenging for many people. The quick spread of the pandemic left no time at all for preparation for everything that has transpired in terms of job losses and the total upheaval of daily life and relationships. Research from the Great Recession of 2008 shows that a 1% increase in unemployment was accompanied by a 1% increase in suicide rates in the US,

demonstrating the close association between indices like unemployment, mental health, and suicides. After the pandemic is finished, there will be a period where, even though we recover from the threat, the problem will still be that, without the correct support structure, returning to the baseline can take much longer than we may anticipate. People may begin to withdraw, experience despair, or seek out other means of avoiding the trauma once the threat has left its immediate area. It has the potential to almost take on an infection of its own. Some people never move from the peak's summit, the valley's base, or any other location in between. Not everyone reverts to the starting point. We begin to worry about mental illness at that point. To ensure that appropriate programmes and therapies are supported, the governments must take action so that everyone who might require it might get access to it (Brooks et al., 2020).

So, for now all we can do is just sit back and wait for it to get over, we can't go back to our normal lives, these changes won't happen overnight, for many it won't be easy to go from 0 to 100 right away, as fears and uncertainties will prevail. We have got to be cognitively active and got to be agile. This really has an adverse effect on people. Rapid efforts are being made to put an end on this deadly pandemic. Resources are being fully utilized. Only by standing strong against all the odds can help us to a complete victory in this battle. All this probably shouldn't have ever started but we just have to realize that there's a light at the end of the tunnel. We need to get out of this and get back to work and avoid major depressive disorder and lead a peaceful life ahead (MD, 2020).

7. Conclusions

The preservation of immune homeostasis during life and re-enforces immunity mechanisms particularly between vulnerable people (elderly, pregnant and child groups) constitutes an important element of nutrition for the development and decrease in immune status. Nutrition help is a medical source and COVID-19/Corona virus infection is avoided with no particular diet or supplement. They also propose that the nutritional quality of the general therapies of contaminated COVID-19 patients should be assessed in the past. When COVID-19 spreads widely, it is important to stick exclusively to infection control and protection protocols to avoid exposure. Home residence is a crucial step towards protection that is able to restrict the spread of pathogens. Daily physical activity and sleep in a stable environment must be kept combating anxiety and depression, which is a technique for healthier living in the corona-virus epidemic. However, the safest way to eliminate infection is the correct and consistent practice of grooming and to avoid contact with others.

8. Conflict of interest

The authors claim to have no conflicts of interest.

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13.

DEASA: SKILL BASED LEARNING SYSTEMS

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Abstract

Skilled manpower should be the direct outcome of university education system in our country. An undergraduate student with training in the experimental, simulation and data analysis techniques is always an asset to the society. The training imparted to students makes them capable of working in other experiments on the national and international stage. Train the students in essential professional and soft skills such as team work, communication skills, leadership skills, time management skills etc inculcate the human values and professional ethics, the spirit of innovation and critical thinking among the students to promote avenues for display of their talents.

The DEASA is an educational array where the students acquire knowledge and skills in astrophysics and learn present data analysis methods. The author has been collaborating with Cosmic Ray Laboratory (CRL), Ooty and the Inter University Accelerator Centre, New Delhi

for achieving the aims of this experiment. The students first studied on Muon Telescope in the laboratory which was build indigenously by their seniors in the department. All students learnt the techniques and then designed, assembled, and worked in Institute coming back from Cosmic Ray Laboratory Ooty. Creating trained, skilled manpower is the way to reach out to the students who work with the present technologies at par with research laboratories in the country. The designing, painting, stand design, aluminum casing assembling, cable layout was done by post-graduate students of the Nuclear Physics Laboratory with the help of B.Sc. first year students. The value-based education at Dayalbagh Educational Institute, www.dei.ac.in has shaped the outcome of this high energy physics mini array. Our Institute works for the lowest, the least, the lost and the last children in society. All the work was done in house and plastic scintillation detectors were assembled in the Nuclear Physics Laboratory, Department of Physics and Computer Science, Faculty of Science, Dayalbagh Educational Institute, Agra.

Keywords: citizen science, outreach, air shower, higher education, electronics.

1. Dayalbagh educational institute: citizen science

Dayalbagh Educational Institute is visioned on its Educational Policy of 1975 given by Revered Param Guru Huzur Prof. Makund Behari Lal Sahab Ji. The four ethos of the Institute **[**Dayalbagh Educational Institute**]** are cooperation, unity, service, and success. The aim of the Institute is innovation, comprehension, and value-based education to all. The goal of our institute is bringing

academic excellence with the relevance to contemporary needs. This shall lead towards a complete man who is truthful, has general knowledge, discharges his duties, sensitive to society and has sound aptitude, simple living, emotionally mature, intellectually strong, scientific temperament, high moral values with an interdisciplinary outlook. With these values the author was funded by the Institute in 2014 to design a muon detector in Figure 1 for students in Nuclear Physics Laboratory, Department of Physics and Computer Science. After the successful completion of this prototype instrument, the second phase was sanctioned for setting up DEASA (Dayalbagh Educational Air Shower Array) indigenously by the undergraduate and post graduate students in the campus.

DEI Education policy 1975 "To bring about physical, intellectual and ethical integration of an individual with a view to evolving a complete man who possesses the basic values of humanism, secularism and democracy and who is capable of giving a fuller response to social and environmental challenges." Community science also called citizen science is an important and legal educational tool through which the people with no scientific skill become involved in the research projects. Modern community science is getting wider coverage with the new technologies like internet, android based phones, human networking resulting in new projects. According to Cosmos [Cosmos Science Magazine, 2022] the citizen science was judged as one of the "seven ideas that are changing the world". This endeavor also helps the researcher in data collection as lot of people get involved and resources are created. This is an opportunity for outreach educational studies where the students from school and citizens learn and develop a scientific

temperament. Citizen or community science involves nonscientific audience into science and research such as monitoring the air shower data, seeing the effects of solar flares, relating cosmic rays' flux to the climate patterns, global climate studies using smart phones etc. Apart from the astrophysical aspects of these projects, these research studies involve a lot of volunteers from the community who educate themselves in STEM fields. The most promising way to get to engage the community in citizen science is through school children as they are our future as shown in Figure 2 and 3. This is being done in our institute, where the schools under DEI are spread all over India including Chandigarh, Madurai, and Kakinada and in Rajaborari, Madhya Pradesh. During the semester breaks, schools are learning with the students through one classroom link to the research laboratories of institute with live interactions and demonstrations. Mostly the audience is from primary and high school that do worksheets, projects in the laboratory with senior students. This is a huge opportunity for researchers with less time, volunteers and a gain in resources and generation of self-development skills. In the table below are details of outreach events in the laboratory since 2012.

S.No.	Activity	Class and students
1.	Postgraduate students visit Cosmic Ray Laboratory, Ooty ,2012	M.Sc. II year, 3
2	Poster and Slogan writing, REI, and PV on National Science Day,2013	X to XII, 25
3.	Summer Camp for R.E.I. and P.V.	XII,100

	students,16 June 23 June 2014	
4.	Winter school for REI and PV from 24 Dec to 31 Dec.,2015 on the Muon Telescope	VI XII , 80
5.	Resource person for International Physics Olympiad, July 4-12,2015, Mumbai	B.Sc., 345 students and teachers.
6.	Resource person for Winter School under networking program of University Grants Commission, New Delhi, Jan 24 to Feb 14, 2016.	B.Sc., 54
7.	Summer Course in Experimental Physics2016, at Homi Bhabha Center for Science Education, May 9 to May20, Mumbai.	B.Sc., 67
8.	Sci-High School,23-30March 2016, 2017, 2018 and 2019.	VII to XII,75
8	Workshop on Muon Telescope May 22-29 May 2019.	XII,44
9.	Workshop on DEASA from May22-25,2022	X-XII,110

2. Atmanirbhar Bharat

The value-based education at Dayalbagh Educational Institute, www.dei.ac.in has shaped the outcome of this high energy physics mini array. The muon telescope is a

telescope to observe the flux of muons entering the detectors placed at different altitudes, angular studies to observe the flux of muons (an elementary particle heavier than electron) with zenith angles. The two paddles were made by three post graduate students by going to Cosmic Ray Laboratory, Ooty, Tamil Nadu These experiments were done by the post graduate students from 2014 – 2022 during their laboratory work, dissertation and then finally teaching to school students from Agra, Delhi and other schools under the DEI umbrella in summer schools. The institute organizes summer, winter schools for students to visit various laboratories and interact in them.

