Action Research on Advocating Use of Fortified Foods amongst the parents of the students studying in the Faculty of Family and Community using Diffusion of Innovation Model

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The Requirements for the Degree of
Doctor of Philosophy (Foods and Nutrition)

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Certificate

This is to certify that the contents of the thesis entitled 'Action ***Research on Advocating Use of Fortified Foods amongst the parents of the students studying in the Faculty of Family and Community using Diffusion of Innovation Model'***

has been carried out independently by Ms. Ria Ahuja in pursuit of a Doctoral degree in Foods and Nutrition and represents her original work.

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Acknowledgment

Finally, I am here- the voyage seems worthwhile ☺☺

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If you work on something a little bit every day, you end up with something that is massive.

– Kenneth Goldsmith

For the love and respect of the degree of Philosophy

'*You are not just the paper but a complete chapter of my life*

I have lost people and patience, during the hard years but for you, I strived

Holding you in my hand, was always a dream

Completing those ROL chapters is what I can recall going down the stream

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It was the time when food was on the table and I was stuck on the computer with glue

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Thanks for teaching me a lot about research, I am now ready to deserve it'

~ With Love Ria Ahuja

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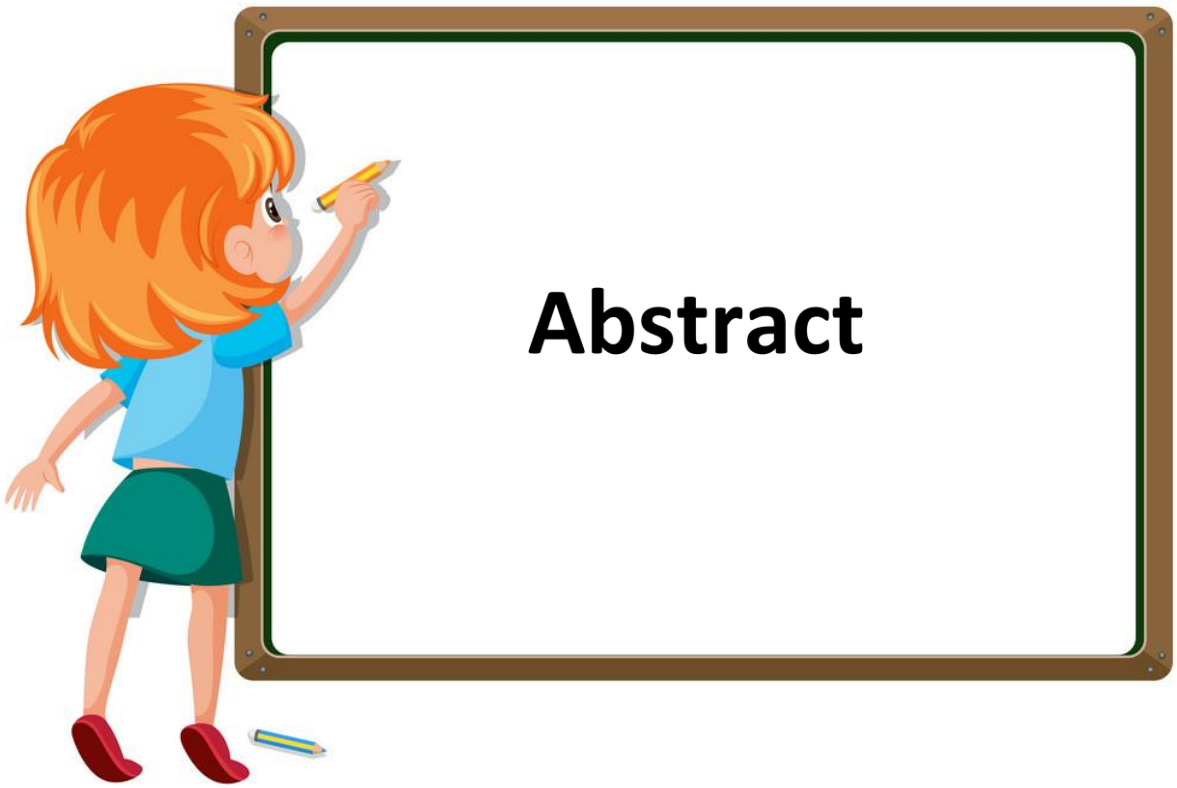
LIST OF ABBREVIATIONS

o B2C	Business to consumer
o CAGR	Compound annual growth rate
o CNNS	Comprehensive National Nutrition Survey of Children
o DALYs	Disability-adjusted life years
o EAR	Estimated Average Requirement
o FPS	Fair Price Shops
o FSSAI	Food Safety and Security Association of India
o FF	Food Fortification
o FFRC	Food Fortification Resource Centre
o FACT	Fortification Assessment Coverage Toolkit
o FAO	Food and Agriculture Organization
o GAIN	Global Imitative for Academic Networks
o GOI	Government of India
o GHI	Global Hunger Index
o ICDS	Integrated Child Development Scheme
o MDM	Mid-Day Meal
o NFHS	National Family Health Survey
o NNMB	National Nutrition Monitoring Bureau
o NSSO	National Sample Survey Organization
o NNS	National Nutrition Strategy
o NS	Not significant
o NDDB	National Dairy Development Board
o NIDDCP	National Iodine Deficiency Disorder Control Programme
o PDS	Public Distribution System
o PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
o RDA	Recommended Dietary Allowance
o RIMS	Rajendra Institute of Medical Sciences
o SBCC	Social and Behaviour Change Communication
o SDG	Sustainable Development Goal
o SAFANSI	South Asian Food and Nutrition Security Initiative
o UNICEF	United Nations Children's Fund.
o USAID	United States Agency for International Development
o VMNIS	Vitamin and Mineral Nutrition Information System

o VAD	Vitamin A Deficiency
o WIFS	Weekly Iron Folic Acid Supplementation
o WRA	Women of reproductive age
o WHO	World Health Organization
o WFP	World Food Programme


Abstract

ABSTRACT

Malnutrition is mostly caused by an inability to afford a healthy diet, a reliance on staple foods, and a lack of understanding of the significance of macro- and micronutrients. Government programmes that support dietary variety and supplementation, of the population's micronutrient status since time immemorial have not proven to be highly effective due to various limitations.

Worldwide, 144 million children under the age of five are stunted, 47 million are wasting, and 38.3 million are overweight (FAO et al., 2020). The nutritional security of the population has gotten worse as a result of the more than 3 billion poor people in the globe who cannot afford even the most basic nutritious diets.

Numerous investigations have raised concerns about micronutrient deficiencies and related health issues due to the prevalence of undernutrition.

People living in urban areas of India are increasingly dependent on packaged foods, while those living in rural areas are denied access to a variety of food groups due to financial hardships. In order to address this, the Government of India (GOI) and the Food Safety and Standards Authority of India (FSSAI) have picked five food items for fortification, namely rice, wheat flour, salt, milk, and oil. Limited research has been done to promote fortified foods among stakeholders in the free-living population.

The Diffusion of Innovation Model (DIM) was used in the current study to promote the use of fortified meals among people who live independently.

The participants received an e-Intervention via WhatsApp for a month that included images, audio, and videos. It is clear from the study's findings that the recommended approach for raising consumer awareness and encouraging the purchase of fortified foods among the chosen participants was very successful. This is true for all five staple foods and pertains to both awareness and perception of fortified foods as well as for purchases of fortified foods.

This realisation led to the planning and execution of a doctoral project named "Action Research on Advocating Use of Fortified Foods Among the Parents of Students Studying in the Faculty of Family and Community Sciences Using Diffusion of Innovation Model" in four phases.

Phase I: Situational Analysis, which entails creating a questionnaire to gather baseline information on socioeconomic characteristics, understanding of several micronutrients for their

sources, functions, and indicators of deficiency, and knowledge of fortification and its present use. The phase includes the enrolment of participants (the parents of the pupils) from the Faculty of Family and Community Sciences and the information-gathering process utilising questionnaires that have already undergone testing. Phase 1 results showed that most participants (76%) were female and had very little understanding (20%) of the correct +F logo at the baseline, whereas only 28% of the subjects could accurately define fortified foods. Only a small portion of the survey individuals was aware of fortified staples. Rice is fortified at 33.3%, followed by wheat flour at 33.2%, milk at 25%, and double-fortified salt at 22%. Only a small percentage of the interviewees (2.3%) were aware of oil fortification.

Phase II: The intervention phase involved the creation of information education communication materials in the form of graphics and videos using PowToon. This phase was followed by an online intervention phase in which participants were informed of the messages and the impact assessment on the chosen parameters was conducted. After a month of e-intervention, the Knowledge, Attitude, and Practice for Fortified Foods increased. Awareness of the definition, logo, and target group of food fortification increased by 17–24%. Following the e-intervention, there was an increase in knowledge of fortified foods from 18% to 66%. Oil saw the largest rise in awareness (66%) and salt came in second followed by milk (33%).

The various attitude metrics showed highly significant change after the e-intervention (P 0.05). Following the e-intervention, a statistically significant difference in the percentage of purchase behaviours of fortified rice, wheat flour, salt, milk, and oil was noted with P 0.001. The attitude about the safety of fortified foods showed the greatest improvement (40%), followed by the individuals' views toward taste and odour (35%) and their willingness to switch to other fortified brands (26%). Additionally, 23% of the individuals believed fortified foods were healthier and 26% were interested in paying more for them. The highest impact of e-intervention on purchasing practises was seen for milk (25%), followed by the purchase of salt (17%), While just a small impact (7% for wheat flour and 3% for rice) was investigated.

The Diffusion of Innovation Model showed that 12.4% of the subjects fell into the innovator category, 24.3% into the early adopter category, 26.2% into the early majority category, 8.2% into the late majority category, and 24.7% into the laggard category.

Phase III: Market research for the fortified food brands that are currently sold in India for the five staples of rice, wheat flour, double-fortified salt, milk, and oil. Traditional Kirana

shops, superstores, and online retail outlets were all surveyed regarding their product offerings. In the Vadodara hypermarkets, it was noted that 7 to 10 Fortified oils were accessible. Fortified milk could be purchased at Spencer's and Big Bazaar. Wheat flour that had been fortified was unavailable. In the supermarket, there is just one brand of each Double Fortified salt and Fortified rice.

Phase IV: Creation of the Integrated Education Catalog (IEC), a guidebook that contains all the answers to queries about Fortified Food and the Five Staples.

The proposed e-intervention technique for promoting fortified foods utilising DIM has a considerable influence, as evidenced by the study; as a result, the null hypothesis was rejected and the alternative hypothesis was approved for the current investigation. By classifying participant characteristics based on their rate of adoption and actual purchase of fortified meals, the Diffusion of Innovation Model has been adopted. For the purpose of raising awareness regarding the safe intake of fortified foods, researchers can employ a variety of e-communication methods.

Less than 20% of fortified product production, according to Dalberg's estimation, may be a barrier to people's consumption of fortified foods. Making the products available on the market is crucial for adoption. Due to the unavailability of fortified products in the market, close to 40–60% of products are not reaching consumers; therefore, it is crucial to have effective communication channels to spread the word about the advantages, identify and encourage producers to fortify their products and make them easily accessible in the Indian market.

It is possible to employ a variety of communication methods, models, and instruments to promote behaviour change. Utilizing behavior change communication through a variety of channels for the general public will aid in the adoption of +F products by customers. Additionally, providing training sessions with manufacturers and producers will assist them in effectively meeting demand and supply.

It is crucial to give manufacturers and producers support tools about fortification in accordance with FSSAI regulations, regular monitoring and evaluation of the plant designated for the process, and training for employees and employers on how to fortify various staples would help in regulating the initiative.

In addition, a conducive framework is required for the Fortification programme to succeed in order to ensure that the supply and demand are regulated effectively.


Introduction

CHAPTER 1

INTRODUCTION

Micronutrient Deficiency is the burning issue that has disturbed and increased the complexity of the world. The recent trend has observed the transition from traditional home-based diets to processed foods, and junk food which has further diminished the micronutrient intake, since these foods are only calorie-dense, leading to obesity and diet-related Non Communicable diseases, further leading to a triple burden of malnutrition. The triple burden consists of undernutrition wherein people do not receive an adequate amount of macro and micronutrients, obesity where there is an excess of calorie intake, and micronutrient deficiency which means the body lacks the essential micronutrients required by the body in tiny amounts (Pinstrup-Anderson., 2006).

Micronutrient deficiency has been in the talk for last so many years and it's rising with every passing year. It is also known as 'Hidden Hunger 'because its signs are not visible instantly and thus it can be more harmful to individuals having such deficiency. Worldwide 2 billion people are facing micronutrient deficiency and out of it, 1 billion people are from India (FSSAI., 2018), Micronutrients are required in trace amounts but hold a very important role in one's diet for healthy growth and development. Nearly 50-60% of the preschool children and an equal number of women in India are anemic, (Gonmei and Toteja., 2018), 62% of the Indian Population have low levels of Vitamin A, and 50-94% of people in different states of India suffered from Vitamin D deficiency. (Gulati., 2018). India ranks 102nd out of 117th countries in Global Hunger Index 2019 (von Grebmer et al., 2019). According to estimations, 190.7 million (14.5%) people were undernourished in India from 2016 to 2018 (SOFI., 2020). According to (NFHS 4., 2017), micronutrient deficiencies are prevalent in all the age groups and the recent (NFHS 5., 2022) data has not shown any significant improvement in the nutritional status of the children. The rates for stunting and wasting have increased or showed no improvement as compared to the NFHS-4. The Novel Coronavirus has also worsened the situation and has impacted the health of the people, efforts should be made to achieve the sustainable development goals (SDG., 2016) by the United Nations which aims to eliminate hunger and all forms of malnutrition by 2030. Several programs and schemes targeting iron and Vitamin A deficiency are active in India amongst various age groups but the results have not shown any significant improvement in the overall status which leaves the micronutrient

deficiency as one of the grim public health concerns for India. Thus to combat micronutrient deficiency, WHO has recognized Fortification to abridge the micronutrient gap which is an affordable and viable approach since it doesn't require any dietary modifications. According to the FSSAI report (Dec 2018), all the food business operators must comply with Fortification regulations by January 1st, 2019 (Gonmei and Toteja., 2018). At present, there are 157 Fortified brands available in the open market across the country (Singhal., 2021). Specifically stating, there are 80 brands of Fortified edible oils, 55 for milk, 12 of wheat flour, 2 for rice, and 8 brands of double Fortified salt FSSAI., 2020). Now the question arises about the safety of consuming Fortified staples for a long time. According to a recent study conducted in Ethiopia and United States, Fortifying food with an excess of Fortificants for a long time can be toxic, especially when it's consumed along with the supplements or when it is provided to a population with mild deficiencies, (Dwyer et al., 2015) and (Dasa., 2019). Fortificants levels are to be decided to keep in mind the whole diet of an individual. Hence it has been stated that for Fortification programs to be implemented, there should be enough dietary gaps in the diet of the targeted population, levels set for Fortification should be low, and changes in dietary habits of people should be kept in mind (Neufeld et al., 2019).

Currently, a Fortificant range has been developed by FAO/WHO as per the standards which are well below the upper tolerable limit, premix added to foods as Fortificant is less than 0.02%, making it safe to consume (Gonmei and Toteja., 2018) Also, as per the 68th round of Nutritional Intake in India report, conducted by NSSO, GOI (2011-2012), people in India have very low intake of fruits (30g/day) and vegetables (<50g/day) which are far less than the recommended intakes (NSSO., 2014). The report also indicating, that Indians lack certain micronutrients in their diet and so Fortification can currently be adopted as a strategy to improve and meet the micronutrient needs of the population at large. A retrospective cross-sectional study was conducted on the evaluation of Vitamin B12 levels in people from a three-tier city in an urban area with or without diabetes. Results of a study involving 1913 subjects revealed 47% vitamin B 12 deficiency (B12 level <200pg/ml) (Singla et al., 2019). According to the National Health and Nutrition Examination survey of 1999-2006, in the USA the deficiency of vitamin B 12 deficiency is 3.3.% while in India is high due to the predominantly vegetarian diet making Individuals deficiencies in Vitamin B12 sources (Reinstatler et al., 2012).

The micronutrient deficiency is the emerging public health issues in many developing countries. The adequate micronutrient intake is considered as crucial especially during the first 1000 days of life. A systematic review and meta-analysis study found that iron multi micronutrient fortification leads to increase in the haemoglobin level by 0.87g/dl and reduces the risk of anemia by 57% when compared to the non-fortified food (Eichler et al., 2012)

A study was conducted on infants aged 6-12 months to understand the impact of the fortified porridge on the improvement status of anemia and motor development. The study concludes that those infants who were provided with the fortified porridge, the proportion decreased from 45% to 17% compared to the control group (>40%). Also, the scoring of 25 motor development found improved (15.5) than the control group (14.4) (Faber et al., 2005).

A study was conducted among school aged children (6-15 years) on whole wheat flour reduces the iron deficiency and improves body Fe stores along with cognitive performance. With the intervention for 7 months, the prevalence of iron deficiency anemia significantly reduced from 18% to 9%. The body Fe stores increased (0.04 ± 0.04 mmol/kg body weight) among the intervention group of the children, however, it decreased (-0.02 ± 0.04 mmol/kg body weight) among control group (Muthayya et al., 2012). A similar study was conducted where Multi-micronutrient food fortification tends to improve micronutrient status and consequently reduce anemia prevalence (Best et al., 2011).

Efforts have been made to overcome micronutrient deficiency in India. ‘Lauhyatra’, a mass movement to free India from micronutrient malnutrition is the FSSAI Initiative to create awareness about healthy eating with a focus on the consumption of Fortified staples to eradicate micronutrient malnutrition (Agarwal., 2020).

The current eating habits of the Indian community, cannot be ignored and should be addressed in a timely as the practice of consuming junk food is being followed by a large section of the people both in an urban and rural setup. Junk food is often rich in calories, loaded with highly refined carbohydrates fats, and sugars, contributing to the causes of obesity and leading to a rise in NCDs amongst the people, since these foods are energy dense they provide a quick feeling of satiety which fills up the stomach and leaving no more space for the healthy food and creates an imbalance in the micronutrient needs. The research conducted by (Keshari et al., 2019), considered the craving for junk foods amongst people of all age groups, it becomes necessary to adopt a Fortification strategy along with dietary

changes and supplementations, which are the other two possible and proven interventions to tackle the burden of deficiency. Supplementation is not considered a viable approach for the masses due to its limitation in making it accessible and available to the whole population whereas on the other hand dietary changes need time, and chance in the current eating practices of an individual. Since the two strategies have their limitations, Fortification seems the best way to start since it can be executed at a larger scale with no dietary changes required. In India's National Nutritional strategy, 2017 report it has been mentioned that Fortification is one of the interventions to address anemia, vitamin A and iodine deficiencies apart from supplementation and dietary diversification (Niti Ayog., 2017).

Food Fortification is the process in which micronutrients are added to the foods which are highly consumed by the population to increase the intake of micronutrients that are deficit in the diet of a given population and to improve the health of the population (Olson et al., 2021). Fortification vehicles in India include rice, *wheat flour, double Fortified salt, oil, and milk,* as these are highly consumed by the Indian population and are a part of their staple diet. It has been reported that Fortification helps in overcoming the micronutrient deficiency in many countries, but it is equally possible that the strategy will not bring in expected changes and will not show effective impact even after its implementation (Olson et al., 2021) due to a lack of social marketing, behavioural changes and advocacy amongst the general population which not only includes producers, and manufacturers but also the consumers. All these stakeholders hold a very important position in making any program implementation successful. According to the literature it is seen that the knowledge amongst the population about Food Fortification is very limited (Ahuja and Sheth., 2021), also the attitude and practice toward the consumption of Fortified Foods in daily diets are not appropriate. A Study on awareness and consumption of Fortified Foods among female adults (N=100) of Mumbai- revealed that over 43 subjects were aware of the definition of food Fortification and 52 subjects knew that salt should be compulsorily Fortified with iodine in India. Twenty-seven percent of subjects knew about various vitamins and micronutrients used as Fortificants while 33% of subjects gave mixed responses. Hence, although the consumption was unconsciously more due to the availability of such products in the market (Battalwar and Syed., 2017). Looking at the literature a need was felt to create awareness about food Fortification amongst the general population,

Another area of concern apart from advocacy is the availability of Fortified Foods in the market which will help in reaching a large section of people. A research study conducted by Dalberg on Business to consumer (B2C) production, estimates that around 20% of production is being done for Fortified edible oil, salt, and about 3% for milk, and much less for wheat flour, and rice. Also, it was found that nearly 40-60% of Fortified Food production is either not reaching or is not being consumed (Bhatnagar and Kanoria., 2020).

Thus, to gain an insight into the scaling up of the Food Fortification strategy, it was important to create advocacy and to study the market availability of various Fortified Foods through surveys.

Discussing about advocacy, different models have been made which help in studying the pattern and creating the advocacy videlicet health belief models (LaMorte., 2019b), theory of planned behavior (LaMorte., 2019d), social cognitive theory (LaMorte., 2019c), transtheoretical theory (LaMorte., 2019e), etc.

The model adopted in the present study is the 'Diffusion of Innovation Model' which helps in looking at the pattern by which an idea diffuses or how individuals adopt a new strategy that is innovative and new (LaMorte., 2019a). The model gives adopters categories which helped us in finding out the individuals who started the purchase of Fortified Foods. The categories differ from innovators to laggards, differentiating through the time taken to adopt the new innovative product or not adopted at all.

There needs to be constant availability of Fortified Food in the market along with the demand, which will not be possible without advocating to the public and the stakeholders for the benefits of Fortified Foods. Thus to create supply and demand, it is essential to study both sides of the coin.

The compound annual growth rate (CAGR) and the market potential researched by ARC Industry states the CAGR of 6.1% during the period 2021-2026 for Fortified foods market availability. The global Fortified Food Market has the dominant share in North America, in terms of revenue in 2019. North America holds the largest market share of 44%, and the market in Asia-Pacific is set to grow with the highest CAGR during the forecast period 2021-2026 (*FFM - Forecast(2022 - 2027)*, n.d.).

Thus, creating advocacy using the Diffusion of Innovation model and conducting a market survey for the available Fortified Food products, a present study entitled '***Action Research on***

The present study was carried out with the following objectives:

1. To develop Graphics, Videos and other IEC material for the intervention phase
2. To collect baseline information on awareness, attitude, and purchasing practices of Fortified Foods
3. To sensitize the enrolled subjects on Fortified Food and its components
4. To evaluate the impact of e-intervention sessions given to the enrolled subjects at intervals
5. To identify the available brands for Fortified products (focusing on 5 staples, namely DFS, Milk, Wheat Flour, Rice, and Oil) in the hypermarkets and Traditional Kirana stores (Grocery Stores) from the four Zones of Vadodara

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

The Literature was collected on the following topics, for the present research:

2.1 Micronutrient Deficiency

2.1.1 Global Prevalence of Micronutrient Deficiency

2.1.2 Studies on Micronutrient Deficiency Across the World

2.2 Strategies adopted for overcoming the Micronutrient Deficiency

2.2.1 Dietary Diversity

2.2.2 Supplementation Programs

2.2.3 Food Fortification

2.2.3.1 Fortification as a promising strategy and choice of Vehicles

2.2.3.2 Consumer awareness for Fortified Foods

2.2.3.3 Lack of Dietary Diversity as a Factor of Micronutrient Deficiency

2.3 Fortified Staples in India

2.3.1 Milk Fortification

2.3.2 Rice Fortification

2.3.3 Wheat Flour Fortification

2.3.4 Oil Fortification

2.3.5 Salt Fortification

2.4 Food Fortification and its safety

2.5 Fortification logo and Claims

2.6 Food Fortification Awareness

2.7 Social Marketing

2.8 Food Fortification around the world

2.9 Fortification and Way Forward

2.1 Micronutrient Deficiency

2. 1.1 Global Prevalence of Micronutrient Deficiency

India currently has 195.9 million undernourished people, leading to alarming issues of food insecurity. (World Food Program., 2019). According to a recent Global Hunger Index report published in 2019, India ranks 102 out of 117 countries (von Grebmer et al., 2019). Micronutrients are defined as the 'Compounds required in very smaller amounts, <100mg/dl). It includes vitamins and minerals that are required in small quantities but holds a very important role in our body. They are vital for carrying out the various functions in our body, in managing growth, and production of hormones as defined by the World Health Organization. Micronutrient deficiency is also called 'Hidden Hunger' which is described as the habitual diet which lacks the essential micronutrients at necessary levels or cereal-based diets lacking other food groups thus impacting the health of the individual in the long run, which might not be acutely visible. Micronutrient deficiency complications result in early death, impoverished health, stunted growth, etc. WHO has reported deaths of under-five children due to undernutrition by 45%, iron deficiency by 42% in children, and 40% amongst pregnant women (Venkatesh et al., 2021).

Malnutrition starts early, right from the inception of Pregnancy. One of the forms of malnutrition is Micronutrient Deficiency which is a Global issue. Worldwide 2 billion people are facing Micronutrient deficiency and out of it, 1 billion people are from India. (FSSAI., 2018a), Micronutrients are required in tiny amounts but hold a very important role in one's diet for healthy growth and development. Nearly 50-60% of the preschool children and an equal number of women in India are anemic (Gonmei and Toteja., 2018), 62% of the Indian Population have low levels of Vitamin A and 50-94% of people in different states of India are suffering from Vitamin D deficiency (Gulati., 2018b). According to (NFHS 4., 2017), micronutrient deficiency is prevalent in all age groups. (Refer: Figure 1) Thus to combat micronutrient deficiency, WHO has recognized Fortification as a bridge in filling the micronutrient gaps which is an affordable and viable approach. According to the FSSAI report, all the food business operators must comply with Fortification regulations by January 1st, 2019 (FSSAI., 2018a).

At present, there are 157 Fortified brands available in the open market across the country (Teaotia and Singhal., 2020). Specifically stating, there are 80 brands of Fortified edible oils, 55 for Milk, 12 for Wheat flour, 2 for rice, and 8 brands of double Fortified salt (FSSAI., 2020).

According to Micronutrient Forum, 2020 (Osendarp and Kraemer., 2020), approximately 3 billion people are lacking access to basic nutrients in their diets throughout the year. Post pandemic, an additional 4.8 million mothers are prone to be impacted by anemia due to affected availability and affordability during Covid. Poor diets among the population are the main challenge resulting in micronutrient deficiency, which has also led to societal challenges and economical burdens since it leads to the cause of morbidity and mortality, especially in infants and pregnant women. In the year 2017, WHO and UNICEF have conducted a worldwide assessment and reckoned that 34% of households did not have access to iodized salts, and approximately 190 million children and pregnant women are deficient in Vitamin A and other micronutrients.

In India, National Family Health Survey 4 – has recorded the highest burden of anemia worldwide, 58.6% in children and 53.2% in non-pregnant women, and 50.4% in pregnant women in 2016. The National indicators (NFHS 5., 2022) has recorded an increase in anemia in women of all age group to 57% from 53% in NFHS 4, children (6-59 months) by 67% from 58% in NFHS 4. Gujarat has recorded 80% of anemia prevalence in children between the age group of 6-59 months, however, Bihar has recorded the highest anemia prevalence amongst pregnant women at 63%.

According to a recent National report (2016-18) conducted by the Ministry of Health and Family Welfare (*CNNS Report.*, 2019), the prevalence of deficiency in various vitamins is: 16% vitamin A deficiency among adolescents, 24% vitamin D, 32% Zinc, 31% Vitamin B12 and 37% folate deficiency CNNS report also provides insights into the dietary habits of adolescents 10-19 years old, it states that the Consumption of Fruits and eggs is less than 10% for boys and girls. Over 25% of adolescents reported no consumption of green leafy vegetables even once a week. Milk products are consumed by only 50% percent of adolescents daily Nearly 25% of girls and boys do not receive any of the four school-based services (mid-day meal, biannual health check-ups, biannual deworming, and weekly iron-folic acid supplementation) Prevalence of zinc deficiency in Gujarat is 55% and vitamin B 12 is 48%.

The report reveals a spike in poverty levels, and food prices, affecting the consumption pattern of cereals and cereal substitutes which fell by 20.4% in rural India and by 7.9% in urban India. The fall in total food consumption expenditure was 9.8% for rural India while it increased marginally by 0.2% for its urban counterparts.

The comprehensive National Nutrition Survey of Children (CNNS) has been conducted in partnership with UNICEF, to assess the burden of malnutrition in children and adolescents. Prevalence of zinc deficiency was recorded by 19% in pre-school children, and 32% in adolescents.

Multiple efforts have been taken up by the Government of India by launching various programs and schemes to address micronutrient malnutrition.

The prevalence of undernutrition according to NNMB, among infant boys was 29% for underweight, and 23% for stunting and wasting by 25%. Karnataka, Andhra Pradesh, Gujarat, Madhya Pradesh, Orissa, and Uttar Pradesh were a few states which recorded the highest prevalence of stunting. The report records a decline in household intake of cereals and millets and marginal improvement in uptake of leafy vegetables. The anthropometry recorded better nutrition status however the possible cause of which could be accessibility to health care facilities, sanitation, etc. (NIN., 2012).

The existence of micronutrient deficiency and its association with undernutrition with diet-related diseases has been categorized as a Double Burden of Malnutrition. Various micronutrient deficiency leads to stunting, and wasting since the growth of the child gets hampered. In 2016, 41 million children under the age of five, were under the category of overweight, whereas 155 million suffered from low height for age during the same time (WHO., 2017).

2.1.2 Studies on Micronutrient Deficiency across the World

There are 19 types of micronutrients needed to maintain a healthy human body. (Fig 2.1) Though micronutrients are required in less quantity their function is huge. Lack of micronutrients cause impaired poor physical and mental health. Today, two billion people are suffering from micronutrient deficiency which is also known as hidden hunger since it rarely shows any visible sign in an individual. The burden of deficiency accounts for 10% of the global health issues. Major health complications caused due to lack of micronutrients include

Goiter, Spina Bifida, Nigh Blindness, reduced work productivity, and affected concentration (GAIN., 2015)

Figure 2.1 Functions of Various Micronutrients

Micronutrient holds important functions in the body throughout the life span of an individual. If left untreated during the in utero stage it may extend and affect the other stages of life from childhood to adolescence to pregnant women and old age. Apart from affecting the stages of

life it also affects the generations since it starts before the stage of conception creating developmental delays and deficits. The 4th report on The World Nutrition shared the conceptual framework of micronutrient deficiency across the lifespan (Kweba., 2019) (WNS., 2000)

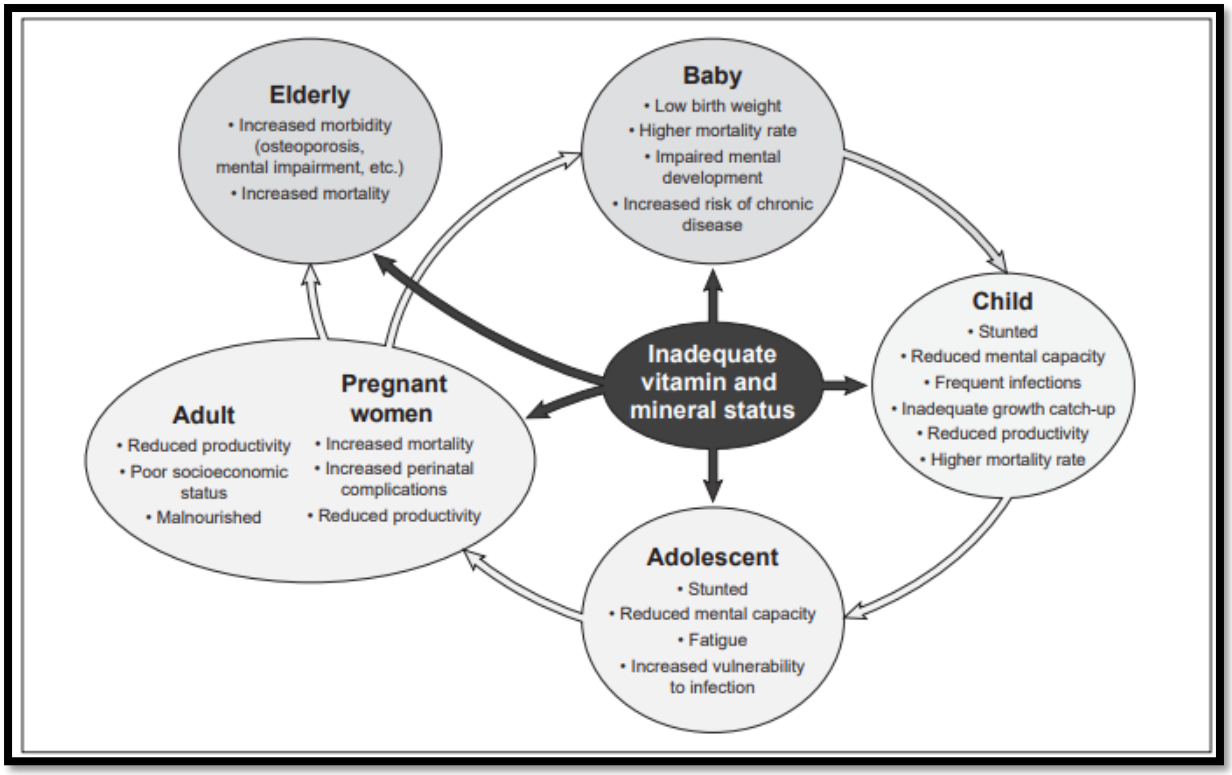


Figure 2.2 Micronutrient Deficiency throughout the lifespan

Micronutrient deficiency has been studied worldwide and it has been found that the majority of the population in different countries is suffering from micronutrient deficiency and food has been given importance in context to calorie requirements and not micronutrients that are equally important for a diet (Kimenju et al., 2015).

In Kenya, 33% of women and nearly 7% of children are experiencing vitamin A deficiency because of which 30% of children are suffering from eye infections while others are encountered infectious diseases as an outcome of vitamin A Deficiency.

Vitamin A is considered an important micronutrient as its deficiency can lead to a weak immune system which makes an individual prone to infectious diseases which at times can be fatal. Vitamin A deficiency (VAD) has been seen in every age group and country, giving rise to mortality rates It has been seen that around 60,000 women every year due to VAD. Plant-based foods have less bioavailability of Vitamin A as compared to animal sources, which are a good source of retinol, In India, animal-based foods are consumed by the minority, thus

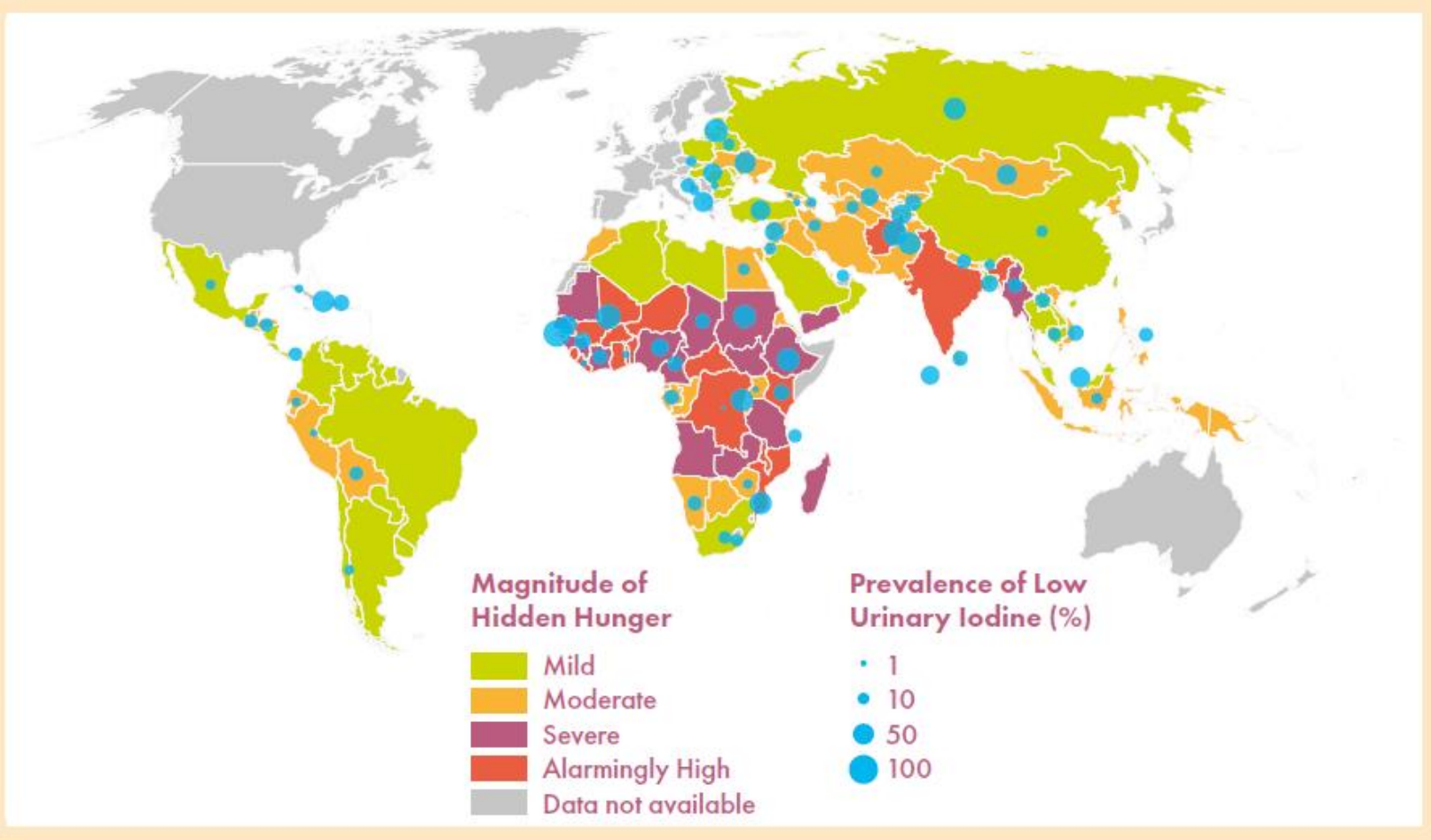
making it evident to Fortify major staples with Vitamin A, to reach people of every community and strata.

Kenya has high rates of deficiency, nearly 70% of children and women around 33% are suffering from VAD, and animal-based sources rich in Vitamin A are limited thus Fortifying sugar with Vitamin A was a much-needed step in Kenya (Pambo et al., 2014a).

A study was conducted in South Africa on 260 women (Age 19-69 years) of Gauteng Province where dietary diversity was assessed using 24-hour dietary recall, the study revealed that women 36 years and older were at risk of micronutrient deficiency, especially for Vitamin A, calcium and Vitamin C (Acham et al., 2012a).

Malnutrition is a major problem in Vietnam despite a decrease in poverty rates from 37.4% in 1998 to 13.4% in 2008. Iron deficiency has been a major problem amongst pregnant women for which Fortification has been considered the safe and most cost-effective strategy to combat the situation since it does not require a change in food habits. The staple items consumed in Vietnam are soya, fish sauce, condiments, spice powders, and edible oils. According to National Nutrition Survey conducted in Vietnam recorded the prevalence of anemia amongst children by 9.1%Iron deficiency of which iron deficiency is 12.9% and zinc deficiency amongst 51.9%, Vitamin A by 14.2% leading to malnutrition of more than one micronutrient (Turk and Spohrer., 2016).

India, following a predominantly vegetarian diet, has a limited intake of animal and animal-based food products which are rich in Vitamin D, Vitamin B12, Vitamin A, Iron, etc., thereby negating the benefits of these food sources and worsening the deficiency amongst the people. The change in lifestyle in rural and urban settings has limited the exposure of the people to sunlight which is a natural source of Vitamin D and plays a crucial role in preventing issues like osteoporosis, rickets, diabetes, cardiovascular diseases, Immunity, etc. Vitamin D is a natural source that is photosynthesized in the skin through UVB rays exposure, but the alarming prevalence rates in India despite plentiful sunshine is worrisome. Vitamin D Deficiency often goes unnoticed and unaddressed even if the Indian staple diet is adequate since the diet lacks the sources of Vitamin D (Ritu and Gupta., 2014).



Source: *https://www.plantagbiosciences.org/people/nyamisi-kweba/2019/05/22/why-Fortify-foods/*

Figure 2.3: Magnitude of Hidden Hunger Around the World (Kweba., 2019)

A review paper on Vitamin A deficiency has recorded scientific data which reveals the severity of Vitamin A in various states of India. A survey conducted in Maharashtra assessed the prevalence to be 9.8% amongst the children aged between 5-15 years of age. Similarly, another study conducted in Jodhpur amongst 5135 students has recorded similar results. (Shaikh., 2018). A study was conducted in Ahmedabad amongst preschool children (5-15 years) to find out the prevalence of Vitamin A deficiency (VAD). The study finds out prevalence amongst girls by 4.1% and 1.9% in boys which was significantly higher in girls. The researcher also observes that there is insufficient consumption of green leafy vegetables, and fruits amongst these children, which could be the cause of VAD. Efforts should be made for strict policy by which deficiencies can be addressed on large scale (Chauhan et al., 2011).

2.2 Strategies adopted for overcoming the Micronutrient Deficiency

Micronutrient Deficiency is the burning issue that has disturbed and increased the complexity of the world. The recent trend has observed the transition from traditional home-based diets to processed foods, and junk food which has further diminished the micronutrient intake, since these foods are only calorie dense, leading to obesity and diet-related Non Communicable diseases, further leading to a triple burden of malnutrition. The triple burden consists of undernutrition wherein people do not receive an adequate amount of macro and micronutrients, obesity where there is an excess of calorie intake, and micronutrient deficiency which means the body lacks the essential micronutrients required by the body in tiny amounts (Pinstrup-Anderson., 2006). Multiple surveys have been undertaken by WHO and other renowned organizations for the ways that can be adopted to combat the micronutrient deficiency and are at the same time cost-effective.

2.2.2 Dietary Diversity

Dietary Diversification is the form of changing the food habits of the people by promoting the intake of more food groups in the diet at the household level and having a diversity such as animal-based food products and leafy vegetables in the daily diet. The aim of changing the diets of the people is to have more food groups that will supply different micronutrients to the body in adequate proportions (USAID, n.d.). Getting all the essential micronutrients from only selected food groups is not a plausible strategy, especially in India which is predominantly vegetarian in nature, and lacks the essential micronutrients like Vitamin D, Vitamin B 12, and

Iron, also because the major part of the Indian diet is cereal based in nature owning to the sheer intake of cereals. Dietary Diversification, however, cannot be scaled up for overcoming the deficiency of micronutrients, since it lacks the evidence and the monitoring of the diets people of the community are having on a daily basis, it is difficult to ensure whether the people are having adequate food groups in their daily diet just by educating them once. Also, dietary diversity is a challenge for countries or people having limited income sources, since having a diet rich in various food groups, puts a lot of pressure on the pocket of the individual, which further hampers the affordability of the fruits and vegetables. To call dietary diversification a successful strategy for overcoming micronutrient deficiency will take a lot of effort and advocacy sessions since breaking the inertia of developed habits is quite a challenge. The strategy will need a lot of time to be absorbed by the people by having extensive self-monitoring of their diets (Nair et al., 2016).