Figure 1.Muon Telescope

Figure 2 School students

Figure 3 Workshop for school students.

The second phase set up was DEASA which was done in-house in Figure 4. The array was set up by 3 post graduate students, one Ph.D. scholar and three UGRA (Undergraduate Research Award) students as seen in **Figure 5**.They had to assemble the detectors (each of dimensions 1m x1m x 2cm) from 4 pieces of 50 cm x50 cm x2cm leading to total eight detectors in the array. The rain cover was designed in laboratory, cut by the mechanical laboratory technical students in the Institute and then welded. This assembly also had a small extension on top of aluminum sheet for photomultiplier tube each. The students cleaned each detector after assembling it, painted inner surface with white TiO2 paint, then sealed the detector, carried to its location, and put on the iron stand. Cable laying was done with help from Construction department in laying 100 m high voltage cable and signal cable for all the eight detectors.

Figure 4 DEASA experiment.

The photomultiplier tubes (PMT's) were fixed to each detector and the PMT base was checked in laboratory and then connected. The designing, painting, stand design, aluminum casing, assembling, cable layout was done by the B.Sc. I year students of the nuclear physics laboratory. These students worked initially in Cosmic Ray Laboratory, Ooty which is a field station of Tata Institute of Fundamental Research, Mumbai, where detector pieces were made all components of the detectors in house. These students in batch of 4 went and learnt the techniques, in two batches, funded by Institute. Apart from technical knowhow, they worked in groups and learnt welding, cutting, grinding, polishing and most important the making of plastic scintillator of 2cm thickness.

3. Community science

Our Institute works for the lowest, the least, the lost and the last child in the society. The students came to the laboratory, through their interest, picked up the topic of muon telescope. The students first studied on Muon Telescope in the laboratory which was built indigenously by their seniors in the department. They visited Cosmic Ray Laboratory, sponsored by T.I.F.R., Mumbai by Prof. Sunil Gupta, Spokesperson of GRAPES3, anational experiment. All the students learnt the techniques and then designed, assembled, and worked in Institute coming back from C.R.L., Ooty as seen in **Figure 5**. Creating trained, skilled manpower is the way to reach out to the students who are sharp minds and hard working.

The plastic scintillation detectors which can detect high energy particles read the energy deposited by a charged

particle and study time behavior of the signal generated. These detectors are low-cost devices tested in the Cosmic Ray Laboratory, Ooty for calibration, uniformity of signal and the block. To do Monte Carlo simulations in this area student were trained on CORSIKA (**CO**smic **R**ay **SI**mulations for **KA**scade) and GEANT4 (**GE**ometry **AN**d **T**racking) software in physics laboratory. These packages are open projects from the Pierre Auger Experiment group in Germany and CERN in Europe respectively. All work has been published in Journals, Book Chapters with students presenting their work in student conferences and international forums.

Figure 5 Undergraduates setting up DEASA detectors in the field.

The university curriculum must be skill-based where the students learn Monte-Carlo simulations and data analysis. The setting up of DEASA has enabled students to learn simulation skills and analysis techniques. Training manpower is an important aspect of teaching in the university: where the scientific Investigation in planning the experiment, setting up the detectorcones, trays and preliminary studies of the detectors are included. Cosmic ray physics experiments include a wide arena: Particle Physics, Astrophysics, Mathematical Analysis, Fast Electronics, Data Analysis Tools, Monte-Carlo Simulation Toolkit. These software's are open and require a lot of detailed study before installing them and latermust be updated regularly according to the various versions and the requirements. The physics involves fundamental leptons and fundamental forces, which are to be carefully studied and defined in these toolkits: based on their energies, the physics process and models change. The Geant4 is a toolkit to define the passage of charged lepton, hadron, or meson in a detector (defined and constructed by the student), track the particle in different regions and then analyzing the information from histograms generated in ROOT. The students learn to create an air shower in CORSIKA and then use ASCII and excel files to analyze the bulk data generated. After simulating in Geant4, CORSIKA and analyzing in ROOT, the student has already acquired multi-dimensional skills and is a trained manpower for bigger experiments in our country LIGO, INO, GRAPES 3 etc.

Figure 6 UG students checking the photomultiplier tube and learning the basics.

Geant4 is a toolkit, which has more applications in medical physics like hadron therapy, ocular cancer, DNA, and space physics. Thus, a student trained in Geant4 can actually pick up many avenues for further research. CORSIKA studies of the simulated data shall train the undergraduate students in software and visualization.

In the UGC quality mandate for document dated 4.6.2018, “1. Improve the graduate outcomes for the

students, so that at least 50 % of them secure access to employment/self-employments or engage themselves in of higher education. “The line of work in this proposal shall surely increase the employability of the students. Train the students in essential professional and soft skills such as teamwork, communication skills, leadership skills, time management skills etc inculcate the human values and professional ethics, the spirit of innovation and critical thinking among the students to promote avenues for display of these talents.” This is again reconfirmed in the New Education Policy 2020.

4. Conclusions

The outcome of DEASA is learning outcome-based curriculum framework and use ICT based learning tools for effective teaching-learning process. To teach the soft skills in high energy physics to students, promoting quality research by faculty and creation of new knowledge. This inculcates team work, communication skills, leadership skills, time management skills etc in the students based on human values and professional ethics, the spirit of innovation and critical thinking among the students to promote avenues for display of these talents. This laboratory made the students think big with very minimum resources and taught the students to present their own papers in Student Conferences. With help of institute, teachers, and students DEASAwas set up for the students. Now this is a laboratory for the studentsby the students as in **Figure 7** withwork ethics including the complete human with resource generation and management. This is a small step towards the vision of our Institute and our country.

In future such mini arrays can be designed in the different Central Universities of our country which can be nodes for future scientific work by students. This will also be a bigger picture in which all different mini arrays can combine their data to see the larger picture of air showers, thus reaching out to supernovas and pulsars. Let the students interact with multi-messengers from the Universe. Cosmic ray physics is an eye-opener of the Universe for the undergraduates and post-graduate students. The DEASA (Dayalbagh Educational Air Shower Array) trains manpower in the field of astrophysics through activities-based workshops, summer, and winter internships. The aim of these activities is to educate the students two-fold: firstly, the undergraduates (UG) work on the experiment at their pace and secondly the post-graduates (PG) carry forward the detailed work.

Figure 7 Peer Learning.

In the workshops the UG and PG students learn the Monte-Carlo simulations in Geant4 and CORSIKA. The author has been collaborating with CRL, Ooty and the Inter University Accelerator Centre, New Delhi for achieving the aims of this experiment. The objectives of the experiment are mainly in accordance with the

GRAPES3, INO, LIGO experimental work as the manpower trained in the laboratory shall be their task force. Secondly the soft skills acquired shall make them employable and better to face the modern world challenges.

The students have worked in space physics, medical physics, and nuclear physics as applications of plastic scintillation detectors **[**Sonali Bhatnagar,2021**].** In space physics the student designed a shield for astronauts from galactic cosmic rays using polyethylene [K. Garg, S. Bhatnagar, 2018]. Different parameters were studied in this work and students learnt about the hazards of energetic particles in space exposures. This is very important for the present studies on Mars. The students were exposed to medical physics through Geant4 simulations of proton therapy, carbon ion therapy for cancer patients[S.N.L. Sirisha, S. Bhatnagar, 2019]. The work was based on different organs and with various age groups of child, teenager, adult, and old human body. In nuclear physics students have studied muon particle, neutrinos [Bhatnagar, S. 2023] and applied them to societal applications like lepton coincident technique [Sonali Bhatnagar, 2021] and muon tomography [K. Garg, S. Bhatnagar 2021]. The alumni of the laboratory are post-doctorate students in Institute of Plasma Research, Ahmedabad, University of Pisa, Italy, Istituto Nazionale di Fisica Nucleare, Pisa, Italy and other research institutes of our country.

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14.

ROLES AND EFFECTS OF SOCIAL MEDIA ON COMMUNITY DEVELOPMENT

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Abstract

In this modern age, social media has developed into a powerful instrument for addressing any public issue, and occasionally people are eager to participate and share their ideas. Social networking websites provide a venue for maintaining existing ties. There is a network of friends, family, and coworkers to communicate with each other's. We have eventually lost touch with but social networking sites help to connect with them. Social media play a crucial role in the growth of an online community because

they provide a platform for the discussion of a wide range of different topics and the process of development is also influenced by social media. Social media formation brings out together various community members to discuss and solve their various issues. A community range can be a big project that involves a big group or a small audience with a modest problem. Social networking sites, such as ***Twitter, WhatSapp, Facebook, LinkedIn, etc***., have a significant impact on the social, economic, educational, and a variety of other sectors in communities. Social media and social networks are now widely used as important community development tools to connect with a large audience, distribute information instantly, enhance communication and forge connections.

Keyword: Community development, digital world, social media, social networking

1. Introduction

The social media is an online platform that people use to create social networks or social relationships with others who have similar hobbies, interests, backgrounds and connections in real life or in their field of work. The term "social media" refers to a group of online communication platforms used for collaboration, sharing, and community-based input. A social networking site or app is a website or software program that enables users to connect with others through online in order to share daily activities, interests in their certain subjects, or widen their social networking.

According to *Boyd and Ellison's (2007)* defined a social networking sites as platforms which let users construct their personal profiles of themselves that include details

like age, location, and interests. In order to communicate information with each other, their personal accounts can be linked with family, friends, and coworkers and through these connections, a network of users is created, allowing everyone with network access to see and communicate with everyone else's profile *(Boyd and Ellison, 2007).*

These platforms provide as online social spaces for communities through chat rooms, forums, and other means. There are websites for dating, friendship, and business, as well as combination of these. Hundreds of millions of people throughout the world, especially young people, have signed up for one social networking site or another to forge new connections and keep the ones they already have.

The U.N. defined the term “Community Development” as suggested that the process by which the efforts of people themselves are united with those of governmental authorities to improve the economic, social and cultural conditions of the communities, to integrate these communities into the life of the nation and to enable them to contribute fully to national progress.”

Using their own initiative or the assistance of governmental organizations, community people are meant by this concept to foster development in their surroundings. According to ***Omale and Epitome (2005),*** there are four essential components of community development. These are as follows:

1. A community effort goes into community development.
2. A response to a perceived need, community development is a self-help movement.

3. It is particularistic and predicated on initiative of the persons involved since it is a self-help endeavor and because it responds to felt needs.
4. It responds to a need that is actually felt.

2. Popular social media websites include

2.1. Facebook

In terms of the total number of users and brand recognition, this is the biggest social media platform on the Internet. Since its founding on February 4, 2004, Facebook has amassed more than 1.59 billion monthly active users, which instantly places it among the greatest platforms for bringing customers from around the world into contact with your organizations.

2.2. Instagram

Instagram is a big platform for visual networking online. Facebook owns this website, which has over 400 million active users. It is used by a large portion of its customers to share information on topics like travel, fashion, food, craftsmanship, and similar ones. The stage is also known for its incredible channels and features for changing videos and photos.

2.3. Twitter

We might believe that limiting the length of our posts to just 140 characters is a bad idea for marketing our company, but we'd be surprised to learn that this social media platform has more than 320 million active monthly users who can make use of the character limit to spread news. San Francisco, California serves as the home of Twitter, which was established on March 21, 2006.

2.4. Google

One of the most well-known social networking platforms today is Google+. Any small firm must use this tool because of its SEO value alone. "*Google* launched on December 15, 2011, and as of December 2015, it had 418 million active users".

2.5. YouTube

The largest and most well-known video-based social networking service, YouTube, was started on February 14, 2005 by three former PayPal workers. Later, Google purchased it in November 2006 for $1.65 billion.

2.6. Snap- chat

"Bobby Murphy, Evan Spiegel, and Reggie Brown" created Snap Chat while they were Stanford University undergraduates as a training tool for image-sharing applications.

2.7. Whatsapp

Whatsapp Messenger is a multi-platform instant messaging app for tablets, smar tphones, and computer. To share files including photos, texts, documents, audio messages, and videos to other users who have the program

installed on their devices, this application needs an Internet connection.

2.8. BizSugar

For entrepreneurs, directors, and visionaries, ***BizSugar*** serves as a direct-to-person communication tool and specialized resource. A maker of award-winning business distributions, DBH Communications, Inc., created the website in 2007. Small Business Trends LLC later acquired it in 2009.

2.9. Delicious

This website was founded in 2003 by ***Peter Gadjokov and Joshua Schechter***, and Yahoo purchased it in 2005. By the end of 2008, Delicious allegedly, it will have acquired more than 5.3 million users and had 180 million URLs bookmarked. Delicious Media announced that it has acquired the administration in January of this year.

3. Roles of social media on community development

Social media play a crucial role for growth of an online community since it provides a forum for all of these discussions. It was difficult to gather a group of people in one place to hear their ideas, but social media has made it possible to use community forums to understand the viewpoints of many people in one place.

Community and social media are two entirely different concepts. Social media facilitates communication between people. Social networking services to connect the groups of friends, family, coworkers, and other people we all talk to on a daily basis.

3.1. Various types of social networking apps

There are numerous sorts of social media platforms active online and you can build your own social networking website. Here, we display the various available social networking websites and online community platforms.

3.2. Platform for sharing media

Users of this kind of platform can share media files like slides, movies, photographs, and documents. This platform also offers editing capabilities, which helps to grow its user base.

3.3. Online review platforms

Online review platforms offer information and feedback to support others. It gathers all the data required to display customer reviews of a product.

3.4. Social networking websites

These websites improve connectivity between individuals. You can use this platform to add your friends and family. Making both your personal and professional websites is beneficial. There are several components to this as well.

- Personal networking websites for individual purpose
- Websites for professionals alone, such as networking ones
- Dating web pages.

3.5. Discussion forums

Discussion forums are a venue for exchanging ideas and interacting with others. It is a place for conversation that is used to find a solution to a specific issue.

3.6. Bookmarking websites

These websites are typically utilized for advertising. You can share your web page link with this portal by saving it. It compiles materials into a personal library.

3.7. Social publishing platforms

These platforms make it easier for both experienced and novice bloggers to upload their work. Additionally, content publishing websites aid in promoting your company online and increasing awareness.

4. Effects of Social Media on Community Development

4.1. Social media effects on medicine and health

Health care providers can interact with the public, disseminate information, promote healthy lifestyles, and connect with clients, students, and coworkers through social media. HCPs can use social media to inform the public about health issues, encourage patients, develop a professional network, and increase personal awareness of news and advancements.

4.1.1. Social media's beneficial effects on health

- Giving prescriptions from doctors to friends, family, and coworkers.
- Online doctor consultations available any time
- Disseminating advice about various diseases and their symptoms among friends, family, and coworkers.
- Information access in underdeveloped areas.

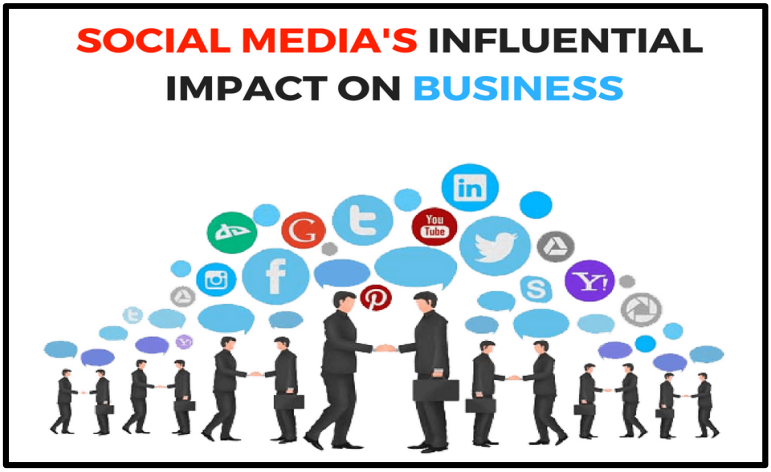
- Mutual accountability and support in online health forums.
- Support for causes involving health.
- Assisting health services with the prioritization of urgent situations.

4.1.2. Negative health impacts of social media

- Inaccurate self-diagnosis
- Potential privacy violation

4.2. Social media and business: its effects

- The newest hot topic in advertising is social media, which includes businesses, associations, and brands that influence partners, form relationships and create communities. Businesses use web-based social networking to improve an organization's performance in a variety of ways, including meeting business goals and increasing the association's annual offerings.



4.2.1. Social media's beneficial effects for business

- Social media assists with global business promotion.
- Social media increases sales and customer retention through trusted connections and favorable client benefits.
- Social media offers enticing user experiences.
- You can get vital information about your rivals by using social media monitoring.
- Share business-related content more quickly and easily with the use of social media.
- By offering a variety of services, social networking sites assist in gaining new clients.