2.2.2 Supplementation Programs

Multiple programs have been running in India to combat the micronutrient deficiency rates which need immediate attention due to its ever-increasing prevalence in the states due to changes in food habits and preferences towards processed foods. Food supplementation through various programs like Mid-Day Meals is the largest program active in government schools that provides lunch to the students and is currently reaching 104.4 million children in approximately 1.2 million schools across Indian states (C. Mirajkar and Ravindra., 2016). The program was started to increase the rate of attendance of the children in schools and to provide a meal to ease the pressure of the families to meet the need for two square meals for their children. The program has observed a reduced number of absentees, however, it cannot be scaled up as a strategy for addressing micronutrient deficiency, since its targets only one sector of the socioeconomic group and particular age group. Micronutrient deficiency is not observed only amongst the poor section of the society, thus need was felt to adopt different strategies which could address all at once and is cost effective.

Another program- Integrated Child Development Scheme (ICDS) has packages for children, pregnant women, and lactating women wherein supplementary food packed or in meals is provided to beneficiaries (Sachdev and Dasgupta., 2001).

Other Programmes include the provision of iron folic acid tablets to women and children, under Weekly Iron Folic Acid Supplementation (WIFS), Vitamin A prophylaxis program, Iodine Deficiency Disorder Programme, Poshan Abhiyan which has recently launched in 2018, 8th March intending to improve the nutritional status of the people.

All these supplementation programs need a long-term commitment and require constant supervision at regular intervals by the team of government and private stakeholders. The major limitation in the program observed was it needs too many human resources to keep a check on monitoring and evaluation of the program at different states at different levels and was high on cost. Such programs were not targeting the population at large of all socioeconomic groups.

Thus Food Fortification was considered the best and most viable strategy to overcome micronutrient deficiency rates since it has the potential to address many concerns all at once (Pritwani and Mathur., 2015).

2.2.3 Food Fortification

Food Fortification is the enrichment of the food with essential micronutrients for improving its nutritional content and improving the deficiency rates amongst the population. Food Fortification is usually done in food items that are commonly consumed by people and are a part of their daily diets. Premixes are added to staple foods like wheat flour, rice, salt, milk, and oil for restoring the micronutrients in them which are either not present or lost due to manufacturing processing. Food Fortification is considered cost-effective since it is done on a massive scale and targets people of every socioeconomic scale (Lovedeep et al., 2018).

Food Fortification is an upcoming area of interest for researchers, public health nutritionists, and other health professionals. Food Fortification is seen as one of the effective methods to tackle micronutrient deficiencies amongst the general population by Fortifying the staples that are being eaten in significant quantities by almost everyone and is a part of their daily diets. But this strategy is not as simple as it seems, because a lot of work is required to educate the population about its benefits and the need, without which the aim of having less prevalence of hidden hunger will not be achieved.

Micronutrient deficiency is associated with factors like consumption of animal products that are rich in vitamin B12, poor bioavailability of certain micronutrients, and lack of hygiene practices that again affect bioavailability and digestion process, lack of food availability, lack

of awareness amongst the population which affects their dietary diversity (Murphy and Allen., 2003).

2.2.3.1 Fortification as a Promising Strategy and Choice of Vehicles

According to one of the studies conducted in Bangladesh amongst children between 2-4 years and women had non-lactating women, it has been observed that 44% of children and 30% of non-lactating only had adequate micronutrient intake for which the source was starchy staples, thus it becomes really important to choose a vehicle which is consumed in large quantities in every country to efficiently target micronutrient deficiency (Arsenault et al., 2013).

The micronutrient deficiency is the emerging public health issues in many developing countries. The adequate micronutrient intake is considered as crucial especially during the first 1000 days of life. A systematic review and meta-analysis study found that iron multi micronutrient fortification leads to increase in the haemoglobin level by 0.87g/dl and reduces the risk of anemia by 57% when compared to the non-fortified food (Eichler et al., 2012).

Another study conducted in Bangladesh on preschool children tried to find out the percent RDA of micronutrient deficiencies amongst children and the result showed that for iron it was 23.7%, zinc (28%) Vitamin A (50%) folic acid (26%) and vitamin B12 intake (62%). Consumption of Fortified Foods amongst Non-pregnant and non-lactating women in Bangladesh was 100% for Fortified rice, Fortified bread (10%) Fortified wheat flour (41%), and sugar (30%). As Rice is consumed in high quantity and is a part of their staple diet, it has been said that if rice is being Fortified with Iron, it will serve 40-80% of RDI values of iron, which is 13-20mg of iron/per day which will further help in overcoming iron deficiency, whereas 7.5- 17.5 mg of zinc/day can be provided following rice Fortification. According to the results of the study, it has been concluded that wheat flour and rice Fortification alone can help in overcoming micronutrient deficiency of iron, vitamin B12, zinc, and folic acid to certain limits as they are the part of staple diets for the majority (Leyvraz et al., 2016).

There are two types of Fortification strategies, voluntary and mandatory Fortification. The Netherlands follows voluntary Fortification of foods with micronutrients within a range of 15% to 100% of the reference intake. A study was conducted by Jong et al, 2021. Using the food consumption survey data amongst the Dutch Population with the aim to study the consumption

of Fortified Foods amongst the adults aged 16-70 years. A total of 75% of the population were consuming Fortified beverages, oils and fats, and dairy products, contributing to micronutrient intakes by 9%- 78%. The study recorded the impact of voluntarily Fortified Foods on the micronutrient intake amongst the users. Since the regulations were not mandatory in the country, voluntary Fortification led to the Fortification of meat, alcohol, and other items which were also contributing to higher fat, sugar, and salt intake, thus raising a question regarding healthy choices according to the wheel of five which is a nutrition guide of the Dutch population (De Jong et al., 2022).

A study was conducted on infants aged 6-12 months to understand the impact of the fortified porridge on the improvement status of anemia and motor development. The study concludes that those infants who were provided with the fortified porridge, the proportion decreased from 45% to 17% compared to the control group (>40%). Also, the scoring of 25 motor development found improved (15.5) than the control group (14.4) (Faber et al., 2005).

Fortification of refined vegetable oil and wheat flour is a mandate in Cameroon since 2011 with Vitamin A and iron, zinc, Vitamin B12, and folic acid respectively. A study was conducted to identify the barriers to food Fortification by conducting interviews of the factory owners (n-19) and the consumers for recording their consumption levels (n=613 households). The researcher collected samples of Fortified Foods from factories, households, and open markets using purposive sampling. The study recorded low levels of micronutrients added to the products in the samples of factories needing consistent monitoring to Fortify the staples as per the regulations of the country. Reach of Fortified oil was higher amongst the women whereas wheat flour consumption was high amongst the children. Fortifiable" oil was consumed by 63% of women and 52% of children during the previous week of the survey and wheat flour by 82% of women and 86% of children. The micronutrient analysis for wheat flour and oil showed differences amongst the samples collected from factories, markets, and households (Mark et al., 2019).

A study was conducted among school aged children (6-15 years) on whole wheat flour reduces the iron deficiency and improves body Fe stores along with cognitive performance. With the intervention for 7 months, the prevalence of iron deficiency anemia significantly reduced from 18% to 9%. The body Fe stores increased (0.04 ± 0.04 mmol/kg body weight) among the intervention group of the children, however, it decreased (-0.02 ± 0.04 mmol/kg body

weight) among control group (Muthayya et al., 2012). A similar study was conducted where Multi-micronutrient food fortification tends to improve micronutrient status and consequently reduce anemia prevalence (Best et al., 2011).

Different countries and reports have calculated the cost-effectiveness of Fortification as a strategy to be effective in reducing the micronutrient deficiency. Every single dollar invested for Fortification will provide 16 times of return in the total economy of the nation. Uganda, on the other hand, has an estimated lack of productivity due to micronutrient deficiency which has affected the nation's GDP by 14% (Kistner., 2017).

In 2010 research was conducted on scaling up nutrition by WHO which calculated a return of US$ 7.2 billion in a year similarly in Jordan the cost of treatment and the cost of Fortification for anemia were compared. It was calculated that the Fortification process would cost 0.03 dinars (approx. US$0.04) per capita per year, whereas the treatment of the anemic population will cost 4.9 dinars (approx. US$7.00) (GAIN., 2015).

2.2.3.2 Consumer Awareness for Fortified Foods

Fortification is one of the strategies to overcome micronutrient deficiency which has been taken up by many countries other than India namely, the USA, Kenya, Bangladesh, etc.

Kenya conducted one study on consumer awareness about Fortified Foods using binary logit regression, it has been found that 26% of the subjects were aware of Vitamin A importance, 34% were consuming sugar Fortified with Vitamin A and nearly 55% were aware but not consuming Fortified sugar in Kenya (Pambo et al., 2014b).

A study conducted in Australia on Consumer Awareness, Attitudes and Behaviours to Fortified Foods reported that the participants were skeptical regarding mandatory Fortification of foods due to concern for increased prices of the products because some big companies were Fortifying their brands voluntarily, thus making it more expensive considering it to be healthy. Another concern of the participants was regarding the naturally occurring nutrients that the ones induced through technology. The study reported low awareness of folate amongst the participants, regarding its health benefits and its sources, only women who had experienced pregnancy in the past reported good knowledge of folate. One of the limitations of the referred study is that it has not given definite percentages (Rowland and Dugbaza., 2010).

A study conducted in China assessed Awareness, Attitude toward the Industrial Food Fortification in Mongolia and Harbin district. The survey collected the data from men and women between 2014-2017 aged more than 18 years. Less than half a percentage of people were aware of food Fortification, the survey questioned the participants about its acceptance and recorded that 50% of the participants from Mongolia and 18% of participants from Harbin favored food Fortification on learning the purpose of it (Bromage et al., 2019).

A cross-sectional study was conducted in 13 different countries for assessing Fortification awareness using a structured questionnaire. The survey assessed the information of 1435 respondents. The awareness was limited to 28% of the respondents, the major source of knowledge being the radio for 27% of the respondents. The subjects could mark the correct response for the risk relating to deficiency of micronutrients (76%) The study assessed the association with the occupation of the participants with $P< 0.001$, household size, education level, and age. The study also noted that respondents lying in the above age bracket had better knowledge of nutrients than their younger counterparts. The knowledge regarding different micronutrients was limited in the study (Linda et al., 2020).

A study conducted amongst 150 urban women in Delhi, reported good (48%) awareness of the Fortified Foods logo, where 69.8% agreed to the consumption of Fortified Foods as essential (Premkumar and Garg., 2020). An interventional study conducted by (Sirohi et al., 2015), amongst 400 subjects, recorded awareness of Fortification-- as 12% at the baseline which increased to 72% after the intervention. A study conducted in Kenya on 1435 subjects found that only 28% of the respondents had awareness of Fortified Foods (Linda et al., 2020).

A study conducted in NkowaNkowa Township, Africa, to determine the awareness of women on Fortification reported that 57% of the participants were able to define Food Fortification correctly, and 72% of the participants were aware of the foods that are being Fortified, the staple that is being Fortified in South Africa is maize, which was reported by 70% of the participants. The target group for which Fortification is essentially being done are the children (<6 years of age) who were answered correctly by 72% of the participants (Motadi et al., 2016). The possible reason for better awareness amongst the Africans was the mandatory use of the Fortification logo on bread, flour, and maize, however, in India, the +F logo for identification of Fortified Foods was created in 2016 after the development of the food Fortification resource center (Teaotia and Singhal., 2020).

Fortification in South Africa was started with iodization of salt in 1995 and Fortification of maize and wheat with Vitamin A, thiamine, riboflavin, niacin, folic acid, zinc, B6, and iron in 2003 with the aim to deliver 33% of the RDA per serving to eliminate micronutrient deficiency in the South Africa population (Acham et al., 2012b).

Apart from being cost-effective, food Fortification is the easier and more practical approach well, as it doesn't pressurize people to change their food habits, thus making it a more effective strategy. This strategy can only be successful if consumers will be aware of the importance of including Fortified Foods in their diet and taking the final decision to purchase these products, which can be addressed through advocacy.

The world is becoming digital and due to advancements in technology major source of new information is the internet and mobiles for consumers to keep a track of new information, mobile phones are also being used in Kenya for advertising purposes as people are becoming advanced and it is easy to create awareness using mobile as a medium for advocacy (Pambo et al., 2014a).

A cross-sectional study was conducted in Jaipur in 2012 amongst the 300 rural and urban mothers from the health center. The data used a structured questionnaire for assessing the knowledge of food Fortification. The study revealed a total of 53% of rural mothers and 65% of mothers from the urban area were consuming the targeted Fortified food products, the source of knowledge being the doctors and health care workers for 71% of rural mothers and 65% of urban mothers. Few of the mothers were not consuming Fortified Foods for the reasons it was unavailable (73%) and at higher prices (22%). The researcher linked the low level of awareness with the subject's literacy levels. Low consumption of Fortified Foods was linked to children who were moderately or severely malnourished due to poor dietary practices (Nagaraj et al., 2013).

Studies conducted in India and at the Global level so far have proved Fortification as one of the solutions to improve the Micronutrient level of the person (Khadgawat et al., 2013) (Gera et al., 2012).

A study conducted in Kenya on males/females for consumer awareness of Fortified Foods revealed that the females are less likely to be aware of Fortification due to exclusive control over media and other information by men (Pambo et al., 2014b).

A study conducted in Tanzania on Caretakers of Kinondoni Municipality revealed that only 8% were able to define micronutrient deficiency and more than 50% of the Mother/Child Caretakers were not aware of the health benefits of the micronutrients Thus, the knowledge and awareness regarding food Fortification are very low and there is need to conduct Advocacy (Kasankala et al., 2018).

A study on awareness and consumption of Fortified Foods among female adults (N=100) was conducted in Mumbai. Over 43 subjects were aware of the definition of food Fortification and 52 subjects knew that salt should be compulsorily Fortified with iodine in India. 27% of subjects knew about various vitamins and micronutrients used as Fortificants while 33% of subjects gave mixed responses. Hence, although the consumption was unconsciously more due to the availability of such products in the market (Battalwar and Syed., 2017).

2.2.3.3 Lack of Dietary Diversity as a Factor of Micronutrient Deficiency

Micronutrient deficiency also known as Hidden Hunger, is affecting all people irrespective of age, sex, demography, education, etc. Micronutrient deficiency is one of the reasons for high stunting rates in India, one of the ways to detect deficiency is through the dietary diversity score of an individual, it is important to have variety in the diet to fulfill the needs of each micronutrient.

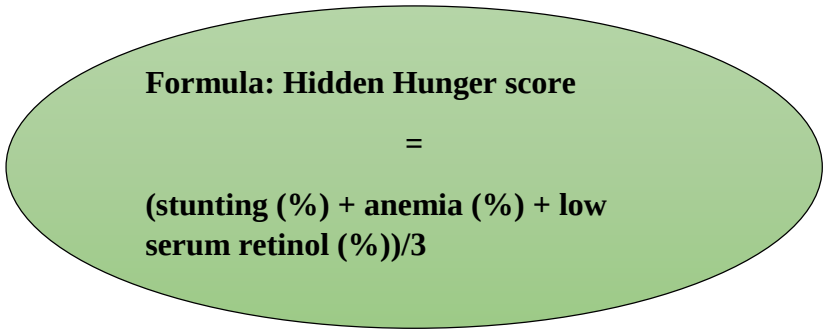


Figure 2.4: Calculation formula for Hidden Hunger

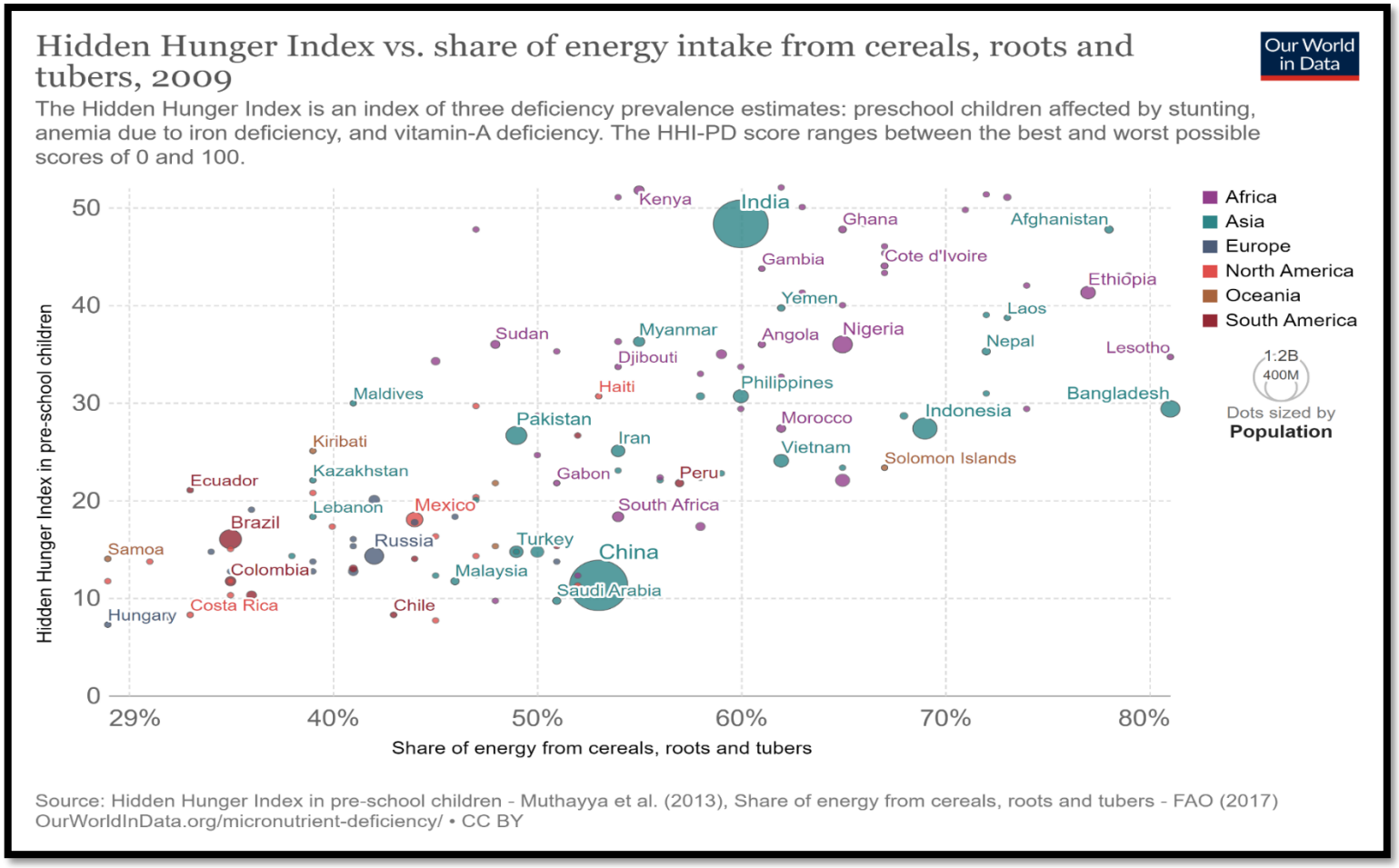
The hidden hunger Index takes into account three major indices- stunting, iron deficiency, and Vitamin A deficiency amongst preschool children.

Figure 2.4 shows that 60% of the Indian population gets their requirements for energy from roots, cereals, and tubers. Twenty countries have reported the highest Hidden Hunger Index scores where India is one of the contributors with an alarming score of 48.3. The report can

be used as an advocacy tool for Fortification to come into play and provide essential micronutrients. The share of micronutrients in the total burden of disease in India is 7% which cannot be ignored any further (Muthayya et al., 2013).

A study was conducted in Pediatric Outpatient Department at Rajeshwari Medical Hospital on children 6month-23 months to assess the minimum dietary diversity using 24-hour dietary recall, according to WHO consumption of four food groups in a daily diet out of seven is considered to be the Minimum Dietary Diversity Score for Children (N et al., 2018).

Children with a lack of Vitamin A deficiency experience serious complications and severe illness. It has been reported that half of the children lose their life within 12 months of losing their sight due to vitamin A deficiency. Nearly 250 million preschool children suffer from Vitamin A deficiency of which the majority (500,000) become blind. Similar findings have been reported for iron deficiency anemia which affects 50,000 women and 18 billion babies lack essential requirement for iodine which hampers their mental growth. Twenty percent of cases of maternal hemorrhage have been associated with iron deficiency and 800,000 people globally die due to zinc deficiency. There are various interventions taken up by the different governments in various countries, however, the one with maximum reach and cost-effectiveness has been Food Fortification. The adoption of Fortified Foods will not alter the food habits of the population while providing them with the essential micronutrients (DSM., 2017)



Source: (DSM., 2017)

Figure 2.5: Hidden Hunger and The Energy Intake from Cereals

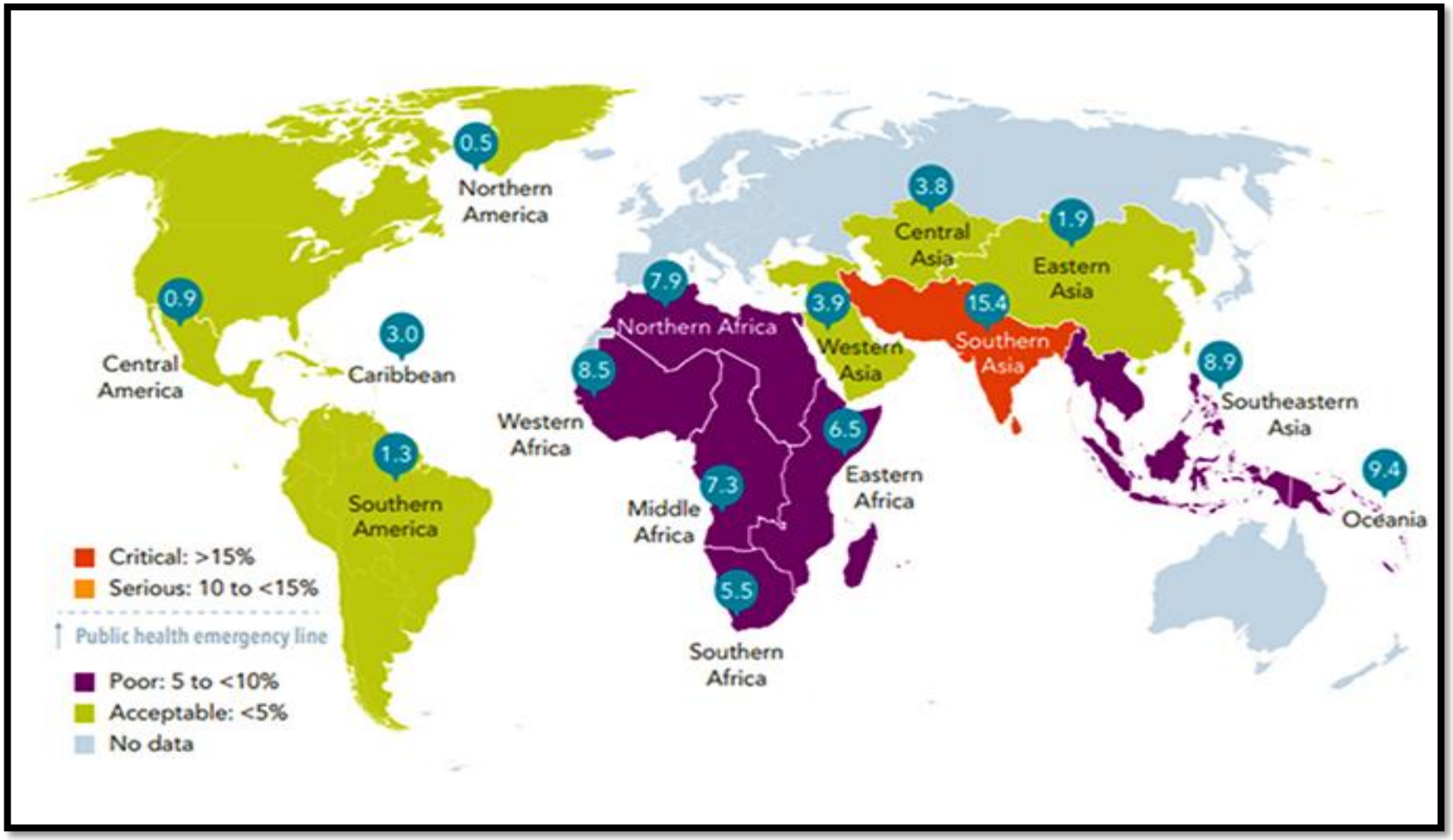
Indonesia has been Fortifying its Oil with Vitamin A, in 24 villages of west Java, since the staple diet focuses more on rice and vegetables where the vitamin A content is limited. The limited variety in the diet of Indonesians and the poverty results in the majority of Vitamin A deficiency. Fortified oil has contributed to the daily intake of Vitamin A by 26-40%, which observed a fall of 18-6% in the total deficiency rates amongst the selected villages. From the abstract in Public Health Nutrition, December 2014 Vitamin A-Fortified cooking oil reduces vitamin A deficiency in infants, young children and women: results from a program evaluation in Indonesia (Sandjaja et al., 2015) (GAIN., 2015)

Globally, junk food consumption has increased especially among children and adolescents. Junk foods are often labeled as foods high in salt, sugar, calories, and fats and they lack important micronutrients like iron, zinc, iodine, and vitamins like Vitamin A, Vitamin D, Vitamin B12, etc. Junk foods provide the feeling of fullness, however regular consumption of such foods deprives people of access to important micronutrients which are important for carrying out major functions in the body, thus leading to obesity and Non Communicable Diseases. According to a study it has been calculated that the lack of fresh fruits and vegetables has led to DALYs i.e. Disability-adjusted life years amongst 16 million of the world's population and 1.7 million people are on the mortality radar. Junk food consumption has been observed amongst both families with good and poor socioeconomic status, thus it cannot be said that price parity is the hindrance behind purchasing the healthy food options or consumption of fruits and vegetables. A cross-sectional study was carried out amongst natives of Kaski district, Nepal. A total of 538 adolescents participated and gave in their inputs in a structured questionnaire. It was observed that approx. 60% of the adolescents were consuming junk foods in the last third days (Month), of which 58% were fond of consuming salty snacks and 57% preferred sweets. Despite adequate knowledge among children about a balanced diet and the harmful effects of junk foods, students were opting for junk foods due to their availability and affordability (Bohara et al., 2021).

The major sources are eaten as a staple in India like cereals, roots, and tuber, which are energy dense and provide and fulfill the calories requirement of the body, however, are deficient in essential micronutrients. To meet the daily requirement of micronutrients, it is essential to have diversity. Due to affected availability and affordability, people from low socioeconomic classes lack the inclusion of other food groups in their daily diet and thus consume energy-dense foods (Neufeld et al., 2017) and (Kweba., 2019). Our world in Data assessed the hidden hunger i.e.

micronutrient deficiency and the common foods consumed worldwide with their share of energy. In India, 60% of the energy is derived from cereals, roots, and tubers, and the prevalence of hidden hunger amongst preschool children accounts for 48% (1.22 billion people). The countries with low Gross Domestic Product per capita have more no. of cases hidden hunger compared their counterparts. India stands amongst the lowest GDP groups with $3,794.76 according to 2011 International standards (Ritchie and Roser., 2017).

Figure 2.5 depicts critical needs for India which has a prevalence rate of more than 15% and needs immediate action to be undertaken, followed by Africa which stands between 5-10%. India accounts for 185 million people lacking the essential micronutrients in their diet. Vitamin D deficiency among children under five is 70% and the prevalence of vitamin A deficiency is 57%.



Source (Bresnyan and Gadha, 2018)

Figure 2.6: Micronutrient Prevalence across the Countries

Policies like MDM, ICDS, and PDS though made an effort to contribute to the diet of the people, by providing minimum calories, however, these policies created a lopsided by focusing more on cereals like wheat flour and rice, which further left the people food insecure. These diets lack the provision of fruits and vegetables, thus catalyst the mono diets and depriving the people to achieve minimum dietary diversity which is having 4 or more 4 food groups in the daily diet (Ruel., 2003). Even according to NFHS 4, only 9.6% were found who are being fed a minimum acceptable diet whereas according to CNNS that figure declined to 6.4% According to the report published by ICMR on 'What India Eats' (Hemalatha et al., 2020) it has been found out that irrespective of regional disparity and socioeconomic classes, cereals are the most commonly consumed food groups. The ICMD and NIN have recommended a daily portion of various food groups which is being called a daily plate, that should consist of 45% of cereals, 17% of pulses and other protein rich foods like eggs and chicken, 12% to oils and fats, and 10% to milk and milk products, 8% for nuts and seeds and rest of the 8% to fruits and vegetables (R. Kaur et al., 2022).

Dietary Diversity amongst any individual is considered as improved health status/outcome. A study was conducted amongst women from 3600 households in 4 districts in India using dietary scores. The study collected the data using 24 dietary recalls for 7 days and considered 37 food items. The WDDs and HDDs recorded that women eat fewer food groups as compared to the household's dietary diversity by 0.1 to 0.5, the major food groups lacking in the women's diet are Vitamin A-rich fruits and vegetables. The results of the study are similar to other studies conducted in Uttar Pradesh, Bihar, and Orissa (2 districts), which were the other sites of the study. Women were consuming less GLV by 9.6%, vitamin A-rich fruit by 22%, Meat fish, and Poultry products by 16.7%and dairy products only 16% of the women were being consumed in the selected households (Gupta et al., 2020).

The report on Global Burden of Disease (IHME., 2017) states that approx. 19.1% of Indian children out of 5351900 infants under the age of 6 months were not exclusively breastfed by their mothers whereas other children were having less consumption of fruits, vegetables, and protein rich foods, thus leading to deficiency of various micronutrients and causing the child's to be stunted or underweight (Bhattacharjee et al., 2021)

A meta-analysis was conducted from 4302 literature of which 270 articles collected the primary data on micronutrient deficiency of various nutrients across India using the Preferred Reporting

Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The estimated figures showed the prevalence of iodine deficiency by 17%, 27% for folic acid, and 54% for an iron deficiency which is a serious cause of concern, 53% for Vitamin B 12, 19% for Vitamin A, and 61% for Vitamin D, further data was segregated based on age group, where iron deficiency was found more common amongst pregnant women by 61%, population with no specific age group had iodine deficiency by 59%. The prevalence of folic acid was 39% in subjects more than 18 years of age, and 41% in subjects less than 18 years of age, thus affecting all the age groups. The study quotes the results of the Vitamin and Mineral Nutrition Information System (VMNIS 2005) which state that anemia affects nearly 1.62 billion people which consists of 24.8% of the total world's population (Venkatesh et al., 2021).

Fortification is not a new concept, it started 100 years ago in different countries Fortifying their staple foods. India started Fortification in 1953 with Vanaspati which was Fortified with Vitamin A and D and salt Fortification in 1962. In Switzerland, the Fortification of Iodized salt started in 1923, the map depicts the year and the staples Fortified in different countries. Denmark started Fortification of Oil and Milk with Vitamin in 1918, Indonesia in 1996, New Zealand in 2007, and Mexico in 2002. Fortification of Sugar and Wheat Flour with Vitamin A started in the USA, the UK in 1923, Malaysia in 1985, Thailand in 1993, Mexico in 2002, chile in 1997 with other countries like central America, Phillippines, Costa Rice, Puerto Rico, Trinidad, and Tobago. The timeline further highlights the history of Fortification in different countries (Gulati., 2018a). (Figure: 2.6)

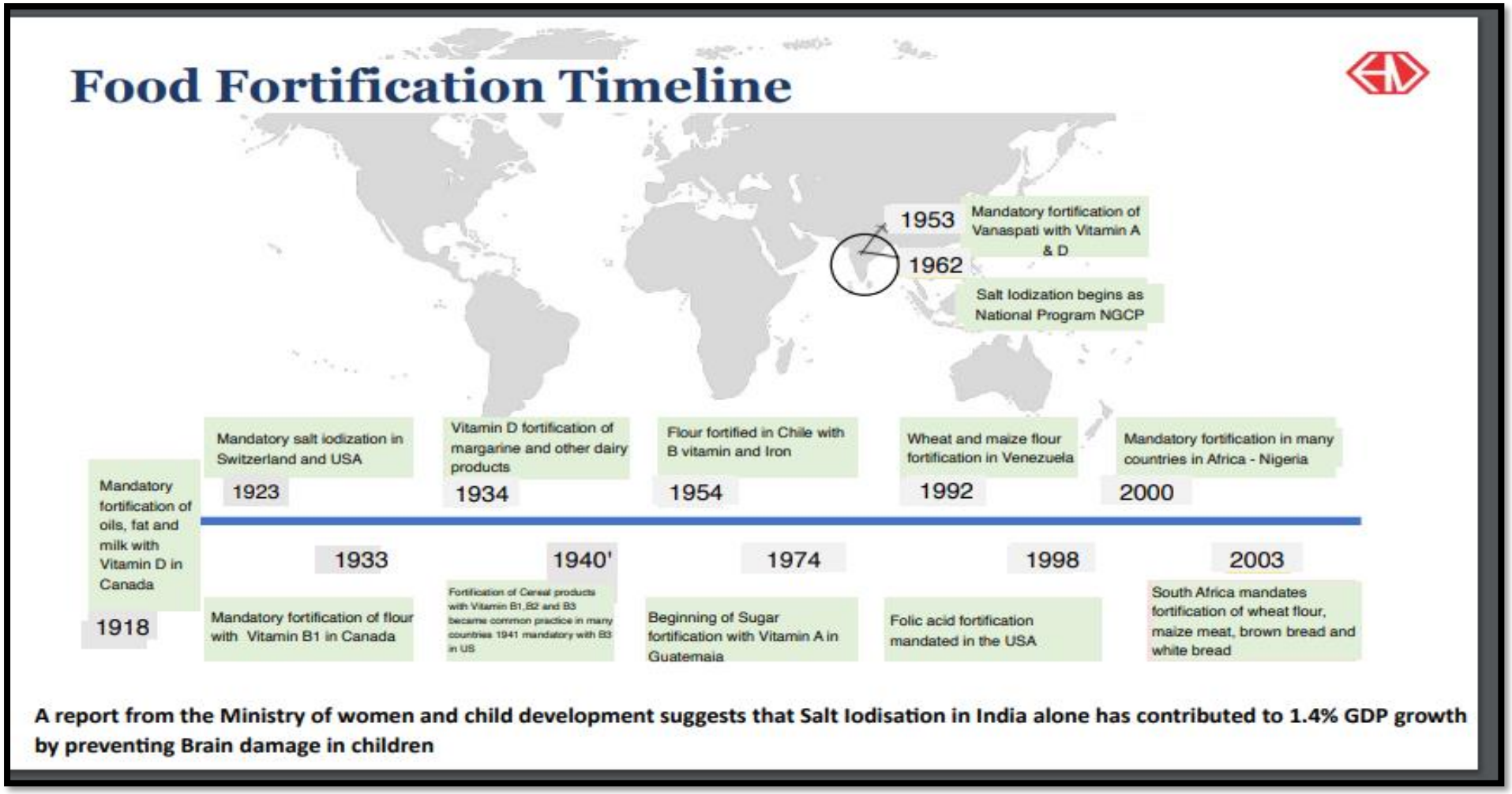


Figure 2.7: History of Food Fortification Worldwide (Mandke., n.d.)

2.3 Fortified Staples in India

2.3.1 Milk Fortification

Food Fortification is the enrichment of foods with certain nutrients that otherwise are missing in the food. One of the regulations on food Fortification states that the 'Levels of Food Fortification have been adjusted to provide 30-50% of RDA' thus a product needs to provide 30-50% of RDA to be able to use the +F logo (MoHFW and FSSAI., 2018)

Food Fortification is not a new concept in India. It started way back in 1962 by Fortifying salt with iodine, Fortification of milk with Vitamin A andD in 1980, and Fortification of Vanaspati with vitamin A in 1953 (Gulati., 2018b). Currently, there are many programs and schemes which are focusing on specific micronutrient deficiencies like National Nutrition Mission, ICDS, MDM, PDS, Eat Right Moment, Anemia Mukt Bharat, etc., especially for the LIG families but few programs have been initiated on Food Fortification for the general population as a whole.

According to National Nutrition Monitoring Bureau 2012, 62% of the population in India has low levels of blood serum for Vitamin A whereas about 50-90% of the population is deficient in Vitamin D, thus giving way to the health consequences amongst the people (NIN., 2012).

Milk in India is being Fortified with Vitamin A and D as milk is considered one of the staple diet which is consumed by every socioeconomic group, it is important to Fortify milk as vitamins in milk gets depleted upon heating, these vitamins are present in the top fat layer on the milk, formed after giving a boil to the milk, thus Fortifying milk helps in retaining these vitamins back to milk which is water soluble form of Vitamin A and D, so that even after removing or discarding the fat layer from the boiled milk, these vitamins will be present, thus being beneficial for the consumers.

All kinds of milk are being Fortified, toned, double toned, full cream, or no fat milk so that low-income population groups, who buy no fat milk to save their money and also cater to the needs of the population who prefer no fat milk can also be benefited.

NDDB Foundation for Nutrition (NFN) has started the program 'Gift Milk' as a part of their CSR activity where 200ml of Fortified flavored milk is being distributed to children studying

in government schools aged 5 -15 years. NFN has so far distributed 44000 units of milk to children which covers 94 schools in 7 different states (as of March 2019). In efforts to measure the impact, a study was being conducted by the Rajendra Institute of Medical Sciences (RIMS) located in Jharkhand, Ranchi. The study reported improved cognition amongst 24% of children, improved serum vermin B12 levels, a decrease in anemic children, and better IQ (16%) than their counterparts (control group). Apart from this, the program has also increased the attendance of the children by 10% (NDDB., 2019).

Milk is being Fortified at 25-30% of the recommended dietary allowance, which is much below the toxic levels, the values are set by FSSAI 2018 regulations keeping in mind, the upper tolerable limits, hence, making Fortification a safe strategy to combat malnutrition amongst the general population. Milk undergoes some micronutrient loss of 10-15% on boiling as per FSSAI (FSSAI., 2018c).

There are various Diary Cooperatives and private dairies that have joined hands to Fortify tones of milk for the need of the community. The cost of Fortifying milk has been kept low so that it doesn't pressurize the dairies and can easily cater to the needs, the cost is 2 paise per liter of milk which is cost-effective and sustainable (FFRC., 2020).

Fourteen countries have mandatory milk Fortification legislation; however, it was initially started way back in 1935 in a few of the countries. According to scientific evidence (FSSAI., n.d.-b), eleven countries are Fortifying milk with Vitamin A and D, similarly to India's legislation, whereas Costa Rica is Fortifying with Iron, folic acid, Vitamin A, and Vitamin D, and China and Canada are adding Calcium additionally to milk. According to the study conducted by (Sazawal et al., 2007) on milk Fortification in the urban north India amongst the children aged 1-3 years, who were fed Fortified milk (N-316) and others who were in the control group (N=317), Fortified milk has been beneficial in reducing the prevalence rate of diarrhea by 18%, pneumonia by 26%, and high fever by 7% and severe illness by 15% percent, since Vitamin A and Vitamin D have a well-known advantage of boosting the immunity against infections. The study delivered 21 sachets of Fortified milk 32 g serving which needs to be fed to children thrice a day. Fortified milk consumption for one year has been providing additional zinc (7.8mg), Iron (9.6mg), selenium (4.2 µg) Copper (0.27 mg), Vitamin A (156 µg), Vitamin C (40.2mg), and Vitamin E (7.5mg), every day. Additionally, these sachets also had extra Vitamin C for better absorption of iron, and copper. Though milk naturally has some vitamin

A and D in it, however during boiling the removal of cream and fat leads to the loss of these vitamins, since they are fat soluble nutrients.

Table 2.1 Indian Dairies practicing Fortification of Milk

Dairy Cooperative	Private Dairies
1. Chhattisgarh State Co -Operative Marketing Federation Ltd. Devbhog 2. Delhi Milk Scheme (DMS) DMS 3. Haryana Dairy Development Cooperative Federation Ltd. Vita 4. Jharkhand State Cooperative Milk Producers Federation Ltd. Medha 5. Maahi Milk Producer Company Ltd. Maahi 6. Madhya Pradesh State Cooperative Dairy Federation Ltd. Sanchi 7. Mother Dairy Fruit and Vegetable Pvt. Ltd. Mother Dairy 8. Odisha State Cooperative Milk Producers' Federation Ltd. OMFED 9. Punjab State Cooperative Milk Producers Federation Ltd. Verka 10. Rajasthan Cooperative Dairy Federation Ltd. Saras 11. West Assam Milk Producers' Cooperative Union Ltd. Purabi 12. Uttarakhand State Dairy Coop. Federation Ltd. 13. Bihar State Milk Co-operative Federation Ltd. Sudha 14. Pradeshik Cooperative Dairy Federation Ltd. Parag 15. Karnataka Milk Federation 16. Nalgonda Milk Union 17. Maharashtra Rajaya Sahakari Dugdh Mahasangh Maryadit Mahanand Dairy 18. Krishna Milk Union	1. Britannia Industries Ltd. 2. Cream line Dairy Products Ltd. 3. Dairy power Ltd. 4. Goma Foods Pvt. Ltd. 5. Heritage Foods Ltd. 6. Kwality Ltd. 7. Milky Moo PAN 8. Nestle India Pvt. Ltd. 9. Uttar Pradesh Pradeshik Cooperative Dairy Federation Ltd. 10. Sunfresh Agro Industries Pvt. Ltd. 11. Prabhat Dairy Uttar 12. VRS Foods Pvt. Ltd.

Source: (Food Safety And Standards Authority Of India, 2018)

Despite the benefits of Fortified milk, there has been some difference of opinions among the various scientist, academicians, etc. regarding the cost of Food Fortification. FSSAI has calculated the cost of milk to be 2 paise per liter of milk and other staples, making Fortification a cost-effective one. These minimal costs invested for the health of the country's people will reduce the cost of health care, and also the burden on the economic status of the country. The Copenhagen census has reported, that one rupee spent on the Fortification procedure will provide 9 times benefit to the country and its economy which further will promote the overall growth and development of the country (FSSAI, n.d.-a) and (Copenhagen Consensus., 2008).

Table 2.2: Cost of Fortification in an Open market

	Wheat Flour	**Rice**	**Milk**	**Edible oil**	**DFS Salt**
Cost of Fortification per kg (in Rs)	0.08-0.10	0.80	0.015	0.08-0.10	2-3
Cost of Fortification, Processing, Packaging per kg (in Rs)	2.5	1.7	0.015	0.08	00

Source: For salt (MOHFW., 2017)

Source: (Gulati., 2018b)

Although it's a fact that Fortified milk is beneficial and one glass (320ml) is providing 34%, Vitamin A and 47% of Vitamin D, few the companies are not ready to Fortify their brands, to fill in the gap, National Dairy Development Board (NDDB) has partnered with South Asian Food and Nutrition Security Initiative (SAFANSI), the World Bank and The Indian Nutrition Initiative, Tata trust for joining hands and helping in scaling up the food Fortification. The partnership of NNMB with various other organizations has led the 10 milk federations, and dairy producers to start the trail of Fortified milk for their respective brands, which is indeed a great step toward fighting the micronutrient deficiency (Bresnyan., 2018).

2.3.2 Rice Fortification

Rice is another suitable vehicle for Fortification since its being widely consumed by people in different countries, other than wheat flour. The countries with the majority of rice eaters can address the micronutrient deficiency by Fortifying rice with Iron, Vitamin B12.

Most of the rice is being produced by Indonesia, Bangladesh, and India. It becomes important to Fortify rice, as nutrients are lost during the harvest, milling, and polishing process. Rice is a staple of 65% of the Indian population, thus Fortifying it will help in bridging the nutrient gaps (Department of Food and Public Distribution., 2020).