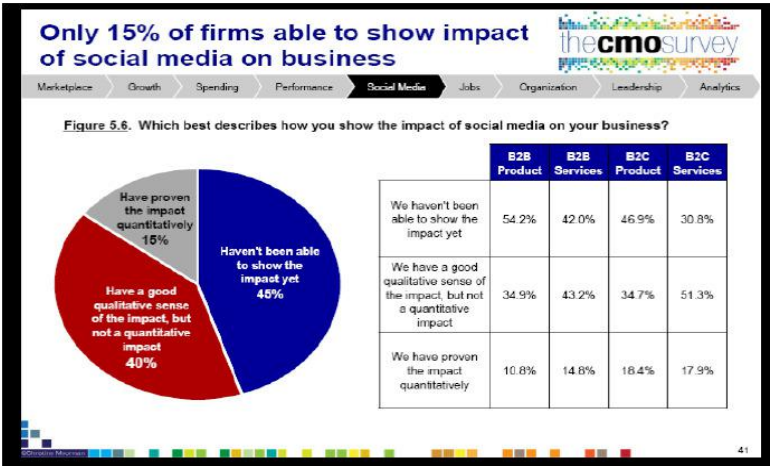
4.2.2. Social media's negative impact on business

- Negative customer reviews are harmful.
- Highly time consuming.

- The web is crowded with more and more content.
- A mistake made on social media is hard to rectify.
- Many of the substantial association have succumbed to the programmers.

4.3. Social media effect on education

The use of social networking technology also makes it possible to communicate ideas with others. Its enables people on other sides of the world to communicate and exchange ideas. Through numerous social networking sites like Facebook, Orkut, and Instagram, among others, students can easily exchange information or communicate with each other using social media.



	B2B Product	B2B Services	B2C Product	B2C Services
We haven't been able to show the impact yet	54.2%	42.0%	46.9%	30.8%
We have a good qualitative sense of the impact, but not a quantitative impact	34.9%	43.2%	34.7%	51.3%
We have proven the impact quantitatively	10.8%	14.8%	18.4%	17.9%

4.3.1. Social media beneficial effects on education

To get successful educational outcomes, one might adopt its benefits.

Socialization: Making friends and socializing are crucial components of growing up. Providing opportunities for

the kids to share ideas and pick up new skills is crucial. They will inevitably become more self-assured as a result of this.

Transferring knowledge: Students can share knowledge in this way in a simple and efficient manner. Students can easily access the knowledge, study it, adapt it as necessary, and share it. Knowledge therefore flows more comfortably.

Refreshing one-self: They will be able to stay informed as new information emerges. They are prompted to update their own unique knowledge base by this.

Using a variety of sources to learn: The long-distance interpersonal communication advancements are designed in such a way that students will be able to choose the group, movement, or person they would like to follow for daily updates.

Readying Oneself: The goal of social networking technologies is to display global trends.

Expressing feelings or thoughts: The appropriate forum for students to express their emotions is usually unavailable. They are offered the opportunity to voice their opinions using social networking technology.

4.3.2. Harmful effect of social media on education

Decreased capacity for learning and research: The information is easily available on these networking sites helpful for most of the students who relied on internet for their learning and study.

Decreased face-to-face interaction: Kids will spend less time engaging with others in person as they spend more

time on these social networking platforms so their capacity for interpersonal interaction suffers as a result due to which they won't be able to interact or communicate properly.

Decreased command over language use and creative writing skills: When communicating with others over great distances, students frequently use slang terms or words that have been truncated and they start off by basing themselves on the PC's grammar and spell-check features.

Waste of time: The use of online networking sites draws students away from their search and focus on the internet, and occasionally they forget why they are using it in the first place.

Lower grades in academic: Due to a lack of the desired writing and informational skills, students receive negative assessments in school.

Lack of motivation: Because of the use of these long-distance interpersonal contact sites, the student's

motivation level declines. Instead of increasing appropriate learning from this current reality, they depend on the virtual mode.

Negative impacts on student health: The excessive usage of these websites has an effect on one's physical and mental wellbeing. Students do not finish their meals on time or get enough sleep.

4.4. Effects of social media on society

We are all aware that social media may have a significant impact on our society. The ways in which people interact and communicate online have altered as a result of some social media platforms.

4.4.1. Social media beneficial effects on society

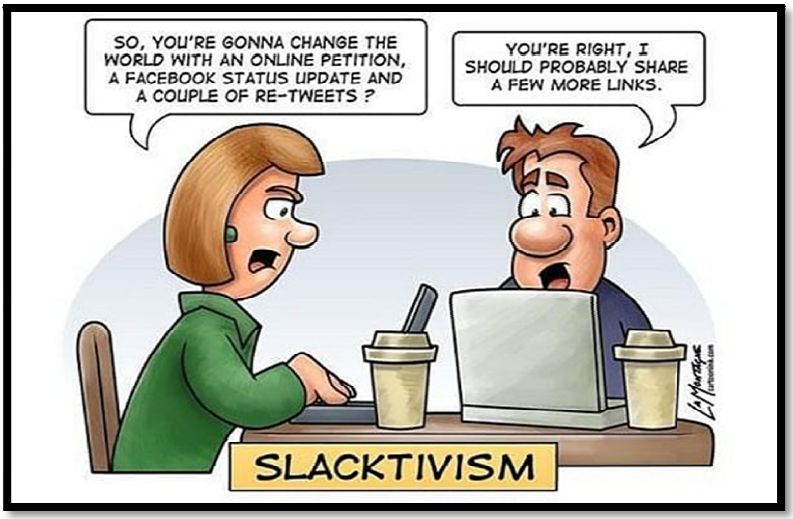
Connectivity: The first and foremost benefit of the social media is connectivity. People from anywhere can connect with anyone. The prettiness of social media is that you can attach with anyone to learn and share your thoughts.

Education: Teachers and students can benefit from social networking in many ways.It is very easy to educate from others who are experts and professionals via the social media. One can follow anyone to learn from him/her and enhance his knowledge about any field.

Help: You can impart your issues to the group to get help and energy. You can seek assistance from the group you are a part of, whether it be in the form of financial assistance or counsel.

Information and updates: The primary favorable position of the web-based social networking is that you refresh yourself from the most recent happenings around on the

planet. More often than not, Television and print media nowadays are one-sided and does not pass on the genuine message.



4.4.2. Harmful effect of social media on society

Social media is now widely used by society, which also faces issues such as depression, anxiety, cyber bullying, irregular sleep patterns, etc.

4.5. Social media's effects on adolescents and children

Teenagers today are greatly influenced by the media. It has a significant impact on every element of a teen's life, whether it is television, computers, video games, or social networking sites. The media is not inherently harmful.

4.5.1. Social media's beneficial effects on children and teenagers

Increased awareness:: Teenagers typically lead secluded lives. However, they can gain knowledge about society

and the outside world by being exposed to a variety of media outlets. Youth can International Journal of Computer Sciences and Engineering with news channels, periodicals, and social networking sites constantly broadcasting global events.

Social skill development: Socially awkwardness is common among teenagers. Additionally, social media increases their chances of growing their network of friends.

Motivating them: Don't merely bemoan the brutality our teen sees in action movies. Teenagers can utilize the movie as inspiration, motivation, and encouragement with only a little supervision! Maybe a Bruce Lee movie may influence our teen to choose to practice in martial arts.

Improve reading and writing skills: Teenagers might be persuaded to pick up a book if a celebrity mentions her favorite novel.

4.5.2. Social media harmful effects on children and teenagers

Unrealistic body image:*:* Today's world is populated by many ideal individuals. The photographs are spread widely thanks to Photoshop and cause many youngsters to have erroneous body images. A result of this body image crises are anorexia and bulimia.

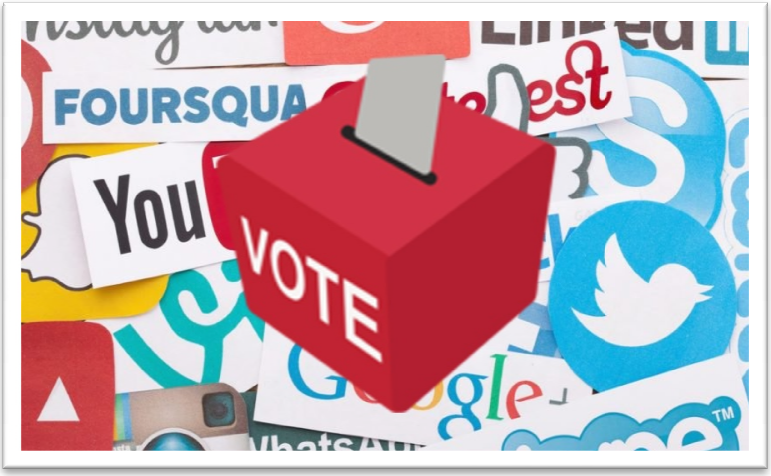
Sexually dangerous practices: Just discovering their sexuality, young folks. Being preoccupied with everything sexual is really common among them. An adolescent, however, could be confused by how sex is shown in today's media.

Low academic performance:: Teenagers who watch much television perform worse on tests. According to a study, people with high degree scores watch less television as children and teenagers.

4.5.3. Managing social media's impact on children and teenagers:

The following are some strategies for reducing social media's impact on teenagers:

- Check out the media your youngster enjoys, including music, movies, TV shows, games, and celebrities. When we are aware of their interests, we can recognize the images and messages that are having an impact on them.
- It is quite simple for our teenagers to view YouTube videos on their phones, making it possible that we may not know what he is seeing. In an effort to set some boundaries and regulations, parents should try to keep an eye on what their adolescent is watching on TV or the internet.
- Discussing messaging with the kids is one of the best ways to assist them in navigating the media's influences. We can discuss female friendships, lifestyle choices, self-esteem, and sexuality with the teen, for instance, if they enjoy hanging out with girls.
- We do not have to forbid teens from watching media if we are observing their choices. They are merely being made aware of the harmful influences.



4.6. Social media's effect on politics

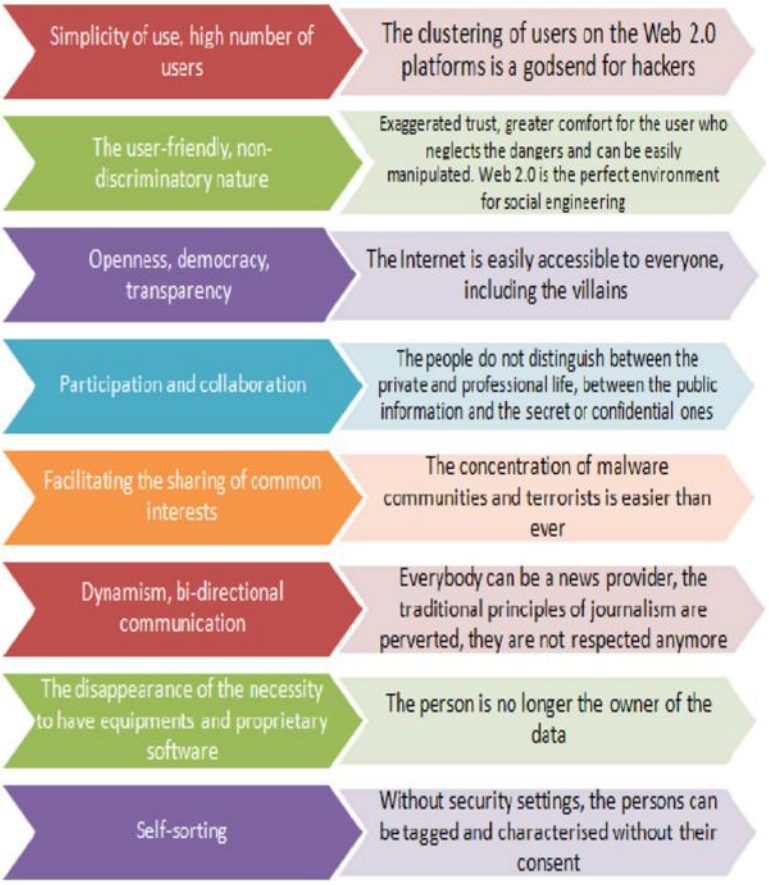
One in five Americans, according to a recent Pew Research poll, get their political news mostly from social media. Additionally, the survey shows that those who primarily rely on social media for their political news are frequently less informed and more likely to encounter unsubstantiated allegations than people who get their news from traditional sources

5. Social media's challenges

It might be challenging to determine the long-term positive and negative effects of social media because it is a relatively newer technology.

Worry that one will miss out (FOMO)

Regular use of social media sites can make you reliant on checking out what others are doing. FOMO is a negative belief that other people are experiencing better times or lives than you.



Online bullying

Teenagers feel the drive to outperform others, blend in, and be popular. Even before social media, this procedure was difficult. Teenagers are suddenly under pressure to mature too quickly in an online environment as a result of Facebook, Twitter, Snap-chat, and Instagram.

Privacy invasion

Social media users run the risk of being stalked, having their identities stolen, getting attacked personally, and

having their information misused. Users are typically at fault, since they divulge information that shouldn't be made public.

6. Benefits of social media

Connectivity

Connectivity is one of social media's key benefits. Anywhere, at any time, a lot of users can connect. Human engagement may be facilitated by social media's connectivity and capacity to transmit knowledge globally.

Education

Social media usage in the classroom is admirable. Students and teachers can sign up for international collaboration platforms to promote positive learning. By promoting knowledge and creativity, it also aids in skill enhancement.

Awareness

Social media has helped people become more aware. It acts as a conduit for information, opening the door for innovation and success by enhancing their skills and expertise.

Share anything each other

Social media is the finest medium for sharing anything, including songs, poems, and works of art, sumptuous desserts, and other things. Anyone may use the platform to let their creativity shine, and millions of people will see it and appreciate it.

Helps in building communities

Live in a diverse culture where people from different ancestries, religions, and backgrounds coexist. Social media unites these people on a shared platform and facilitates their interaction.

Noble cause

Social media can be used to promote good deeds. It is perfect instrument for supporting causes, such as sending money to cancer patients who need it for treatment.

Mental health

Social networking is an excellent stress-reduction tool. People fighting stress, depression, and loneliness can get assistance from a variety of groups.

7. Benefits of social media for businesses

Brand reputation

Social media improves company relationships by fostering user goodwill; its promotion increases sales, which in turn increases profitability.

Brand knowledge

Networking sites help brands become more well-known. Users are drawn to visually appealing content and products, which promotes brand awareness and increases consumer knowledge of certain products and services.

Customer interaction

Social media improves client involvement by offering products and services and asking for feedback on them. Users from different communities provide different

opinions and suggestions, which might help to please them and improve areas of focus.

Promotion

Social media plays an important role in online marketing and commerce. Posts and promotions let users engage with each other effectively and increase a business's revenue.

8. Negative aspects of social media

Impacts social-emotional connection

Social media hampers emotional bonds. Everything is conveyed through texts digitally, which can stunt expressions.

Reduces the ability to think quickly

Due to the decrease in face-to-face encounters and communication, quick wit is becoming less common. People's sense of humor, capacity for enjoyment, and ability to have fun have all been negatively impacted by the detrimental effects of social media on people's mental health.

Affecting someone's emotions in a negative way

People that communicate on social media are apathetic and do not blink an eye when they need to injure someone.

Existing physically but not mentally

When spending time with one another, it's critical to be "present" and in the moment. When friends and family get together, create memories by chatting to one another about the past, present, and future.

Insufficient compassion and understanding

Words and voices can be used to transmit feelings, but in order to do so successfully, one must be physically present in front of the other person.

Inadequate time with family

Simply because families cannot spend quality time together, social media has led to many relationships being strained. Family time has suffered as "me" and privacy have taken primacy (due to the quality of texts that appear on social media).

Virtual aggression

People, especially children, have fallen prey to cyber bullying because they are readily captured by threats, scams, and other undesirable behaviors. Fake news and rumors easily spread, resulting in depression and suicide.

Hacking

Social media's openness has also made it clear how simple it is to collect personal information about individuals. In order to prevent such situations, privacy settings must be updated frequently and profiles must be locked.

Thinking on the move

Spontaneous behavior is displayed on social media. The urge to continuously check your phone for new messages, notifications, and updates can be distracting.

Cheating and relationship issues

Social networking is now being used by individuals as a platform for dating and marriage. However, there's a good risk that the information on the site is fraudulent, which

could ultimately result in a destructive relationship or even divorce.

9. Conclusions

Social media is beneficial for community development and plays a significant role in educational advancement, health advancement, raising community awareness, and social, economic, and communication skill improvement. However, there are some common problems related with social media, such as hacking problems, leaks of personal information, not give enough time to their families, raising stress levels, and negatively affecting children's physical and mental health. Web-based social networking has been ingrained in everyone's daily life as technology advances, and organizations are frequently viewed to be dependent on it. Last but not least, all citizens are urged to embrace social media's positive elements and steer clear of its harmful ones.

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15.