An efficacy study conducted by TATA TRUST from 2018 to 2020 in Maharashtra district, Gadchiroli, saw improved status in the prevalence of anemia by providing Fortified rice through the PDS system for one year. The study observed a reduction in anemia cases by 21.4% amongst women, adolescent girls, and children (FFRC and FSSAI., 2020).

Another study conducted for six months amongst the 250 school children (5-8 years of age) in Punjab examined a significant improvement in the status of Hemoglobin and serum ferritin amongst the children who were being fed Fortified rice through the school meal program. The study blended the Fortified rice with other rice in a ratio of 1:100 which didn't change the taste of the rice and was thus acceptable to the children (Hussain et al., 2014).

There are multiple scientific publications from different countries which states that rice Fortification improves the health status of the people by improving the HB, Vitamin A, Zinc, Folic acid, and Vitamin B12 status. There is minimal loss of micronutrients during the process of cooking rice through boiling or pressure cooking. A study conducted on the retention of nutrients in cooking rice in 5 different ways i.e. absorption method with or without soaking, washing before cooking, cooking in water, and frying rice before cooking, records the retention of micronutrients (Iron, Zinc excess, Vitamin B12, and folic acid) between 75% and 100% with an exception for Vitamin A which doesn't retain during cooking in excess water whereas having 80% of retention when cooked using the soaking technique (Wieringa et al., 2014).

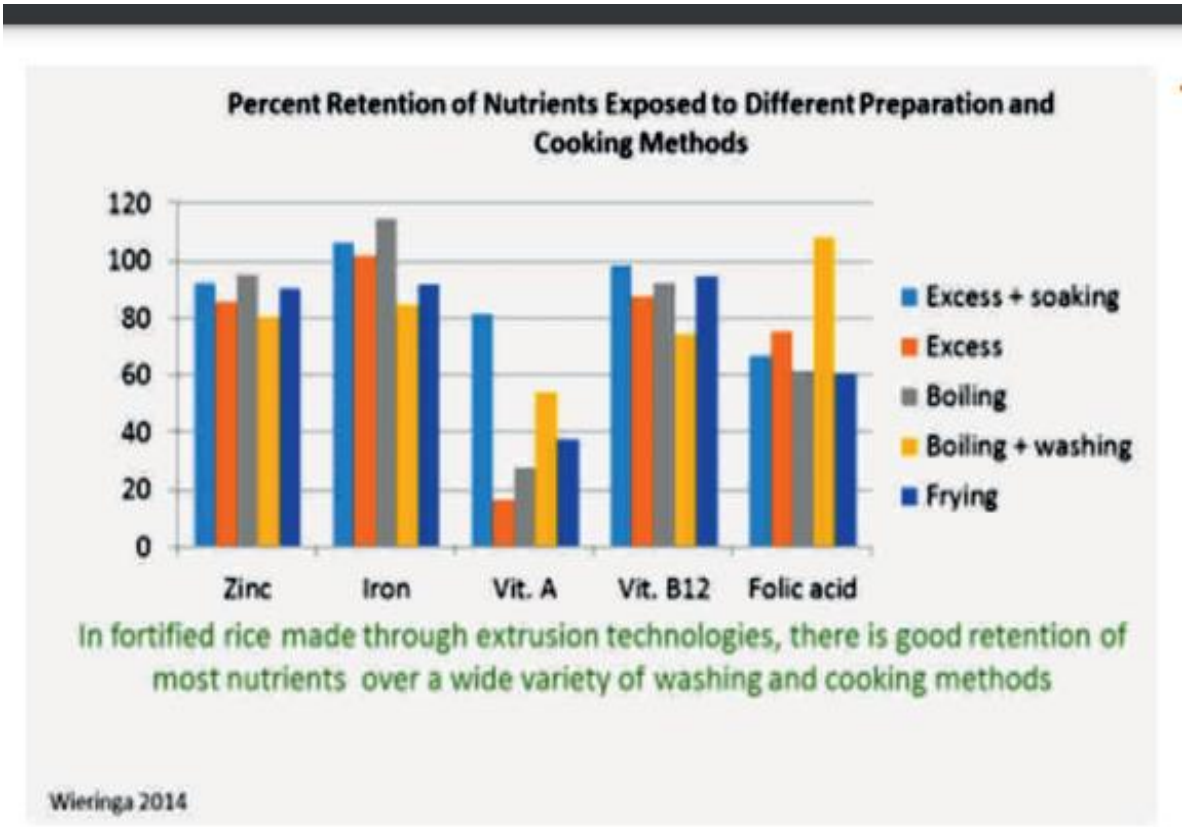


Fig 2.8 Retention of Nutrients after cooking

PATH has been working in different countries on Rice Fortification. In Burundi, PATH, World Vision, and UN World Food Programme (WFP) are conducting research on efficacy trials in the local community for testing the operational feasibility amongst the school children. Similar studies are being undertaken in Cambodia, India, Myanmar, Vietnam, Nigeria, and Brazil (Aung., 2017) (PATH., 2019).

In India, 2700 rice mills have been installed for Fortification where India's blending capacity is 13.67 lakh tones across 14 states. The Central Government has passed a notice for supplying Fortified rice in Government schools to children through Mid-Day Meals and ICDS which will further scale up to PDS. Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, and Chhattisgarh have started the Pilot of distributing Fortified rice out of the 15 states identified by the government (Patro., 2022).

2.3.3 Wheat Flour Fortification

The staple diet of most Indians re Cereals and Millets. Thus Rice and Wheat flour serve as the best vehicle or Fortification. Wheat is grown in India on a large scale and is a part of the

staple diet in India. According to NNMB survey conducted in 2012, Indians consume approx. 375g of cereals in a day. Wheat kernels lose various essential micronutrients during milling and processing such as Iron. Folic acid and Vitamin B12 are stored back with the Fortification process. The average per capita consumption of wheat flour is from 150-to 300 grams. (NIN., 2012)

Gujarat has implemented delivering of Fortified wheat flour in its Social Safety Net Programs (SSNP), namely, ICDS, MDM, and PDS. A study was conducted by (Fiedler et al., 2012), to assess its coverage and the impact on the health of its beneficiaries. The study used the data from National Sample Survey to identify households with deficiency of micronutrients and their daily intake amongst the beneficiaries. The post Fortification levels showed improvement in the intake of nutrients. Vitamin A intake was enhanced by 34% amongst the beneficiaries of MDM and ICDS whereas, amongst the PDS users, intake of iron was enhanced by 94%. Enough studies have indicated the benefits of Fortifying wheat flour on the improvement of birth defects and intake of essential micronutrients (Barkley et al., 2015) (Akhtar et al., 2011). Studies have also claimed a reduction in birth defect cases from regular consumption of wheat flour for a year by 31 to 78%.

2.3.4 Oil Fortification

Oil Fortification has a history in India since 1950 when vegetable oil used to get Fortified along with salt iodization, however, due to a lack of the global evidence it was discontinued and gained momentum again in 2016 with developed standards for Fortification of various staples. The most common oils consumed in India are rapeseed oil, soy oil, cotton seed, and groundnut oil which have a penetration rate of 99% of households.

Oils are being Fortified with Vitamin A and D which are both fat soluble vitamins and can retain even after reaching the frying stage (Bhatnagar and Kanoria., 2020) (FFRC., n.d.).

The total oil consumption has been reported as 24 million metric tons (MMT) in India, which makes oil a suitable vehicle since its being consumed by everyone, at all times as a part of the staple diet. The NSSO report, 2014 has reported the consumption of oil by 20-30 grams/per person/per day (NSSO., 2014).

FFRC has conducted training with key stakeholders for oil Fortification for the implementation of the strategy which has bought together a few brands namely Mother Dairy

Fruits and Vegetables Pvt Ltd, Cargill India, Adani Wilmar Limited, and others who have started the process with new FSSAI standards. At present, there is 43% of Fortified oil available in the Indian market which is reaching 325 million consumers. GAIN on the other hand has joined hands with FSSAI and is conducting various meetings for the implementation of the Fortification strategy in different states, Rajasthan, Madhya Pradesh, Haryana, Punjab, Andhra Pradesh, Maharashtra, and Telangana are a few of the states which have been selected for the promotion, since they are amongst the top oil producing states (Tata Trusts., n.d.) (FFRC., 2016).

There is enough evidence available for Oil Fortification. In 1917 Denmark started the oil Fortification of Vitamin A which lead to a reduction in Xeropthalmia cases in the hospital by 90%. Another study observed a decline in the prevalence rate of serum retinol levels. After consumption of Fortified margarine for at least six months, the serum retinol fell from 25% to 10% (Aykroyd and Jolliffe., 1949).

There is minimal loss of Vitamin A, D, and E in cooking, however through repeated frying loss of micronutrients occurs by 20- 25%. It is recommended not to fry in the same oil which has been used once for frying. As it leads to loss of micronutrients (FFRC., 2016).

2.3.5 Salt Fortification

Salt Iodization was launched in 1962 in India under the National Goiter Control Program, and in 1992 it was renamed as National Iodine Deficiency Disorder Control Programme (IDD and Nutrition cell. Ministry of Health and Family Welfare, 2006). Iodine Deficiency is affecting the world despite its wide consumption on daily basis. Worldwide it is affecting 200 million people and leading to 71 million goiter cases and other disorders. For children aged 6 – 12 years and the first 1000 days are the most crucial time since iodine deficiency leads to psychomotor impairment and affects the growth of the child. Researchers have estimated that 1.88 billion people are at risk of which 241 million are children who are consuming an adequate amount of iodine (G. Kaur et al., 2017). Despite universal salt iodization since 2005, only 71% of households were consuming iodized salt because of non-availability in the rural areas and lack of knowledge amongst the community members. NFHS 5 has reported Daman and Diu, Dadra and Nagar Haveli, and Andhra Pradesh (83%) have minimal consumption of Iodized Salt.

In Switzerland, salt Iodization started in 1920 which has led to mandatory Fortification of

salt in 137 countries in 2019, whereas 68 countries have mandated Fortification for two of the staples to combat the micronutrient deficiency (Gunnal et al., 2021).

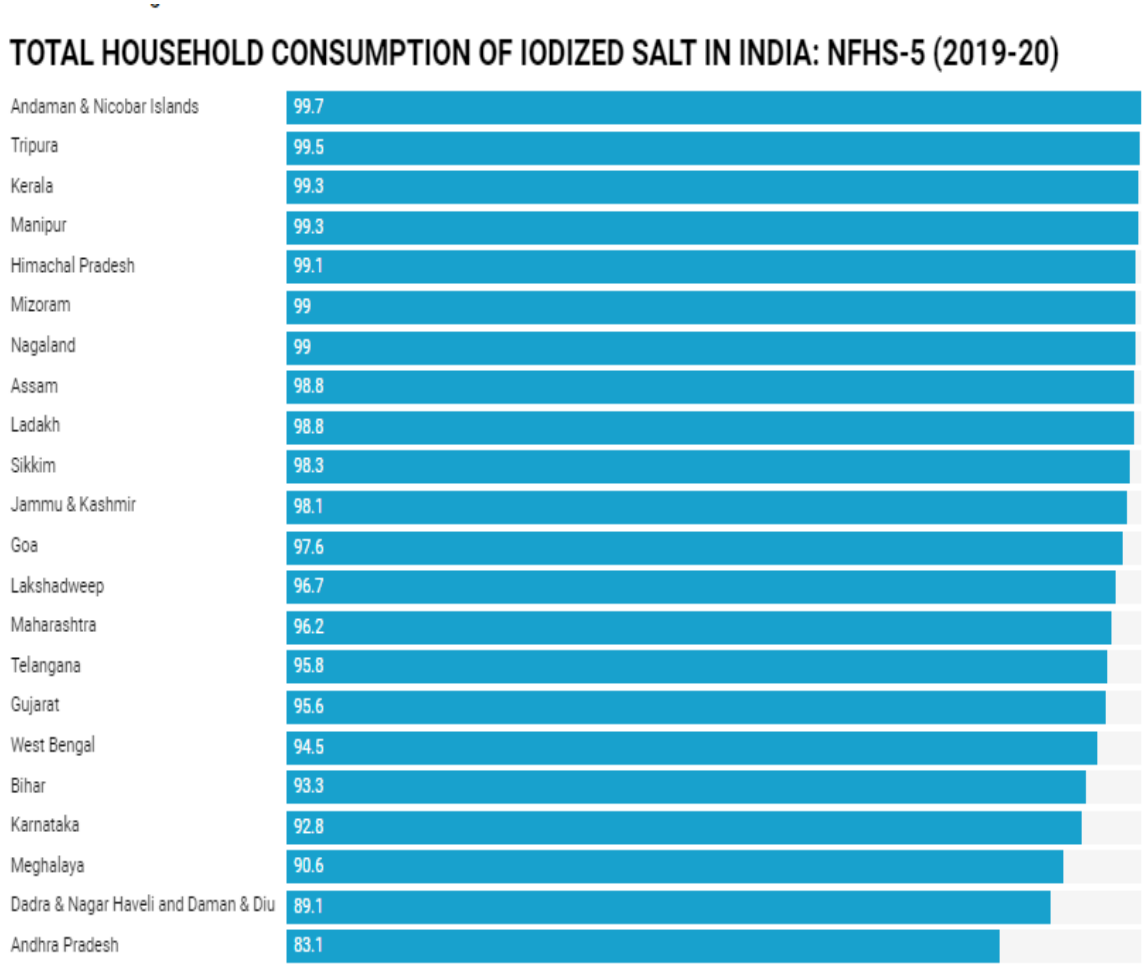


Fig 2.9: Consumption of Salt by Households in India (NFHS 5)

Source: (NFHS 5, 2022) (Gunnal et al., 2021)

A study was conducted to assess the efficacy of Double Fortified Salt (DFS) with iron and iodine amongst 212 women of West Bengal aged between 18 – 55 years. The study was double-blind wherein DFS or a control iodized salt was distributed for 9 months. DFS showed improvement as compared to the control group in hemoglobin, ferritin (34%) and soluble transferrin receptor, and body iron. The study also reported decreased prevalence of iron deficiency after 9 months of consuming Fortified salt (Haas et al., 2014) (Andersson et al., 2008).

It is essential to consume iodine on daily basis and get the recommended dietary allowance, which varies for every age group. Iodine doesn't have any storage organ in the body. Meat,

fish, milk, etc. are a few of the sources of iodine that should be eaten on daily basis, however, to reach the minimum allowance, it is difficult to fulfill the requirements through dietary sources, making Fortification the need of an hour.

Iodine levels have been safely standardized for the Fortification process in the table salt. While cooking, iodine loss ranges from 20- 40% due to the heating process, to compensate for this loss, iodine levels have been standardized by FSSAI considering the safe limit of iodine consumption.

Over 3 billion people are consuming iodized salt as of 2018 according *to* (Mkambula et al., 2018) *in an article published on devex.com. So far, 20 countries have been classified under the red category for utilizing iodized salt below the acceptable limits as per WHO 2017.*

2.4 Fortification and Its Safety

According to the recent studies conducted in Ethiopia and the United States, Fortification for a long time can be toxic, especially when it's consumed along with the supplements or when it is provided to a population with mild deficiencies, (Dwyer et al., 2015) (Dasa., 2019). Hence it has been stated that for Fortification to be implemented there should be enough dietary gaps in the diet of the targeted population, levels set for Fortification should be low, (Table 2) and changes in dietary habits of people should be kept in mind (Neufeld et al., 2019). Currently, a Fortificant range has been developed by FAO/WHO as per the standards which are well below the upper tolerable limit, premix added to foods as Fortificant is less than 0.02%, and thus it is safe to consume Fortified food. (MoHFW and FSSAI., 2018) Also, as per the 68th round of Nutritional Intake in India report, conducted by NSSO, GOI (2011-2012), people in India have a very low intake of fruits (30g/day) and vegetables (<50g/day) which are far less than the recommended intakes (NSSO., 2014). This means Indians are lacking certain micronutrients in their diet and so Fortification can currently be used as a vehicle to improve their micronutrient status.

2.5 Fortification Logo and Claims

On 11th August 2017, FSSAI launched the Fortification logo ' +F' which will enable the consumers in identifying the products with added micronutrients in them. FSSAI has issued clear guidelines on the size, color, and display of the +F logo on the front label of the product.

+F logo has to be displayed on the packet, clearly mentioning the nutrients the product is getting Fortified with.

Fortified products like milk, Double Fortified Salt, Rice, Oil, and wheat flour will have a +F logo which will be a mandate, additionally, producers and manufacturers are allowed to have the nutritional claims for the Fortificants the product carries to advocate the benefits of the product (MoHFW and FSSAI., 2018).

S. No	Nutrients	Claims
1	Vitamin A	Helps against Night blindness;
2	Vitamin D	Supports strong bones;
3	Vitamin B12	Important for maintaining normal functioning of Nervous system and blood formation;
4	Folate & Folic acid	Important for foetal development and blood formation;
5	Iron	Fights Anemia;
6	Iodine	Required for normal growth, thyroid and brain func-tion;
7	Zinc	Supports a healthy immune system;
8	Thiamine	Required for normal nerve and heart function;
9	Riboflavin	Necessary to release the energy from food;
10	Niacin	Necessary to release the energy from food;
11	Pyridoxine	Necessary to release the energy from food.

Fig 2.10: Claims on Fortified Products by FSSAI (FSSAI, 2018b)

Fortificants have been curated safely by FSSAI considering the safety and toxicity levels of each nutrient being used as Fortificant.

Table 2.3. Fortificants and their levels in staple foods (MoHFW and FSSAI, 2018)

S.no	Component	Level of Nutrients
1	**Salt when Fortified with Iron and Iodine**	
	Iodine	20-30 ppm (Manufacture level
	Iron	850-1100 ppm
2	**Fortified oil**	
	Vitamin A	6 ug RE-9.9 ug RE per gm of oil
	Vitamin D	0.11 ug-0.16 ug per gm of oil

3	**Fortified Milk**	
	Vitamin A	270 ug RE-450 Ug RE (per liter)
	Vitamin D	5 ug-7.5 ug
4	**Fortified Wheat Flour (Atta)**	
	Iron	28 mg-42.5mg
	Folic Acid	75 ug-125 ug
	Vitamin B12	0.75 ug-1.25ug
	(other Micronutrients include- zinc, Thiamine, Niacin, etc)	
5	**Fortified Raw Rice**	
	Iron	28 mg-42.5mg
	Folic Acid	75 ug-125ug
	Vitamin B 12	0.75 ug-1.25 ug
	(other Micronutrients include- zinc, Thiamine, Niacin, etc)	

Thus for promoting Fortified Foods at the Community level, It is important to have the availability of sufficient brands Fortifying their products, along with the +F logo which will help in the identification of the Fortified products. Table 3 enlists all the 5 staples and the available brands in an Open Market (FFRC., 2018).

Table 2.4: List of Fortified Foods available in an Open Market in Gujarat or PAN India

Mode of Fortificant	**Company Name**	**Brands**	**Gujarat/ PAN India**
Fortified Wheat Flour			
1.	Future Group	Golden Harvest	PAN India
2.	Mishkat Agro Industries	Energetic	Gujarat
3.	General Mills Pvt Ltd.	Pillsbury	Gujarat
4.	Patanjali Ayurved Ltd.	Patanjali Aata	PAN India
Fortified Rice			
1.	DCP India Pvt Ltd.	Asbah	PAN India
2	LT Foods	Daawat (Rozana)	PAN India

Fortified Oil			
1.	Adani Wilmar Pvt Ltd.	Fortune, Fortune plus, etc	PAN India
2.	AAK Kamani Pvt Ltd.	Komal, Jawan, Classic	PAN India
3.	Cargill India Pvt Ltd.	Gemini	PAN India
4.	Kriti Nutrients Lmt	Kriti	PAN India
5.	Marico Ltd.	Safola Active etc	PAN India
6.	New Bharat Oil Mill	Parmatma Mustard Oil	PAN India
7.	Mother Dairy, Fruit and Vegetable Pvt Ltd.	Dhara	PAN India
8.	AP Organics Ltd.	Hudson Canola oil etc	Gujarat
9	Frigarifico aalana pvt ltd.	Sunny priya radhuni etc	Gujarat
10	Patanjali Ayurved Ltd.	Patanjali Mustard oil and ranges	PAN India
Fortified Milk			
1.	Maahi Milk Producer Company Ltd.	Maahi	Gujarat
2.	Mother Dairy, Fruit and Vegetable Pvt Ltd.	Mother Dairy	PAN India
3.	Britannia Industries ltd.	Britannia	PAN India
4.	Kwality Ltd.	Kwality	PAN India
5.	Nestle India Pvt Ltd.	Nestle a+ Nourish	PAN India
Double Fortified Salt			
	AnkurChem Food Ltd.	Ankur Salt Plus	PAN India
	Indo Brine Industries Ltd.	Dandi, INDO, Kohinoor	PAN India
	Super salts Pvt ltd.	Top Line	Gujarat
	Tata Chemicals pvt ltd.	Tata Salt Plus	PAN India
	Chirani Salt India Pvt Ltd	Sun Gold Plus	Gujarat
	Western India sea Brine Pvt Ltd.	I-Power SNP	Gujarat

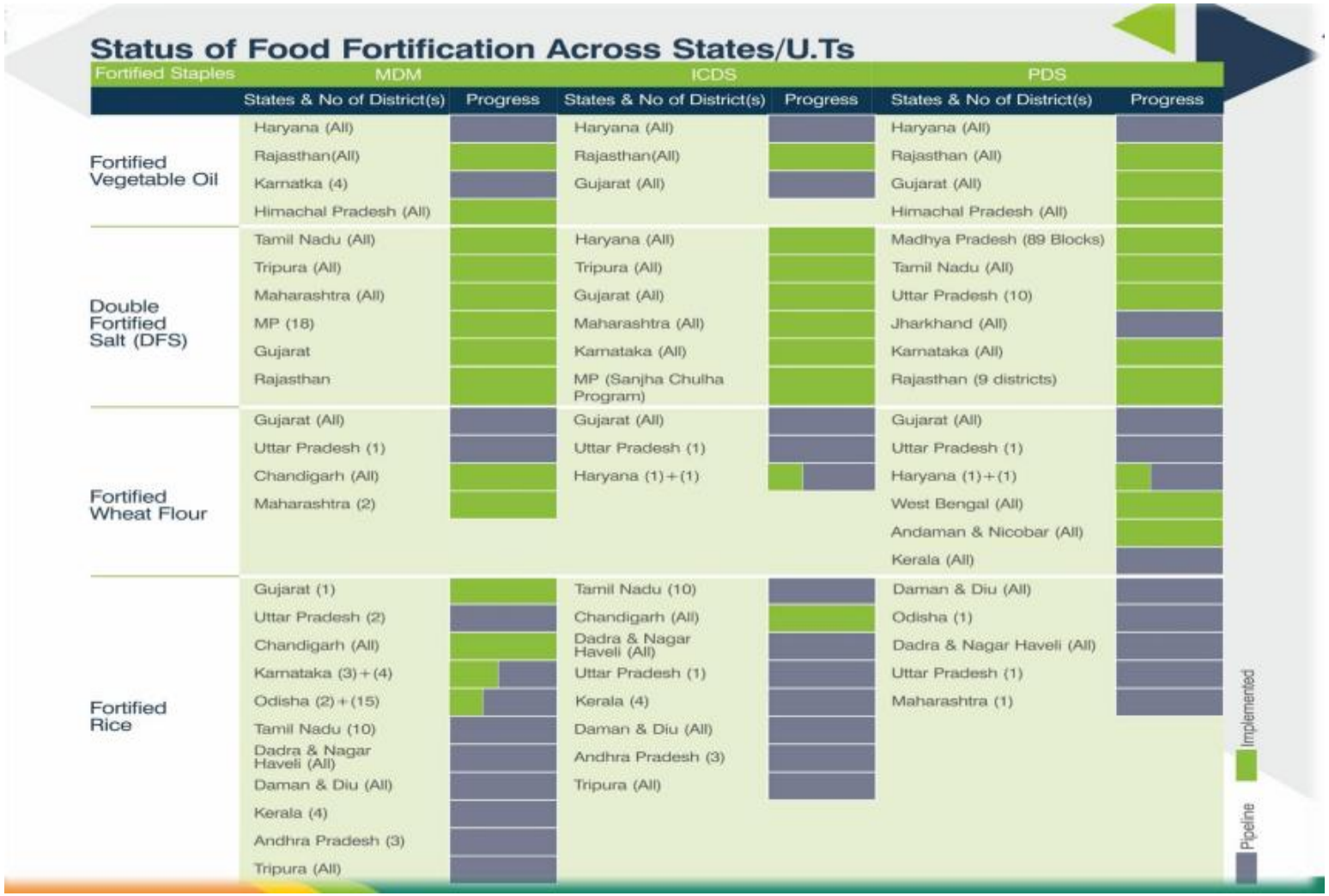


Figure 2.11 Current Progress of States/ UTs with respect to Fortification *(FFRC., 2018)*

The government of India has taken a step forward in Fortifying the staples that are provided under Targeted Public Distribution Scheme under a pilot project in 15 states, one district each. World Food Programme has joined hands with India's Ministry of consumer affairs, Food and Public Distribution, and is providing technical assistance for Fortification in India. WFP has conducted its first Training on Food Fortification of rice in Lucknow and is joining hands with private agencies to Fortify rice and wheat, following the gazette standards issued by FSSAI.

WFP will assist in providing training, procurement of machinery, premixes for the Fortification process, setting up the kitchens and cascade training of the premix suppliers, and constant monitoring and evaluation of the process.

Initiatives have been undertaken by WFP in collaboration with the Department of Basic Education of Uttar Pradesh wherein the distribution of Fortified rice and wheat flour has started in schools of Varanasi in December 2018, so far, approximately 367 tons of Fortified rice and 16.7 tons of wheat flour has been distributed through mid-day meal channels, however, some challenges that the organization has faced were regarding the stability issues in government postings which are subject to frequent transfers (WFP., 2020).

A study conducted in Vietnam has recorded that there was reluctance amongst the people regarding the acceptance of Fortified food since staples have been chosen as a vehicle of Fortification which is consumed in great quantities, a however small variation in the prices is a cause of concern for the consumers who are price sensitive and run their house on a monthly budget basis, which could defer the intentions towards other alternative offering cheap prices than their counterparts. To overcome the concern, it is important to have the support of the Governments and Fortify the products at a larger scale by tying up with the private agencies which could help in adopting and technical assistance. Mandatory regulations by the government would help in addressing malnutrition, making Fortified Foods the 'best buys' option for the community. Another important observation marked in the study was the use of social marketing for the identification of the logo, which could be simple, colorful, and visible on the front packaging, however, the challenge was to make the community familiar with the logo and its importance. The 4 P's approach which is Price, Product, Place, and Promotion was adopted as the strategy for influencing the behaviors of the community (Turk et al., 2016).

2.6 Food Fortification Awareness

On August 29th, 2018, FSSAI addressed the widespread micronutrient deficiency in Chandigarh by promoting Fortified Foods and launching 'EAT RIGHT MOVEMENT' which also addresses the capacity building for Fortified Foods. Other states which have taken the lead are Punjab and Haryana. FSSAI conducted a workshop in Chandigarh to engage and sensitize the local media and stakeholders on food Fortification since the majority of the people are unaware of its benefits and are skeptical considering the costs and myths around Fortification. Mass awareness sessions and programs need to be undertaken by researchers, media, and manufacturers for clearing out the doubts of the community people and promote the uptake of Fortified Foods. The standards for Fortification have been carefully decided by the scientific panel of FSSAI and the limits have been set taking into account the toxicity of micronutrients. The standards provide micronutrients for about 30-50% of the daily RDA of nutrients. Chandigarh has taken a step forward by being the first city for adopting Fortified Foods under ICDS and MDM programs which would address approx. one lakh beneficiaries, followed by Punjab and Haryana (FSSAI., 2018b). Currently, 15 states and 3 UTs have adopted Fortification under the safety net programs.

Fortification Assessment Coverage Toolkit (FACT) is a survey developed by GAIN for assessing the coverage of Fortified Foods for the population who is consuming Fortified Foods. The survey was conducted to assess the barriers and determine the coverage of Fortified Foods and their contribution to total RDA. The FACT survey was conducted in cities of Pakistan where mandatory Fortification for oil and ghee started way back in the 1960s, and salt iodization voluntarily since the 1980s. Nearly 704 households were surveyed in Balochistan, 690 from Punjab, and around 710 in Sindh. The market survey observed that there were 30 brands which were available in the local markets for Fortified salt, 149 brands for Fortified oil/Ghee, and 67 brands of wheat flour. The results revealed that oil and ghee were being consumed by 100% of the households, making it universal amongst the study population and 84% were consuming Fortified salt. The consumption of Fortified wheat flour was lower in the households with 52% in Baluchistan, 31% in Punjab, and 63% consumed in the Sindh region. Further calculations revealed that Fortified salt was contributing 31% of EAR on an average for iodine, especially amongst the children between the age of 12-23 months, 39% of children in 24-59 months, and 40% among women of reproductive age (WRA) in Baluchistan, whereas in Punjab it was 45% for children (12-23months), 54% in children (24-59m) and 51% WRA.

For Vitamin A Fortified oil contributed nearly between 35- 45% of the EAR, and approx. 5-12% for Iron in the selected age groups. (*FACT.*, 2018)

2.7 Social Marketing

Social marketing as defined by (Kotler and Lee., 2011) is the; Process that applies marketing principles and techniques to create, communicate, and deliver value to influence target audience behaviors that benefit society as well as the target audiences'. According to Kotler social marketing is applied to improving public health, preventing injuries, protecting the environment, contributing factors, and for enhancement of the wellbeing of the community.

Food security and Nutrition Public Awareness report on advocacy framework launched in Afghanistan in 2018- 2023 provide the lessons on advocacy and SBCC model which is the Social and Behaviour Change Communication strategy. SBCC is a planned process that follows a systematic approach and identifies the barriers and motivators which could help in changing the perception of the people living in the community. The key components of SBCC are Advocacy, social mobilization, and Behaviour Change Communication. Afghanistan had a disrupted nutrition status which could only be changed by involving stakeholders at different levels by the SBCC framework (USAID., 2018).

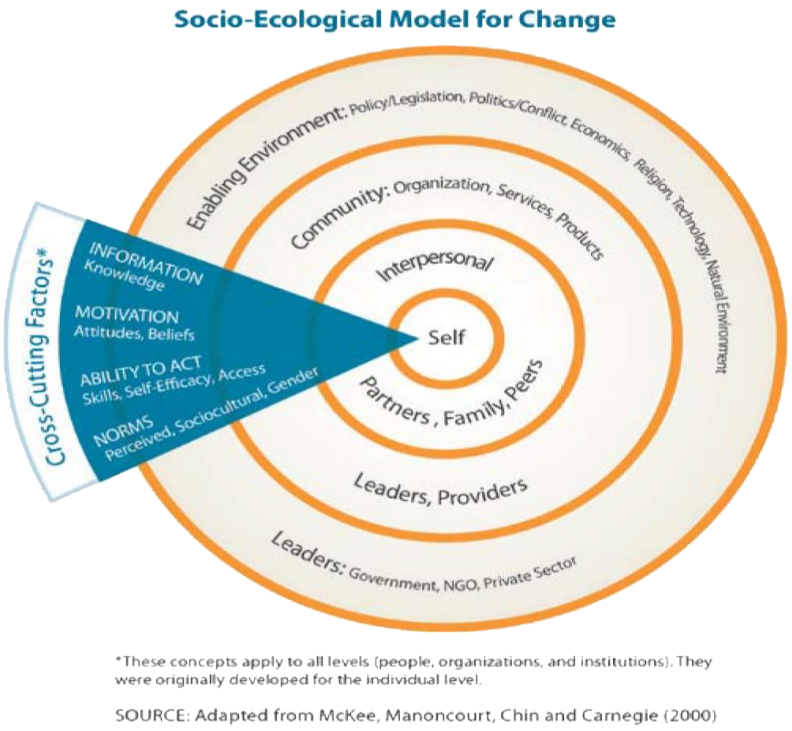


Fig 2.12: Socio-Ecological Model of Change

Dalberg has estimated less than 20% of the production of Fortified products which can be one of the reasons for hampering the uptake of Fortified Foods by the people. For adoption, it is necessary to make the products available in the product. The report has also raised concern regarding the adoption of Fortified products by the vulnerable population. Nearly 40- 60% of products are not reaching due to the unavailability of the Fortified products in the market, thus it becomes important to have strong communication channels to transfer the message regarding the benefits, identification and promote manufacturers to Fortify their products and make them readily available in the Indian market.

Different communication tools, strategies, and models can be used for promotion using behavior change communication through various means for the masses which will help in the uptake of +F products by the consumers and also conducting training sessions with the manufacturers and producers for addressing demand and supply effectively (Bhatnagar and Kanoria., 2020).

It is important to provide manufacturers and producers with support equipment and Fortifying according to the standards issued by FSSAI, regular monitoring, and evaluation of the plant set for the Fortification process, and training of the staff and the employers for the procedure of Fortifying different staples (Mkambula et al., 2020).

Every effort taken for Fortification and to fight micronutrient deficiency will lead to higher benefits for the health of the individual as well as for the economy.

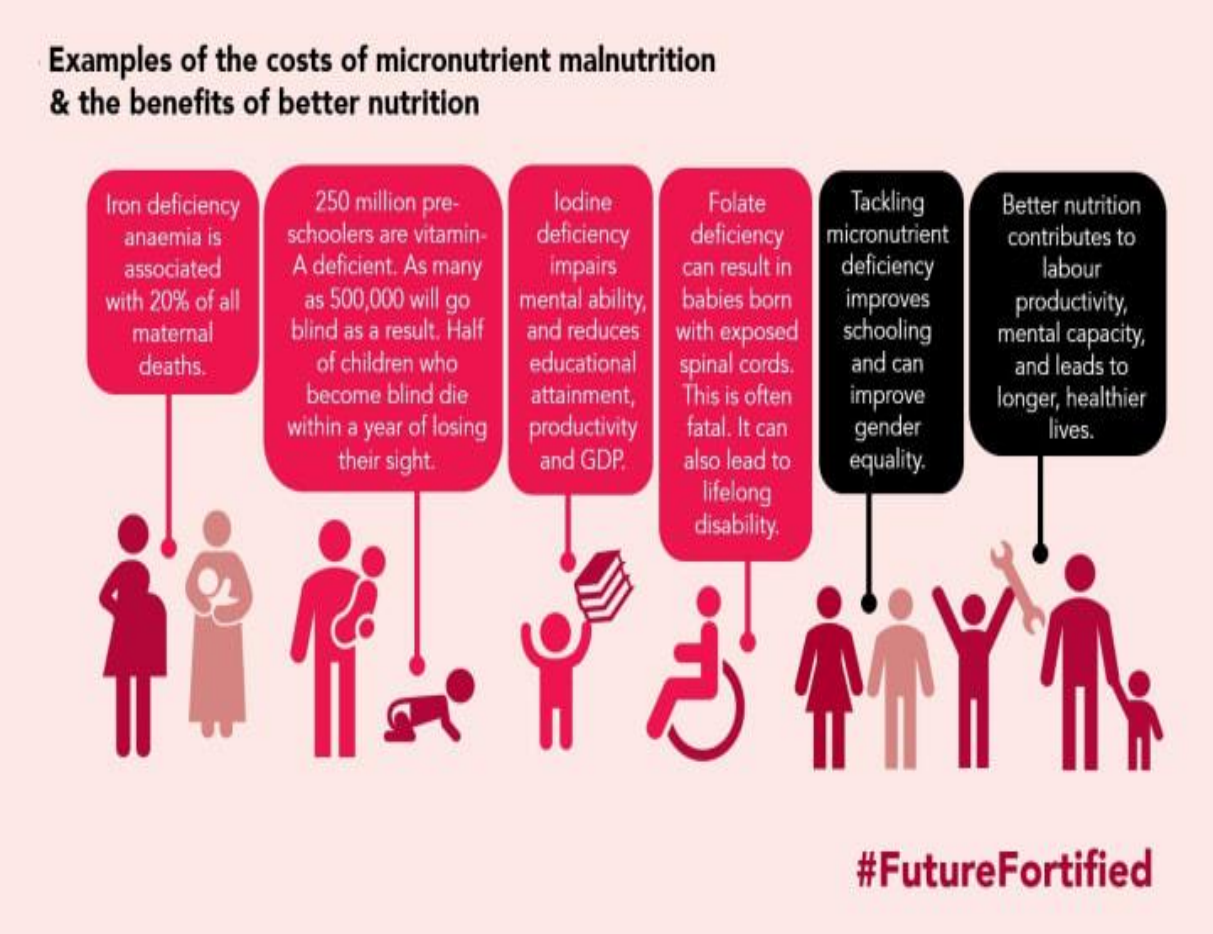


Fig 2.13: Investments in Malnutrition and its Return (Pic Reference: GAIN: Food Fortification for a smarter, healthier, Moe Productive World)

2.8 Food Fortification around the World

Food Fortification imitative provides technical support and assistance to government, Private partners, producers, manufacturers, and agencies for the implementation of food Fortification. The 2021 report of (FFI., 2021a) states that the efforts taken by the agency have helped the countries to reduce micronutrient deficiency for nearly 1.3 billion people.

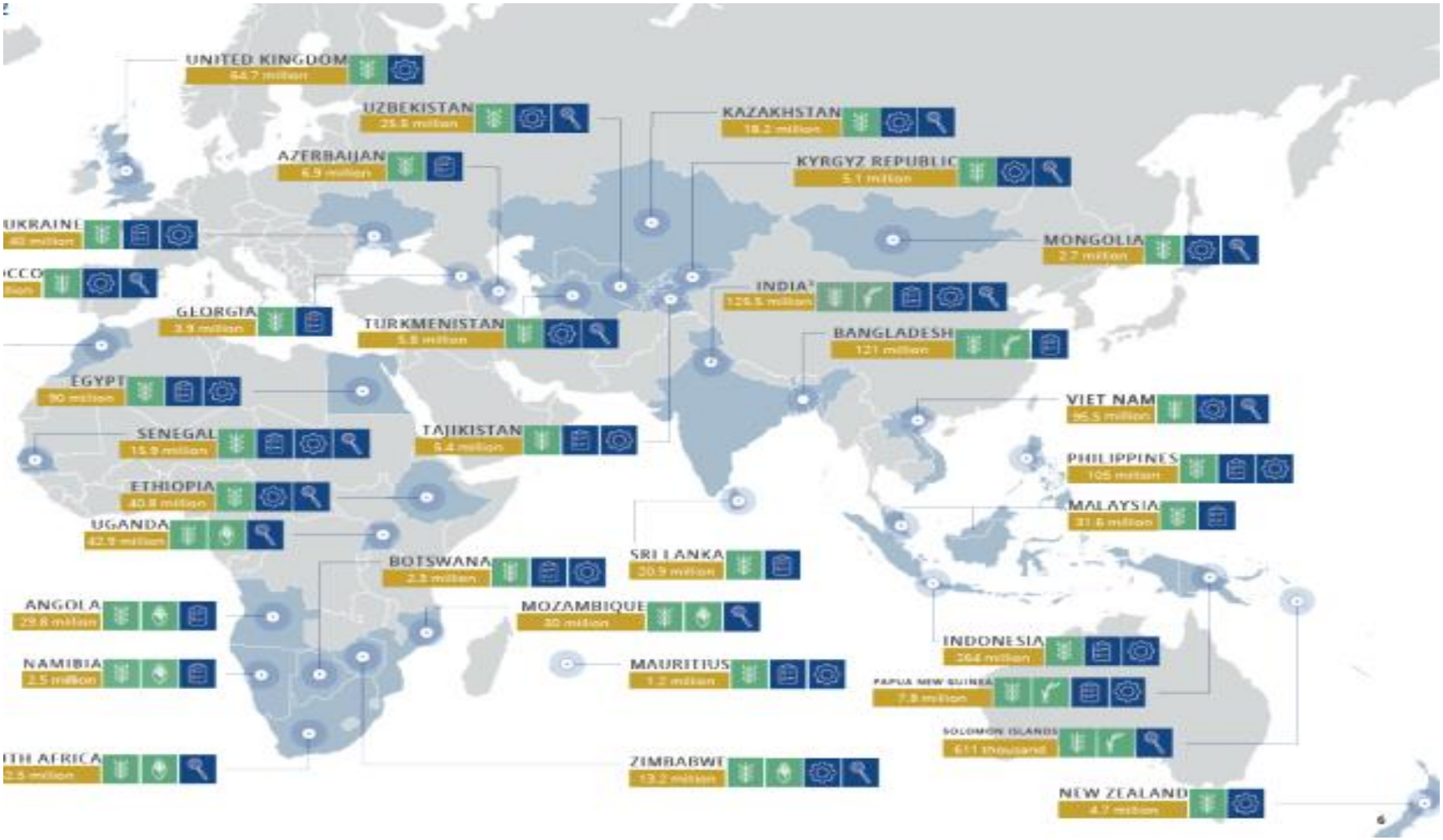


Fig 2.14: Reach of Fortified Foods across the world

Table 2.5: Food Fortification around the World

S.no	Country	Progress by FFI	Organizations working Together
1	AFRICA	‘ Smarter Future’ is the program running in Africa that has been running for the last 15 years and has conducted 27 meetings for the stakeholders and provided technical support to government officials, producers, manufacturers, and organizations in 26 countries. Smarter Future has reached 723 million people through the implementation of mandatory food Fortification of grain (Wheat flour Maize, Rice) in 29 countries, as of December 2021. The initiative has prevented 21 million cases of anemia amongst WRA and 43k cases of neural tube defects by providing Fortified grains to the people	1. Global Alliance for Improved Nutrition 2. International Federation for Spina Bifida and Hydrocephalus 3. Buhler 4. Hellen Keller international Muhlenchemie 5. Nouryon 6. Nutrition International 7. World Food Programme 8. Ministry of Foreign Affairs of the Netherlands

2	EGYPT	FFI conducted Flour Fortification advocacy workshops in Egypt for millers, along with various stakeholders from the private and public sectors. The recent workshop was conducted on 21st April 2021 which demonstrated the process of Fortification and its significance concerning reduction in anemia and neural tube defect cases amongst children. Wheat flour is the main vehicle of Fortification in Egypt since its consumption is 17 million tons annually. Baladi bread which is made of wheat flour is widely consumed in EGYPT, through safety net programs and open markets, the Fortification of wheat will enable 90% of the population to receive the benefits of vitamins and micronutrients added to it.	1. Ministry of Supply and Internal Trade 2. Ministry of Health, National Nutrition Institute 3. National Food Safety Authority 4. The Food Holding Company 5. The American Chamber of Commerce 6. MOSIT, FCI, UNICEF, GAIN, USAID and 7. International Federation of Spina Bifida and Hydrocephalus

3	UGANDA	In Uganda, the food Fortification initiative was undertaken for wheat flour, Maize flour, and oil. Uganda faced a tremendous shortage of food during the hit of the covid wave, however, the workshops made all producers of wheat, 90% of oil producers, and 6% of maize producers, Fortify their products according to national standards. The implementation of daily premix reconciliation helped in overcoming the challenges of distancing, and shortage of workforce during covid. The potential reach of Fortified food was 42.9 Million people in the country.	
4	New Zealand	New Zealand mandated the Fortification of wheat flour with folic acid which has benefitted 5 million people. FFI has helped in growing political support in NZ and Australia and has connected public and private industrialists. The Australian Fortification strategy has led to a decrease in Neural Tube Defects by 14.4% since 2009. The potential reach is 4.7 million people in the country.	