SPIRITUAL DEVELOPMENT

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Abstract

From I to Us. From Myself to Ourselves. From Darkness to Light. From Hatred to Love. From low vibration to high vibration but ultimately through "DIVINE". The journey of the soul towards True Happiness. Living like a saint, unattached from worldly things from the inside but from the outside living in this materialistic world. Hence, maintaining a balance between the two becomes very essential. Spiritual development usually arises from pain and sufferings and thus increases your awareness to make you capable of merging your soul into the Divine. Spiritual development helps in removing the illusion called 'MAYA'. Spiritual development gives you wings for doing your best in this materialistic world and on the other hand materialistic world provides you with suffering and lessons for your spiritual development. Understanding the pain of others is a very painful yet beautiful and blissful phenomenon as it keeps you moving in the direction of true happiness, your ultimate goal. Each human being goes through it whether consciously or unconsciously. Sometimes you don't understand what you are going

through, or why you are going through but all this happens for your ultimate good, you just need to keep your faith high in your difficult times. Greatly said, everything happens for a reason. When you go through the path of suffering, then only you become capable of understanding the pain of others, making you sensitive and ultimately the innocent being, removing all your lower vibration and maintaining the aura of higher vibration and becoming one with all, creating the stage of ONENESS. Spiritual development helps to live life to the fullest. Every living being is a seed of god and understanding the pain of others is like understanding the pain of god. The spiritual development mission is to make heaven on earth for all of you so that you remain in a state that you have never felt before. Sprinkle wisdom and love with each breath.

Keywords: Spiritual Development, Spirituality, Soul, Awareness.

1. Introduction

Spiritual Development is the development of the soul, increased awareness, and journey of the soul to find its truest form. It is a broad concept that points out an inward journey. A process that has been continuing for successive births. It is like going back home, you were waiting to reach it for many years, some people are far away from their house, some are nearby, and some are in the middle while some have already reached, on the basis of their development. (Spiritual Development, 2022)

The term that is constantly ringing around this topic is spirituality. For each individual, the meaning of this term is different. Spirituality means finding your authentic self, the truest form that has been calling you since your origin.

That inner voice, soul, light, divine relationship that you all have. Some people associate it with religion, some consider it beyond religion. Some people may think that you should become spiritual in old age, some think it is a young age process but in my opinion, you are not with spirituality, but spirituality is with you from your origin itself. (Winfrey, 2017)

All are spiritual beings, but people usually feel after some evolution, the soul begins to realize its origin, and then it all makes sense. The secret of this life begins to unfold.

In this article, you will explore spiritual development and its stages from a broader perspective.

2. Phases of spiritual development

Spiritual development can be divided into several phases of life as it is different for each person because everyone has different experiences. From a broader perspective, it can be divided into three major phases.

1) Suffering

2) Realization

3) Love

2.1. Suffering

Suffering contributes immensely in the development of the soul. It acts as a trigger so that you can look within and can find the ultimate truth The Absolute Reality. Sufferings are a very critical part of one's spiritual development as it awakens you. It made you capable of understandings things at a wider scale. It increases your

awareness. Some lessons are only learned when you go through that path. Path of pain, suffering, sorrow, and grief is very painful, but it keeps you moving in the direction of Absolute Reality.

Regardless of gender, color, caste, or sex you all go through the path of suffering. Your bad time, as you usually say, is when you go through serious medical issues, toxic relationships, toxic family environment, trauma, tragedy, or any kind of pain that drives you to dive into the pain of ocean. (Spiritual Suffering: Why Spiritually Evolved People Suffer More, 2016)

During this phase, you don't understand what is happening to you? Why life always serves salt on your plate? For all this sufferings you are here, you do all the good things in life, but in the end, you are the one who suffers the most. It is the most difficult phase of one's spiritual development as the person is unaware of what is happening? Why is this happening? How to deal with it? An infinite number of questions arise in your mind, it seems like you are in a trap.

At this stage, people usually live in low vibrations such as greed, hatred, jealousy, anger, self-sabotage, etc. Inability to understand others, ego dominates at this stage, selfishness etc. are common traits found in the individual. The burden of negative thoughts is high in proportion, and the ray of hope is minimal at this stage. The soul feels immense suffering, pain and misery.

Physical symptoms also begin to appear because there is no peace within. People start indulging in bad habits, addiction, and various other activities that are harmful to you as well as to the society. The world is full of sorrows.

People continue to meet their physical needs. If the need is met, they look for another need. And if that need is not met, they easily get upset. (Hurst, 2022)

After suffering the same and same, the soul begins to realize that this life is much more than fulfilling your physical needs. There is some divine energy that is responsible for the whole creation. People start indulging themselves in religious activities. Religion helps to connect to divine forces. People start doing good deeds through religious leaders (gurus). (Winfrey, 2017)

2.2. Realization

Realization means being aware and understanding things more deeply. After suffering, you gradually become aware of this world. The whole scenario seems to change. Your perception regarding people, situation, and sufferings shifts. You become more and more adaptive in this world and human nature. With each realization and lesson learned, transformation takes place.

Transformation of moving yourself from darkness to light, I to Us, hate to love, low vibration to high vibration, myself to ourselves. It seems you just had a lack of understanding, lack of realization and lack of awareness. The root cause of pain automatically begins to appear in front of you. As awareness increases, it will begin to reflect in your attitude, you feel more grounded, humble, passionate, integrated, acceptable, joyful, peaceful, simple, and powerful. (Winfrey, 2017)

People with low awareness live in this world with lower vibrations such as hatred, greed, fear, anger, worry, complaining, argumentative, shame, guilt, sadness, anxiety, and self-sabotage, while people with higher

awareness spend most of their time in higher vibrations like gratitude, love, compassion, peace, patience, forgiveness, understanding, intuitive. People who are in a phase of suffering are not fighting with the world but actually with themselves. (Hurst, 2022)

As you become more aware, you also begin to understand your inner world, which is infinite, more than this external world. Spiritual development is more of an inner journey than an external journey. Journey of the self to true self. The true self has been calling you from our origin but due to lack of awareness, you were not able to reach it. The mystery of life begins to unfold in front of you.

All the things that you realize now, were already in place. It is just that you were not capable of realizing it. Sometimes you say your life has changed completely, but in reality, it's your inner world that has changed, hence your outer world. This means that your inner world is the reflection of your outer world. Now, there is no doubt in saying that your inner world controls your outer world. You do not become part of the crowd, but you are the one for whom the crowd has gathered.

The realization that we all are interconnected; we all are part of god. (Winfrey, 2017)

2.3. Love

The ultimate magic of this universe. It is that sacred thread which is connecting all of us. Each living being possesses it as well as needs it. Love is the magic that gives meaning to life, gives purpose to the soul, and reason for the whole existence. It is that force which keeps you moving otherwise, you remain stable. It brings out strength,

kindness, courage, and hope. Furthermore, it has the power of transformation. It turns devil to angel, dark to light and bad to good.

There are many definitions of love that you can find around the world. Loving someone means being with them wholeheartedly regardless of their situation. It can be easily understood by mother's love. She lives for her child. She works day and night, without any leave. Not only that, but she loves her child in any condition.

At this phase, you realize the purpose of your soul, and you begin to act in that particular area of interest. By this, you can illuminate many souls and can become a light worker. Now, you have the ability to increase the consciousness of the earth, to increase the vibrations of the earth. It becomes quite easy to follow and achieve your dreams as you are on high vibrations.

You align yourself with the universe, cosmic energy. When you radiate love, you automatically receive it. The vibes you are putting into this universe, eventually, come to you. So, choose wisely at which frequency you are vibrating. (Winfrey, 2017)

As god is present in every atom of the universe, you start loving everything in this universe. You begin to feel like heaven on earth. Everything seems beautiful and blissful. The happiness of others feels like your God is blissful, on the other hand, if others are in pain you feel like your God is in pain. People who will come in contact with you will automatically become better person as their consciousness begins to expand. You now become the light that is spreading love in all directions.

At this phase, you have attained the stage of oneness. The stage that all want in their life for unknown years. Oneness means feeling connected with everything. When everything is yours, the thought of me and your vanishes. We all are one. The part of the Divine. (Winfrey, 2017)

3. Impact of spiritual development in material world.

The impact of spiritual development is very crucial in a material world. Physical needs are endless and demand a lot of courage at each step of success. Spiritual development teaches you how to live in this world with fewer desires. It helps you to maintain a state of success in this material world as it keeps negative emotions away from you which are the main cause of the collapse. Connection with an inner self is highly stronger and nobody can break it easily because it is a connection with your own self. Spiritual development helps you find the true happiness that is hidden within yourself. To find out true happiness, you have to remove various layers that are covering it. It helps you to reach the goal of your inner calling. Therefore, spiritual development plays a major role in the development of human beings as outer world is the reflection of your inner world.