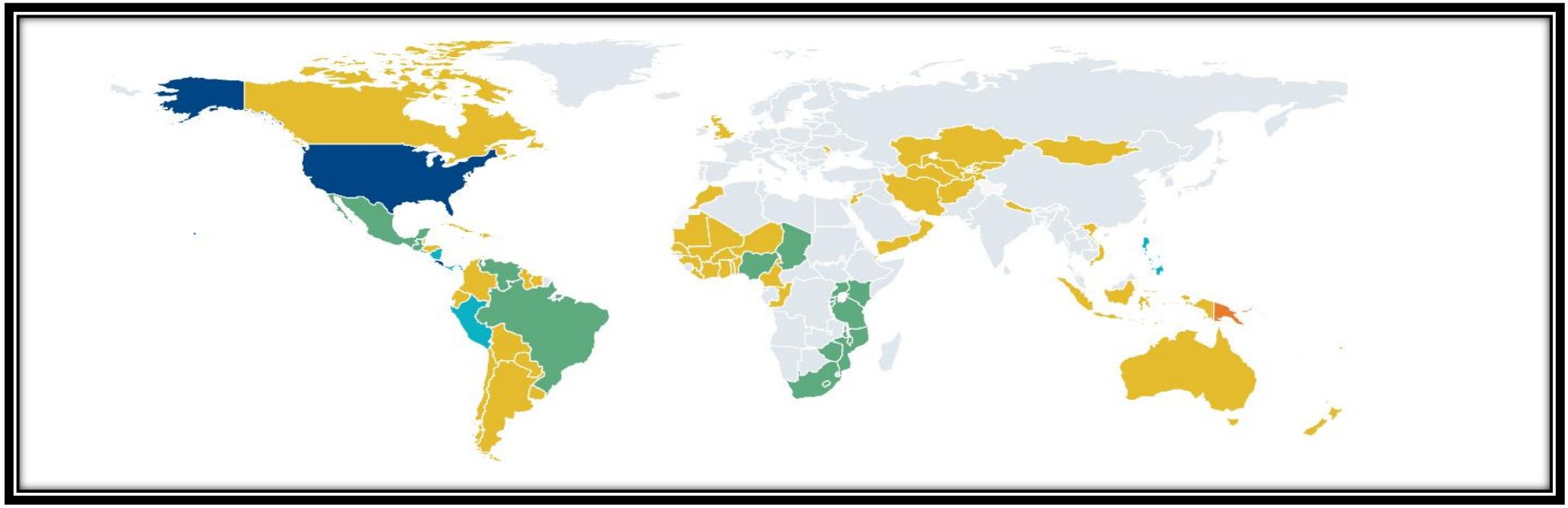
5	Solomon Island	Fortification started on Soloman Island in 2015. FFI built a robust program and technical support for wheat flour and rice. FFI is creating a sustainable, impactful strategy for the program. The Major success of the FFI initiative was intense training and providing technical support to the ministry and training for the regular inspection of Fortification of wheat flour and rice. A high compliance rate was observed for both producers and importers according to the national standards. The quarterly report of MHMS states that there was 100% compliance with spot testing at ports and certificate checks for all the Fortified rice received.	1. Australian Department of Foreign Affairs (DFAT) 2. Ministry of Health and Medical Services (MHMS) 3. Customs and Biosecurity
6	Ukraine	A deputy of Ukraine Parliament, OMNI NET Ukraine Birth Defects Monitoring Program submitted a draft for wheat flour Fortification on 16th June 2021. FFI gave their inputs for holistic Fortification in the grains and provide technical assistance. FFI has been helping in planning, implementation, and monitoring, however, due to political instability, FFI workshops and contributions have been hampered.	1. OMNI NET Ukraine Birth Defects Monitoring Program 2. Ivan Mirashnichenko, a former Ukrainian Government official 3. Olga Trigub, leader of Business-Guard, a nongovernmental

7	United Kingdom	The UK mandated wheat flour Fortification in 1940. However, in 2021, Fortification with folic acid has been updated in the standards. Since 2013 FFI has been conducting advocacy sessions with government agencies on Fortification with folic acid for overcoming neural tube defect cases in the country and participated in 2019 in public consultation with various other key stakeholders, which resulted in support from stakeholders who agreed to the Fortification. Finally, the UK has made wheat flour Fortification with folic acid a mandate.	1. Queen's Nursing Institute - Scotland, 2. International Federation for Spina Bifida and Hydrocephalus, and Shine, a UK

8	India	The potential reach in India is 125.5. million people. The Multi-Sectoral group formed by FFI has provided scientific based evidence for Fortifying wheat flour and revising the national standards for Fortification. BDPTF and FFI conducted various meetings with government officials and made a momentum for Fortification to be adopted as the strategy to be adopted for overcoming micronutrient deficiency and which suits the Indian context. IN 2022 BDPTF will be conducting media workshops for the involvement of media with their scientific panel on changing the standards.	1. Food Safety and Standards Authority of India (FSSAI 2. World Health Organization 3. Spina Bifida Foundation 4. Health Minister, 5. Minister of Women and Child Development, and 6. Minister of Social Justice and Empowerment

Source: (FFI., 2021a)

Global Food Fortification exchange creates analysis and provides visualization of data across the world. The data covers 196 countries in total and provides information for different Fortificants and staples in these countries and their status



	Wheat flour alone – 64 countries		**Wheat flour and rice – 5 countries (Nicaragua, Panama, Peru, Philippines, Solomon Islands)**
	Rice alone – 1 country (Papua New Guinea)		**Wheat flour, maize flour, and rice – 2 countries (Costa Rica and the United States)**
	Wheat flour and maize flour – 17 countries		**No mandatory Fortification legislation or data not available**

Fig 2.15: Status of Fortification of Wheat Flour and Rice in 91 Countries

Source: https://www.ffinetwork.org/globalprogress October 2021.

In India, Haryana has been Fortifying Wheat Flour even during the hit of the COVID 19 wave in 22 districts of Haryana which is being supplied through the Mid-Day Meals and Integrated Child Development Scheme (ICDS). With the support of FFI, state cooperatives of Haryana having control of the market and supply federation are conducting advocacy sessions with 50 millers to meet the demands (FFI., 2021b). Recently in India, the union cabinet decided to distribute Fortified rice of 37.5 mt till March 2024 through government programs like ICDS and MDM, for which FCI has procured 88.65 Mt of Fortified rice which has cost approx. 270 crores /per annum which will be borne by the center under the subsidy bill (Mukherjee., 2021).

2.9 Fortification and Way Forward

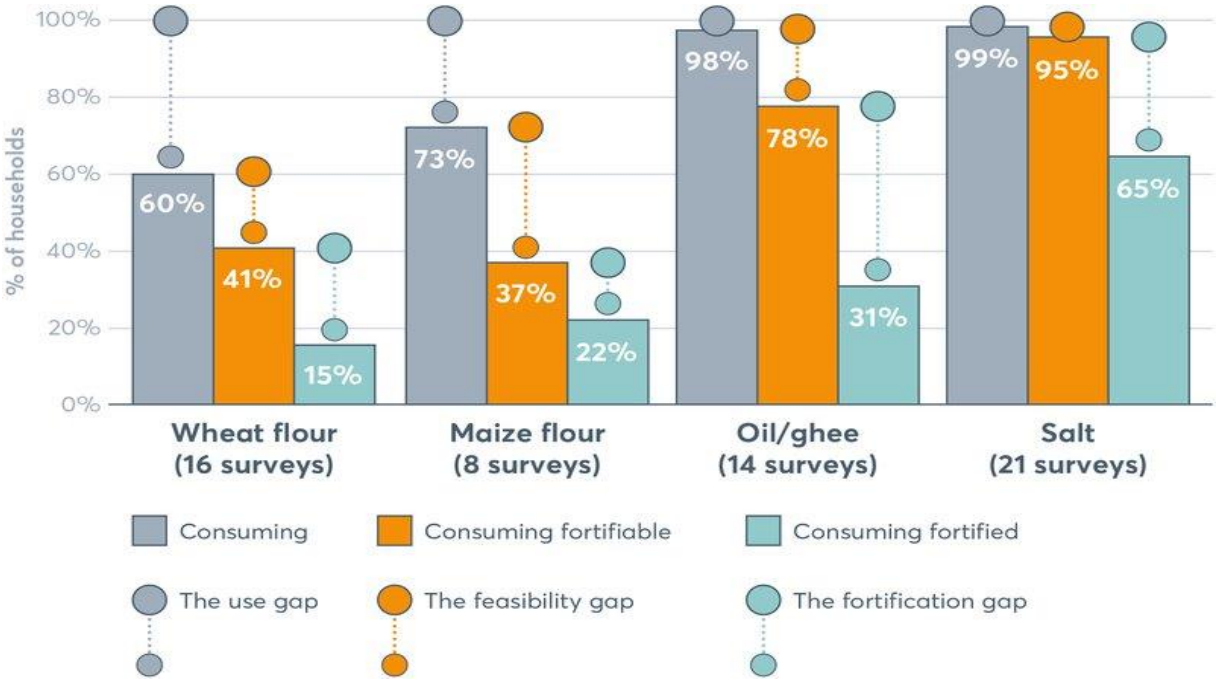


Fig 2.16: Global Status of Fortification (Keats, 2019)

The FACT sheet developed by GAIN has been used to collect information on the consumption of Fortified Foods from 16 countries and to assess the coverage of Fortified Foods from 2013 to 2017. The image represents the gap in the usage, feasibility, and the Fortification gap amongst the selected households. The results will help in monitoring and evaluating the Fortification according to the standards (Keats., 2019).

India has achieved a lot with its Food Fortification Programme. Various pilot schemes are being organized for the distribution of rice under PDS, ICDS, and MDM systems worth INR 174

crores (Approx) with the support of the Ministry of Women and Child Development and Ministry of Human Resource Development.

There are multiple programs and celebrations organized in schools and for the public for awareness with the support of FSSAI. A separate section has been added by Amazon India for Fortified Foods which creates a sensitization amongst the consumers through its +F logo.

National Ear Right Day is celebrated during December, Swasth Bharat yatra, Project Dhoop by TINI, Seminars on Fortification for stakeholders, coverage of Fortified milk on DD national by Tata Trust, and Endorsement of Fortified Foods in Vistara Airlines are few of the initiative taken by FFRC and FSSAI for creating the awareness for the Fortified Foods (Teaotia and Singhal., 2020).


Scope of
Investigation

CHAPTER 3

SCOPE OF INVESTIGATION

Based on the literature reviewed, the present study entitled '*Action Research on Advocating Use of Fortified Foods amongst the parents of the students studying in the Faculty of Family and Community using Diffusion of Innovation Model*' was undertaken. The hypothesis that has been formulated were: -

Research Hypothesis

Null Hypothesis–

One-month ***e***- Intervention sessions **will not have a positive impact** on

1. subject's Purchasing Practices for Fortified Foods
2. and on their ability to identify FORTIFIED SAMPOORNA POSHAN SWASTH JEEVAN logo found on Fortified staples

Alternative Hypothesis

One-month ***e***- Intervention sessions **will have a positive impact** on

1. subject's Purchasing Practices for Fortified Foods
2. and on their ability to identify FORTIFIED SAMPOORNA POSHAN SWASTH JEEVAN logo found on Fortified staples

To substantiate the above-mentioned hypothesis present study was designed with the following objectives

1. To enroll parents of the students from the Faculty of Family and Community Sciences until the desired sample size is reached
2. To develop tools for the socio-economic profile of the enrolled subjects and to

assess their awareness of the health benefits, sources, and deficiency signs for the various Fortificants (Micronutrients)

3. To develop Graphics, Videos for the intervention phase
4. To collect baseline information on awareness, perception, and purchasing practices of Fortified Foods
5. To sensitize the enrolled subjects on Fortified Foods and its components
6. To evaluate the impact of ***e***-intervention sessions given to the enrolled subjects
7. To identify the available brands for Fortified products (focusing on 5 staples, namely. DFS, Milk, Wheat Flour, Rice, and Oil) from the hypermarkets, online retail platforms, and traditional Kirana stores (Grocery Stores) from the four zones of Vadodara


Methods
And
Materials

CHAPTER 4

METHODS AND MATERIALS

Significant research findings are established on credible methodologies. In this chapter, all methodology and experimental designs that were used are mentioned and discussed in detail to accomplish the objectives of the study.

The present research was designed as a community-based 'cross-sectional' study entitled '***Action Research on Advocating Use of Fortified Foods amongst the parents of the students studying in the Faculty of Family and Community using Diffusion of Innovation Model*'.**

The study was conducted to increase the awareness and consumption of Fortified staples amongst the enrolled subjects by using ***e***-intervention strategies in the Vadodara district of Gujarat. This chapter outlines the experimental design and discusses the methods and materials used to fulfill the objectives of the study under the following heads.

4.1. Locale of the study
4.2 Sample size calculation
4.3 Phases of the study
    4.3.1 Phase I- Situational Analysis
    4.3.1 .1 Questionnaire Development
    4.3.1.2 Enrollment of the Subjects
    4.3.1.3 Collection of baseline information of the Subjects on
        a) Socio-economic profile
        b) Awareness of Fortified Foods
        c) Beliefs regarding Fortified Foods
        d) Purchase Practices for Fortified Foods
        e) Knowledge of Micronutrients

    4.3.2 Phase II- Intervention Phase
        4.3.2.1 Tool Development
        4.3.2.2 Steps for Intervention
        4.3.2.3 Messages Shortlisted for Intervention Period

4.3.2.4 Impact Evaluation

4.3.3 Phase III- Market Survey for the available Fortified Foods

4.3.4 Phase IV- Development of IEC Material

4.4 Inclusion and Exclusion Criteria

4.5 Expected outcomes

4.6 Statistical Analysis

4.7 Ethical Clearance

4.8 Tools/Terminologies used in the study

4.8.1 Diffusion of Innovation Model

4.8.2 Kuppuswamy Socio-economic Scale

4.8.3 Hyper Markets

4.8.4 Fortified Staples

4.8.5 Traditional Kirana (Grocery) Stores

4.8.6 e-Health Communication

The experimental design of the study is depicted in figure 4.1.

Experimental Design

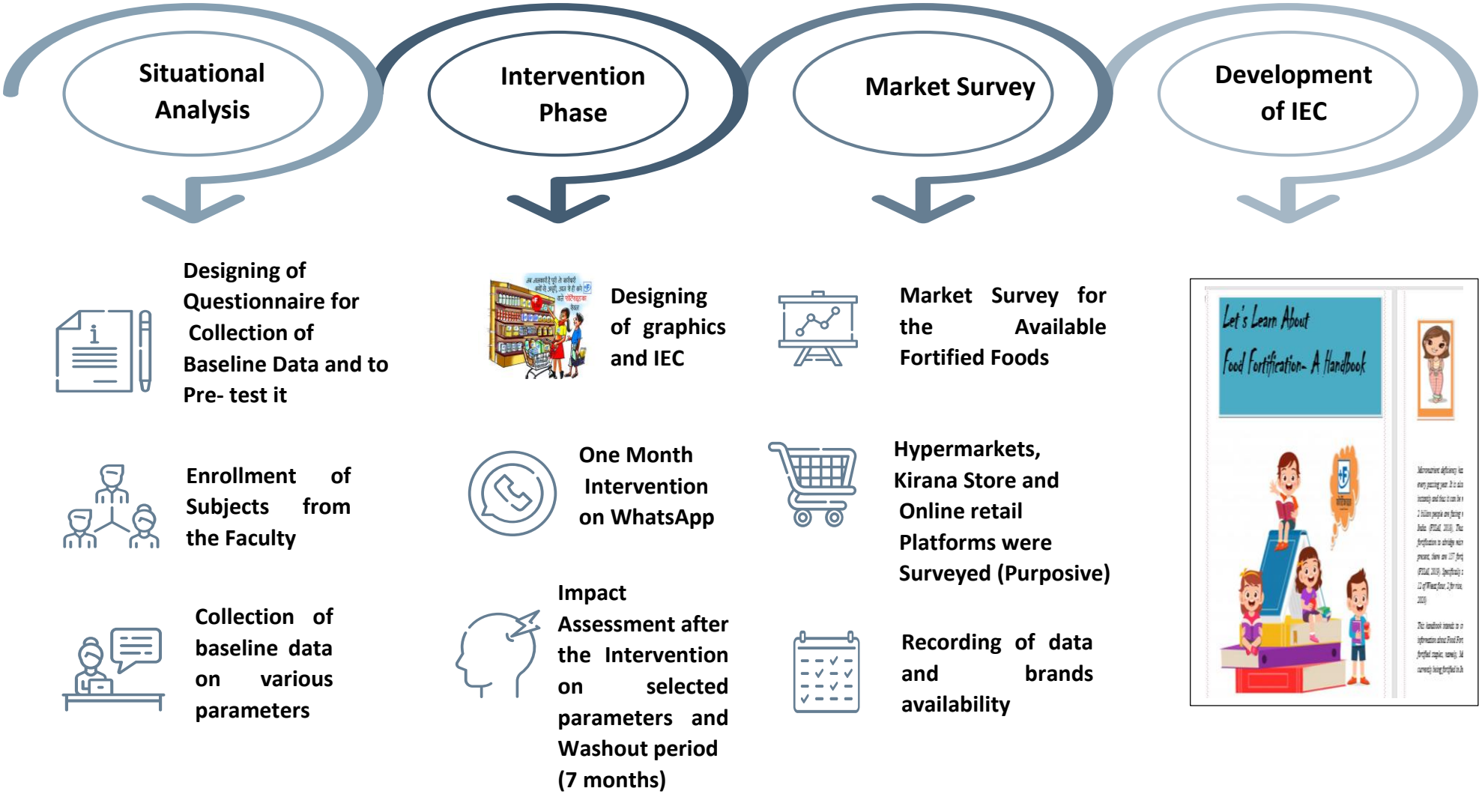


Figure 4.1: Experimental Design

4.1. The Locale of the study:

The study was conducted in the Vadodara city of Gujarat (India). According to the census of 2011, the population of Vadodara is 3 million (GOI, 2011).

Department of Clothing and Textiles, Department of Extension and Communication, Department of Family and Community Resource Management, Department of Food and Nutrition, Department of Human Development and Family Studies in the vicinity of The Faculty of Family and Community Sciences, The MS University of Baroda, Gujarat were purposively selected for carrying out the current research**.**

4.2. The sample size for the enrolled subjects:

Using a cross-sectional study design, parents of the students (N=1600) from the Foods and Nutrition department of the Maharaja Sayajirao University of Baroda were screened to elicit the data. A total of 349 parents participated until the completion of the study (Fig 4.2). Subjects who were responsible for buying groceries for the family, having an active internet connection and WhatsApp, and could comprehend the Hindi language was included in the study.

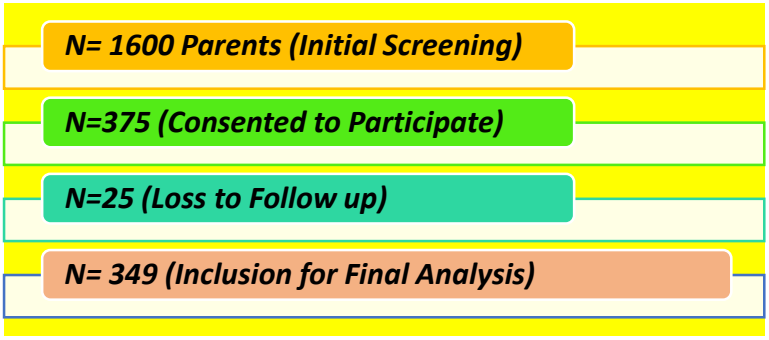


Figure 4.2: Sample Selection for the study

4.3 Phases of the Study

The study was divided into 4 Phases: -

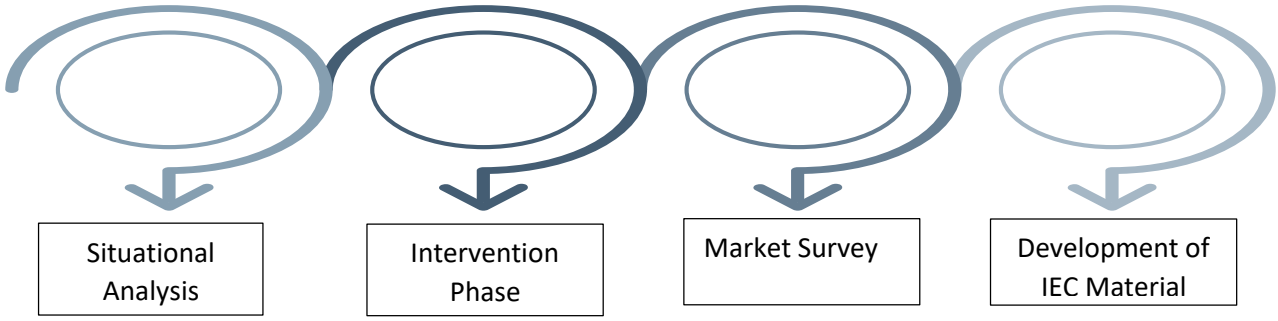


Figure 4.3: Phases of the study

4.3.1. Phase I: Situational Analysis

4.3.1.1 **Questionnaire Development**

A validated Google questionnaire was developed in Hindi and English to collect the baseline information (A detailed Questionnaire is appended in Annexure I-Pre Assessment Form).

4.3.1.2 **Enrolment in the subjects**

Permission was taken from the Dean of the Faculty of Family and Community Sciences to collect the contact numbers of students of the different departments (Annexure-II). Parents of students who consented to participate in the study, from the Faculty of Family and Community Sciences, (The Maharaja Sayajirao University of Baroda Department) were enrolled in the study

Note: Faculty of Family and Community Sciences have various streams from the nutrition and non-nutrition department- clothing and textiles, family and community resource management, extension and communication, human development, and family studies.

4.3.1.3 Collection of the baseline information of the subjects on the following heads:-

a. Socio-economic profile (Educational qualification, Family Income, Profession, Family type)
b. **Awareness of Fortified Foods (**existence and availability of Fortified Foods**,** source of knowledge about Fortified Foods**,** knowledge about +F logo on the labels**,**)
c. **Beliefs about Fortified Foods (**purchase, acceptability, willingness to pay for Fortified Foods)
d. Purchase **practices for Fortified Foods (storage, consumption, purchase).**
e. Knowledge regarding micronutrients used as Fortificants (Health benefits, sources, and signs of deficiency)

Steps for collecting baseline Information

1. WhatsApp Group was created for the subjects who agreed to participate in the study
2. Consent was taken by all the enrolled subjects (Parents of the students)
3. Upon Enrolment, a link to Google forms was shared with the subjects

for pre-assessment of their awareness, beliefs, and purchasing practices towards Fortified Foods

4.3.2 Phase –II Intervention Phase

4.3.2.1 Tool Development: Development of graphics in the national language (Hindi), for the e- Intervention on topics stated below: (Appended in Annexure III: Post Assessment Form and Annexure IV: Graphics)

a) What is Fortification
b) Why it is important
c) Current deficiency rates of different vitamin/micronutrients
d) Health benefits of different vitamins/micronutrients
e) Staples which are being Fortified and their Fortificants
f) Where we can buy Fortified food from
g) Information that the sources are vegetarian
h) Claim for Thalassemia Patients
i) Identification of logo only on packed branded foods and not on unpacked/local Items

4.3.2.2 Steps of Intervention

a. One month was allotted to the intervention period, where 5 messages every week were shared by the participants on various topics, (Messages were in the form of Memes, Videos, Audio, and illustrations).
b. Existing open videos by FSSAI and of 'EAT RIGHT MOMENT' focusing on Fortification were shared with the enrolled subjects via WhatsApp
c. A selfie contest along with the Fortified product or the bill of their purchase for Fortified food was organized for the enrolled subjects, they were requested to share their selfies with the +F Fortification logo (Appended in Annexure V- Whatsapp Group Screenshots)
d. Participants were asked to fill in the purchase form for the diffusion of innovation model on Sundays (Appended in Annexure VI).

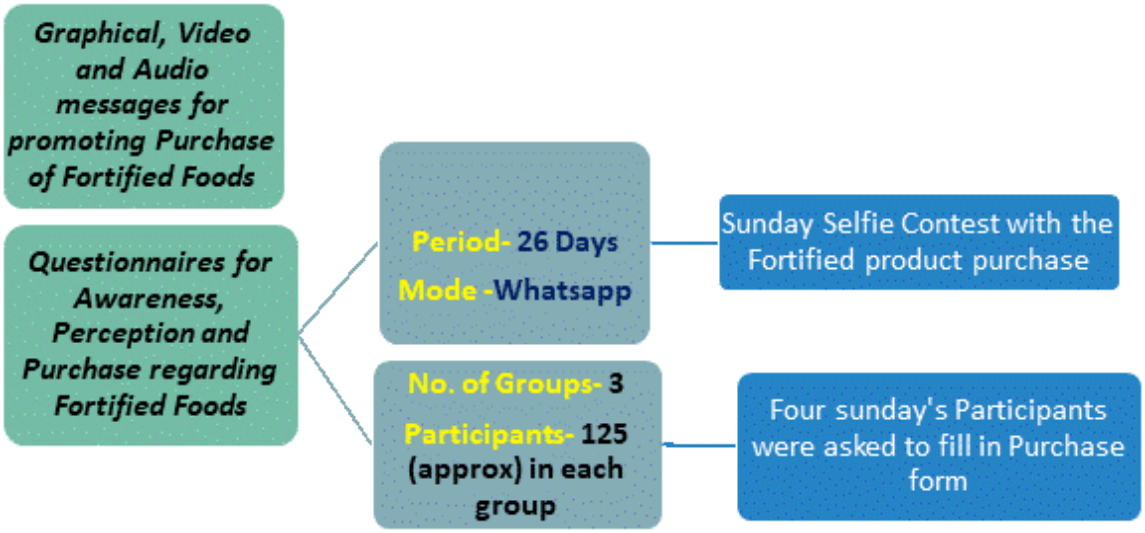


Figure 4.4: The e- Intervention Methodology

4.3.2.3 Messages Shortlisted for the Intervention Period were:

1. **What is Fortification and why do we need it? - Knowledge**

   Fortification is the addition of key vitamins and minerals such as Iron, Iodine, Zinc, and Vitamins A and D to staple foods such as rice, wheat, oil, milk, and salt to improve their nutritional content. These nutrients may or may not have been originally present in the food before processing or may have been lost during processing.

2. **Why do we need it? - Attitude**

   Access to safe and nutritious food is a must and sometimes due to lack of consumption of a balanced diet, lack of variety in the diet, or unavailability of food does not get adequate micronutrients. Often, there is a considerable loss of nutrients during the processing of food as well. One of the strategies to address this problem is the Fortification of food.

3. Health and prevalence - Knowledge

India has a very high burden of micronutrient deficiencies caused by Vitamin A, Iodine, Iron, and Folic Acid leading to Night Blindness, Goitre, Anaemia, and various birth defects. According to the National Family Health Survey (NFHS-4)

58.4 percent of children (6-59 months) are anemic

53.1 percent of women in the reproductive age group are anemic

35.7 percent of children under 5 are underweight

4. Safety of Consuming Fortified Foods- Attitude

Consumption of Fortified Foods is a safe method of improving nutrition among people. The addition of micronutrients to food does not pose a health risk to people. The quantity added is small and well under the Recommended Daily Allowances (RDA) and is well regulated as per prescribed standards for safe consumption. It does not alter the characteristics of the food like the taste, aroma, or texture of the food.

5. Knowledge

Staples that are being Fortified under FSSAI 2018 Regulation and their Fortificants

Milk- Vitamin A and D

Salt: Double Fortified with Iron and Iodine

Wheat- Iron, Folic Acid, and Vitamin B12

Rice- Iron, Folic Acid, and Vitamin B 12

Oil- Vitamin A and Vitamin D

Table 4.1: Benefits of various Fortificants (FSSAI, 2018a)

Vitamin A	Helps against Night blindness
Vitamin D	Supports strong bones
Vitamin B12	Imp for maintaining normal functioning of the nervous system and blood formation
Folate and folic acid	Imp for fetal development and blood formation
Iron	Fights anemia
Iodine	Req for normal growth thyroid and brain function

Zinc (optional)	Supports a healthy immune system
Thiamine (optional)	Req for normal nerve and heart function
Riboflavin (optional)	Necessary to release energy from food
Pyridoxine (optional)	Necessary to release energy from food

6. **Identification of Fortified Foods through +F logo and where it can be found on the label – Practice**

   +F logo on the front label in blue color and people need not worry because the source is purely Vegetarians are thus safe for every person to consume +F foods

7. **Attitude** Fortified staples should be consumed by every person irrespective of their age group, Gender, Religion, or Caste. (Males and Females, old, young, Infants and adolescents).

8. **Knowledge** Fortified staples are only the branded ones, loose wheat grains, rice, etc. are not being Fortified yet, and thus it is important to shift to branded ones to easily identify Fortified Foods with the +F logo. One can shop these from any *K*irana store, supermarket, or online retail shop.

9. **Knowledge** – Consumption of all Fortified staples together regularly will not harm your body as the dosages added to the staples are adjusted to provide only 30-50 percent of an individual's daily nutrient requirement so it is advisable to start purchasing and consuming Fortified Foods.

10. **Attitude -**Food Fortification is a "complementary strategy", and "not a replacement of balanced, diversified diets" to address malnutrition. Dietary diversification is indeed the best choice but with the current eating habits it's not possible or either difficult to get all our micronutrient requirements, thus consumption of Fortified Foods is being promoted.

11. **Practice -**The incremental cost of Food Fortification is minimal. by incurring these minimal costs, the disease burden of widely prevalent problems like anemia can be reduced. Thus anyone can easily afford it without disturbing their monthly budget.

12. **Video Message 1:** Fortified Rice and Wheat FSSAI video on 'How Fortified Foods are helpful during pregnancy.

13. **Video Message 2**: Fortified Oil and Milk FSSAI Video on 'How Fortified food helps in making one feel energetic and improves bone health

14. **Video Message 3**: FSSAI Message featuring Sakshi Tanwar

15. **Video Message 4:** FSSAI Message Featuring Virat Kohli

16. **Video Message 5**: FSSAI 'EAT RIGHT QUICK TIPS' video on Salt Iodization

17. **Video Message 6:** FSSAI 'Eat Right Quick Tips' Video on Fortified Wheat Flour and Rice

18. **Video Message 7**: Shreemati Vlogger on Fortified food and Healthy Tips, also on awareness on Fortification guidelines and website for the general population to refer to for more information. Awareness about the vegetarian source being used and not different in taste, smell, etc.

19. **Video Message 8**: on Documentary of Fortification of Food from FFRC Website (Annexure VII)

4.3.2.4 Impact Evaluation of enrolled subjects on Fortified Foods and its Components

A pre-tested Google questionnaire was used to mark the impact of ***e-*** intervention sessions on their purchase practices for Fortified Foods. The assessment was done thrice – at pre intervention stage, during the intervention, and after the e- intervention.

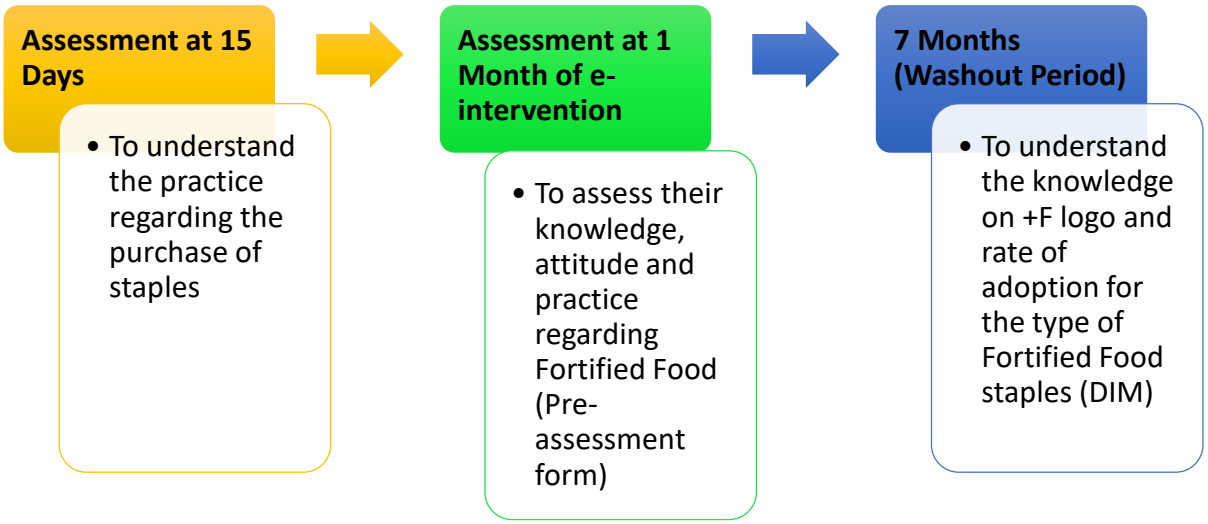


Figure 4.5: Stages of Assessment after e-intervention

4.3.3 Phase- III Market Survey

A market survey was added to supplement the research work as per the request by respondents who were willing to know where Fortified Foods are available. Markets were selected purposively, two from each zone of Vadodara.

a. Kirana stores were visited to track the availability of Fortified staples in the market (Rice, wheat flour, oil, double Fortified salt, and milk). Two Kirana Stores were selected purposively from the four zones of Vadodara North, East, West, and South

b. Online Grocery stores like Amazon, Big basket, Jio mart, and Grofers were explored for the availability of Fortified Foods for the 5 staples (Rice, wheat flour, oil, double Fortified salt, and milk).

c. Hypermarkets like Big Bazaar, Spencer's, and D-Mart were visited to track the availability of Fortified staples in the market (Rice, wheat flour, oil, double Fortified salt, and milk)

Refer to Figure 4.4 for the detailed methodology for the market survey

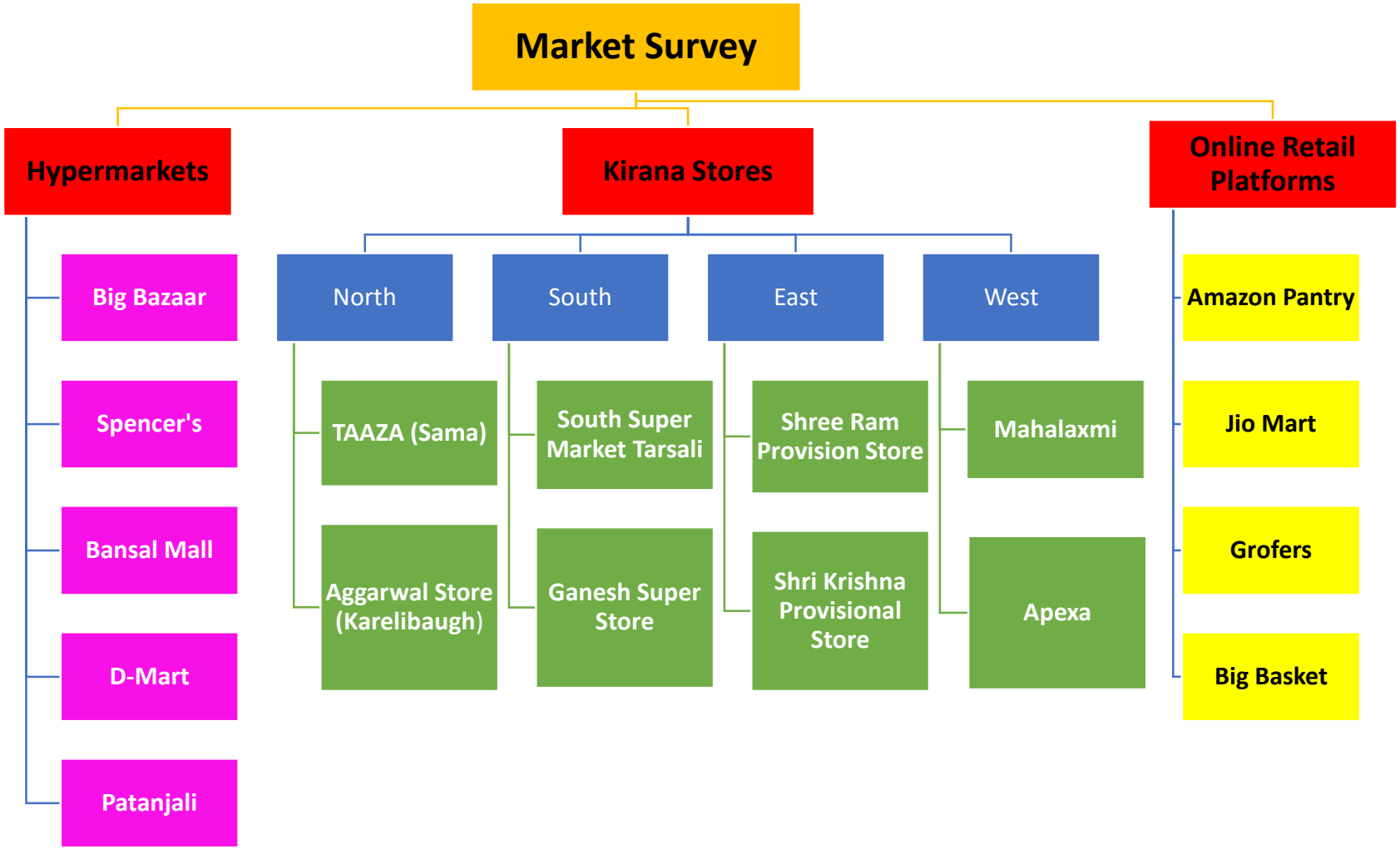


Figure 4.6 Methodology for identification of Fortified food staples in selected markets of Vadodara

4.3.4 Phase IV- Development of IEC Material

Food Fortification Booklet was developed for sensitizing the general population at large for the following components"-

A. Benefits, signs of deficiency, and food sources for various micronutrients being used as Fortificants
B. Need for Fortified Foods and their benefits
C. Identification of Fortified Foods through its logo
D. List of stores and brands where Fortified staples are available

4.4 Inclusion and Exclusion Criteria

➢ **Inclusion Criteria**

- Parents of the students from the Faculty of Family and Community Sciences from a various socioeconomic backgrounds
- Subjects who gave consent to participate in the study
- Subject buying groceries for their family
- Subjects having access to Smartphones and active internet connection

➢ **Exclusion Criteria**

- Subjects who did not have WhatsApp accounts
- Subjects were not residing in Vadodara

4.5 Expected Outcomes

➢ **Expected Primary Outcomes**

- Improved Purchase Practice for Fortified Foods
- Awareness of FORTIFIED SAMPOORNA POSHAN SWASTH JEEVAN logo amongst the subjects

➢ **Expected Secondary Outcome**

- Positive perception towards Fortified Foods
- Improved knowledge of various micronutrients

4.6 Statistical Analysis

Categorical variables were presented as proportions while continuous variables were either presented as mean with standard deviation (SD) or median with range. Categorical variables were compared by Fisher's exact test or Pearson's Chi-square test. The McNemar test was used to determine if there were differences in a dichotomous dependent variable between two related groups. All tests were 2-tailed and a p-value of less than 0.05 was considered significant. Data were analyzed using SPSS software version 25 (Armonk IBM Corp). The Statistical analysis was outsourced by a professional statistician.

4.7 Ethical approval for the study: -

The study was approved by the Institutional review board of the Department of Foods and Nutrition, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The ethical number was allotted on 6th November 2020. The ethical approval of the number is IECHR/FCSC/ 2020/62

4.8 Tools and Parameters used in the study:

4.8.1 Diffusion of Innovation Model Adopted in the Study

The diffusion of innovation theory seeks to explain how, why, and at what rate new ideas and technology spread through cultures 'as defined by sociologist Everett Rogers in 1962. The newness of Innovation depends on: -

1. Knowledge
2. Persuasion
3. Decision to adopt

The four main elements of the diffusion model are: -

1. **The innovation –** What an Innovative idea is about
2. **Communication channels –** How the message is being spread amongst the population
3. **Time –** Certain amount of time is needed to spread the idea amongst the masses.
4. **Social system –** According to Rogers, a social system is "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal."

In this model roger has categorized the adopters based on their time of adoption: -

1. **Innovators:** Those who are interested in trying new ideas or technology. Thus in our study, we have defined innovators as those who have adopted Fortification staples within the 1st week of intervention.
2. **Early adopters:** These are those who can be the opinion leaders as they measure the advantages and disadvantages of the innovation and decide whether they want to adopt the innovation or not, further these are the people who persuade others to adopt that product or technology that is being promoted. Thus in our study, they have been categorized as those who adopt Fortification within 2nd week of intervention
3. **Early majority:** They are categorized as those who purchase in the 3rd or 4th week of intervention
4. **Late majority:** They are skeptical to adopt the new idea; they are categorized as those who purchase in the 5th week of intervention
5. **Laggards:** Those who are more skeptical and have less knowledge regarding innovation, are categorized as those who do not adopt at all or were in doubt.

Five stages of the Innovation Model

1. Knowledge
2. Persuasion
3. Decision
4. Implementation
5. Confirmation/Continuation

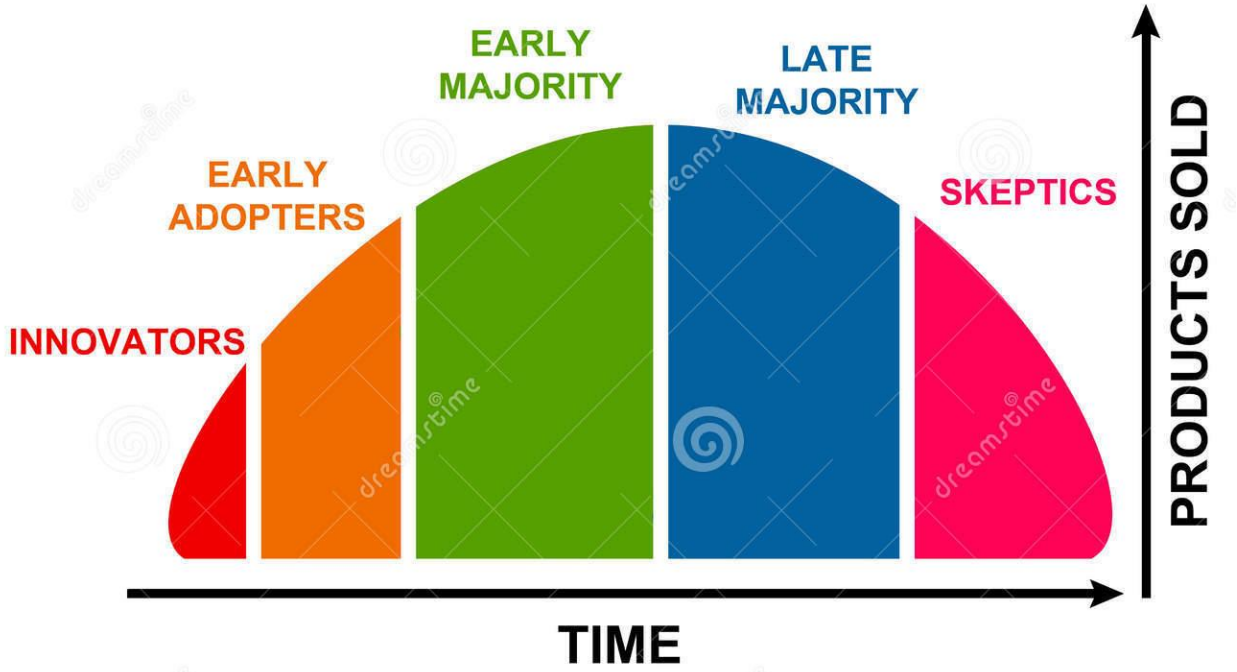


Fig 4.7: Adopters categorization in DIM

4.8.2 Kuppuswamy Socio-Economic Scale: The most important determinant of health status is the Socio-Economic Status of the Individual. The Kuppuswamy scale was used in the study for categorizing the socioeconomic status of the families. Kuppuswamy takes into consideration Education, Family Income, and Occupation of the head of the family.