4. Conclusions

Spiritual development is a continuous development right from the origin of our soul. People start realizing it after a certain time period, after reaching some level of awareness. This inner development plays a very crucial part in the development of one’s external world. The external world is a reflection of one's inner world. This article lays emphasis on three major phases of one’s

spiritual development namely Suffering, Realization and Love. Love has all the healing powers of this universe. It is the reason for the whole existence. It is beautiful and blissful state. All the mysteries of this life begin to unfold at the right time and at the right level of awareness.

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16.

FOOD SECURITY

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Abstract

Food security can be described as the medium of attainability of food and the capability of an individual to approach it. The United Nations' Committee on World Food Security, states food security as the medium that every single person, at every times are considered to have physical, communal and financial approach to adequate, secure and nutrients rich food, which meets up with their dietary requirements and food choices for an deedful and flourishing life". The fundamental concept of food security takes the approach to healthy food and optimum nutrition for all. Currently, India States the greatest figure of underfed people in the world i.e., about 19.5 crore approximately 4 out of 10 children in India don't get their full human potential because of lingering underfed or impaired growth and development. In India, the farm producibility is very short.

Keywords: food security, food insecurity, underfed, human well-being and nutrition security.

1. Introduction to food security

Food security is the state of having physical, communal and financial approach to adequate, secure and nutrient rich food which meets up with their nutritional requirements and food choices for a vital and flourishing life. FAO 2002. The State of Food Insecurity in the World 2001. Rome.

1.1. What is food insecurity?

Food insecurity means people don't have substantial physical, communal and financial approach to food for usual extension and evolution and a vital and flourishing life. This probably due to inaccessibility of food and/or lack of resources to attain food.

The Department of Agriculture describes food insecurity as "confined or volatile attainability of nutritionally sufficient and secure food or confined or voletile aptitude to get eligible food in socially admissible ways."

"Food Security in the U.S." Economic Research Service. Retrieved 15 December 2013.

1.2. Dimensions of food security

Availability: we can say that it is merely the food that exists within a group. Availability is nearly related to the capacity of "food" manufacturing and food coming-in. The availability of food is impossible if there are not enough resources within easy reach for that, for instance, if there is no availability of water, then the manufacture of food would be challenging.

Access: It can be defined as an individual's access to the food. Food access is that every single person who needs a nutrient rich diet will be able to carrying out his

requirements. The true food approachability will be possible when even the low paid people have approach to it. Accessibility of food can be influenced a lot by communal and governmental issues. Factors including geographic state and cost can seriously influence food accessibility.

Utilization: Food security and utilization do not include only food in its focus. But it means the "nutrient" rich food. The food to intake for every single person should be of high quality. It is very crucial that food should be flourishing so that all distinct person can obtain sufficient nutrients from the food.

Stability: It involves the components of food access, availability and utilization. It can be state as the situation where each of three mentioned conditions should be completed. Stability can be described as the easy approach and attainability of food to all distinct persons. Short durability of food can be dreadful in the community.

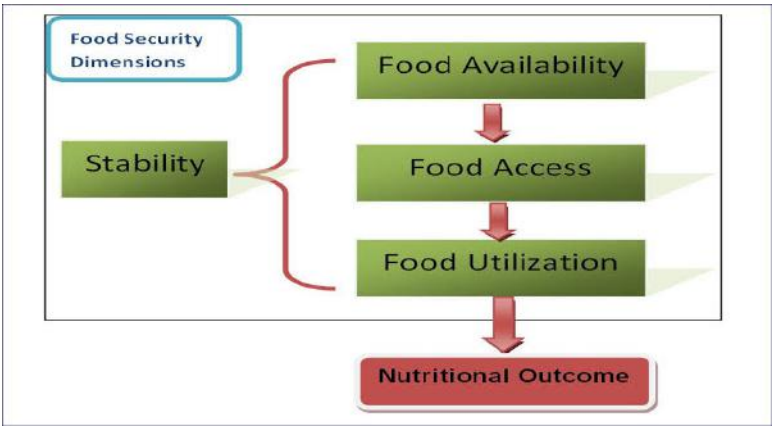

Fig: 1. The dimensions of food security (Source-https://www.foodandenvironment.com/2013/01/basic-concept-of-food-security).

2. Food and nutrition security at various levels

"Food security, at the different levels such as individual, household, national, regional and global levels is reached when every single person, at every times are considered to have physical and financial approach to adequate, secure and nutrients rich food to meet their dietary requirements and food choices for an deedful and flourishing life". FAO. 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit 13-17 November 1996. Rome.

3. Food security in India

In India, food security has been a major concern since long ago. It mentions to making sure that sufficient food should be provided to all individuals, especially those are not get basic nutrition. According to UN-India, India States the greatest figure of underfed people in the world i.e., about 19.5 crore underfed people, which is one third of the world's hunger table. Also, approximately 43% of children in India are persistently underfed.

"Nutrition and Food Security – UN India". *UN India*. Retrieved 5 January 2018.

4. Challenges to food security

- **Weather Changes:** Because of high degrees and undependable rain agriculture become challenging. The weather change not only affects harvest production but also affect cattle stock, trees and sea-foods, and it can cause serious communal, and financial outcomes in the aspect of diminished

wages, eroded liveliness, business break-down and unfavorable health outcomes.

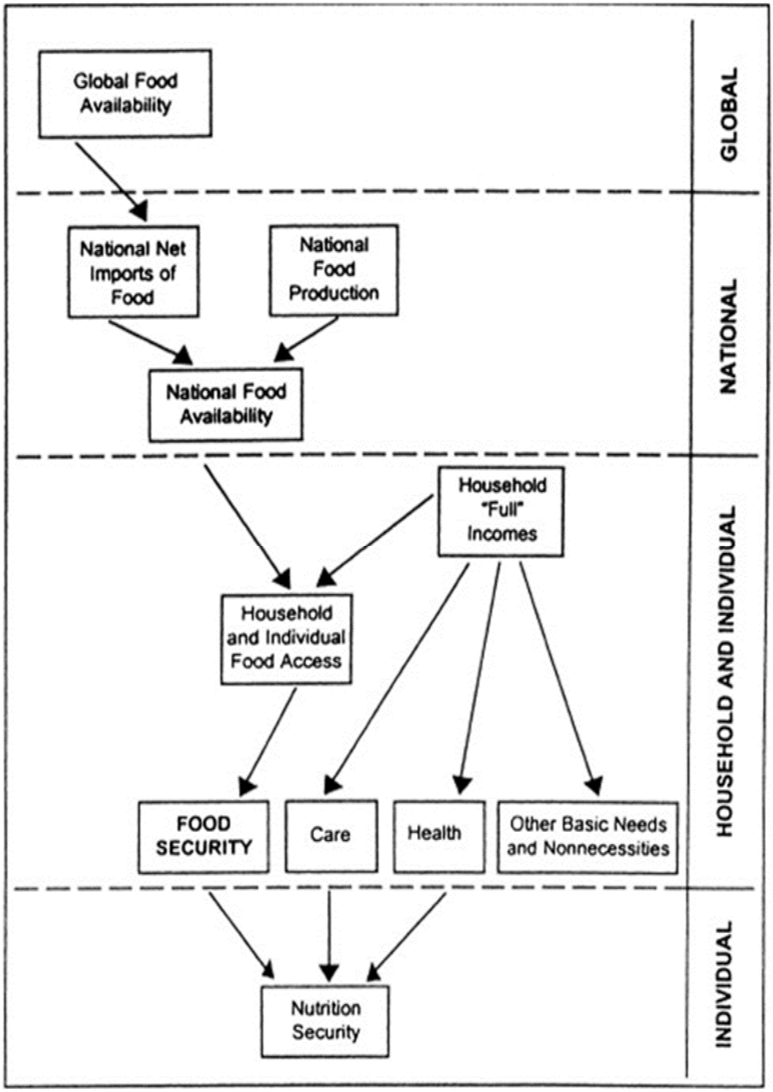

Fig: 2. Food and nutrition security at various levels (Source - ScienceDirect.com)

- **Conflict:** The food can be practiced as a tool against the enemies by stops their food supplies to take their land. Harvest can also be harmed during the clash.
- Over-population, illiteracy, indigence, shortage of instructions and sexual dissimilarity.
- Insufficient dispensation of food via popular dispensation appliances (PDS i.e., Public Distribution System).
- Uncontrolled nutrition programmes.
- Lack of compatible food and nutrition schemes.
- Corruption.