Table 4.2 Socioeconomic status scale-Kuppuswamy

Education of head of family			Score
Professional degree			7
Graduate or postgraduate			6
Intermediate or post high school diploma			5
High school certificate			4
Middle school certificate			3
Primary school certificate			2
Illiterate			1
Occupation of head of family			
Professional (white collar)			10
Semi-professional			6
Clerical, shop-owner/farm			5
Skilled worker			4
Semi-skilled worker			3
Unskilled worker			2
Unemployed			1
Monthly income of family			
In 2001 (Base year)	**In 2017 (January 2017 CPI)**	**In 2019 (February 2019 CPI)**	**Score**
≥15,197	≥41,430	≥52,734	12
7,595-15,196	20,715-41,429	26,355-52,733	10
5,694-7,594	15,536-20,714	19,759-26,354	6
3,793-5,693	10,357-15,535	13,161-19,758	4
2,273-3,792	6,214-10,356	7,887-13,160	3
761-2,272	2,092-6,213	2,641-7,886	2
≤760	≤2,091	≤2,640	1
Socioeconomic class			**Total score**
I	Upper		26-29
II	Upper middle		16-25
III	Lower middle		11-15
IV	Upper lower		5-10
V	Lower		01-04

Table 4.1 Socioeconomic status scale- Kuppuswamy (Chowdhury and Chakraborty, 2017)

Since the **CPI** for February **2019** is 307, the conversion factor for February **2019** was 307/88.428 = 3.47. Multiplying the income **scale** of 2001 by 3.47 updates the **scale** for February **2019** (Chowdhury and Chakraborty, 2017)

4.8.3 Hyper Markets

A **hypermarket** is a retail store that combines a department store and a grocery **supermarket**. Often a very large establishment, **hypermarkets** offer a wide variety of products such as appliances, clothing, and groceries (Kenton, 2020). It is a self-service market with a wide range of products and brands for the customers. Some of the Features of hypermarkets are:-

a. Discount Prices are provided in hypermarkets with profit margins that local competitors might not be able to sustain
b. Wide range of products available in these stores
c. Freebies available which attract more people

4.8.4 **Fortified Staples: '**The Food Safety and Standard's (Fortification of Foods) Regulations, 2018 have been notified in the Gazette of India on 2nd August 2018. The new standards provide a range for the Fortification of staples like wheat flour (atta), maida, rice (with Iron, Folic Acid, and Vitamin B12), double Fortified salt (with Iodine and Iron), vegetable oil, and milk (with Vitamin A and Vitamin D); the dosage of the micronutrients has been adjusted to provide 30 to 50 percent of the daily requirements. In Wheat Flour and Rice Fortification, bioavailable sources of Iron have been added. Further, Vanaspati Fortification has been excluded'. Food Safety and Standards have used the term 'Staples' in their Gazette of India and so the research also categorizes Wheat Flour, Rice, Salt, Milk, and Oil as staples (MoHFW and FSSAI, 2018).

4.8.5 **Traditional Grocery Stores (Kirana**): A small, usually family-owned shop selling groceries and other sundries. These stores remain relevant and thrive based on their value propositions of (1) local access and convenience, (2) having locally relevant goods, (3) the store owner's amazing pulse on the needs of the local consumers, (4) building a personal relationship with customers, (5) providing a relationship-based credit facility to known and regular customers, (6) free home delivery by the store staff and, (7) serve as a local community building venue (*Kirana Store Business*, n.d.).

4.8.6 ***e*-Health Communication:** The crafting and delivery of messages and strategies, based on communication consumer research, to promote the health of individuals and communities through the Internet and related technologies (Eysenbach, 2001).


Results
and
Discussions

Chapter 5

RESULTS AND DISCUSSIONS

The broad objective of the present study was to create awareness among the participated subjects regarding Fortified Foods using the Diffusion of Innovation Model. This chapter presents the results of the study under the following heads.

5.1 PHASE I Situational Analysis

5.1.1 General Information

5.1.1.1 Sociodemographic characteristics of the study population

5.1.1.2 Classification of the subjects based on nutrition background

5.1.2 Awareness of the subjects regarding various parameters of Fortified Foods

5.1.2.1 Awareness of Food Fortification

5.1.2.2 Source of information regarding Fortified Foods

5.1.2.3 Verification of subject's awareness of Food Fortification

5.1.2.4 Awareness of the Food Fortification logo

5.1.2.5 Awareness of Fortified staples in India

5.1.3 Attitude of the subjects towards Fortified Foods

5.1.4 Purchase Practices of the subjects for Fortified Foods

5.1.4.1 Purchase preferences for the grocery items

5.1.4.2 Purchase Practices for Fortified Foods (Foods with +F logo)

5.1.4.3 Purchase of Fortified Staples

5.1.4.4 Consumption of multivitamin tablets

5.1.4.5 Yearly storage of staples that are being Fortified in India

5.1.5 Association between awareness and purchase practice of Fortified Foods amongst the subjects

5.1.6 Awareness regarding health benefits, sources, and deficiency signs for micronutrients

5.1.6.1 Awareness of Vitamin A

5.1.6.2 Awareness of Vitamin D

5.1.6.3 Awareness of Vitamin B12

5.1.6.4 Awareness of Iron

5.1.6.5 Awareness of Iodine

5.1.7 Association between awareness of various Fortificants with educational levels of the subjects'

5.1.8 Association between awareness of various Fortificants with occupation levels of the subjects

5.1.9 **Association between Subjects having Educational Qualification s in the field of Nutrition with their Awareness of various micronutrients**

5.2 Phase II- *e*- intervention on Food Fortification

5.2.1 Effect of the e-intervention on Subjects' Awareness of Fortified Foods

5.2.1.1 Impact of e-intervention on subjects' awareness of different parameters of Fortified Foods, post-intervention

5.2.1.2 Impact of e-intervention on awareness of staples that are being Fortified in India under FSSAI regulations 2018

5.2.1.3 Impact of e-intervention on subjects' attitude for various parameters for Fortified Foods

5.2.1.4 Impact of e-intervention concerning the purchasing practices of Fortified Staples

5.2.1.5 Bottlenecks reported by the subjects for procuring Fortified Foods

5.2.1.6 Impact of e-intervention on purchase practices during the Sunday selfie contest

5.2.2 Mid-Level evaluation of e-intervention

5.2.2.1 Attitude regarding the purchase of Fortified Foods

5.2.2.2 ***e***-intervention feedback responses

5.2.3 Effect of e-intervention after 7 Months of Washout Period

5.2.3.1 Purchase Practices for Fortified Foods after Washout Period

5.2.3.2 Identification of Correct logo for Fortified Foods

5.2.4 Association amongst the awareness, attitude, and purchase practices post e-intervention

5.2.5 Analysis of Subjects' purchasing practices using 'Diffusion of Innovation Model'

5.3 Phase III - Market survey for Fortified Foods Availability

5.3.1 Market survey for Fortified Foods availability on Online Retail Platforms

5.3.2 Market survey for Fortified Food availability in hypermarkets of Vadodara

5.3.3 Market survey for Fortified Food availability in Traditional Kirana

5.3.4 Market survey for the retail shops where Fortified milk is available in Vadodara

5.4 Phase IV- Development of IEC Material on Food Fortification for all segments of population groups

PHASE-I

5.1 Situational Analysis

5.1.1 General Information

5.1.1.1 Sociodemographic Characteristics of the Study Population

The sociodemographic characteristics of the subjects are presented in table 5.1.1. The gender profile of the study population revealed that 76% were females and 24% were males. Most of the respondents were among the age group of 41-50 years (47.7%), having an honors degree (57.6%) followed by High School (15.2) and Intermediate (11.5). The data on occupation shows that majority of the respondents were either unemployed or belonged to the Profession category. The majority of the households belonged to Upper Middle Class (48.3), followed by Lower Middle Class (39.5).

Table 5.1.1 Sociodemographic Characteristics of the Study Population

Indicators	No. of Subjects	Percent
GENDER		
a. Male	90	24
b. Female	**285**	76
AGE GROUP (in Years)		
a. 20-30	**--**	--
b. 31-40	103	27.5
c. 41-50	179	47.7
d. 51-60	93	24.8
EDUCATION		
a. Graduate	37	9.9
b. Honors	**216**	57.6
c. Intermediate	43	11.5
d. High School	57	15.2
e. Middle School	16	4.3
f. Primary School	6	1.6
PROFESSION		
a. Profession	**125**	33.3
b. Semi Profession	23	6.1
c. Clerical	36	9.6
d. Skilled	34	9.1
e. Unskilled	24	6.4
f. Unemployed	**133**	35.5
MONTHLY INCOME OF THE FAMILY (in Rupees)		
a. INR 199862	-	-
b. INR 99931-199,861	32	8.5

c. INR 74755- 99930	73	19.5
d. INR 49,962-74,755	159	42.4
e. INR 29,973-49,961	111	29.6
TYPE OF FAMILY		
a. Nuclear Family	283	75.5
b. Joint Family	92	24.5
SOCIOECONOMIC GROUP		
a. Upper	7	1.9
b. Upper middle	181	48.3
c. Lower middle	148	39.5
d. Upper Lower	39	10.4

5.1.1.2 Classification of the Subjects based on Nutrition Background

Information regarding the number of subjects who belonged to nutrition and non-nutrition background is depicted in table 5.1.2. The results revealed that only 33% of the respondents were from a nutrition background, while the rest 66% of the subjects were from a non-nutrition background.

Table 5.1.2 Classification of the Subjects on the basis of Nutrition Background

Nutrition Background	No. of subjects	Percent
a. Non- Nutrition Background	250	66.6
b. Nutrition Background	125	33.3
Total	375	100

5.1.1 Awareness of the subjects regarding various parameters of Fortified Foods

Various questions were asked from the subjects regarding their awareness of food Fortification, viz source of their awareness, and identification of the +***F*** logo

5.1.1.3 **Awareness of Food Fortification**

Out of 375 Subjects, 33% self-reported that they knew about the term ‘Fortified Foods’ while the majority of the subjects 66.7% did not hear about Fortified Foods at all (Fig 5.1.1).

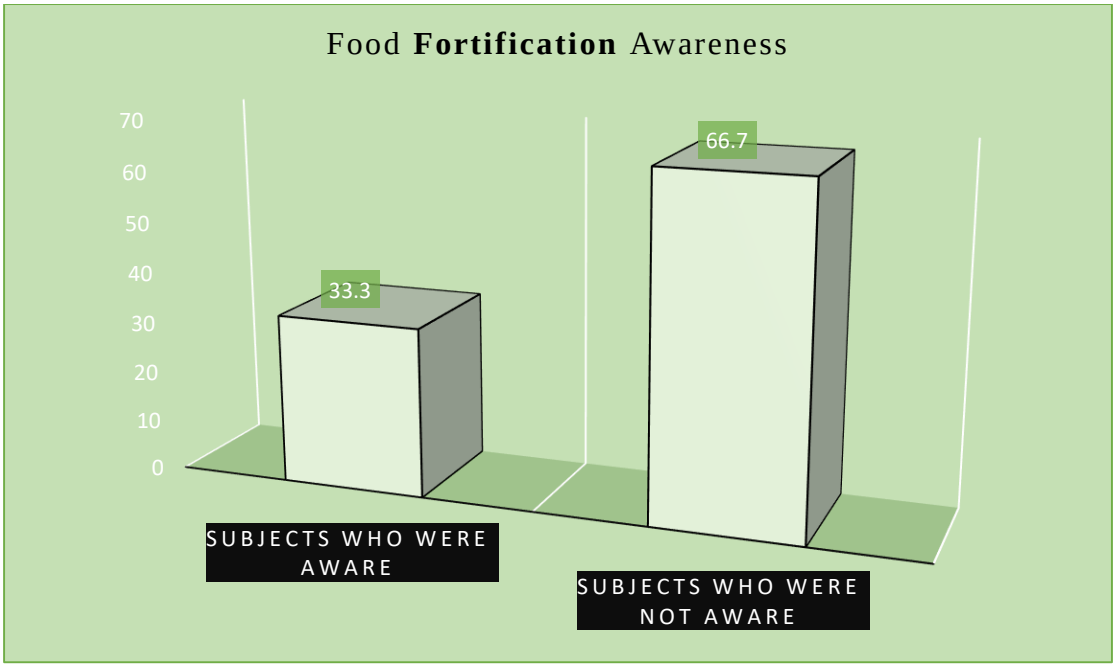


Fig 5. 1.1: No. of Subjects' who were aware and not aware of Food Fortification

5.1.1.4 Source of information regarding Food Fortification

The Source of information regarding Fortified Foods was elicited only from those subjects who reported they were aware of Fortified Foods (n=125). The majority of the subjects (45.2%) reported broadcast media (television, radio, internet, etc) as the major source of information from where they learned about Fortified Foods, followed by print media, internet, and outdoor media by 38.7%, 8.9%, and 7.3% respectively (Fig 5.1.2).

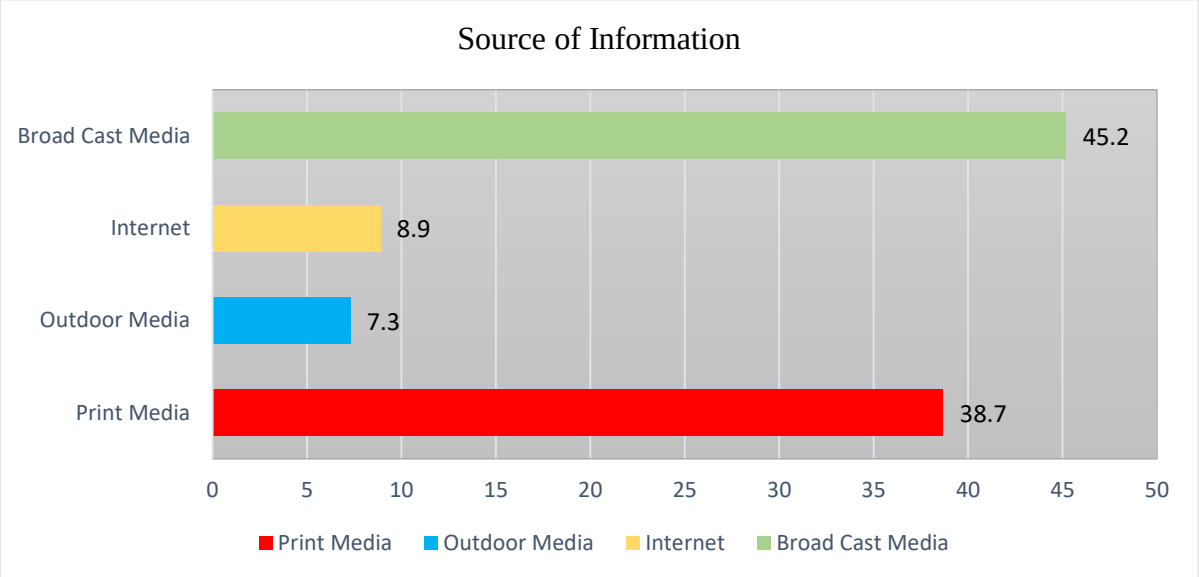


Fig 5.1.2: Percent subjects reporting the source of information for Fortified Foods (N=125)

5.1.1.5 **Verification of subject's awareness of Food Fortification**

Verification was undertaken amongst the subjects who self-reported having awareness of Food Fortification. They were asked to give the correct definition of Fortified Foods. Multiple options were given to the subjects, like foods rich in micronutrients, foods low in sugar and salt, etc. Only 28 subjects gave correct responses to the definition. The verification helped us in identifying the correct number of respondents who knew about Fortified Foods (Table 5.1.3)

Table 5.1.3 Number of Percent subjects identifying attributes of Fortified Foods accurately

	No. of subjects	Percent
Inaccurate Identification	270	72
Accurate Identification	105	28

5.1.2.4 Awareness of Fortification Logo

Subjects were asked about the correct food Fortification logo. Three images were shown to them in the questionnaire (Appended in appendix II) and were asked to mark the correct logo used for Food Fortification in India. As depicted in table 5.1.4, twenty percent (20%) identified the correct +F logo for the identification of Fortification in staple packed foods in India.

Table 5.1.4 Number of Percent subjects reporting correct identification of logo

	No. of Subjects	Percent
Inaccurate Identification	303	80
Accurate Identification	72	20

5.1.2.5 Awareness of Fortified staples in India

As depicted in Fig 5.1.3 majority of the subjects were aware of wheat flour Fortification (33.2%) and rice Fortification (33.3%), followed by milk (25%) and double Fortified salt (22%), only a few subjects were aware of oil Fortification (2.3%).

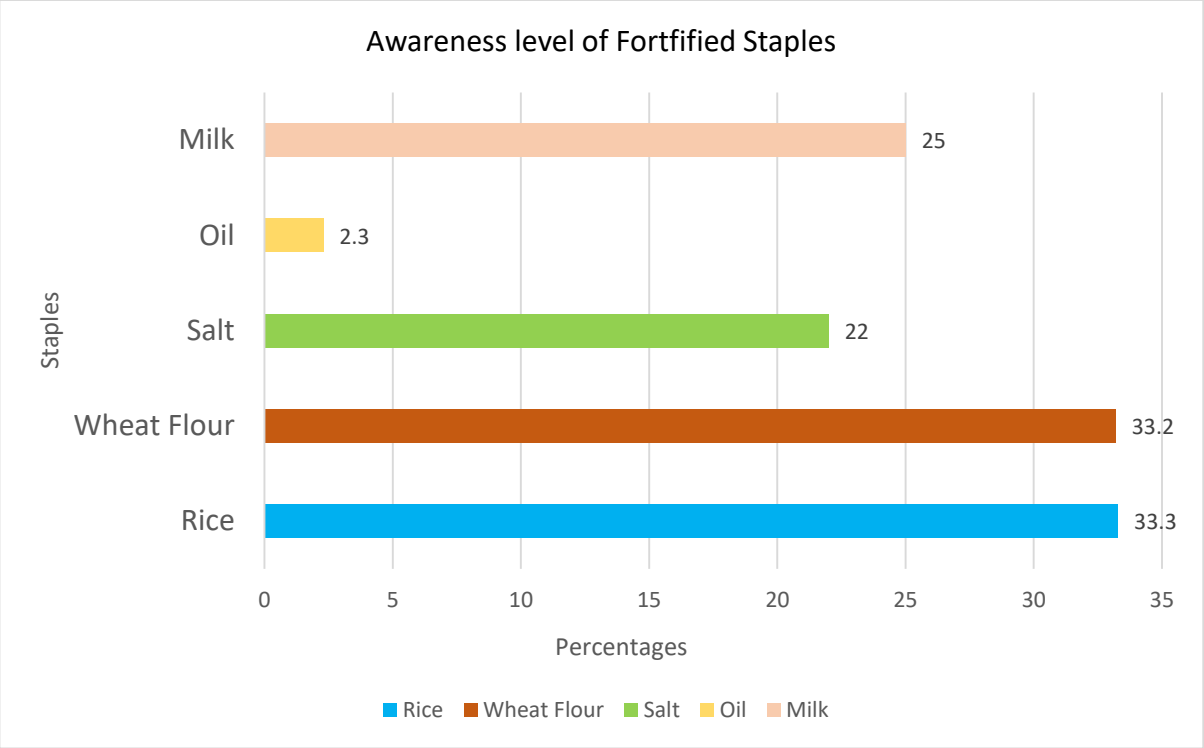


Fig 5. 1.3: Percent subjects reporting about awareness of staples that are being Fortified in India

5.1.3 Attitude towards Fortified Foods

Food Fortification definition was introduced to all the 375 subjects and thereafter questions on various aspects of their attitude towards Fortified Foods were asked.

Table 5.1.5 Number of Participant's indicating their Attitude towards Food Fortification (N=375)

Attitude Indicators	**No. of Subjects**	**Percent Subject**
A. Consumption of Ff Should Be For Everyone		
I) Agree (Positive Response)	7	2
II) Disagree (Negative Response)	368	98
B. Ffs Are Harmful		
I) Agree (Negative Response)	187	49.9
II) Disagree (Positive Response)	188	50.1
C. Willingness To Pay More For Ffs		
I) Agree (Positive Response)	251	66.9

II) Disagree (Negative Response)	124	33.1
D. Ffs Are Healthy		
I) Agree (Positive Response)	284	75
II) Disagree (Negative Response)	91	24
E. It Might Alter Taste And Smell		
I) Agree (Negative Response)	271	72.3
II) Disagree (Positive Response)	104	27.7
F. Readiness To Shift To Other Brands		
I) Agree (Positive Response)	247	66
II) Disagree (Negative Response)	128	33

As indicated in table 5.1.4, only 2% of subjects felt that the consumption of Fortified Foods should be for everyone while the majority (98%) felt, that its use is limited to a certain age group. The attitude regarding safe consumption of Fortified Food was uniform (50%) for correct and incorrect responses. Subjects were asked whether they were willing to pay more for Fortified Foods. Most subjects (66.9%) said 'yes,' while the rest 33.1 % were not willing to pay more for Fortified Foods. Further, subjects were questioned regarding the benefits of consuming Fortified Foods, where the majority (75%) felt Fortified Foods are safe. Regarding the change in taste and smell due to Fortification, 72% of subjects felt that Fortification will change the taste and smell of food. Sixty-six percent of the subjects agreed to shift to other brands after choosing Fortified Foods while 33% were reluctant for changing their preferences.

5.1.4 Purchasing Practices of Fortified Foods

5.1.4.1 Purchase Preferences for the grocery items

The purchasing preferences for grocery items are presented in table 5.1.6. The options provided to the subjects were a combination of organized and unorganized retail shops. The majority of the respondents preferred 'Traditional Stores' also known as 'Kirana stores' in India (32.3) for the purchase of grocery items, followed by, malls (27.7) and a combination of malls and traditional stores (20.5) depending on the convenience of the subjects.

Table 5.1.6 Purchasing preferences of the subjects for grocery items from organized/unorganized retail shops

Organized/Unorganized Retail Shops	Frequency	Percent
a. Malls	104	27.7
b. Traditional Stores	121	32.3
c. Online Application	16	4.3
d. Online and Traditional Stores	12	3.2
e. All the Options	45	12.0
f. Malls and Traditional Stores	77	20.5

5.1.4.2 Purchase practices for Fortified Foods (Foods with +F logo)

Subjects were categorized based on intentional and unintentional buying of Fortified Foods. Intentional buyers were those who knew about Fortified Foods and were practicing its purchase for the benefit of their health, while the unintentional were those who were not aware of Fortified Foods but were purchasing. According to table 5.1.7, the majority of the subjects (57.1%) were not buying Fortified Foods. Further, it was observed that 60% of the subjects were practicing un-intentional buying of Fortified Foods.

Table 5.1.7 Percent Subjects who were Purchasing Fortified Foods at the Baseline

Purchase Indicators	No. of Subjects N= 375	Percent
I) Purchasing	60	16
II) Not Purchasing	315	84
Intentional/Unintentional Purchase of FFs		
I) Intentional Buying	24	40
II) Unintentional Buying	36	60

5.1.4.2 Purchase practices of Fortified staples by the subjects at the baseline

As seen in Fig. 5.1.4 purchase of Fortified Foods for different staples varied from 7% to 15%. None of the subjects purchased Fortified milk. The purchase of Fortified rice and oil was being

practiced by 6% and 15% of the subjects respectively as reported, followed by wheat flour (13.6%) and salt (7.7%).

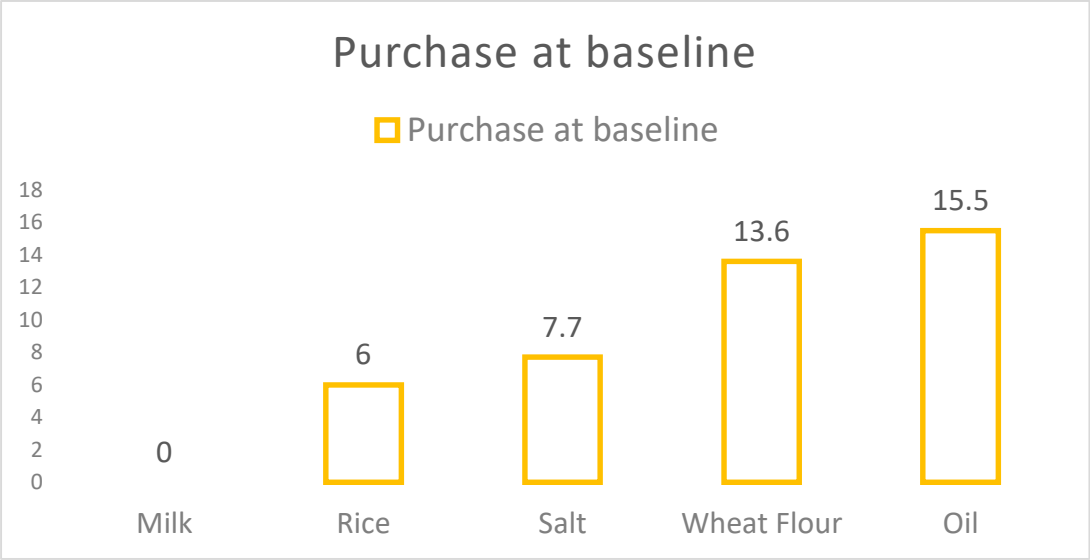


Fig 5.1.4: Percent subjects purchasing Fortified Staples at Baseline

5.1.4.2 Consumption of Multivitamin Tablets

As seen in Table 5.1.8, subjects were asked about their practices regarding the consumption of multivitamin tablets, 14.7% of the subjects self-reported consuming the tablets regularly, while the majority of the subjects were not consuming the tablets.

Table 5.1.8 Percent Subjects who were consuming Multivitamin Tablets

Multivitamin Tablets		Frequency N= 375	Percent
I)	**Consuming Multivitamin**	55	14.7
II)	**Not Consuming Multivitamin**	320	85.3

5.1.4.3 Yearly storage of staples by the study population

Subjects were questioned whether they stored any of the staples (Wheat Kernels, Oil, and Rice) for a year or purchased in bulk. Out of 375 subjects, 59% reported that they practiced yearly storage. The subjects further shared the list to mark which staple they stored for a year. The results are depicted in Fig 5.1.5

The majority (33%) of the subjects were storing Wheat Kernels for a year. It is a Traditional practice in Gujarat to make wheat flour at home using Traditional Chakkis. Rice was being stored by 16% of the subjects, while the storage of oil (2%) was practiced by a minority group.

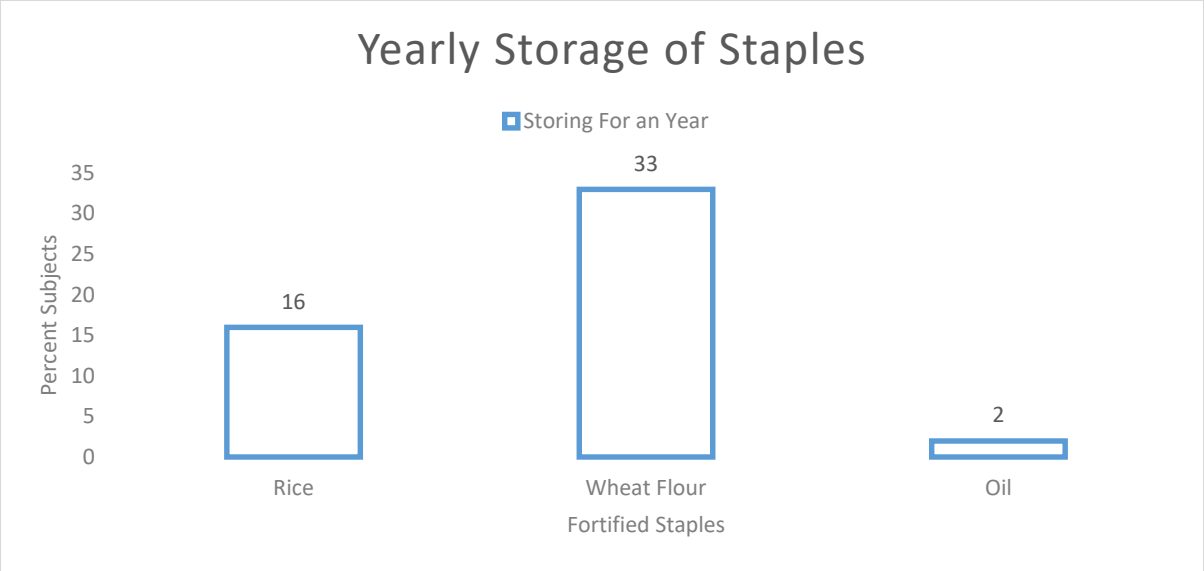


Fig 5.1.5: Percent subjects storing staples for a year

5.1.5 Association between Awareness and Purchase Practices of Fortified Foods amongst the subjects

The data was analyzed to study the association between subjects who could identify Food Fortification accurately and who were also practicing it. According to Fig 5.1.6, nearly 40% of the subjects were aware of Fortified Foods and were also practicing its purchase, whereas 31.8% of the subjects knew about Food Fortification but were not purchasing. Using the Chi-Square test, efforts were made to look at the association between two parameters. The results showed that there was no significant association between recognition of Fortified Foods and purchase practices of Fortified Foods with ($P < 0.219$), which means both variables were independent of each other.

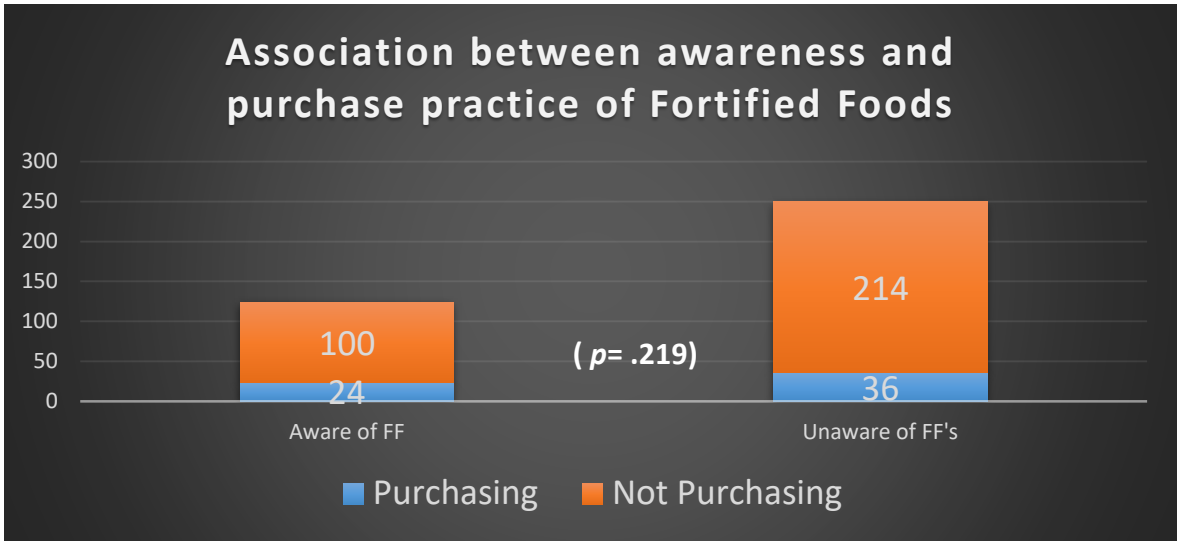


Fig 5.1.6 Association between awareness and purchase practices of Fortified Foods

5.1.6 Awareness regarding health benefits, sources, and deficiency signs for micronutrients

It was important to determine the existing awareness of micronutrients of the subjects for various parameters, to positively affect the purchase of Fortified Foods through e-intervention.

5.1.6.1 Awareness of Vitamin A

Referring to Fig 5.1.7, it was reported that the majority of the subject's awareness regarding Vitamin A was correct for the health benefits (65%) and signs of deficiency (77.3), however, the awareness of food sources for vitamin A was limited.

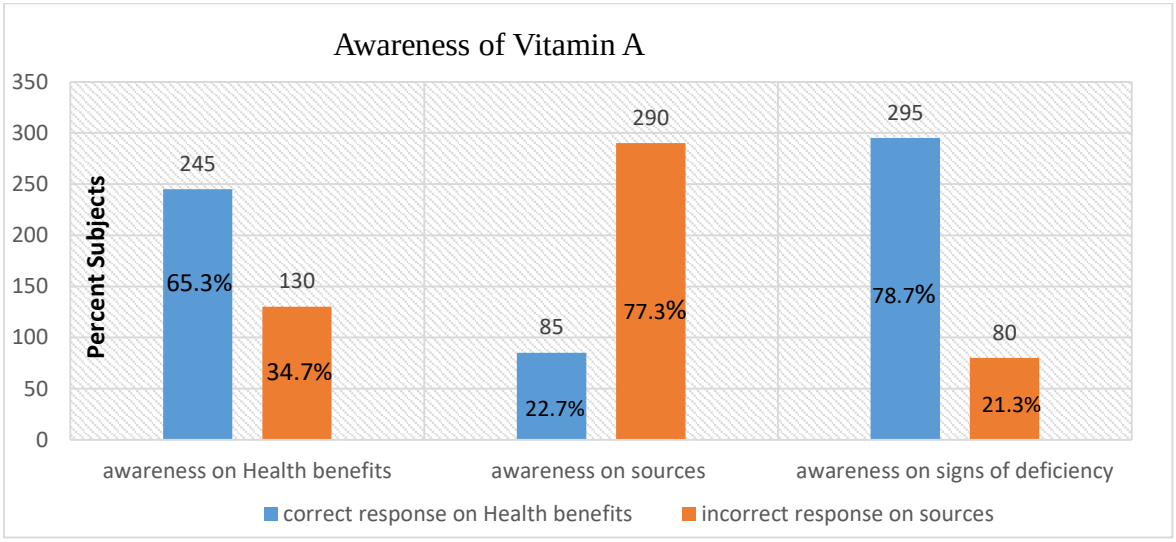


Fig 5.1.7 Responses of the subjects for Vitamin A Health Benefits, Sources, and Signs of Deficiency

5.1.6.2 Awareness of Vitamin D

Awareness of Vitamin D health benefits, sources, and signs of deficiency were identified correctly by, 67%, 60%, and 72% of subjects respectively (Fig 5.1.8).

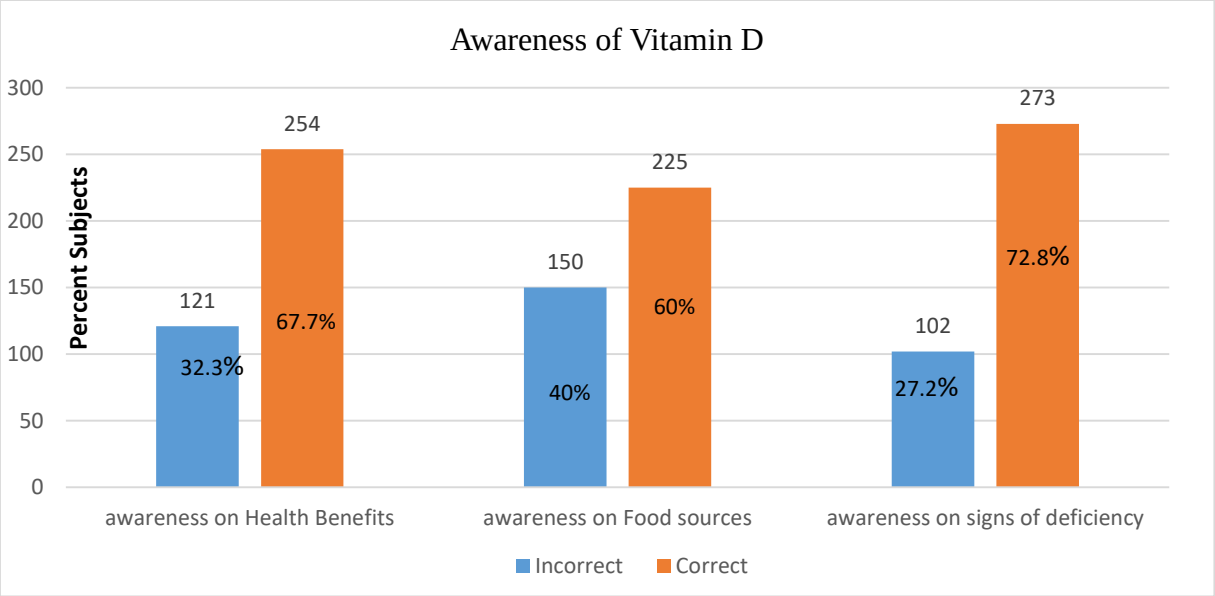


Fig 5.1.8 Responses of the subjects for Vitamin D Health Benefits, Sources, and Signs of Deficiency

5.1.6.2 Awareness of Vitamin B12

Awareness of Vitamin B12 health benefits was identified correctly by the majority of the subjects (73.6%), sources by 50%, and signs of the deficiency by 57.6% of the subjects (Fig 5.1.9).

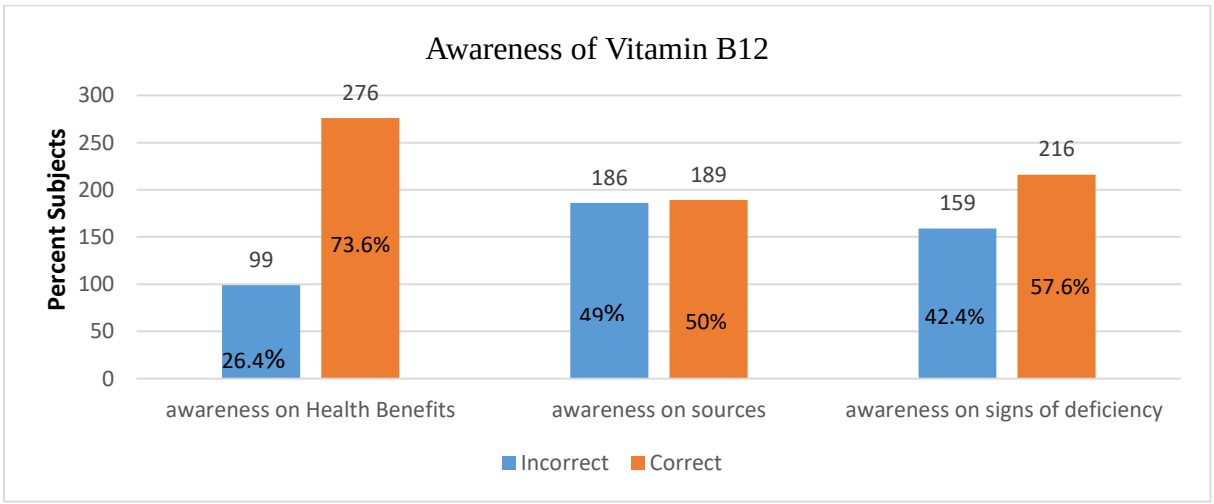


Fig 5.1.9 Responses of the subjects for Vitamin B12 Health Benefits, Sources, and Signs of Deficiency

5.1.6.3 Awareness of Iron

Awareness regarding the health benefits of food sources and signs of deficiency of Iron was identified correctly by the majority of the subjects (77.9%), sources and signs of the deficiency by 78% and 61% of the subjects, respectively.

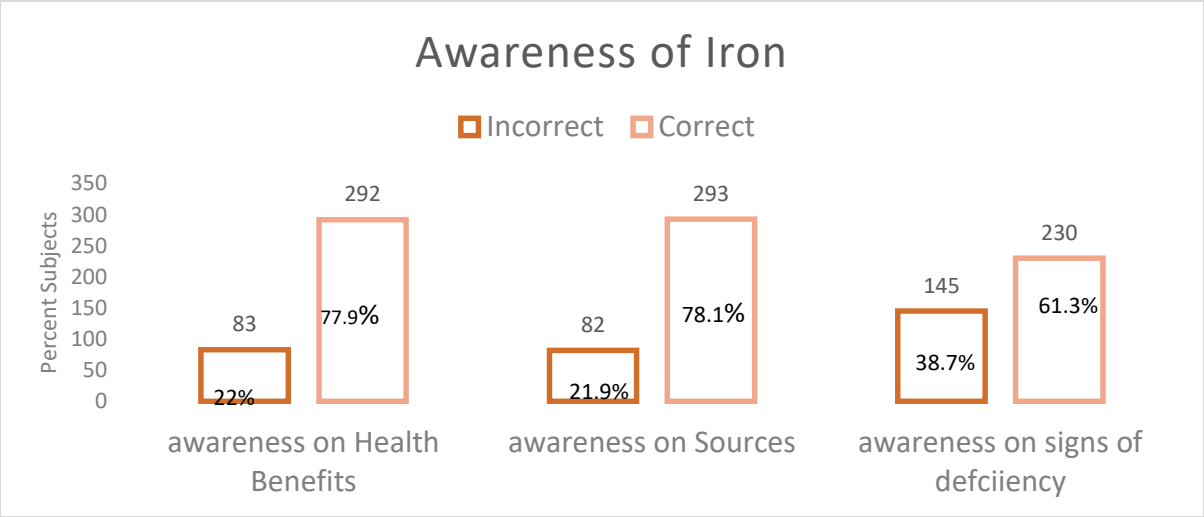


Fig 5.1.10 Responses of the subjects for Iron Health Benefits, Sources, and Signs of Deficiency

5.1.6.4 Awareness of Iodine

Awareness of Iodine health benefits was identified correctly by only a few of the subjects (5.3%), whereas awareness regarding sources was known to (43.2%) and signs of deficiency to (57.6%) of the subjects.

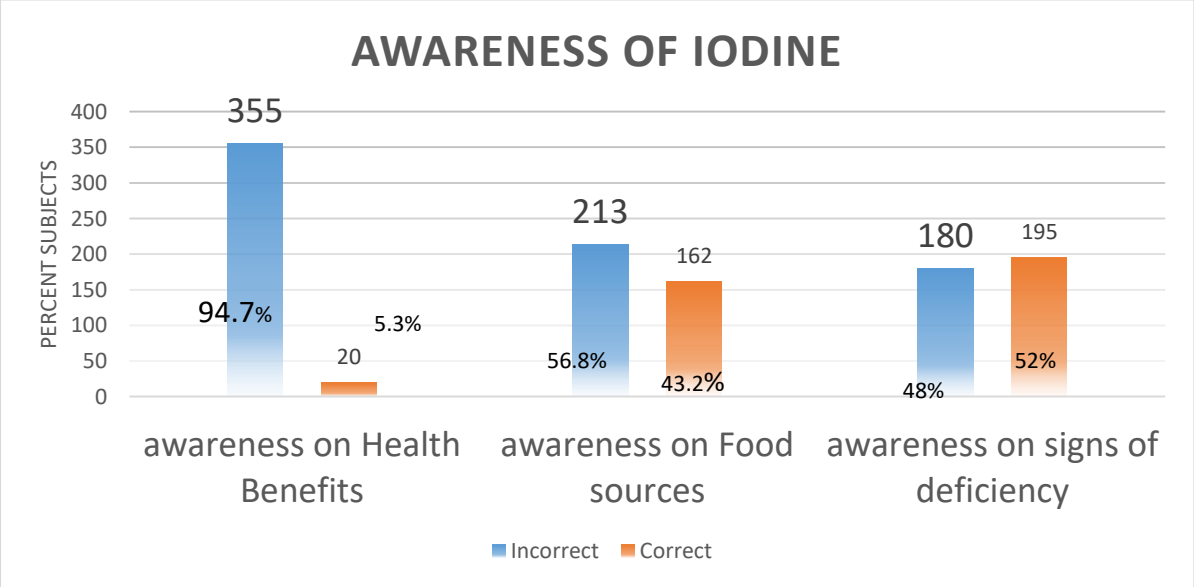


Fig 5.1.11 Responses of the subjects for Iodine Health Benefits, Sources, and Signs of Deficiency

5.1.7 Association between Awareness of various Micronutrients with Educational levels

Information regarding five micronutrient awareness, health benefits, and signs of deficiency was collected, and further its association with the subjects' educational levels was studied**.**

As seen in Table 5.1.9, a significant association was observed between awareness regarding signs of deficiency of Vitamin D, Health benefits of Vitamin B12, and Iodine, and with educational levels of the study subjects. Subjects having the highest degree of education had better awareness of the micronutrients. However, the degree of association was weak as per Cramers' V test. However, no such association was observed between the degree of education and awareness scores of vitamin A and Iron.

Table 5.1.9 Association between Awareness of Fortificants with Education levels of the subjects

Educational Levels		*Chi-Square/Fischer's test* Value	*p*-Value
Vitamin A	a. Health Benefits ***(Chi-Square)***	6.246	0.182 (NS)
	b. Food sources ***(Fischer's Exact Test)***	4.280	0.367 (NS)
	c. Signs of Deficiency ***(Fisher's Exact Test)***	4.225	0.372 (NS)
Vitamin D	a. Health Benefits	6.341	0.175 (NS)
	b. Food sources	1.190	0.884 (NS)
	c. Signs of Deficiency	13.983	**0.007 (Significant) Cramer's V= .193 Weak degree of association**
Vitamin B12	a. Health Benefits	17.469	**.002 (Significant) Cramer's V .216 Weak degree of association**
	b. Food sources	8.852[a]	0.064 (NS)
	c. Signs of Deficiency	0.926[a]	0. 094 (NS)
Iron	a. Health Benefits **(Fischer's Exact test)**	-3.539	0. 470 (NS)
	b. Food sources **(Fischer's Exact test)**	1.283	0.869 (NS)
	c. Signs of Deficiency	1.763[a]	0.783 (NS)

Iodine	a. Health Benefits (Fischer's Exact test)	8.570	**0.045(Significant) Cramer's V Value=.0154 P Value=.065 Weak degree of association**
	b. Food sources	7.026[a]	0.134 (NS)
	c. Signs of Deficiency	0.876	0.930 (NS)

NS= Non-Significant

5.1.8 Association of various Micronutrients awareness and Occupation of the study subjects

Information regarding five micronutrient awareness, health benefits, and signs of deficiency was collected, and further its association with the subject's occupation levels was studied. Efforts were made to study whether the subjects belonging to the highest category in the hierarchy (Professional Kuppuswamy Scale) had better awareness than their counterparts (Table 5.1.10).

Table 5.1.10 Association between Awareness of Fortificants with Occupation Levels of the subjects

Occupation Levels and Awareness of Fortificants		*Chi-Square* Value	*p*-Value
Vitamin A	a. Health Benefits	16.386	**0.005 (Significant) Cramer's V = 0.006 (Weak Degree of Association)**
	b. Food sources	6.905	0.367 (NS)
	c. Signs of Deficiency	2.034	0.851 (NS)
Vitamin D	a. Health Benefits	3.926	0.565 (NS)
	b. Food sources	3.965	0.559 (NS)
	c. Signs of Deficiency	2.237	0.815 (NS)
Vitamin B12	a. Health Benefits	5.695	0.339 (NS)
	b. Food sources	8.674	0.123 (NS)
	c. Signs of Deficiency	4.584	0.469 (NS)

Iron	a. Health Benefits	7.069	0.215 (NS)
	b. Food Sources	1.637	0.897 (NS)
	c. Signs of Deficiency	1.415	0.925(NS)
Iodine	a. Health Benefits	4.932	0.356 (NS)
	b. Food sources	1.913	0.864 (NS)
	c. Signs of Deficiency	1.596	0.902 (NS)

NS= Non-Significant

A significant association between awareness regarding the health benefits of Vitamin A and the occupational levels of the subjects was observed (P<0.05). It was observed those who belonged to the highest hierarchy in the occupational level had better awareness of the health benefits of Vitamin A. Using Cramer's V test weak association was observed between the two variables.

5.1.9 Association between Subjects having Educational qualifications s in the field of Nutrition with their Awareness of various micronutrients

Efforts were made to study whether the subjects belonging to the nutrition background had better awareness than their counterparts (Table 5.1.11).

Table 5.1.11Association between awareness of micronutrients and with nutrition background of the subjects

Nutritional and Non-Nutrition Background and Awareness of Fortificants		*Chi-Square* Value	*p*-Value
Vitamin A	a. Health Benefits	16.386	**0.005 (Significant) Cramer's V = 0.006 (Weak Degree of Association)**
	b. Food sources	6.905	0.367 (NS)
	c. Signs of Deficiency	2.034	0.851 (NS)
Vitamin D	a. Health Benefits	3.926	0.565S)
	b. Food sources	3.965	0.559S)
	c. Signs of Deficiency	2.237	0.815 (NS)

Vitamin B12	a. Health Benefits	5.695	0.339S)
	b. Food sources	8.674	0.123S)
	c. Signs of Deficiency	4.584	0.469 (NS)
Iron	a. Health Benefits	7.069	0.215 (NS)
	b. Food Sources	1.637	0.897 (NS)
	c. Signs of Deficiency	1.415	0.926(NS)
Iodine	a. Health Benefits	4.932	0.356 (NS)
	b. Food sources	1.913	0.864 (NS)
	c. Signs of Deficiency	1.596	0.902 (NS)

NS= Non-Significant

Only Vitamin A health benefits were significantly associated with the nutrition background of the subjects ($P<0.005$), however, no such association was observed for the other micronutrients.

Result Highlights

PHASE I

- At baseline, 33% of the subjects reported that they have heard the term' Fortified Foods'
- Major source of information was the Broadcast media – Television, Radio, internet etc for 45% of the subjects
- Only 28% of subjects could identify the correct definition of Fortified Foods
- Awareness of +F logo was amongst the 20% of the subjects
- Awareness regarding Fortified staples was limited amongst the study subjects. Wheat flour Fortification for 33.2%, rice Fortification for 33.3%, followed by milk 25% and double Fortified salt (22%). Only a few of the subjects were aware of oil Fortification (2.3%)
- Only 2% of the subjects believed Fortification should be for everyone, irrespective of age and gender
- The Unintentional purchase practice for one or few of the staples was being followed by 60% of the subjects

Phase II- Interventional Phase on Food Fortification

5.2.1 Effect of the e-intervention on subjects' awareness, attitude, and purchase Practices regarding Fortified Foods

At the baseline 375 subjects were enrolled in the study, however, there was a dropout of nearly 26 subjects. The final sample size on which the impact of the e-intervention was studied was 349 subjects.

5.2.1.1 Impact of e-intervention on subject's awareness of Fortified Foods

Impact of e- intervention regarding awareness parameters of the Fortified Foods showed a significant increase for the awareness of Fortified Foods by definition, awareness regarding logo and target group who can consume it. Using McNemar's test, a significant level was calculated at P<0.001 for all the parameters.

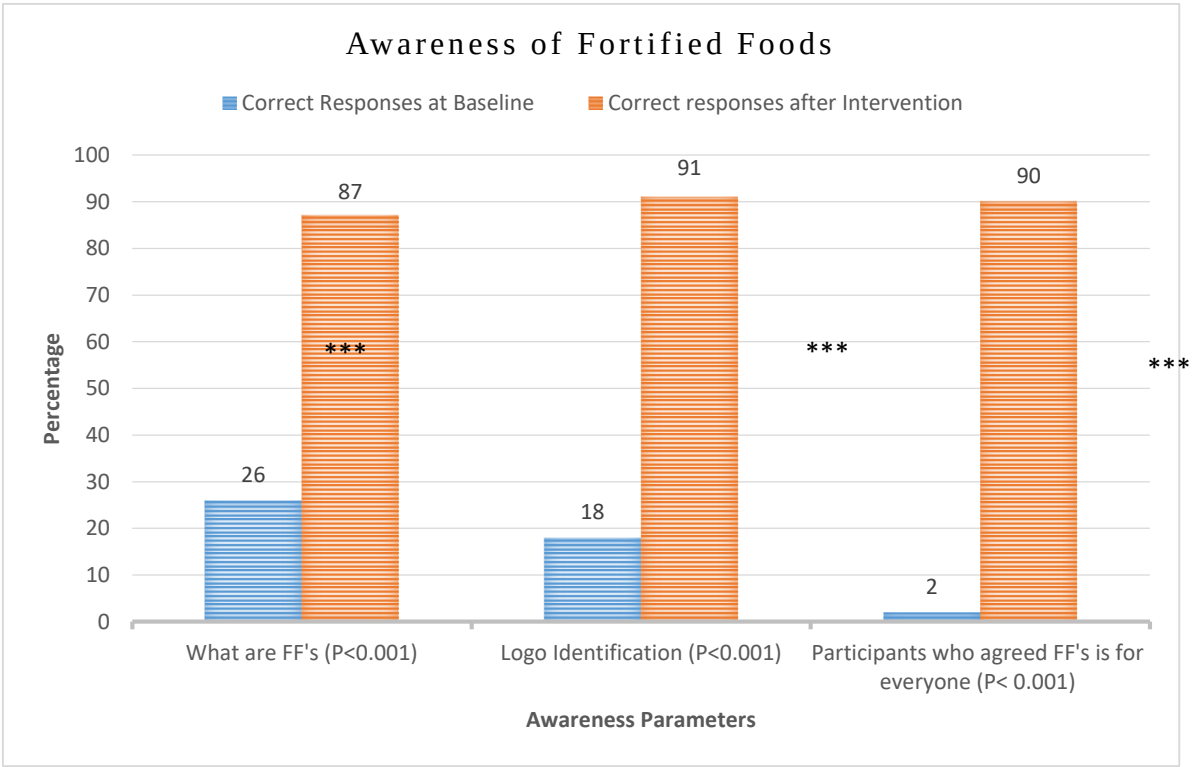


Fig 5.2.1: Increase in Awareness of Fortified Foods

Table 5.2.1 shows the percent improvement post e-intervention in the awareness parameters of Fortified Foods amongst the subjects. There was an improvement of 17- 24% in the total awareness parameters of Food Fortification.

Table 5.2.1 Percent shift in awareness parameters of the subjects for Fortified Foods

I. Awareness Parameters	Impact of E-intervention	Percentages
a. FF Awareness	Pre Interventions	6%
	Post Intervention	23%
	% increase	**17%**
b. Awareness of +F logo	Pre- Interventions	4.8%
	Post Intervention	24%
	% increase	**19.2%**
c. Awareness of FF target group (It's for everyone)	Pre- Interventions	0%
	Post Intervention	24%
	% increase	**24%**

5.2.1.2 Impact of e- intervention on awareness of staples that are being Fortified in India under FSSAI regulations 2018

Awareness of staples that are being Fortified under FSSAI 2018 regulations in India are rice, wheat flour, oil, salt, and milk. The yellow shaded part is the number of respondents who responded incorrectly before the e-intervention but gained awareness after the e-intervention. One hundred and sixty-one subjects could identify rice as one of the staples being Fortified in India, followed by 157, 252, 183, and 185 for wheat flour, oil, salt, and milk respectively.

Using McNemar's test it was determined that there was a statistically significant increase in the proportion of awareness of all the Fortified staples, post-e-intervention, $p < 0.001$.

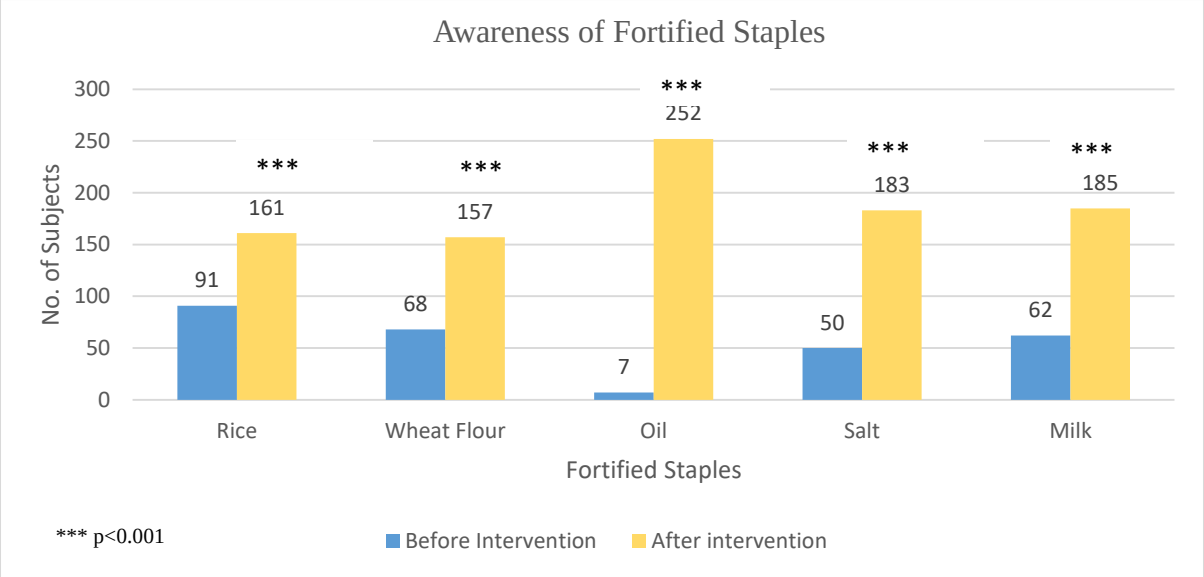


Fig 5.2.2: Impact of E-intervention on Awareness of Fortified Staples amongst the Subjects (N=349)

Table 5.2.2 Percent shift in awareness parameters of the subjects for Fortified Foods

II. Awareness of FF staples		
a. Rice	Pre- Interventions	24%
	Post Intervention	42%
	% increase	**18%**
b. Wheat Flour	Pre- Interventions	18%
	Post Intervention	41%
	% increase	**23%**
c. Oil	Pre- Interventions	1%
	Post Intervention	67%
	% increase	**66%**
d. Salt	Pre- Interventions	13%
	Post Intervention	48.8%
	% increase	**35%**
e. Milk	Pre- Interventions	16%
	Post Intervention	49%
	% increase	**33%**

The percent increase in the awareness of Fortified staples was studied. The awareness regarding Fortified Foods, post-e-intervention improved from 18% to 66%. A maximum increase in awareness was observed for oil (66%) followed by salt (35%) and milk (33%).

5.2.1.3 Impact of e-intervention on subject's attitude toward Fortified Foods

The researcher shared brief information about what are Fortified Foods and why it is being done, to know about the baseline attitude of the subjects after knowing the crucial details about Fortified Foods.

Various questions related to the attitude towards Fortified Foods were asked to the subjects during the post-assessment stage to know the change in their attitude after e-intervention. Highly significant improvement was observed in the various attitude parameters, post-e-intervention ($P<0.05$) Fig.5.2.3.

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Attitude regarding the safety of consuming Fortified Foods improved for 140 subjects, willingness to pay more for Fortified Foods was improved for 92 subjects, while 80 subjects agreed that the Fortified Foods will be beneficial for their health. Nearly 221 subjects accepted the fact that there will not be any change of taste in the Fortified Foods and 91subjects agreed that shifting to other brands for choosing Fortified Foods, will be beneficial for their health.

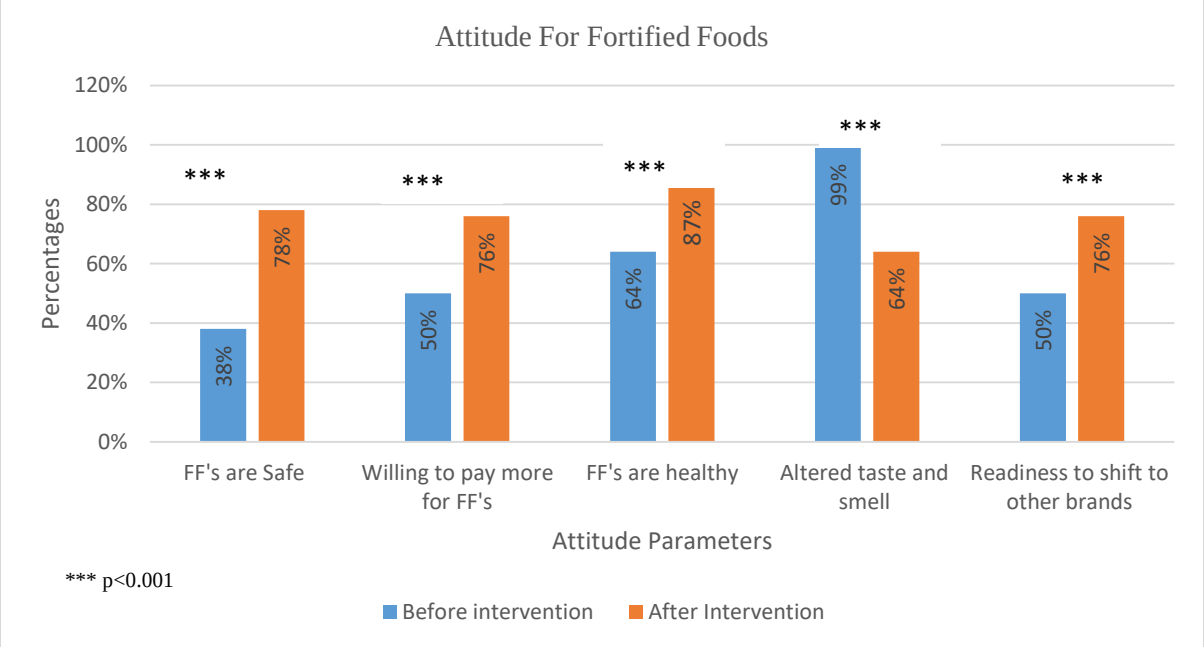


Fig 5.2.3 Impact of e-Intervention on Attitude of the subjects toward Fortified Foods

McNemar's test determined that there was a statistically significant improvement in the proportion of attitude about Fortified Food, post-e-intervention, p <0.001.

Table 5.2.3 shows a percent shift in the attitude parameters of Fortified Foods amongst the subjects

Table 5.2.3 Percent shift in the attitude of the subjects' toward Fortified Foods

I. Attitude Parameters	Impact of E-intervention	Percentages
a. FFs are safe	Pre- Interventions	38%
	Post Intervention	78%
	% increase	**40%**
b. Willingness to pay more	Pre- Interventions	50%
	Post Intervention	76%
	% increase	**26%**
c. FFs are healthy	Pre- Interventions	64%
	Post Intervention	87%
	% increase	**23%**
d. Change in Taste and Smell of FFs	Pre- Interventions	99%
	Post Intervention	64%
	% decrease	**35%**
e. Readiness to shift to other brands	Pre- Interventions	50%
	Post Intervention	76%
	% increase	**26%**

Maximum improvement was seen in the attitude towards the safety of Fortified Foods (40%), followed by their attitudes about taste and smell (35%) and 26% of the subjects were willing to shift to other brands that are Fortified. Also, 26% of the subjects were willing to pay more for Fortified Foods and 23% considered it to be healthy.

5.2.1.4 Impact of e-intervention concerning the purchase practices regarding Fortified Foods

The purchase practices for five staples were observed and there was a significant increase in the purchase practices (refer to Fig 5.2.4). Thirty-seven subjects started the purchase Fortified rice after the e-intervention, while 69 subjects started the purchase of Fortified wheat flour, 87 subjects Fortified salt, 95 subjects started the purchase of Fortified milk,

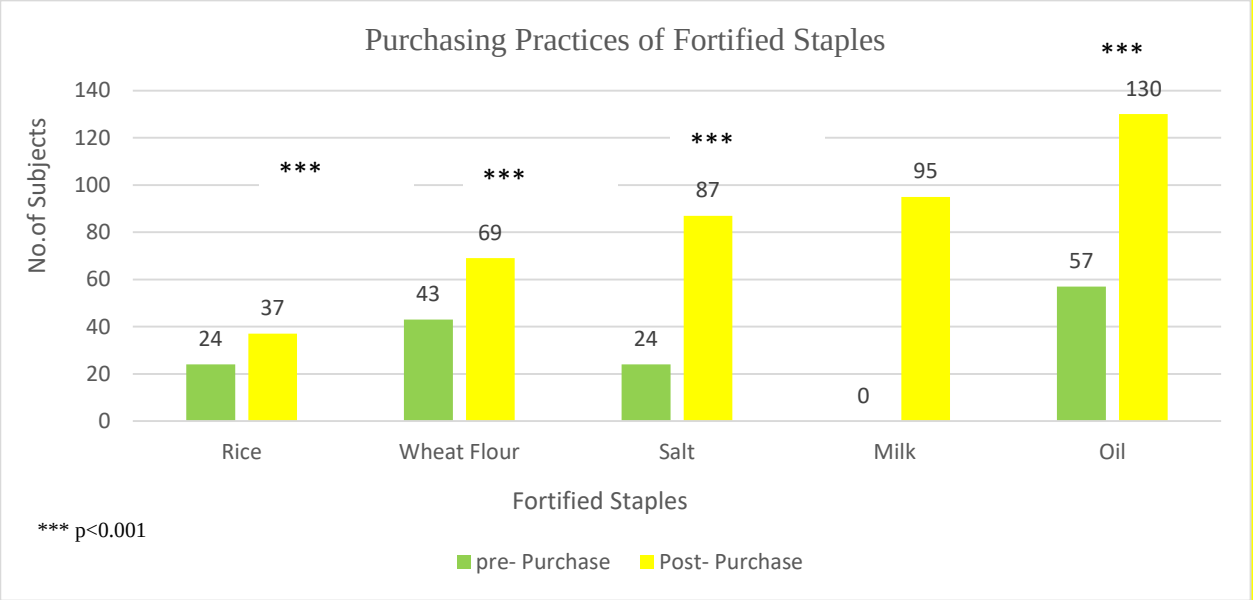


Fig 5.2.4: Impact of e-intervention on Purchase Practices for the five staples

Table 5.2.4 provides information regarding the shift in purchase practices after the intervention. The maximum impact of e-intervention was observed for milk (25%), followed by the purchase of salt (17%), while there was very little impact studied for wheat flour (7%) and rice (3%). Using McNemar's test, it was determined that there was a statistically significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk, and oil, pre-and post-e-intervention, with $p < 0.001$.

Improvement in the purchase practices was minimal due to factors affecting the purchase such as availability in an open market as per the preferences of the subjects. A maximum percent increase was observed for Fortified milk which increased by 25%.

Table 5.2.4 Percent shift in the Purchase Practices of the subjects for Fortified Foods

I. **Purchase Practices**	**Impact of e-intervention**	**Percentages**
a. Purchase of Rice	Pre- Interventions	7%
	Post Intervention	10%
	% increase	**3%**
b. Purchase of Wheat Flour	Pre- Interventions	11%
	Post Intervention	18%
	% increase	**7%**
c. Purchase of Salt	Pre- Interventions	6.4%
	23.2%	87%
	% increase	**17%**
d. Purchase of Milk	Pre- Interventions	0
	Post Intervention	25%
	% increase	**25%**
e. Purchase of Oil	Pre- Interventions	15%
	Post Intervention	34%
	% increase	**19%**

5.2.1.5 Bottlenecks reported by the subjects for procuring Fortified Foods

Subjects were asked about the reasons that were impeding their purchase of Fortified Foods. The majority (38%) of subjects reported unavailability of Fortified Foods in the nearest store, followed by a preference for buying local/ unpacked staples such as rice and wheat kernels (34%) (Table 5.2.5).

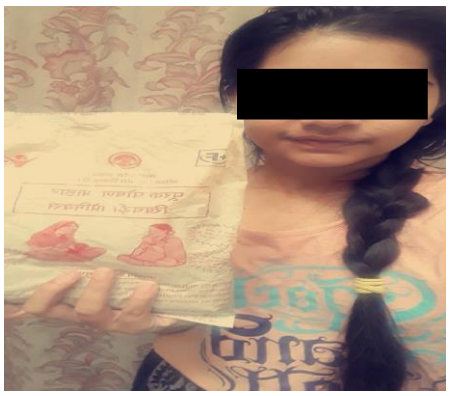
Table 5.2.5 Bottlenecks regarding Purchase of Fortified Foods by the subjects (N=326)

Reasons	**No. of subjects (N=326)**	**Percent**
Unavailability in the nearest store	144	38.4
It's Expensive	2	0.5
Prefer buying loose products	129	34.4
The preferred brand is not Fortified	51	13.6

5.2.1.6 Impact of e-intervention on purchase practices during the '*Sunday Selfie Contest*'

A total of 17 participants shared their pictures during the selfie contest while others shared pictures of the products brought them. Some of the selfies are shown below.

a. Selfie with Fortified Activa Oil



b. Selfie Contest with Fortified Anganwadi Product

d. Selfie with Fortified Dhara oil

c. Selfie with Fortified Gulab

e. Selfie with Fortified Gulab oil

f. Selfie with Fortified Gulab

Plate 5.2.1 (a-f) Subjects displaying purchase of Fortified Foods during the Sunday selfie Contest

5.2.2 Mid-level evaluation of e-intervention

The study period was on of one month, i.e. 30 days, subjects were shared one small questionnaire in the middle of the e-intervention (second Sunday- 14 days after the e-intervention started) to know whether they initiated buying Fortified Foods and to know their views about the messages being shared.

5.2.2.1 Attitude regarding the purchase of Fortified Foods

The mid-e-intervention assessment form was shared with the subjects, however, it was optional. Out of 239 subjects, 93% changed their attitude within fifteen days time frame for buying Fortified Foods. Out of 224 subjects, 74% reported that they already started the purchase of Fortified Foods. The subjects were further asked about which staple they have started buying. Purchase of Fortified wheat flour (41%) and salt (37%) was practiced by the majority of the subjects (Table 5.2.6).

Table 5.2.6 Change in attitude regarding the purchase of Fortified Foods during the mid-evaluation

Indicators	**No. of Subjects N= 239**	**Percent**
a. Will not purchase	15	6.3
b. Will purchase/Started Purchase	401	93.7
Staples	**Fortified Staples**	
a. Rice	8	4.4
b. Wheat Flour	75	41.7
c. Milk	-	-
d. Salt	68	37.8
e. Oil	29	16.1

5.2.2.2 e-intervention Feedback Responses

Subjects were asked whether the messages shared with them using WhatsApp are insightful for their health or not. Results revealed that the messages were insightful as reported by 98% of the subjects (N=239)

Table 5.2.7: Percent of subjects who felt messages were insightful

Feedback Responses	No. of Subjects	Percent
a. Messages were not insightful	4	1.7
b. Messages were insightful	235	98.3

5.2.3 Effect of e-intervention after 7 months of Washout Period

5.2.3.1 Purchase Practices for Fortified Foods after Washout Period

Google questionnaire was administered after 7 months of the e-intervention period for assessing the sustainability of purchasing practices for Fortified Foods and subjects' awareness of the Fortified Food logo (Primary outcomes of the study).

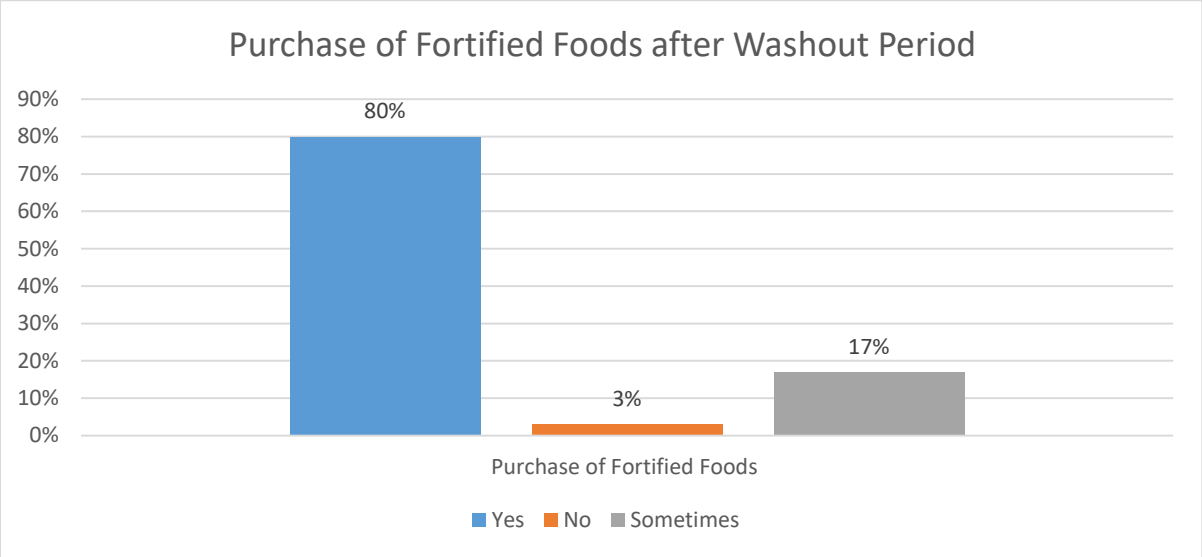


Fig 5.2.5: Purchase of Fortified Foods after 7 months of Washout

Washout Form was undertaken by 244 subjects, of which 80% (n=195) were still consuming Fortified Foods after 7 months of washout, while 17% (n= 42) were purchasing sometimes and 3% (n=7) marked 'No' as their response.

Subjects who marked 'Yes' as their response for purchase of Fortified Foods were further questioned about the staple. The majority of the subjects (70%) were purchasing oil, followed by 53% for Double Fortified Salt, Milk (40%), Wheat Flour (20%), and Rice (13%).

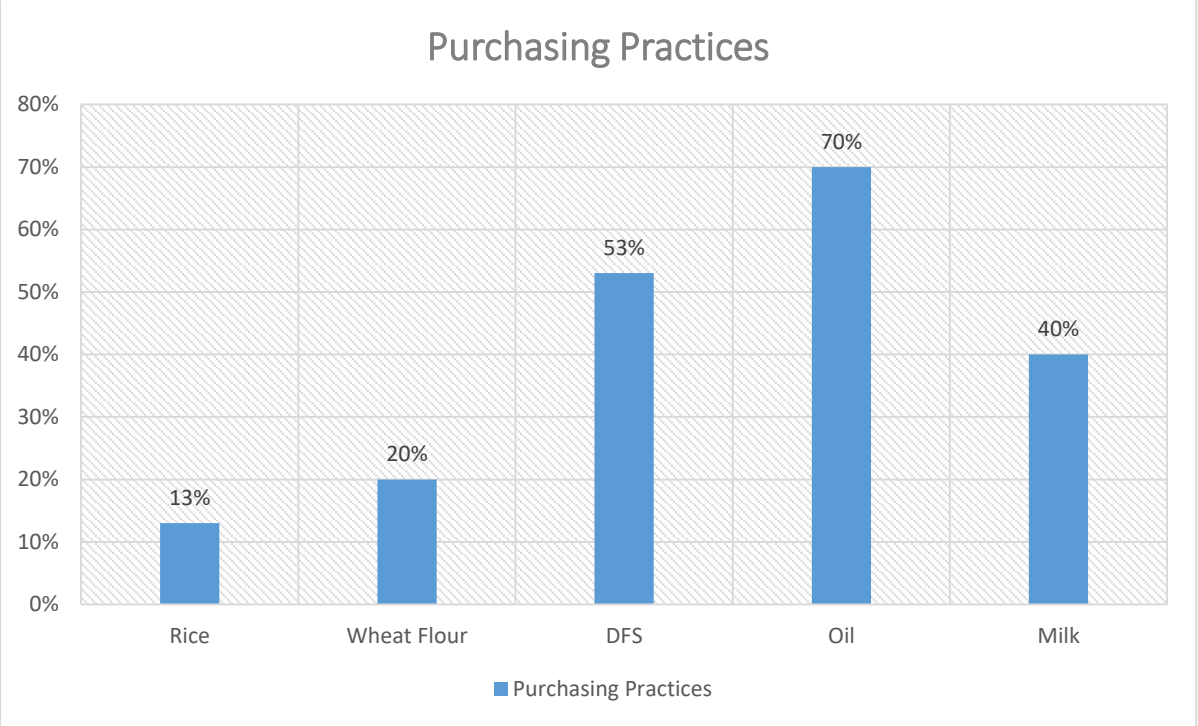


Fig 5.2.6: Purchase Practices of Fortified Staples after 7 months of Washout

5.2.3.2 Identification of correct logo for Fortified Foods

All the respondents (100%) who undertook google form post 7 months of washout period, marked the correct logo for Fortified Foods as their response.

5.2.4 Statistical Association between Pre and Post data of awareness, attitude, and purchase practices for Fortified Foods

Using Wilcoxon signed ranks, for the three parameters (Awareness, Attitude, and Purchase) it can be seen that the positive ranks were more i.e. improvement from pre to post-. There was a significant improvement for all the parameters (P<0.001) (table 5.2.8).

Table 5.2.8 Ranks chart for awareness, Attitude, and Practice

		N	Mean Rank	Sum of Ranks
Post – Pre Awareness	Negative Ranks	4[a]	28.00	112.00
	Positive Ranks	95[b]	50.93	4838.00
	Ties	9[c]		
	Total	108		
Wilcoxon Signed Ranks Test	Z	-8.480[b]		
	Sig. (2-tailed)	<.001		
Post – Pre Attitude	Negative Ranks	80[a]	136.30	10904.00

	Positive Ranks	236[b]	166.03	39182.00
	Ties	33[c]		
	Total	349		
Wilcoxon Signed Ranks Test	Z	-8.731[b]		
	Sig. (2-tailed)	<.001		
Post - Pre-purchase	Negative Ranks	6[a]	66.25	397.50
	Positive Ranks	232[b]	120.88	28043.50
	Ties	116[c]		
	Total	354		
Wilcoxon Signed Ranks Test	Z	-13.203[b]		
	Asymp. Sig. (2-tailed)	<.001		

a. =Post < Pre, b. Post> Pre, c, post= Pre

Diffusion of Innovation Model

The study followed the Diffusion of Innovation Model (DIM) as one of the strategies. According to this model, subjects were categorized according to Innovators, Early adopters, late adopters, and Laggards depending on when they started the purchase of Fortified staples from the time of e-intervention. The model helped in recording the time taken for an innovation to be adopted by the people.

5.2.4 Analysis of Subject's Purchasing Practices using Diffusion of Innovation Model

Using the Diffusion of Innovation Model, Purchase practices were categorized based on adopters, depending upon the rate of adoption which was adopted by the enrolled subjects. The results revealed that 12.4% of the subjects were categorized as Innovators, 24.3% as early adopters, 26.2% as the early majority, 8.2% as the late majority, and 24.7% as laggards. Table 3 clearly describes the week of adoption and the category of the subjects following the diffusion of innovation model (table 5.2.9).

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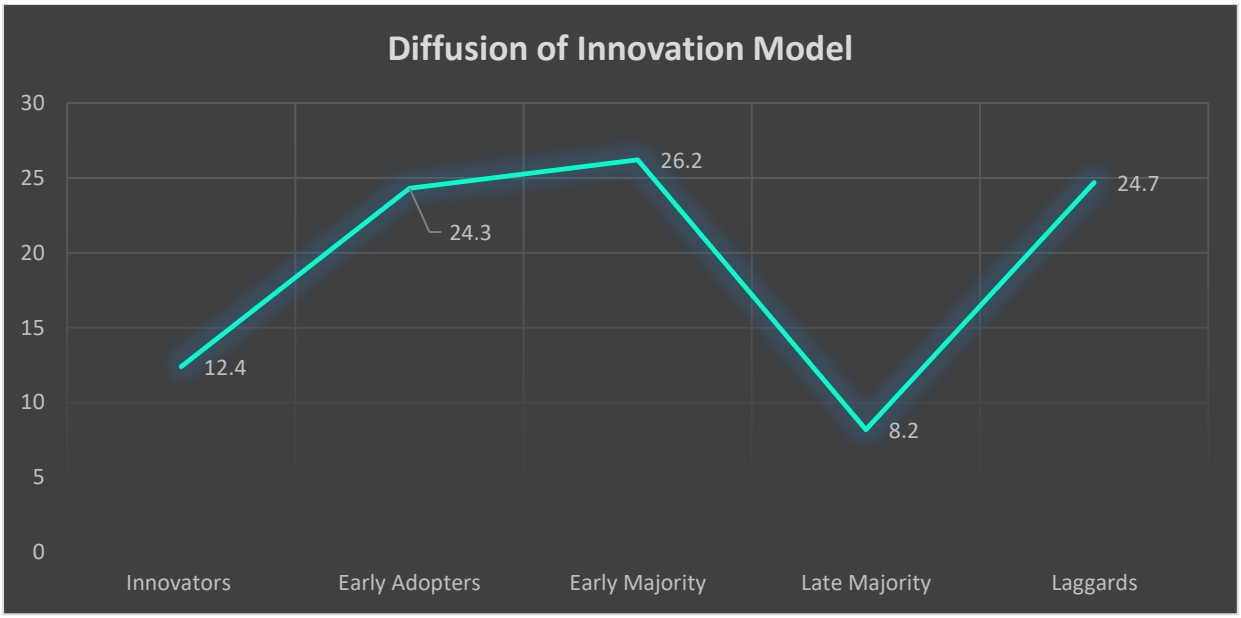


Fig 5.2.7: Purchase practices concerning the DIM Model

Table 5.2.9 Categorization of subjects based on the Diffusion of Innovation Model

Week of Adoption	**No. of Subjects**	**Percent**	**DIM (%)**	**Statistical Analysis**
1st week - Innovators	27	12.4	2%	**Mean = 1.89** **Median= 2nd week** **Std. Dev= 1.601**
2nd week-Early Adopters	53	24.3	14%	
3rd -4th Week Early Majority	57	26.2	34%	
5th week – Late Majority	18	8.2	34%	
>5th Week -Laggards	54	24.7	16%	

Result Highlights

PHASE II

- Food Fortification awareness for definition, logo and the target group increased by 17- 24%
- The awareness regarding Fortified Foods, post e-intervention improved from 18% to 66%. Maximum increase in the awareness was observed for oil (66%) followed by salt (35%) and milk (33%).
- Highly significant improvement was observed in the various attitude parameters, post e-intervention ($P<0.05$)
- Statistically Significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk and oil, was observed post e-intervention with $P<0.001$
- All the respondents (100%) who undertook google form post 7 months of washout period, marked correct logo for Fortified Foods as their response
- The results revealed that 12.4% of the subjects were categorized as Innovators, 24.3% as early adopters, 26.2% as early majority, 8.2% as late majority and 24.7% as laggards when assessed using Diffusion of Innovation Theory.

5.3 Phase III- Market survey for Fortified Foods Availability

A market survey for available Fortified Foods was conducted in the Vadodara city of Gujarat. Different markets like online retail platforms, hypermarkets, and traditional *Kirana* stores were selected for the wide coverage. Currently, there are 157 Fortified brands available in India of which 80 brands are for Fortified edible oils, 55 for milk, 12 for wheat flour, 2 for rice, and 8 for double Fortified salt (FSSAI, 2019).

The rationale for conducting the market survey was to record the number of brands that were Fortifying the five staples (rice, wheat flour, salt, oil, and milk) and are available in Vadodara city which may help the manufacturer to design the strategies for further promotion and availability in the city.

5.3.1 Market survey for Fortified Foods availability on online retail platforms

	Amazon	Big Basket	Jio Mart	Grofers
Rice	-Dr. Rice Granova Naturals India Pvt ltd (Unavailable) Lohitha Nutri Rice	-	-	-
Wheat Flour	P Mark Chakki Atta	• Superior MpChakki Wheat Atta (Fortified with iron) • Superior Chakki Wheat Aata • BB Royal Multigrain 100% MP Sharbati	-	-
DFS	Tata Salt Plus -	-	-	-
Oil	Refined sunflower oil DharaKachi Ghani oil Dhara Rice bran oil Sundropsuperlite advanced sunflower oil Anjali cold-pressed Gingelly /sesame oil Sun drop heart oil Patanjali Fortified Mustard Oil	• Fortified Mustard Oil Patanjali • Active Corn Oil • Cotton Seed Oil Tirupati • Ankur Cotton Seed Oil • Tirupati Cotton Seed Oil • Groundnut Oil Ankur • Oil Hear Sundrop • Sundrop Heart Oil vegetable • Tirupati Active Corn oil • Cotton Seed Oil, • Gulab Double Filtered Groundnut Oil • Superlite Advanced Oil • Sunflower Sundrop • Gulab Refined Sunflower Oil • Sunflower Bucket Gulab	• Ankur Double Filtered Groundnut Oil • Gulab Double Filtered Groundnut Oil • Groundnut Health refined cottonseed oil • Sundropsuperlite advanced sunflower oil • Tirupati refined cottonseed oil	• Gulab Cottonseed oil • Gulab groundnut oil • Tirupati Cotton Seed Oil • Sundropsuperlite advanced sunflower oil • Tirupati Rice bran oil

		• SundropNutrilite Oil Blend		
Milk	Nestle Nido Fortified Milk Anchor Fortified Full cream milk Nezline Fortified milk powder			• Britannia Milk • Grofers Fortified Milk • Nestle Milk

It was observed that the Fortified Wheat Flour was available only on Big Basket in its brand name, however, the oil brands that were available varied from 7 to 17 types of oils on online retail platforms. There was one brand of Double Fortified salt and two brands of Fortified rice on any of the platforms. Fortified milk was available in three brands on Grofer's online retail platform.

5.3.2 Market survey for Fortified Food availability in Hypermarkets of Vadodara

As seen in Table 5.3.2 shows the availability of Fortified Foods in the hypermarkets of Vadodara. The hypermarkets in Vadodara that were selected were Big Bazaar, Spencer's, D-Mart, Bansal mall, Spencer's, and Patanjali. It was observed that nearly 7 to 10 Fortified oil was available in the hypermarkets of Vadodara. The availability of Fortified milk was available in Spencer's and Big Bazaar. There was no availability of Fortified wheat flour. Availability of one brand for Fortified rice and Double Fortified salt each in the hypermarket.

Table 5.3.2 Market survey for Fortified Food availability in Hypermarkets of Vadodara

	Spencer's	**Bansal Mall**	**D-Mart**	**Big- Bazaar**	**Patanjali**
Rice	-	-	-	Dawat Sehat Mogra	-
Wheat Flour	-	-	-	-	-
DFS		-	TATA Salt Lite	TATA Salt Lite	-
Oil	AnkurKapasiya oil SundropSuperlite Advanced oil Sundrop Heart Oil Sundrop Low absorb Superlite Advanced	Fortune SunLite refined sunflower oil Tirupati active refined corn oil plus Akur Groundnut Oil	Raani Gold Filtered Groundnut Oil Korndrop Refined Corn Oil Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil Tirupati refined sunflower oil	Patanjali sunflower oil PatanjaliSarso oil Patanjali Rice bran oil

	Tirupati Kapasiya Oil		Tirupati refined sunflower oil SundropSuperlite Advanced Fortune SunLite refined sunflower oil	SundropSuperlite Advanced	
MILK	Maahi Milk			Maahi milk Britannia Milk Nestle milk	-

5.3.3 Market survey for Fortified Food availability in Traditional Kirana (Grocery) stores of Vadodara

Two Kirana Stores were selected at random from the four zones of Vadodara North, East, West, and South.