5. Recent government initiatives

5.1. National food security mission

- This scheme was started in 2007. It is a Centrally funded scheme. The focus of this scheme is to enhance the manufacture of food grains and trade harvest, by increasing the area and improvement in fertility.
- This scheme works for re-establishing the soil producibility at the personal field scale and improving field scale wealth.
- It also focuses to boost the handiness of vegetable oils and to decrease the importation of edible oils.

5.2. Rashtriya krishi vikas yojana (RKVY)

- This scheme was started in 2007, and altered into a Centrally funded Scheme in 2014-2015 with 100% central aid.

- The states are granted to be the owner of their farming and associated zone evolution project according to the district/state agriculture plan.

Objectives: The objectives of this scheme are:

- To make farming a money-making activity to give strength to the farmers for their efforts.
- Chance reduction.
- Upgrading farming industrialism.
- The focus is on pre &post-crop framework and also upgrading agriculture industry and modernity. .

5.3. Integrated schemes on oilseeds, pulses, palm oil and maize (ISOPOM)

5.4. Pradhan mantri fasal bima yojana

5.5. E-marketplace

It is an electronic national agriculture market (eNAM). The government has formed it to link each controlled wholesale manufacture markets via a pan India trading portal.

5.6. Anganwadi systems

The Anganwadi system is also started by the government to conferration to pregnant women and lactating mothers below the poverty line, to give **food grain** via a public distribution system.

5.7. The National food security act (NFSA), 2013

This act is started to give food grains to the rural and urban population at the low cost, the ration provided to rural population is 75% and for the urban population it is 50% under the Targeted Public Distribution System. Under this

act, the head of the household is instructed to issuing the ration card.

"Food Security in India. (n.d.)".*as per Economic Survey (2018-2019)*, Retrieved fromhttps://www.drishtiias.com/printpdf/food-security-1

6. Public sector programmes for improving food and nutrition security

- Public Distribution System (PDS) and the Targeted Public Distribution System (TPDS),
- Antyodaya Anna Yojana (AAY),
- Annapurna Scheme
- National Food for Work Programme (NFFWB) public distribution system:

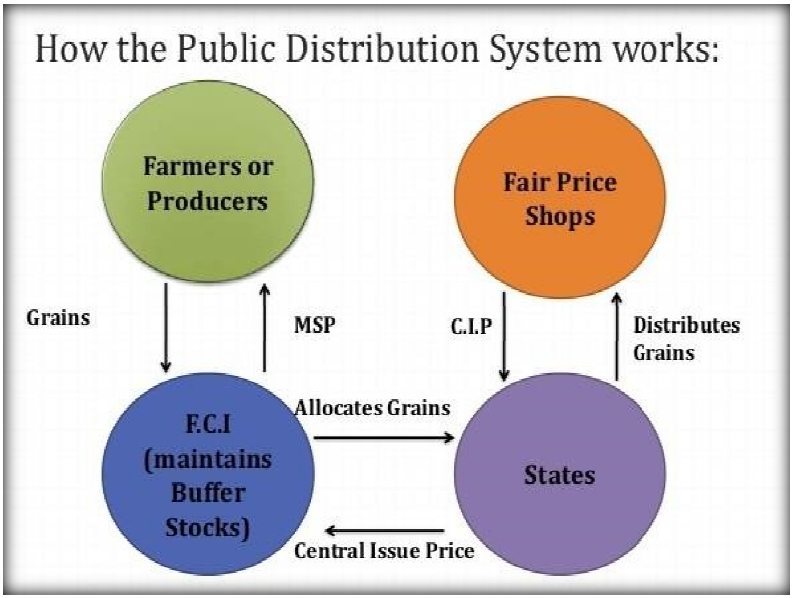

Fig: 3. Functioning of Public Distribution System (PDS) in India (Source – IAS EXPRESS)

6.1. Public Distribution System (PDS)

PDS is an Indian food Security System formed under the Ministry of Consumer Affairs, Food, and Public Distribution. It works to manage scarcity via the dispensation of food grains at reasonable rates. It is controlled by the Central and State Governments. PDS keeps the safeguard of food materials in the storehouse so that the motion of food be left over deedful even during the time of smaller farm food producibility.

Under the PDS, presently the assets provided by the States/UTs are namely wheat, rice, sugar and kerosene for the dispensation. Some States/UTs also provide extra food materials such as pulses, edible oils, iodized salt, spices, etc. through the PDS outlets

6.2. Targeted public distribution system

Indian government started the Targeted Public Distribution System (TPDS) in June, 1997. The main attention of the targeted public distribution system is on those who have not money to take sufficient food.

The scheme is proposed to advantage around 6 crore poor families and 72 lakh tonnes, food grains was reserved to provide yearly. The dispensation of food materials to the States was formed on the groundwork of the average expenditure in the past.

The beneficiaries of this system are :households below the poverty line and households above the poverty line.

In 1997, 10 kg to 35 kg ration per month has been provided to BPL households. The level of the issue was upgraded from 10 kg to 20 kg per month in 2000. The allotment for APL households has been prevented as the

equal scale as at the period of introduction of TPDS. The allotment of food materials for BPL households has been carry forwarded from 20 Kg to 25 Kg/month from July, 2001.

6.3. Antyodaya Anna Yojana

This scheme was started in December, 2000 to provide benefits to 1 crore poor families. The key purpose of this scheme is to confer food, for poor families and to reduce hunger among the below poverty line population. Approximately, 5% population of India sleep without having one meal in a day so the target of this scheme is to provide sufficient food for poor families.

At the beginning the families are provided 25 kg per month that was extended with influence from 1st April 2002 to 35 kg/ month.

This Scheme was extended in 2003-2004 to cover 2.50 crore poor households by linking another 50 lakh BPL families. Which includes helpmate ladies, ill or disabled people, old age people and those who haven't societal support.

6.4. Annapurna scheme

This scheme focus at giving food security for elderly citizens. It targets at fulfilling the food requirements of the old age persons who are also eligible for the National Old Age Pension Scheme. Under this scheme, the beneficiary will get10 kg food grains per month. However, the number of people who will be benefitted under this scheme will be for example, 20% of the total people who are qualified to get a pension under the National Old Age Pension Scheme in all the states and Union Territories.

6.4.1. Eligibility

- The beneficiary must qualify these following terms to be eligible for the scheme:
- The age of the person benefitted must be 65 years old or above.
- The Candidates should be "Poor" which means that they should not be getting a small or No usual mode of survival of their personal resource of earnings or by financial help from any family member or other resources.
- To decide hardship, the criteria now are in force in the states or union territories can also be pursued.
- The applicant must not be a receipting of pension schemes under the NOAPS or the State Pension Scheme.

6.5. National food for work programme (NFFWP)

- This scheme was started to provide extra resources except the mode extant under the Sampoorna Grameen Rozgar Yojana (SGRY) to 150 extreme behind of the country so that the generation of complementary income job and provide food security.
- This scheme distributes food grains as part of income, it is the main objective of this programme. It is founded on the maxim of protecting the actual income of the workers apart from enhancing the nutritional norms of the households of the rural poorer.
- Under the scheme, the dispensation of food grains are part of income to the rural poor at the rate of 5 Kg per Monday.

- In exceptional concerns extra food grains can be provided to the workers "National Nutrition Programs". (n.d.). *NUTRITION POLICY AND PROGRAMMES* pdf. Retrieved 2020

7. Steps to be taken to ensure food security

- To ensure food security healthier food storage strategies should be taken into practice.
- It can also be ensured by the Blue Revolution for ex. Sea, lakes and rivers can be used to attain food and nutrition security. Sea foods like fishes are considered as a rich source of protein and it doesn't need the appropriate soil.
- Biotechnology and suitable techniques can be used to produce crops.
- Food security can also be ensured by providing education to the local community on digital household well-being and nutrition practices.
- In India, collaborative performs an important part in food security, mainly in the south and west section of the country. Collaborative communities place the shops to trade little cost materials to poor people. Collaborative should be inspired of doing so. "Food Security in India. (n.d.)", *as per Economic Survey (2018-19),* Retrieved from https://www.drishtiias.com/printpdf/food-security-1

8. Conclusions

A family is mentioned to be food secure when their all members has the proper approach to food require for a flourishing life and when there is not any kind of harm to damage such approach. The food should be sufficient and

safe in terms of the standard, amount, and well-being. People who have reach to enough food do not experience hunger or the threat of starving.

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