	Mahalaxmi Alkapuri (WEST)	**Apexa Alkapuri (WEST)**	**Taaza New Sama (NORTH)**	**Aggarwal Store Karelibaugh (NORTH)**	**Shree Ram Provision Store NyayMandir (EAST)**	**Shri Krishna Provisional Store Gotri (EAST)**	**South Super Market Tarsali (SOUTH)**	**Ganesh Super Store (SOUTH)**
Rice	-	-	-	-	-	-	Dawat Sehat Mogra	
Wheat Flour	-	-	-	-	-	Golden Harvest	-	
DFS	-	Tata Salt Lite	-	-	-	Tata Salt Lite	-	TATA Salt Lite
Oil	AnkurKapasiya oil SundropSuperliteAdvanced oil Sundrop Heart Oil Sundrop low absorb Superlite Advanced TirupatiKapasiya Oil	Fortune Sun-Lite refined sunflower oil Tirupati active refined corn oil plus	Raani Gold Filtered Groundnut Oil Korndrop Refined Corn Oil Gulab Cottonseed oil Gulab groundnut oil	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil Tirupati refined sunflower oil	Fortune Sun Lite refined sunflower oil Tirupati active refined	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil Tirupati refined sunflower oil	Fortune Sun Lite refined sunflower oil Sundropsuperlite Advanced oil Tirupati refined sunflower oil	AnkurKapasiya oil Sundropsuperlite Advanced oil Sundrop Heart Oil Tirupati active refined

		Akur Groundnut Oil	Gulab sunflower oil Tirupati refined sunflower oil Sundropsuperlite Advanced	Sundropsuperlite Advanced		Sundropsuperlite Advanced	Gulab Cottonseed oil Gulab groundnut oil Gulab sunflower oil	Gulab groundnut oil

The Fortified oil was widely available at the Traditional store (Kirana). However, the availability of other Fortified staples like Wheat flour, DFS, Milk, and Rice was not available or was limited to one brand.

5.3.4 Market survey for the retail shops where Fortified milk is available in Vadodara (Maahi Milk)

1. Jalaram Bangle, SobhanabenJadavOppAnand Nagar bus stop Akshta Society near Hanuman Temple Karelibaugh

2. Amar Medical Store- A, 3-4 Tilak Park society Opposite Sangam Society Nr. Kavita nursing home. Harni Road

3. Patel Store Karelibaughopposite Ambica School, Jay Santoshi Nagar -2

4. Maahi Milk Parlour Balaji Exotica, TP 13, Chaani Vadodara

5. Gael MAA Essentials-Maahi Milk Parlour
   G-8 Siddheshwar Happy Homes b/h Cygnus school Harni- Motnath road oppMadhuvan Elegance, Vadodara, Gujarat- 390022

6. Maahi milk parlor 653/16 Vaikunth 1 shopping center, Waghodia Road, Jakat Naka, Vadodara, Gujarat, 390019

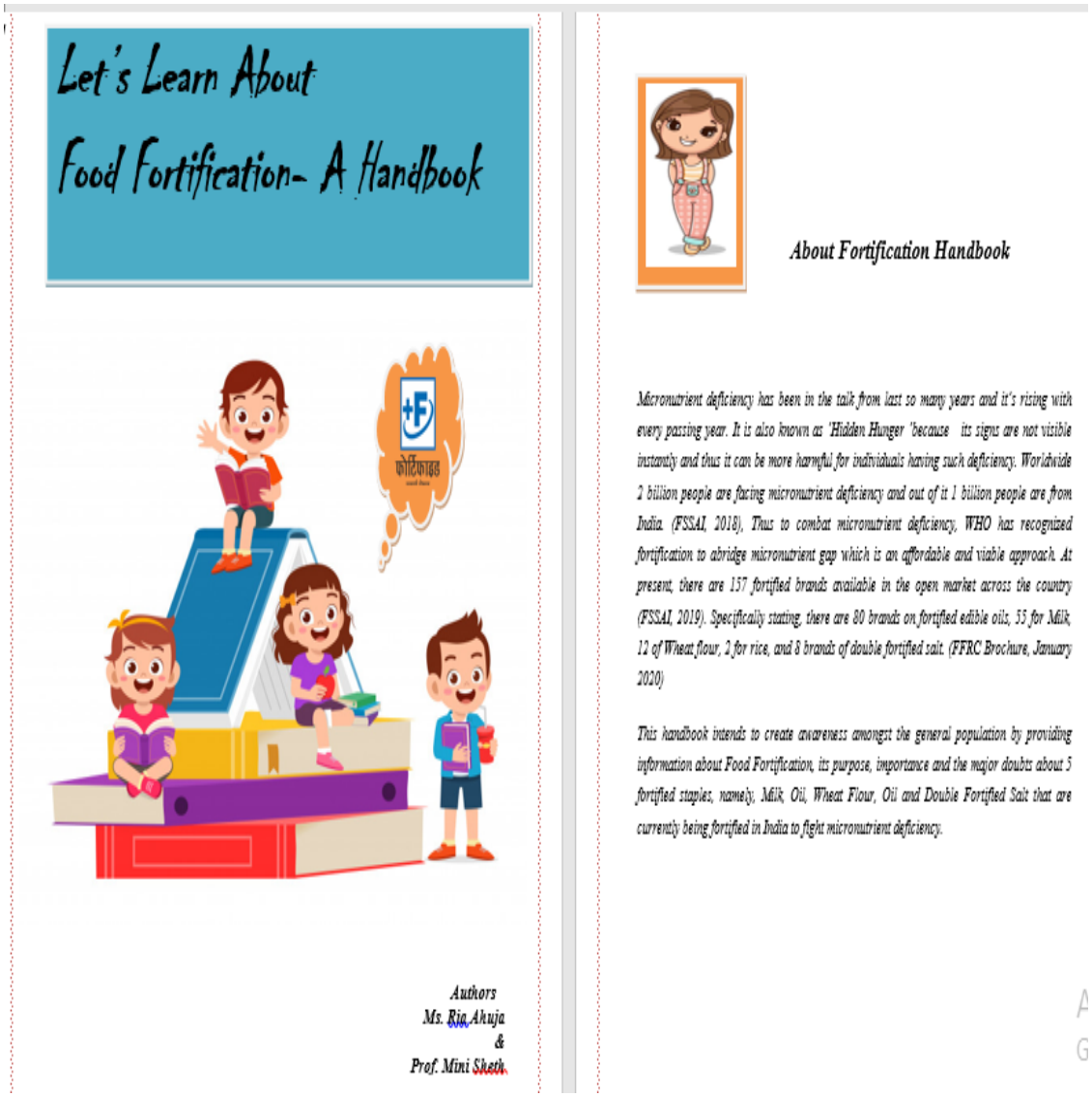
7. Balaji Firm, Manjalpur Vadodara shop no. 8, Gujarat 390011

Market Survey was conducted on 15th July 2021

5.4 Phase- IV Development of IEC Material

A Booklet on ***'Let's Know about Food Fortification'*** was developed to create awareness about Food Fortification amongst the general population for the following components"-

A. Benefits, signs of deficiency, and food sources for various micronutrients being used as Fortificants
B. Need for Fortified Foods and their benefits
C. Identification of Fortified Foods through its logo
D. List of stores and brands where Fortified staples are available



DISCUSSIONS

One of the strategies with the broadest impact on micronutrient deficiency is the Fortification of Food due to its cost effectiveness, sustainability, and viability, however, there is a lack of extensive data on advocacy strategies adopted by the government or agencies of food producers. (Bromage et al., 2019)

In the present study, knowledge, attitude, and practice for Fortified Foods were studied at the baseline, following which an e- intervention session was organized for the enhancement of knowledge and practice of the subjects on Food Fortification. The e- intervention was WhatsApp based, wherein messages were shared with the participants for one month using Graphics, Videos, and Voice recordings as a tool for a shift in knowledge and change in practices.

A study was conducted by Battalwar and Syed, 2017 conducted a study to assess awareness, attitude, and consumption patterns for Fortified Foods. The study was conducted on 100 females from Mumbai in the age group of 18-60 years and it was found that 43% of subjects knew the definition of Fortified Foods, ($p< 0.01$), and 52% of subjects knew that salt iodization is mandatory in India. The results revealed that 76% of subjects were practicing the consumption of Fortified Foods while others gave mixed responses. On enquiring about the reason for consumption, 28% of subjects marked "Healthy'' as an option. (Battalwar and Syed., 2017)

The results were similar and close to Battalwar, In the present study out of 375 Subjects, 33% self-reported that they knew about the term 'Fortified Foods' while the majority of the subjects 67% did not hear about Fortified Foods at all. However, post-intervention, awareness of Fortified Foods has been recorded at 66%, post-intervention which statistically stating is highly significant compared to the recordings of baseline with $p <0.001$. Subjects were asked about the correct definition of Fortified Foods, 28% of subjects who self-reported they are aware of Fortified Foods were able to identify the correct definition while the rest gave mixed incorrect responses.

Another study on Food Fortification awareness in Tanzania by (Kasankala et al., 2018). The study undertook the capacity building for Fortified Foods and their importance. The study was conducted on 200 Mothers and children from four health facilities in Tanzania. The results

reported that 29% of the respondents heard the term Fortified Foods while the majority (71%) had no idea about it. The knowledge of Fortified Food was low amongst all the participants. The researcher also studied the knowledge of various micronutrients amongst the participants, 64% of the participants were aware of the term 'micronutrients', on prompting further only 7.9% of mothers were able to define micronutrients correctly. The study undertook sessions on capacity building, however, participants were not able to define it correctly, in post-education sessions due to ignorance of the participants, as reported by the researcher. On questioning about the type of foods getting Fortified in Tanzania, only 9% of the participants could identify maize, 4% for wheat flour, and salt, while 2% mentioned edible oil and margarine, however majority (68%) could not respond for the sources of food.

The results were similar to the present study in terms of low awareness of Fortified Foods and Micronutrients amongst the study population at baseline. The present study focused on micronutrients knowledge from Vitamin A, Vitamin D, Vitamin B12, Iron and Iodine for the importance, health benefits, and source of knowledge.

A study was conducted in Bangladesh in Tangail Sadar Upazila to assess the knowledge of people residing in residential areas for Vitamin A Fortified staples. The study selected 400 subjects randomly and collected the data through face-to-face interviews. The study concluded that the knowledge and the consumption of Vitamin A oil and Rice were poor. Only 15% had awareness about vitamin A Fortified oil while 3.5% knew rice was Fortified with Vitamin A. Majority of the subjects (62%) were not consuming the Fortified staples (Begum et al., 2021).

In Australia, a community-based knowledge assessment was carried out amongst 1000 Australians aged 18 and above, selected from the Australian Directory. The study was cross-sectional in design using telephone interviewing through computer assisted. The study reported a response rate of 76%. The knowledge was present amongst the 13% of the subjects, however, the knowledge regarding the staples that were voluntarily Fortified was limited. Nearly 9% of the respondents reported that they would avoid foods with Fortification due to the uncertainty of the benefits which was majorly reported by 50% of the respondents (Molster et al., 2007). The results of the study are similar for the knowledge however, inconsistent for the barriers reported, since the present study observed availability as one of the major barrier for not being able to buy Fortified Foods, since the change in perception reported after successful e-intervention. The benefits of Fortified Foods were well known to subjects after the intervention strategy.

A study conducted amongst 25,297 households in Zimbabwe with under 5 years children, revealed that 12% of the households had knowledge about Fortified Foods and practiced the consumption. The study captured that the households headed by females were less likely to adopt the Fortified Foods as compared to households headed by males with a 5% of significant level. The association was studied between the households having good education background and their consumption of Fortified Foods, however, the present study recorded no such difference which might be due to the availability and limited advocacy regarding Food Fortification or due to self-selection bias in the adoption of limited available products (Kairiza et al., 2020).

A cross-sectional intervention-based study in Australia amongst 139 pregnant and 75 non-pregnant women was conducted. The study was conducted before Fortification was initiated in the country and after. The study recorded poor knowledge of both pre and post-food Fortification wherein 66% of the women were not aware of the adequacy of iodine in their diet while only 5% of women were able to identify bread as the source of iodine Fortification in Australia. Only 21% of the respondents were able to identify mental retardation as one of the causes of iodine deficiency, post-intervention, the change in practice for iodine Fortified salt was observed in 11% of the women while others reported a rise in the intake of seafood as the alternate of iodine source. The Mean dietary intake was recorded using Food Frequency Questionnaire which increased significantly post Fortification (Charlton et al., 2012).

Awareness amongst the Chinese and Mongolian communities was recorded by (Bromage et al., 2019), among men and women of age > 18 years. The knowledge amongst Mongolians was between 19-30% for the rural and urban communities while it was 48% amongst the residents of China. Fourteen to 38% of the respondents were reluctant about the Fortification. The acceptance regarding Fortified drinks with Vitamin D was more amongst Mongolians (90%) than in Harbin (52%), The influence regarding the change in practice was more amongst Mongolian 44% than their counterparts were only 19%. The study recorded no significance amongst the socio-demographic characteristics and lifestyle characteristics pertaining especially to practice.

Majority of the studies discussed in the chapter are similar with the present research, where the findings on the awareness level was low irrespective of the country, intervention geography, sample size and target population. However, the level of awareness on Fortified Food has found significantly improved through one-month of *e*-intervention.

On asking about the affordability, 64 subjects responded that it's affordable ($P<0.01$). The source of knowledge for Fortified Foods was through TV, magazines, and food labels for 42 subjects ($p<0.01$). Forty percent of subjects believed that Fortification changes the taste of Fortified Foods while 38% believed its taste, and appearance to be changed.

The source of knowledge was broadcast media (45%), print media (38.7%), Internet (9%), and Outdoor media (7.3%). In another study, conducted in Tanzania, the main source of knowledge was health workers for 41% of the participants, followed by village leaders (21.3%), radio (6.3%), seminars (5.5%), and television (5.5%), schools, friends, etc. A similar study conducted in Pakistan for knowledge, attitude, and practice of Fortified Foods, also reported that the major source of information in Pakistan was health workers (Aliya, Mahmood, et al, 2014).

(Battalwar and Syed, 2017) reported the highest frequencies for Fortified products that were being consumed by the subjects, 86% of subjects reported consuming Tata salt plus on daily basis, Tata salt with Iodine and Iron by 66%, followed by Dabur glucon (39%) and others like Marmite honey, Mother's Horlicks, etc.

The present study focused on the consumption of staples that are being Fortified in India, 6% reported consumption of Fortified rice, 7.7% salt, 13.6% for Wheat Flour, and 15.5% for Oil.

A similar study was conducted by Motadi, Mbhatsani, and Shilote in South Africa, NkowaNkowa Township on 360 women of childbearing age. The study comprised participants who were between the age group of 20 and 29 years (42.8%), majority of participants (66.7%) had tertiary education. Fifty-Four percent of subjects were able to identify staple foods that are being Fortified in South Africa, 57% were able to identify the correct definition of Fortified Food, 72% were able to identify the sources of Fortified Foods, 72% of participants knew that the target population for Fortified Foods in South Africa is for children in the age group of 6 months and above (Motadi et al., 2016).

In the present study, only 2% of the subjects said Fortified Food is for everyone at the baseline since in India staples that are being consumed by all the age groups are being Fortified.

The present study showed improved results after undertaking e- intervention sessions for one month through WhatsApp, and it was observed that awareness of Fortification improved by 50- 80% for different questions on awareness, and the awareness regarding staples improved from 18% to 66% post e- intervention. Maximum improvement was seen in the attitude towards

the safety of Fortified Foods (40%), followed by their attitudes about taste and smell (35%) and 26% of the subjects were willing to shift to other brands that are Fortified. Also, 26% of the subjects were willing to pay more for Fortified Foods and 23% considered it to be healthy.

McNemar's test determined that there was a statistically significant improvement in the proportion of attitude about Fortified Food, post-e-intervention, p <0.001.

For Purchasing Practices, the maximum impact of e-intervention was observed for milk (25%), followed by the purchase of salt (17%), while there was very little impact studied for wheat flour (7%) and rice (3%).

Using McNemar's test, it was determined that there was a statistically significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk, and oil, pre-and post-e-intervention, with p <0.001.

The present study also looked at the bottlenecks that the subjects are experiencing while purchasing Fortified Foods, the majority (38%) of subjects reported unavailability of Fortified Foods in the nearest store, followed by preference towards buying local/ unpacked staples such as rice and wheat kernels (34%).

A study conducted in Australia on Consumer Awareness, Attitudes and Behaviours to Fortified Foods reported that the participants were skeptical regarding mandatory Fortification of foods due to concern for increased prices of the products because few of the big companies were Fortifying their brands voluntarily, thus making it more expensive considering it to be healthy. Another concern of the participants was regarding the naturally occurring nutrients that the ones induced through technology. The study reported low awareness of folate amongst the participants, regarding its health benefits and its sources, only women who had experienced pregnancy in the past reported good knowledge of folate. One of the limitations of the referred study is that it has not given definite percentages (Rowland and Dugbaza, 2010).

The study conducted in China assessed awareness and attitude toward the Industrial Food Fortification in Mongolia and Harbin districts. The survey collected the data from men and women during the year 2014-2017 aged more than 18 years. Less than half a percentage of people were aware of food Fortification, the survey questioned the participants about its acceptance and recorded that 50% of the participants from Mongolia and 18% of participants from Harbin favored food Fortification on learning the purpose of it (Bromage et al., 2019).

A Cross-sectional study was conducted in 13 different countries for assessing Fortification awareness using a structured questionnaire. The survey assessed the information of 1435 respondents. The awareness was limited to 28% of the respondents, the major source of knowledge being the radio for 27% of the respondents. The subjects could mark the correct response for the risk relating to deficiency of micronutrients (76%) The study assessed the association with the occupation of the participants with $P<0.001$, household size, education level, and age. The study also noted that respondents lying in the above age bracket had better knowledge of nutrients than their younger counterparts. The knowledge regarding different micronutrients was limited in the study (Linda et al., 2020).

The attitude amongst the people of 76 people in the United Kingdom the Fortified Foods showed 67% of the responses in favor of the Fortified Foods while it was opposed by 20% while the remaining were unsure regarding their attitude. The subjects who were willing to use Fortified Foods were amongst the younger generation. The willingness to pay extra for the Fortification was reported by 40% of the respondents while 13% were not eager to pay extra, while others were skeptical (Dixon and Shackley, 2003).

The knowledge about Food Fortification will directly reflect in the attitude and the practices of the people, however since the low price is the main criterion affecting the buying practice of the individuals, especially belonging to the low or middle category in the socioeconomic status. A study conducted in Delhi amongst 930 consumers who were selected randomly using the interview recorded the willingness and behavioral intentions of the people for Fortified Foods. Amongst the surveyed population 4.65 was taken as an average tend to buy Fortified products when they are cheaper, other factors affecting the purchase were fear of additives, and side effects, which were the major cause of concern amongst the selected population (Satyapriya et al., 2021).

It has been observed that the knowledge of specific health benefits for the Fortificants or Fortified Foods will significantly increase the willingness to purchase Fortified Foods since it will expose the benefits of the functional foods, amongst consumers.

(Dolgopolova and Teuber., 2018) concluded that specification on nutrition and health claims receives high valuations than any other claims

The increased micronutrient deficiency has given food Fortification a way to combat the situation, as it is one of the cost-effective and viable approaches (Premkumar and Garg., 2020). The advantage of the strategy is to provide micronutrients without altering the dietary practices of the

population. The vehicles for Fortification are chosen based on staple foods that are consumed frequently and in large quantities (Das et al., 2013).

Few researchers have collected the data from the different communities regarding the consumer's awareness, perception, and practice of Fortified Foods which created the need for intervention-based studies.

A study conducted amongst 150 urban women in Delhi, reported good (48%) awareness of the Fortified Foods logo, where 69.8% agreed to the consumption of Fortified Foods as essential. (Premkumar and Garg., 2020) An interventional study conducted by (Sirohi et al., 2015), amongst 400 subjects, recorded awareness of Fortification as 12% at the baseline which increased to 72% after the intervention. A study conducted in Kenya on 1435 subjects found that only 28% of the respondents had awareness of Fortified Foods (Linda et al., 2020). Findings of the present study have recorded awareness at baseline at 26% which increased to 88% after the e- intervention.

A study conducted in NkowaNkowa Township, Africa, to determine the awareness of women on Fortification reported that 57% of the participants were able to define food Fortification correctly, and 72% of the participants were aware of the foods that are being Fortified, the staple that is being Fortified in South Africa is maize, which was reported by 70% of the participants. The target group for which Fortification is essentially being done are the children (<6 years of age) answered correctly by 72% of the participants (Motadi et al., 2016). The possible reason for better awareness amongst the Africans was the mandatory use of the Fortification logo on bread, flour, and maize, however, in India, the +F logo for identification of Fortified Foods was created in 2016 after the development of the food Fortification resource center (Teaotia and Singhal., 2020).

The subjects in the present study were willing to pay more for Fortified Foods by 50% at the baseline, which increased to 76% after the e-intervention. The results of Garg and Kumar 2020 also observed similar findings ($P<0.01$). On questioning about the difficulties for purchase Fortified Foods, only 0.5% of the subjects marked price as one of the reasons for not buying Fortified Foods, while unavailability (38%) and preference for buying unpacked staples (38%) were the other reasons which jeopardized the purchase of Fortified staples amongst the participants.

A report by Dalberg estimated that 40-60% of the Fortified Food production in India is not reaching the general population. Thus, it becomes important to create supply and demand for Fortified Foods simultaneously (Bhatnagar and Kanoria., 2020).

The results of the study have shown a significant difference in the awareness, perception, and purchase of Fortified Foods for all the five staples post-intervention, which provides enough evidence that the proposed strategy for creating awareness and promoting the purchase of Fortified Foods amongst the selected participants was highly effective.

A cross-sectional study conducted among school going kids in Benghazi city, amongst 200 students, observed a significant reduction in the consumption of chocolate ($p<0.01$), chips ($p<0.01$), bread, and other fast foods, post nutrition intervention (Sachithananthan et al., 2012), however due to pandemic e-education sessions using WhatsApp as the education platform proved to be highly effective in terms of improving the awareness, perception and purchase practices.

In an educational intervention study, carried out amongst 400 subjects, the improvement in awareness of soybean oil increased to 62% from 10%, and awareness about various Fortified Food products also enhanced to 83% from 40% (Sirohi et al., 2015). Multiple studies have undertaken advocacy strategies for improvement in the awareness, perception, and practices of the subjects, however, the results of the intervention can vary depending upon the outcome variables, characteristics of the subjects, and the tool used for advocacy strategies (Contento., 2007).

A study was conducted in Iran on the knowledge of micronutrients amongst the 14136 subjects using a cluster sampling method. The knowledge of food sources of calcium was 11.6-64.7%, zinc (12.8%-16.7%), and iron (50.9- 46%) in rural and urban Iranian provinces, respectively. Since nutrition knowledge is one of the biggest factors in influencing the diet and dietary habits amongst the people, it looks appropriate to come up with interventions focusing on enhanced knowledge and awareness (Heshmat et al., 2016). The present study also recorded the knowledge regarding Food sources, signs of deficiency, and functions of different micronutrients being used as Fortificants in India. In the current study knowledge and food sources of Iodine were known to few of the subjects as compared to the knowledge of other micronutrients which ranged from 60-75% for the three indicators of knowledge.

Attempts were made to create awareness about Food Fortification in the general population through the last phase of our research which was the development of IEC boo, whereas in the Intervention phase an audio-visual animated movie, developed Government and FSSAI videos on Food Fortification featuring Sakshi Tiwari and Virat Kohli and the audio messages promoting Fortified Foods in the content of the message were shared with the participants. Moreover, additional animated videos were created for addressing the additional messages through

information- education -communication (IEC). Multimedia-based communication has got better retention possibilities compared to other methods.

The advent of technology and the internet has gained momentum in recent times in India, thus it is considered an appropriate strategy for changing health-related behaviors since the majority of the population relies upon the internet for information related to health or any other topic. Social media has great potential over other print media since it can reach the masses with ease and doesn't require time for printing and distribution which could otherwise delay the timing of the messages. A study developed a Smart health awareness framework. The study included 701 individuals and recorded their acceptance of the messages disseminated through media. The response rate recorded was 55%. Sixty-nine percent of the people use Social Media whereas 305 hardly or never use social media, indicating the potential to reach messages to the people amongst the majority (Alsisi et al., 2020).

Social media can be clubbed with other techniques to reinforce the messages already disseminated through social or mass media networks. One of the biggest advantages of the technique is it creates change in the behavior of the people who were not even exposed to the messages directly but were influenced by the people who were exposed or shared the messages with. The social network of the people gets educated with word of mouth or the practices that have been accepted by their fellow networks. This can influence the behavior directly or indirectly, however, attention has to be given to the designing of messages which should be short, interesting, and clear in terms of what change one is expecting in the behavior of the people after the exposure. The likelihood of success will increase when mass media or social media interventions will be used with other mulita intervention techniques (Wakefield et al., 2010).

Worldwide 4 billion users are using social media which is projected to increase by 7% every year, for the delivery of public health-oriented messages like tobacco, smoking, physical activity, and vaccination. Studies have reported better health outcomes when exposed to web-based interventions. A systematic review of 71 studies on the use of social media for behavior change techniques amongst participants >18 years revealed that the use of Facebook with tailored messages on health education amongst 31 studies with a better rate of adoption, however, the use of Facebook in the studies doesn't dismiss the effectiveness and the popularity of other social media platforms (Simeon et al., 2020) (Jones et al., 2012) (Korda and Itani., 2013).

In one of the blogs published by the World Bank, the use of social media as the next step for communication channels has been appreciated due to the wide use of social media usage amongst

people irrespective of age, geography, and socioeconomic characteristics. The use of Social media for creating awareness during the Covid pandemic for taking up the vaccines and maintaining the social distancing has proven to be effective since the online seeking behaviors have been exponentially rising. The use of e- intervention techniques offers a window of opportunity for recording the evaluation and addressing the doubts of the people and providing a platform with interaction where doubts can be instantly answered (Sanchez-Paramo and Legovini., 2021).

The present study is closely related to the evidence since the rise in knowledge and practice has been observed amongst the participants through the use of e- intervention strategy. The strategy adopted in the study can be scaled up in partnership with government or private agencies wherein the larger section of the people in different geographical settings can be reached out with tailored language specificity, enhancing the capacity and behavior change in the people and promoting the use of Fortified Foods.

Besides, the impact of the intervention, the present study has followed the Diffusion of Innovation theory (DOI). DOI is often used for spreading awareness about the innovation through communication channels over a period of time to the target population. The pattern that has been proposed by the researcher is the sigmoid pattern which is commonly reported (S- Shaped, however, the S- shape is often observed when the influence of opinion leaders or the fellow community members is passed on to the next group of people in the community over a period of time. The key components of DOI are the innovation, the adopters reflecting the earliness in the adoption of technology compared to their counterparts, the social pressure of leaders, adoption process, to track the adopter's categories (Dearing and Singhal., 2020).

According to Rogers's model, the four components that can persuade a person to the adoption of innovation are relative advantages, compatibility, complexity, and trial ability, which were considered while sharing the messages on WhatsApp during an intervention. Messages regarding the advantages of Food Fortification, safe use while cooking and consumption, and the availability of Fortified Foods in the markets for promoting trialability were ensured. The DIM model has been applied in agricultural, public health, social marketing, and educational-based interventions (Dearing., 2009).

A study using the Diffusion of Innovation Model was conducted to understand the factors affecting the acceptance of e-health interventions in Australia. The study was longitudinal, with 29 months of observational pattern that was recorded for the diffusion of a new idea. The study revealed an increase in the adoption of e- appointment services by 1.5% in 3 months and by 4%

by the end of the study. The Factors observed for the low adoption rates were insufficient communication, lack of value of *e*- communication, preferences towards oral communications, and low level of internet literacy levels. During the study though 300 people out of 7189 were visiting the website for the electronic appointments, however, only 6% adopted it for continuous use till the end of the research (Zhang et al., 2015).

Roger has proposed the attitude of the individuals in a social structure will affect the rate of adoption of the innovations. Multiple studies have been using the DOI model for studying the adoption of new healthcare technologies. Chew et al., conducted a study using DOI for internet health care services. amongst physicians wherein, the response rate was 63 %. The majority of the respondents were able to identify the benefits of the Internet and agreed to use it as an information access platform. Helitzer, in his study, used DOI for studying the adoption of telehealth programs in the social systems (Helitzer et al., 2003) (Chew et al., 2004).

The success of DIM can vary with the type of technology and innovation that is being promoted to the target audience. However, the graph observed in the present study was similar to the bell-shaped graph that was proposed by Roger in his model.

Summary and Conclusion

CHAPTER 6

SUMMARY AND CONCLUSION

Food Fortification is one of the strategies which is convenient and viable due to its cost effectiveness and mass spread without any change required in the diet-related practices. There are number of studies found where the importance of Food Fortification to improve the micronutrient status, reducing the anemia prevalence, and improve the cognitive development. The various efforts have been made to overcome the micronutrient deficiency through introducing the Fortified Foods. The integration of the Fortified staples incorporated into the health policies and National Health Programs to focus on the improvement of the continuum care.

However, there was limited literature available for the advocacy conducted for the Fortified Foods, especially in India, and the consumers' attitude and uptake for it. With this as a rationale statement, the present study was carried out with the aim to increase the awareness of Fortified Foods in Vadodara district of Gujarat. The study followed Diffusion of Innovation as one of the models for categorizing the adopters in different categories based on their rate of adoption of Fortified Foods.

The objectives of the present study were:

1. To enroll subjects from the Faculty of Family and Community Sciences (College) until the desired sample size is reached
2. To develop tools for collecting the information on the Socio-economic profile of the Enrolled Subjects and to assess their awareness various Fortificants (Micronutrients)
3. To develop Graphics, Videos for the intervention phase
4. To collect baseline information on awareness, attitude and purchasing practices of Fortified Foods
5. To sensitize the enrolled subjects on Fortified Food and its components
6. To evaluate the impact of e-intervention sessions given to the enrolled subjects at intervals

7. To identify the available brands for Fortified products (focusing on 5 staples, namely DFS, Milk, Wheat Flour, Rice, and Oil) in the hypermarkets and Traditional Kirana stores (Grocery Stores) from the four Zones of Vadodara

- **Results of Phase I: -Baseline**

- The gender profile of the study population revealed that 76% were females and 24% were males. Most of the respondents were among the age group of 41-50 years (47.7%), having an honors degree (57.6%) followed by High School (15.2) and Intermediate (11.5). The data on occupation shows that majority of the respondents were either unemployed or belonged to the Profession category. The majority of the households belonged to Upper Middle Class (48.3) at baseline, 33% of the subjects reported that they have heard the term' Fortified Foods'
- Thirty-Three percent of the respondents were from a nutrition background, while the rest 66% of the subjects were from a non-nutrition background
- At the baseline 20% of the subjects could identify the correct +F logo for the identification of Fortification in staple packed foods in India.
- Only 28% of subjects would identify the correct definition of Fortified Foods
- Awareness regarding Fortified staples was limited amongst the study subjects. Wheat flour Fortification for 33.2%, rice Fortification for 33.3%, followed by milk at 25%, and double Fortified salt (22%). Only a few of the subjects were aware of oil Fortification (2.3%)
- Only 2% of the subjects believed Fortification should be for everyone, irrespective of age and gender
- The Unintentional purchase practice for one or a few of the staples were being followed by 60% of the subjects
- The major source of information was the Broadcast media – Television, Radio, internet, etc for 45% of the subjects
- The attitude regarding safe consumption of Fortified Food was uniform (50%) for correct and incorrect responses. Subjects were asked whether they were willing to pay more for Fortified Foods. Most subjects (66.9%) said 'yes,' while the rest 33.1 % were not willing to pay more for Fortified Foods
- The purchase of Fortified rice and oil was being practiced by 6% and 15% of the subjects respectively as reported, followed by wheat flour (13.6%) and salt (7.7%).

- Subjects' awareness regarding Vitamin A was correct for the health benefits (65%) and signs of deficiency (77.3), however, the awareness of food sources for vitamin A was limited.
- Awareness of Vitamin D health benefits, sources, and signs of deficiency were identified correctly by, 67%, 60%, and 72% of subjects respectively
- Awareness of Vitamin B12 health benefits was identified correctly by the majority of the subjects (73.6%), sources by 50%, and signs of the deficiency by 57.6% of the subjects
- Awareness regarding the health benefits of food sources and signs of deficiency of Iron was identified correctly by the majority of the subjects (77.9%), sources and signs of the deficiency by 78% and 61% of the subjects, respectively.
- Awareness of Iodine health benefits was identified correctly by only a few of the subjects (5.3%), whereas awareness regarding sources was known to (43.2%) and signs of deficiency to (57.6%) of the subjects.
- Subjects having the highest degree of education had better awareness of the micronutrients. However, the degree of association was weak as per Cramers' V test. However, no such association was observed between the degree of education and awareness scores of vitamin A and Iron.
- A significant association between awareness regarding the health benefits of Vitamin A and the occupational levels of the subjects was observed ($P<0.05$). Subjects having highest hierarchy in the occupational level had better awareness of the health benefits of Vitamin A.

Phase II Interventional Phase:

- Food Fortification awareness for definition, logo, and the target group increased by 17-24%
- The awareness regarding Fortified Foods, post e-intervention improved from 18% to 66%. A maximum increase in awareness was observed for oil (66%) followed by salt (35%) and milk (33%).
- Highly significant improvement was observed in the various attitude parameters, post e-intervention ($P<0.05$)
- A statistically significant difference in the proportion of purchase practices of Fortified rice, wheat flour, salt, milk, and oil, was observed post e- intervention with $P<0.001$

- All the respondents (100%) who undertook google form post 7 months of washout period, marked the correct logo for Fortified Foods as their response
- Washout Form was undertaken by 244 subjects, of which 80% (n=195) were still consuming Fortified Foods after 7 months of washout, while 17% (n= 42) were purchasing sometimes and 3% (n=7) marked 'No' as their response.
- The majority of the subjects (70%) were purchasing oil, followed by 53% for Double Fortified Salt, Milk (40%), Wheat Flour (20%), and Rice (13%).
- The results revealed that 12.4% of the subjects were categorized as Innovators, 24.3% as early adopters, 26.2% as the early majority, 8.2% as the late majority, and 24.7% as laggards when assessed using the Diffusion of Innovation Theory.

Phase III Market survey for Fortified Foods Availability

- Fortified Foods in the hypermarkets of Vadodara. The hypermarkets in Vadodara that were selected were Big Bazaar, Spencer's, D-Mart, Bansal mall, Spencer's, and Patanjali. It was observed that nearly 7 to 10 Fortified oil was available in the hypermarkets of Vadodara. The availability of Fortified milk was available in Spencer's and Big Bazaar. There was no availability of Fortified wheat flour. Availability of one brand for Fortified rice and Double Fortified salt each in the hypermarket.

To Conclude, the study is one of its kind to the best of our knowledge to Create the advocacy for Food Fortification using e- intervention, capture the public preferences for Fortified Foods in the market, and conduct a market survey, while also focusing on the knowledge of micronutrients, being used as Fortificants like Vitamin A, vitamin D, Vitamin B12, Iron, and Iodine. In addition, the study used the Diffusion of Innovation Model to categorize its subject since the use of WhatsApp during the Covid pandemic was selected as a medium for e- intervention methodology. There is enough evidence on the use of social media as a medium for sharing the public health-related awareness messages and has proven to be effective.

The study has captured the limited availability of the Fortified Food products in an open market and the concern for the shift in the prize, other findings that the study reported which could be the reason for the limited uptake in the practice is the traditional practice of making wheat flour at home in Gujarat, where the study was conducted and the preferences towards the particular brand.

The hesitation of the subjects to shift their brands from one they prefer to the other is, however, difficult to influence in a short period for the benefit of their Health.

The market survey findings recorded multiple brands for the Oil, however, milk, wheat flour, rice, and slat availability was much less than the availability of Oil. Thus to create awareness and create demand, it is important to conduct training sessions with the producers for the supply of Fortified Food in an open market with a rise in prizes only according to the acceptable limits.

Besides, the impact of the intervention, the study has also used the Diffusion of Innovation theory to track the adopter's categories. According to Rogers's model, the four components that can persuade a person to the adoption of innovation are relative advantages, compatibility, complexity, and trialability, which were considered while sharing the messages on WhatsApp during an intervention. Messages regarding the advantages of food fortification, safe use while cooking and consumption, and the availability of fortified foods in the markets for promoting trialability were ensured. The DIM model has been applied in agricultural, public health, social marketing, and educational-based interventions (Dearing et al., 2009).

The success of DIM can vary with the type of technology and innovation that is being promoted to the target audience. However, the graph observed in the present study was similar to the bell-shaped graph that was proposed by Roger in his model.

Thus, with all the results and the discussions kept in mind for the present study, we accept the alternative Hypothesis and reject the Null Hypothesis: -

Alternative Hypothesis: -

One Month e- Intervention sessions **will have a positive impact** on

1. subject's Purchasing Practices for Fortified Foods
2. and on their ability to identify the ***+F*** logo found on Fortified staples

Recommendations

CHAPTER 7
RECOMMENDATIONS

- The Present study has undertaken efforts to generate awareness amongst the study population for Food Fortification using e- intervention strategy and the Diffusion of Innovation Model for categorization of the subjects according to the month of adoption. There are limited research available for measuring the knowledge, attitude and Practice, using different strategies. There is an urgent need to conduct more research in the area of Food Fortification especially for raising the awareness amongst all the sections of the society.

- Diffusion of Innovation Model measures the rate at which a new concept gets adopted by the people. The model helped in the research to know the percentages of early adopters and the laggards. However, the model can be explored further in different community setups and for different strategies

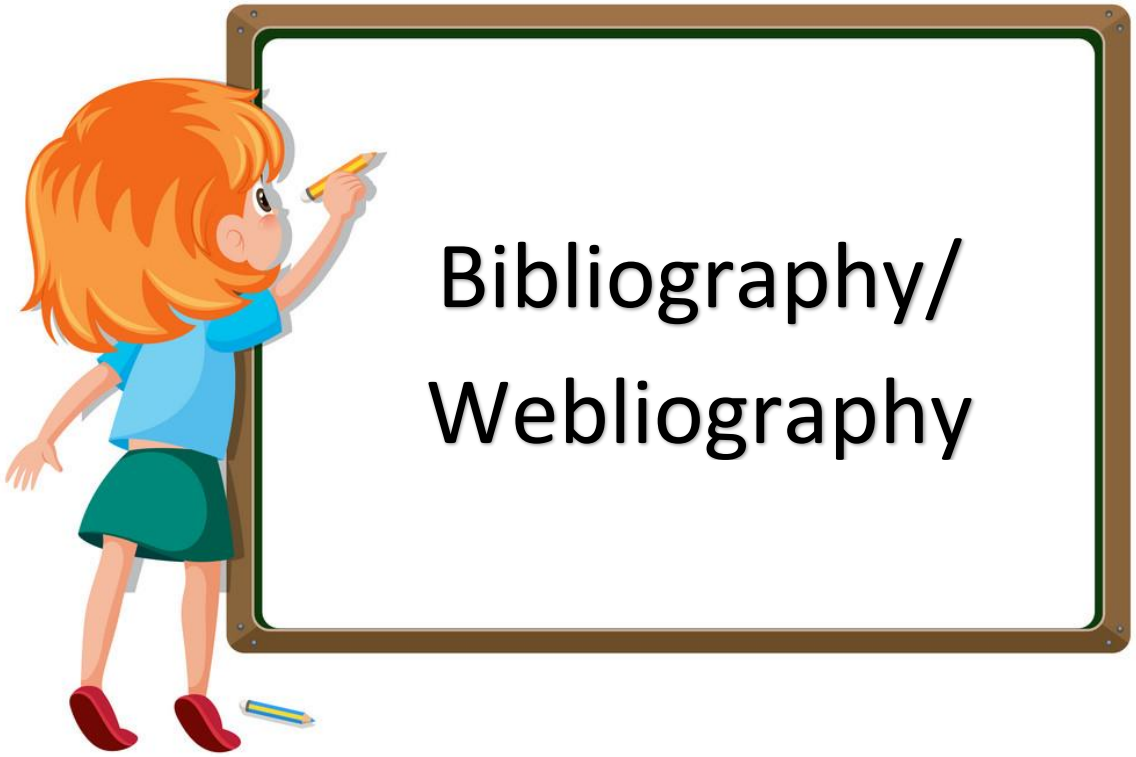
- Messages on WhatsApp were well accepted by the study subjects for generating the awareness on Food Fortification and Micronutrients, however case control study using different mode of communication can be tested.


Future Scope
of
Investigation

CHAPTER 8

FUTURE SCOPE OF INVESTIGATION

1. Reaching out to Industries and manufacturers for fortifying their products and making them available in the market (unorganized and organized sector)
2. Social marketing for introducing fortified foods to the general population and creating awareness
3. Capacity building of stakeholders for the FSSAI standards and the procedure of fortification
4. Wide awareness sessions to be carried out focusing on the advantages of food fortification in different setups
5. Innovations for easy monitoring and evaluation of the fortification process
6. Advocacy sessions for bridging the gaps between political leaders, manufacturers, scientists, and researchers
7. Provision of technical support to the stakeholders and analyzing the samples as per the FSSAI standards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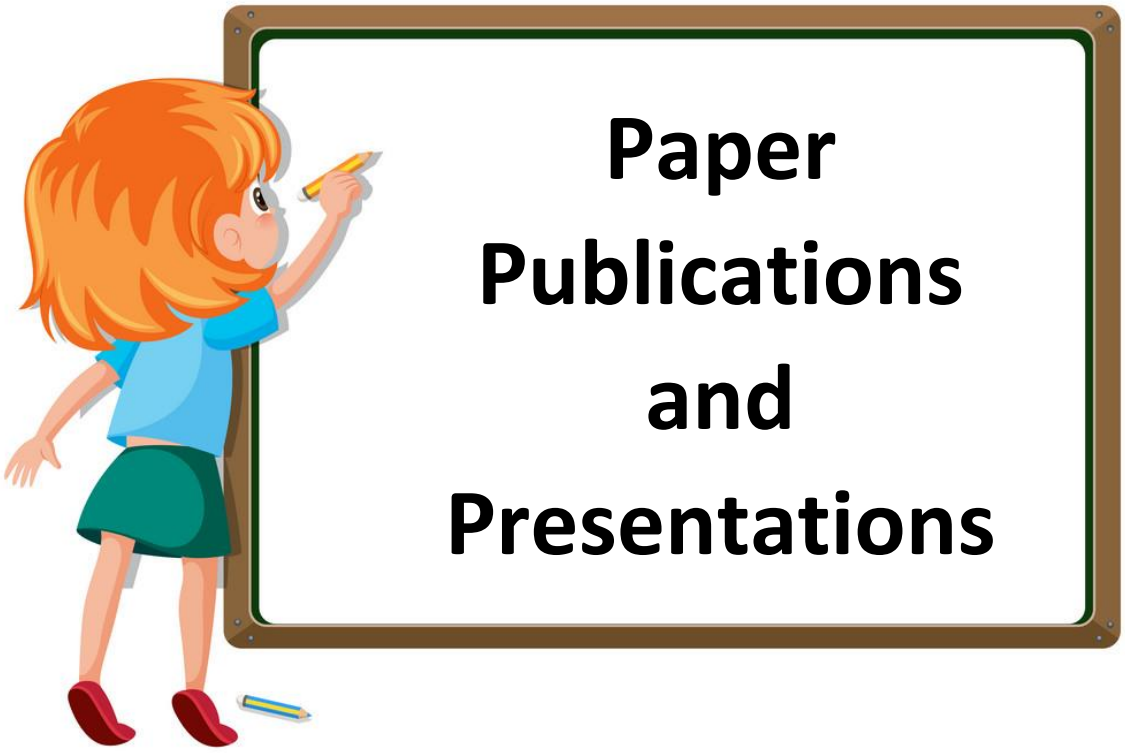

Paper Publications and Presentations

CHAPTER 9

PAPER PUBLICATIONS AND PRESENTATIONS

- **Publications in Peer Review Journals**

1. **Ahuja R and Sheth M (2021)** Action Research on Advocating Use of Fortified Foods in the Free-Living Population of Urban Vadodara using Diffusion of Innovation Model. Asian Pacific Journal of Health Sciences.
2. **Ahuja R and Sheth M (2021)** A Cross Sectional study on Consumer Awareness of Fortified Foods in Vadodara City. Paripex- Indian Journal of Research

- **Presentations in Seminars and Conferences**

1. **Ahuja R and Sheth M (2022) Current** Knowledge of Health Benefits for Various Fortificants amongst the Free Living Population in Vadodara, India: e-Assessment. IAPEN Clinical Nutrition Congress on "Nurture through Nutrition" from I2th -13th February 2021.
2. **Ahuja R and Sheth M (2022)** Implementing e- Intervention for Promoting Fortified Foods amongst the General Population in Vadodara district, Gujarat, India. USFN Conference on Clinical Nutrition and Dietary Lifestyle" during May 20th and 21st, 2022 at Bangalore, India.

- **Conferences/Seminars/Webinars attended for Food Fortification**

1. Attended Gujarat Food Fortification Summit – 2019 -12th April, 2019 in Ahmedabad, Gujrat
2. Attended National Food Fortification Webinar organized by 'Symbiosis Institute of Health Science 'and Nutrition society of India- IDA, NETPROFAN Pune Chapter on 18th December 2020
3. Attended India Milk Fortification Summit – Fortifying Milk for Nutrition and Immunity held on 26 November 2020.
4. Attended Global Summit On Food Fortification Quality Digitization On Wednesday 30 JUNE 2021 held on June 30, 2021.
5. Webinar organized by HADSA on Tackling Malnutrition though the Food System- Why Public Private Partnership is Necessary- 24th September 2021
6. Won the first prize in Slogan Competition on Fortification carried out by NETPROFAN and Department of Foods and Nutrition, MSU, sponsored by HEXAGON Nutrition, February 2022

ORIGINAL RESEARCH ARTICLE e-ISSN: 2349-0659 p-ISSN; 2350-0964

Action Research on Advocating Use of Fortified Foods in the Free-Living Population of Urban Vadodara using Diffusion of Innovation Model

Ria Ahuja[1], Mini Sheth[2]

Abstract

Worldwide, unaffordable healthy diets, dependability over staple food items, and lack of knowledge have been the major cause of malnutrition. Government programs, promoting dietary diversity and supplementation have not given promising results in improving the micronutrient status of the population. Government of India, along with Food Safety and Standards Authority of India have chosen five vehicles, namely, rice, wheat flour, salt, milk, and oil for the fortification process to combat the micronutrient deficiency. Fewer studies aimed at creating advocacy about fortified foods among the free living population and stake holders. The present study undertook the advocacy for fortified foods amongst the free living population using the Diffusion of Innovation Model (DIM) for the purchase of fortified foods. An E- Intervention using graphics, audios and videos were given to the participants on WhatsApp for 1 month. The results in the study have shown significant difference in the awareness, perception and purchase of fortified foods for all the five staples post intervention, which provides enough evidence that the proposed strategy for creating awareness and promoting purchase of fortified foods amongst the selected participants was highly effective. Use of different E-communication channels can be used by researchers at large for creating the awareness about the safe consumption of fortified foods. Besides this, conducive environment is needed for fortification program to be a success, which will ensure the proper supply and demand to make the food fortification program viable.

Keywords: Advocacy, Attitude, Awareness, Food fortification, Micronutrient deficiency, Purchase practice

Asian Pac. J. Health Sci., (2021); DOI: 10.21276/apjhs.2021.8.4.40

Introduction

More than 3 billion poor people in the world are not availing the minimal healthy diets due to its unaffordability, worsening the nutritional security of the people. Less developed countries rely more on staple foods as they are easily affordable which makes the consumption of vegetables and fruits difficult contributing to micronutrient deficiency. Globally, 144 million children below the age of five, are stunted, 47 million wasted, and 38.3 million are overweight.[1]

Although micronutrients are required in tiny amounts but are an essential part of the diet for the development and growth purposes in the human body.[2] Due to the outbreak of COVID-19, food quality and availability have worsen which makes it challenging for the world to achieve the 2025 targets of Sustainable Development Goals of zero hunger.

Several schemes and programs have been going on in India for many years toward eradicating the micronutrient deficiency and reducing the undernutrition status. These include Integrated Child Development Scheme, Mid-Day Meal (MDM) Programs, Anemia Mukt Bharat (Free India from Iron Deficiency), National Iron plus Initiative, and Vitamin A prophylaxis program. However, the burden of all forms of malnourishment continues to be challenging.[2]

Since the nutritional status of the people is one of the factors in deciding the national productivity, it becomes more important to make contributions in the health systems and policies which can further lift up the nutritional status of every individual in the country.[3]

Supplementation and dietary diversity are two strategies which can help in overcoming the deficiency rates however the approaches are not practical to target masses.

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Poor people often find it difficult to include diverse food groups in their diet; hence, it becomes important to employ sustainable solution that will fulfill the micronutrient needs of the people and will also be affordable.[1]

Food Fortification is a process of adding vitamins and micronutrients to staple food items to tackle the rising micronutrient deficiency rates. It is one of the cost effective and viable approaches as it does not alter the dietary habits of an individual. Government of India, along with Food Safety and Standards Authority of India (FSSAI) have chosen five vehicles, namely, rice, wheat flour, salt, milk, and oil for the fortification process and have given the standards for nutrient incorporation in the gazette, FSSAI, 2017.[4]

Enough evidence is available for supporting the food fortification as a strategy to overcome the micronutrient deficiency rates amongst the people. A study conducted by Das *et al*., 2019, has recorded reduction for various micronutrients and vitamins.

Iron deficiency anemia got reduced by 72%, Vitamin A by 58%, Vitamin B2 by 64%, Vitamin B6 by 91%, and Vitamin B12.[5] Studies have also undertaken clinical trials and have reported similar findings as of other researchers.[5-8] However, few studies aimed at creating advocacy about fortified foods amongst the free living population and stake holders. The present study was, therefore, planned to undertake the advocacy for fortified foods amongst the free living population using the Diffusion of Innovation Method to create social marketing for promoting purchase of fortified foods.

The Diffusion of Innovation theory, by Rogers "*is a theory that seeks to explain how, why, and at what rate new ideas and technology spread.*" In this model, adopters are categorized on the basis of their rate of adoption as innovators, early/late adopters and laggards.[9]

The data presented in this study is the part of the research to fulfill Doctoral research work of the researcher.

Methods

Sampling

Using a cross-sectional study design parents of the students (n = 1600) from the Foods and Nutrition department of the Maharaja Sayajirao University of Baroda were screened to elicit the data, of which 349 parents participated until the completion of the study [Figure 1]. Subjects who were responsible for buying groceries for the family, having active internet and WhatsApp connection and can comprehend in Hindi language were included in the study.

Base Line Data Collection

Pre-tested questionnaires were used to collect the data on socio-demographic information, awareness, perception, and purchase of fortified foods using Google form from September 2020 to March 2021.

E- Intervention

The details of the E- Intervention on creating awareness, improving perceptions, and purchasing practices of fortified foods. The details of E- intervention are presented in Figure 2.

List of Messages that were shared during the E- Intervention Period

1. What is Fortification
2. Why it is important
3. Current deficiency rates of different vitamin/micronutrients
4. Staples which are being fortified and their fortificants
5. Fortified foods availability
6. Disclaimer on vegetarian sources being used for fortification purposes
7. Identification of logo only on Packed Branded foods and Not on Loose Food Items
8. Message on fortification does not change taste, smell, shelf life of the product and its consumption is safe
9. List of available fortified brands as per the request from subjects [Figure 3].

Post data were collected on the parameters similar to the baseline.

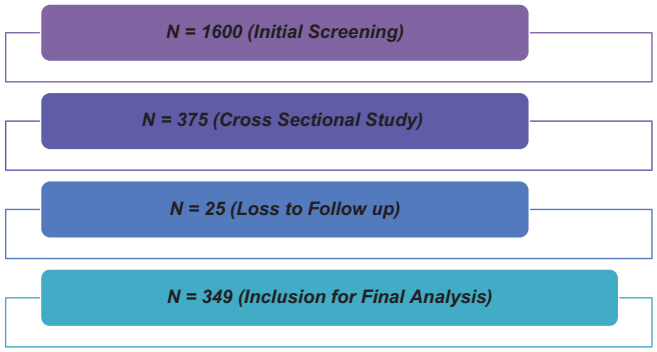

Figure 1: Sample Selection for the study

Statistical Analysis

Categorical variables were presented as proportions while continuous variables were either presented as mean with standard deviation or median with range. Categorical variables were compared by Fisher exact test or Pearson's Chi-square test. The McNemar test was used to determine if there were differences on a dichotomous dependent variable between two related groups.

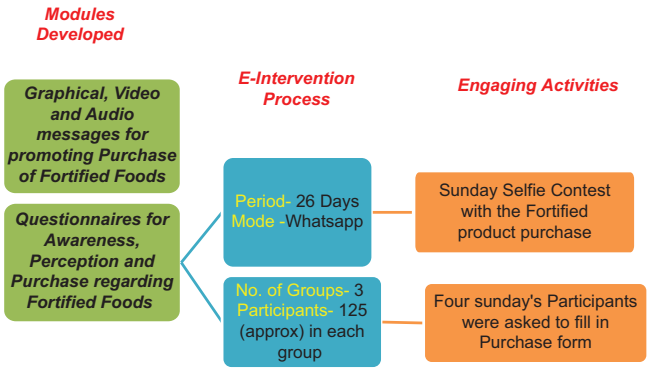

Figure 2: The E-intervention methodology

Figure 3: Glimpse of the Graphics developed in Hindi for E-Intervention strategy

All tests were two-tailed and $P < 0.05$ was considered as significant. Data were analyzed using SPSS software version 25 (Armonk IBM Corp). The Statistical analysis was outsourced by the professional statistician.

Ethical Approval and Consent to Participate

The study was approved by the institutional review board of the Department of Foods and Nutrition, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The ethical approval number of the study is IECHR/FCS/2020/62. Participants were enrolled on the basis of their consent.

Results

Socio-demographic Characteristics of Subjects

The gender profile of the study population revealed that 76% of females and 24% were males. Most of the respondents were in the age group of 41–50 years (47.7%). Most of the respondents had honors degree (57.6%), followed by high School (15.2) and intermediate (11.5). The data on occupation shows that majority of the respondents were either unemployed or belonged to Professional category. Majority of the households belonged to Upper Middle Class (48.3), followed by Lower Middle Class (39.5) [Table 1].

Effect of the Intervention on Subject's Awareness of Fortified Food before and after the Intervention

The impact of the E-intervention session was studied amongst the 349 subjects for the various awareness parameters, presented graphically in Figure 4.

Figure 4 shows the percent of subjects who gave correct responses at the baseline and post-intervention. There was shift of 62%, 73%, and 88% for subjects who gave correct response for what are fortified foods, identification of correct +F logo and for the participants who agreed fortified foods is essential for everyone respectively. Using McNemar's test, it was determined that the results post-intervention were highly significant for all the awareness parameters with $P < 0.001$.

Impact of Intervention on Awareness of Fortified Staples Under FSSAI Regulations 2018

Impact of advocacy regarding staples that are being fortified (FSSAI 2018 regulations in India) is presented graphically in Figure 5. It is evident from the figure that post-intervention, there was a drastic improvement in the awareness of fortified staples. One hundred and sixty one, 157,252,183 and 185 subjects marked correct response for rice, wheat flour, and oil, salt, and milk, respectively.

Table 1: Socio-demographic characteristics the enrolled subjects

Indicators	*No. of subjects*	*Percent*
Gender		
Male	90	24
Female	285	76
Age group (in Years)		
20–30	--	--
31–40	103	27.5
41–50	179	47.7
51–60	93	24.8
Education		
Graduate	37	9.9
Honors	216	57.6
Intermediate	43	11.5
High school	57	15.2
Middle school	16	4.3
Primary school	6	1.6
Profession		
Profession	125	33.3
Semi profession	23	6.1
Clerical	36	9.6
Skilled	34	9.1
Unskilled	24	6.4
Unemployed	133	35.5
Monthly income of the family (in Rupees)		
199,862	-	-
99,931–199,861	32	8.5
74,755–99,930	73	19.5
49,962–74,755	159	42.4
29,973–49,961	111	29.6
Type of family		
Nuclear family	283	75.5
Joint family	92	24.5
Socioeconomic group		
Upper	7	1.9
Upper middle	181	48.3
Lower middle	148	39.5
Upper Lower	39	10.4

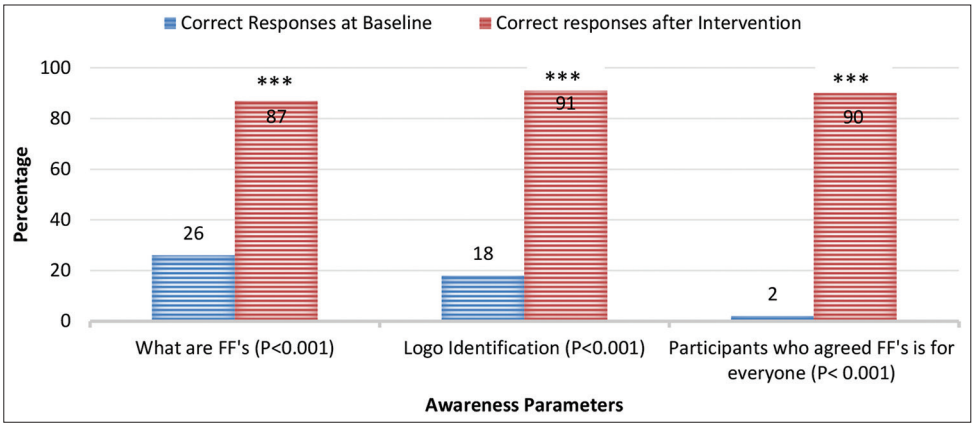

Figure 4: Increase in awareness of fortified foods

Impact of Intervention on Subject's Perception for Fortified Foods

Results on subject's perceptions for preferring fortified foods before and after the intervention are presented graphically in Figure 6. Post-intervention, there was a positive shift in the perception of most of the subjects with regards to safety of fortified foods (40%), their willingness to pay more (26%). Many participants (23%) perceived fortified foods as healthy, 35% accepted that the taste and smell of fortified foods does not get altered. The E- Intervention could persuade 26% of the participants to shift to other brands for choosing fortified staples over the non-fortified staples.

McNemar's test was applied for all the parameters of perception which determined that there was a statistically significant difference post-intervention, $P < 0.001$.

Impact of Intervention on Subject's Purchase Practices regarding Fortified Foods

Figure 7 shows significant increase in the purchase practices of all the staples post-intervention ($P < 0.001$). The purchase of fortified foods at baseline was unintentional for 60% of the subjects; however, post-intervention it was observed that the purchase of five fortified staples increased intentionally.

Using McNemar's test, it was determined that there was a statistically significant difference in the proportion of purchase practices of fortified rice, wheat flour, salt, milk, and oil, post-intervention, with $P < 0.001$.

Barriers for Change in Behavior Toward Purchase of Fortified Foods as Reported by the Subjects

Subjects were asked about the reasons that were impeding their purchase of fortified foods. Majority (38%) of subjects reported unavailability of fortified foods in the nearest store, followed by preference toward buying local/unpacked staples such as rice and wheat kernels (34%) [Table 2].

Association Between Pre and Post Intervention Results for Awareness, Perception, and Practice using Wilcoxon Signed-Ranks Test

Using Wilcoxon signed-ranks, for the three parameters (Awareness, Perception, and Purchase) it can be seen that the positive ranks were more, that is, improvement from pre- to post-intervention data. There was a significant improvement for all the parameters ($P < 0.001$) [Table 3].

Analysis Based on Diffusion of Innovation Model (DIM) for Purchase Practices

Using DIM, purchasing practices were categorized on the basis of adopters, depending on the rate of adoption which was adopted by the enrolled subjects. The results revealed that 12.4% of the subjects were categorized as innovators, 24.3% as early adopters, 26.2% as early majority, 8.2% as late majority, and 24.7% as laggards. Table 3 clearly describes the week of adoption and the category of the subjects following the DIM [Table 4].

The proposed bell shaped curve by Roger's has not been observed in the study as it varies with the product that is being promoted or diffused amongst the subjects, along with socioeconomic characteristics of the adopters [Figure 8]. Orange line in the graph shows the trend followed by the subjects during the E-intervention study with regard to purchase practices. Degree of adoption was higher in the 1st week as compared to the DIM, however in the 2nd and 3rd weeks of intervention the degree of adopters were more or less similar to DIM. Upto 5th week, post-intervention the adopters in the intervention group reduced to 20% and many subjects (21%) remained in the category of laggards who did not report to purchase FF's during the study period.

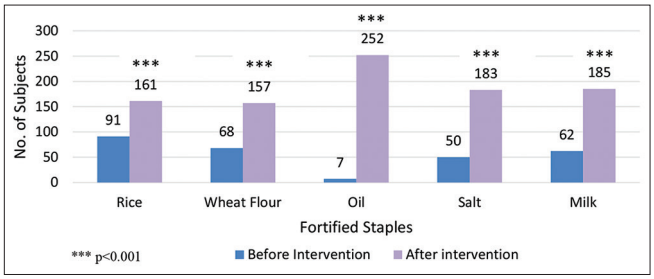

Figure 5: Impact of intervention on awareness of fortified staples among the subjects ($n = 349$)

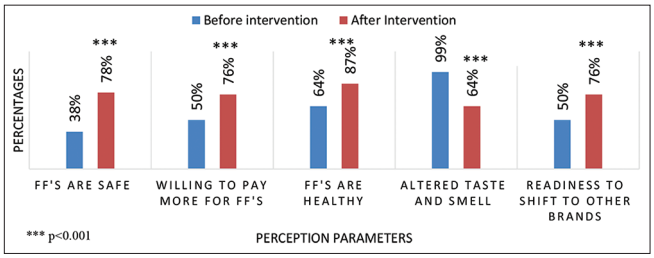

Figure 6: Percent increase in the perception of fortified foods post-intervention

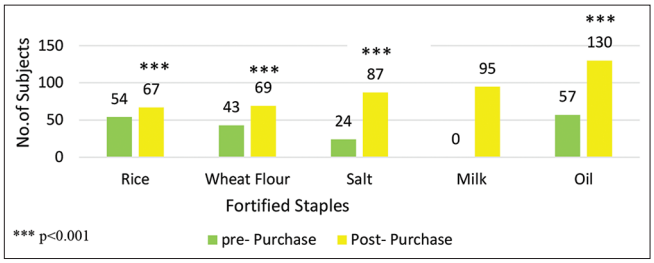

Figure 7: Impact of intervention on purchase practices for the five staples

Table 2: Barriers for change in behavior towards purchase fortified foods by the subjects

Bottlenecks	*No. of subjects (n=326)*
Unavailability in the nearest store	144 (38.4)
It's expensive	2 (0.5)
Prefer buying loose products/Local	129 (4.4)
Preferred brand is not fortified	51 (13.6)

Discussion

The increased micronutrient deficiency has given food fortification a way to combat the situation, as it is one of the cost effective and viable approaches.[10] The advantage of the strategy is to

Table 3: Wilcoxon signed-ranks test for awareness, perception and practice pre- and post-intervention

Pre –Post intervention parameters	*n*	*Mean rank*
Post – pre-awareness		
Negative ranks	4[a]	28.00
Positive ranks	95[b]	50.93
Ties	9[c]	
Total	108	
Wilcoxon signed-ranks test		
Z	−8.480[b]	
P-value	<0.001	
Post – pre-perception		
Negative ranks	80[a]	136.30
Positive ranks	236[b]	166.03
Ties	33[c]	
Total	349	
Wilcoxon signed-ranks test		
Z	−8.731[b]	
P-value	<0.001	
Post - pre purchase		
Negative ranks	6[a]	66.25
Positive Ranks	232[b]	120.88
Ties	116[c]	
Total	354	
Wilcoxon signed-ranks test		
Z	−13.203[b]	
P-value	<0.001	

[a]Post < Pre, [b]Post> Pre, [c]post= Pre

Table 4: Comparison between the percent adopters in the study and the standard DIM

Week of adoption	*No. of subjects*	*Percent adopters during intervention*	*Percent adopters as per DIM*
1st week - innovators	47	13	2
2nd week-early adopters	73	20.3	14
3rd–4th week early majority	87	24.2	34
5th week – late majority	68	20	34
>5th week -laggards	74	21.2	16

DIM: Diffusion of innovation model

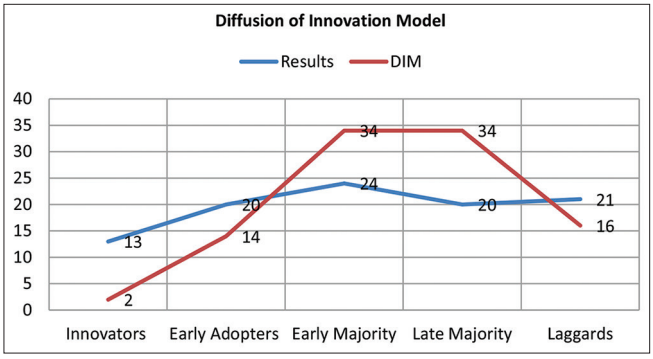

Figure 8: Rate of adoption for the purchase of fortified foods during the intervention

provide micronutrients without altering the dietary practices of the population. The vehicles for fortification are chosen on the basis of staple foods that are consumed frequently and in large quantities.[11]

Few researchers have collected the data from the different communities regarding the consumer's knowledge, attitude, and practice for fortified foods which created the need for intervention based studies.

A study conducted among 150 urban women in Delhi, reported good (48%) awareness on fortified foods logo, where 69.8% agreed to consumption of fortified foods as essential.[10] An interventional study conducted by Sirohi[12] among 400 subjects, recorded awareness of fortification as 12% at the baseline which increased to 72% after the intervention. A study conducted in Kenya on 1435 subjects found that only 28% of the respondents had awareness about "fortified foods." Findings of the present study have also recorded knowledge at baseline at 26% which increased to 88% after the E-intervention.[13]

A study conducted in NkowaNkowa Township, Africa, to determine the knowledge of women on fortification reported, majority (57%) of the participants were able to define food fortification correctly, and 72% of the participants were aware about the foods that are being fortified, the staple that is being fortified in South Africa is maize, which was reported by 70% of the participants. The target group for which fortification is essentially being done are the children (<6 years of age) was answered correctly by 72% of the participants. However, in the present study after the intervention, 87% of the subjects gained knowledge on "*What is fortification*" however only 26% could give correct responses at the baseline. Fifty-seven percent of the subjects were able to identify fortification logo correctly, 18% of the participants were able to identify the correct fortification logo at the baseline, and 91% of the participants were able to identify, post intervention.[14] The possible reason for better knowledge amongst the Africans was the mandatory use of fortification logo on breads, flour, and maize, however in India the +F logo for identification of fortified foods was created in 2016 after the development of food fortification resource center.[15]

The subjects in the present study were willing to pay more for fortified foods by 50% at the baseline, which increased to 76% after the E-intervention. The results of Garg and Kumar[10] also observed the similar findings ($P < 0.01$). On questioning about the difficulties for purchase of fortified foods, only 0.5% of the subjects marked price as one of the reason for not buying fortified foods, while unavailability (38%) and preference toward buying unpacked staples (38%) were the other reasons which jeopardized the purchase of fortified staples amongst the participants. A report by Dalberg estimated that 40–60% of the fortified food production in India is not reaching the general population. Thus, it becomes important to create supply and demand for fortified foods simultaneously.[15] An Australian research found that the notion among the participants who were skeptical regarding purchase of brand products was that fortification is being followed only by expensive products. However, in India and as well as other developing countries, staples are being fortified and even sold through the other government channels.[16]

A cross-sectional study conducted in 13 counties among 1435 subjects to collect information on fortification awareness studied the association of knowledge with different socioeconomic characteristics. It was found that awareness was significantly associated with occupation ($P < 0.001$)), education levels ($P < 0.001$), and age ($P < 0.025$) (13); however, no such association was observed in the present study.[13]

The results in the study have shown significant difference in the awareness, perception, and purchase of fortified foods for all the five staples post-intervention, which provides enough evidence that the proposed strategy for creating awareness and promoting purchase of fortified foods among the selected participants was highly effective.

A cross-sectional study conducted among school going kids in Benghazi city, among 200 students, observed significant reduction in the consumption of chocolate ($P < 0.01$), chips ($P < 0.01$), bread and other fast foods, post-nutrition intervention;[17] however, due to pandemic E- education sessions using WhatsApp as the education platform proved to be highly effective in terms of improving the awareness, perception, and purchase practices.

In an educational intervention study, carried out among 400 subjects, the improvement in knowledge for soybean oil increased to 62% from 10%, knowledge about various fortified food products also enhanced to 83% from 40%,[12] There are multiple studies that have undertaken advocacy strategies for improvement in the knowledge, attitude, and practices of the subjects; however, the results of the intervention can vary depending on the outcome variables, characteristics of the subjects and the tool used for advocacy strategies.[18]

Besides, the impact of the intervention, the study has also used Diffusion of Innovation theory to track the adopter's categories. According to Rogers's model, the four components that can persuade the person toward adoption of innovation are relative advantages, compatibility, complexity, and trialability, which were considered while sharing the messages on WhatsApp during intervention. Messages regarding advantages of food fortification, safe use while cooking and consumption, and the availability of fortified foods in the markets for promoting triability were ensured. The DIM model has been applied in agricultural, public health, social marketing, and educational based interventions.[19]

The success of DIM can vary with the type of technology and innovation that is being promoted to the target audience. However, the graph observed in the present study was similar to the bell shaped graph that was proposed by Roger's in his model.

Conclusion

The study has shown a significant impact of the adopted E-intervention strategy for advocacy of fortified foods using DIM. The adoption of DIM has helped categorize characteristics of the participants enrolled in the study based on their rate of adoption and practicing purchase of fortified foods. Use of different E-communication channels can be used by researchers at large for creating the awareness about the safe consumption of fortified foods.

Besides this, conducive environment is needed for fortification program to be a success, which will ensure the proper supply and demand to make the food fortification program a success.

Acknowledgments

All the participants that enrolled in the study are acknowledged by the authors.

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ORIGINAL RESEARCH PAPER

Health Science

KEY WORDS: Food Fortification, Consumer Awareness, Micronutrient Deficiency, Food Fortification logo

A CROSS SECTIONAL STUDY ON CONSUMER AWARENESS OF FORTIFIED FOODS IN VADODARA CITY

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ABSTRACT

The growing Micronutrient deficiency rates in India and worldwide have been a cause of concern. Recent National Family Health Survey (NFHS) reports have shown that the micronutrient levels are affecting the overall health of the individuals. The diet that the population is having at large is not serving the daily amounts of micronutrients in the substantial amounts, thus, to address this, Government of India (GOI) and The Food safety and standards Authority of India (FSSAI) have implemented food fortification program in India, focusing on five staples, namely rice, wheat flour, oil, milk and salt. The present study was carried out in the department of foods and nutrition in Vadodara, Gujarat, amongst 375 parents who were responsible for buying groceries for their families. The aim of the study was to assess the knowledge of the population regarding fortified foods using google forms. The study revealed that only 33% of the subjects, knew about the term fortified foods, however on asking about its identification attribute, only 28% were able to give the correct answer. Most of the subject (89) subjects marked correct response for the fortification logo. However, the knowledge regarding the food sources of fortified foods was lacking amongst the study subjects. Efforts should be made to create awareness about the new fortified foods and its benefits at large scales through different media channels.

INTRODUCTION

India is a home of 138. 85 crores people according to recent UN report. (World meter, UN as on 15th March 2021) Health of the population is important for every country for improving the economic performances and thus the productivity of the nation. Thus, it becomes important for every nation to monitor the health of the individuals and design strategies to overcome every health related issues that the country is facing. (Raghupathi, 2020). One of the major health problem that the world is facing with, is micronutrient deficiency. Everybody knows how important are the various macronutrients for the development and functioning of the body, but equally important are the micronutrients like Vitamin A, Vitamin D, and B12etc. Which are required in tiny amounts. Micronutrient deficiency is a growing global health, adding onto the burden of various health related problems like anaemia, affecting physical and mental development in children, vulnerability of diseases, night blindness etc. It is also defined as 'Hidden Hunger' as the signs of deficiency are not visible. According to World Health Organization (WHO) nearly two billion people worldwide are suffering from micronutrient deficiency (Ritchie and Roser, 2017).

Researchers have revealed that nearly 50-60% of the preschool children and an equal number of women in India are anaemic, (Gonmei and Toteja 2018), 62% of Indian Population have low levels of Vitamin A and 50-94% people in different states of India are suffering from Vitamin D deficiency. (GAIN, India 2018). According to NFHS-4 (2015-2016 data), micronutrient deficiency are prevalent in all the age groups. The recent NFHS-5 data has not shown any significant improvement in the nutritional status of the children. The rates for stunting and wasting has increased or showed no improvement as compared to the NFHS-4.

The Novel Corona virus has also worsen the situation and has impacted the health of the people, efforts should be made to achieve the sustainable development goals (SDG 2) by The United Nations which aims to eliminate hunger and all forms of malnutrition by 2030.

Several programmes and schemes targeting towards iron and Vitamin A deficiency are active in India amongst various age group but the results have not shown any significant Improvement in the overall status which leaves the micronutrient deficiency as one of the grim public health concern for India.

Thus to combat micronutrient deficiency, WHO has recognized fortification as a bridge in filling the micronutrient gaps which is an affordable and viable approach. Food fortification is defined as 'the practice of deliberately increasing the content of an essential micronutrient, i.e. vitamins and minerals (including trace elements) in a food, so as to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health' (WHO). To overcome the micronutrient deficiency which remains as an obstacle in the development of nation, Government of India (GOI) and Food safety and standards authority of India (FSSAI) has initiated food fortification in five staples, namely rice, wheat flour, oil, milk and salt which are commonly used in an Indian diet, however the knowledge of food fortification is necessary for promoting or creating awareness amongst individuals for the benefits of consuming fortified foods and for identifying the fortified food while purchasing for their grocery needs. Therefore, percent study was undertaken to look at the consumers, perception, awareness and purchase practice regarding fortified foods in urban Vadodara, Gujarat, India.

METHODOLOGY

Study design, and selection of the Participants: Using a cross sectional study design parents of the students (N=1600). From the Foods and Nutrition department of the Maharaja Sayajirao University of Baroda were screened to elicit the data, of which 375 parents consented to participate in the study. Subjects who were responsible for buying groceries for the family, having active internet and WhatsApp connection were included in the study.

Data Collection: The subjects were approached telephonically and were briefed about the study. The study was conducted from September- December 2020. A pre tested Structured questionnaire was administered. Information on sociodemographic characteristics and awareness regarding food fortification was collected using Google forms

Ethical Approval: The study was approved by the institutional review board of the Department of Foods and Nutrition, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. The ethical approval number of the study is **IECHR/FCS/2020/62**

Statistical Analysis: The data was analysed using Microsoft

excel for calculation of percentages and the number of subjects in each category.

RESULTS:

1. Sociodemographic Characteristics of subjects: The gender profile of the study population revealed that 76% of females and 24% were males. Most of the respondents were among the age group of 41-50 years (41.6%). Most of the respondents had honors degree (57.6%) followed by High School (15.2) and Intermediate (11.5).The data on occupation shows that majority of the respondents were either unemployed or belonged to Profession category. Majority of the households belonged to Upper Middle Class (48.3), followed by Lower Middle Class (39.5).

2. Awareness on Food Fortification: As seen in Fig.1, subjects who self-reported about the familiarity with the term 'Food Fortification' 33% self-reported that they knew about the term 'Fortified Foods' while majority of the subjects 66.7% didn't hear about fortified foods at all. When subjects were asked about what they knew about fortified foods, from the multiple options provided to them, 28% marked the correct response.

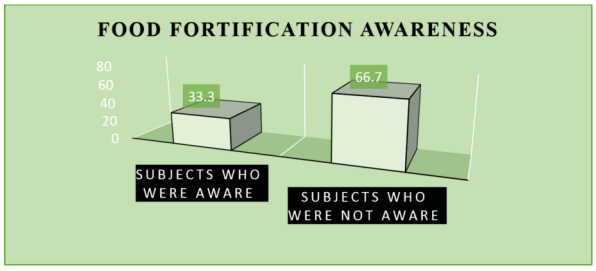

Fig 1: Percent subjects having awareness about Food Fortification (N=375)

The results of our study are consistent with the research conducted in Kenya on1435 subjects it was revealed that nearly 28% of the subjects were aware of food fortification, of which female respondents were more likely to be aware of it. (Linda, et al, 2020).Another study conducted in Urban Delhi amongst 150 women, 56% of women were aware about food fortification and 69% also reported its importance in the daily diet (Kumar Garg, 2020).

Source of Information: Majority of the subjects (45.2%) reported broadcast media (Television, Radio, etc., Internet) as the major source of information from where they learnt about fortified foods, followed by print media for 38.7% subjects, while a few of them reported internet (8.9%) and outdoor media (bill boards, neighbours) by 7.3% of subjects.

3. Awareness about Fortification Logo: Respondents were given three image options and were asked to select the correct logo for fortification used in India. 80% of the respondents who reported about being aware of food fortification, marked the correct responses i.e.89 respondents out of 112. A study conducted in Urban Delhi among 150 women, showed that 48% of the respondents were aware about the correct fortification logo available on pre packed foods (Kumar and Garg, 2020)

4. Knowledge on Foods that are being fortified in India: It was important for the researcher to know whether the subjects who reported about awareness of fortified foods, also knew about the staples that are getting fortified in India. The subjects were given the option to choose multiple responses. Majority of the subjects were aware about wheat flour fortification (33.2%), and rice fortification (33.3%), followed by milk (25%) and salt (22%), while only 3% (approx.) marked oil as the source. Study conducted in Delhi reported that 40% of the respondents knew about the available fortified foods in Indian market. (Kumar and Garg, 2020) **Fig 2**

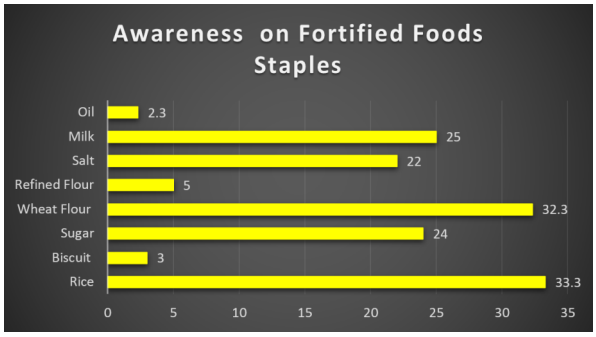

Fig 2: Percent subjects having awareness on Staples that are being fortified

CONCLUSION: The present study revealed that 33% of the subjects, had awareness about the term fortified foods, however on asking about its attribute, only 28% could recognize the correct answer.The major source of knowledge was broadcast media which is television and radio, (45.2%). Out of 375 subjects, 89 subjects marked correct response for the fortification logo. However, the knowledge regarding the food sources of fortified foods was lacking amongst the study subjects. Thus, Efforts should be taken to create awareness about fortified foods and its identification while practicing its purchase to make the implementation of FSSAI 2018 regulation more effective.

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Current Knowledge of Health Benefits for Various Fortificants amongst the Free Living Population in Vadodara, India: E-Assessment

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Rationale: Micronutrients are an important part of the diet and are required in substantial amount for the proper functioning of body. According to various researches and reports it has been seen that the Micronutrient deficiency prevalence is increasing in India because of which it has now became a public health issue. One of the reason for low micronutrient deficiency could be the knowledge of various micronutrients that are now being used as fortificants for overcoming the deficiency rates. **Methods**: A cross-sectional study design has been planned for assessing the current knowledge regarding the health benefits for various micronutrients that are being used as fortificants. The study is planned amongst the parents of the students enrolled in the Faculty of Family and Community Sciences i.e. 1600 students , efforts were made to enrol maximum parents for the study, however minimum sample size that was calculated considering the 20% dropouts came out to be 315 individuals. Subjects were enrolled on call and e-questionnaire using Google form were sent to the individuals. The socioeconomic data was collected using kuppuswamy scoring method. **Results**: The Individuals selected multiple responses for the knowledge on health benefits of Vitamin A, d, B12, Iron and Iodine. 78% of Individuals gave correct responses for Vitamin A health benefits s. 74% of individuals gave correct response for Vitamin D, 37% for Vitamin B12 health benefits, 61% for Iron and 70% for iodine gave correct responses. **Conclusion:** The Knowledge amongst the Individuals regarding the health benefits for various fortificants was highly excellent, however, it is essential to note that there are individuals who had selected ‘don’t know; as their response. Also, knowledge of various sources is also important to make the changes in their dietary habits. The intervention regarding the advocacy can be designed for the overall gain in knowledge for various micronutrients considering their sources.

Organization Logo

Photograph

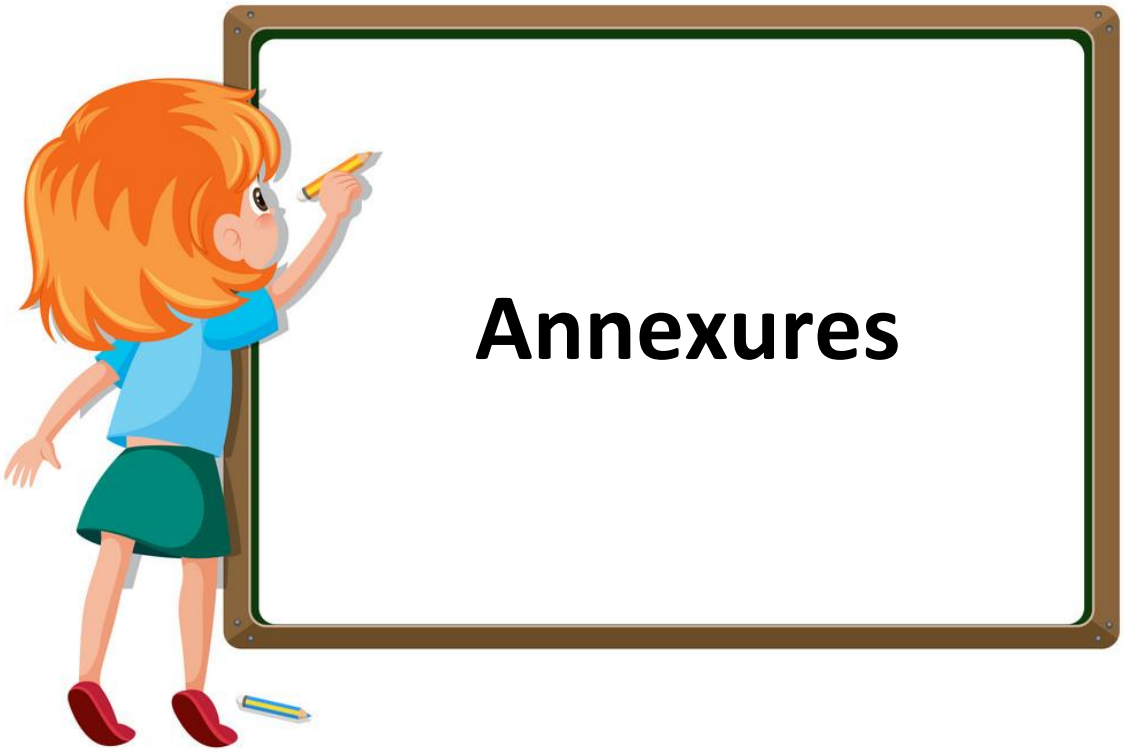
Title: Implementing e- Intervention for Promoting Fortified Foods amongst the General Population in Vadodara district, Gujarat, India

Name: Ria Ahuja and Prof. Mini Sheth
University/Organization: The Maharaja Sayajirao University of Baroda, Gujarat
Country: India

Abstract: Worldwide, unaffordable healthy diets, dependability over staple food items, and lack of knowledge have been the major cause of malnutrition. Government programs, promoting dietary diversity and supplementation have not given promising results in improving the micronutrient status of the population. Government of India, along with Food Safety and Standards Authority of India have chosen five vehicles, namely, rice, wheat flour, salt, milk, and oil for the fortification process to combat the micronutrient deficiency. Fewer studies aimed at creating advocacy about fortified foods among the free living population and stake holders. The present study undertook the advocacy for fortified foods amongst the free living population using the Diffusion of Innovation Model (DIM) for the purchase of fortified foods. An e- Intervention using graphics, audios and videos were given to the participants on WhatsApp for one month. Innovative graphics with messages in Hindi language were developed for creating the interest of the participants, and already existing audios and videos developed by FSSAI, or government were used for creating the awareness on fortified foods. The results of the study have shown significant difference in the awareness, perception and purchase practices of fortified foods for all the five staples post intervention, which provides enough evidence that the proposed strategy for creating awareness and promoting purchase of fortified foods amongst the selected participants was highly effective. The research also undertook a survey for different fortified products available in the markets of Vadodara city. The markets were selected purposively from each of the four zones

of Vadodara, since the purchasing preferences are evolving day by day, efforts were made to include traditional ration shops, online retail shops, and hyper markets. The results revealed that there was limited availability of the products, which further creates the need for availing fortified products in the market in order to promote its purchase and achieving the goal of combating with micronutrient deficiency. Different E-communication channels can be used by researchers at large for creating the awareness about the consumption of fortified foods. Besides this, conducive environment is needed for fortification program to be a success, which will ensure the proper supply and demand to make the food fortification program viable.

Biography: Miss Ria Ahuja is a Ph.D. Scholar who has completed her B.Sc in Foods and Nutrition from Lady Irwin College, Delhi, and her ,Msc in Public Health and Nutrition from the Maharaja Sayajirao University of Baroda. Currently she is undergoing her doctoral degree program along with it she is working with an NGO namely MAMTA-Health Institute of Mother and Child as a Regional Manager in Mother and Child Health Department


Annexures

ANNEXURE - I

INFORMED CONSENT FORM

INFORMED CONSENT FORM

This Form is a part of the Doctoral Research of Ms. Ria Ahuja, in the Field of Public Health and Nutrition from The Maharaja Sayajirao University of Baroda, Gujarat. The aim of this research is to determine the Knowledge, Attitude, and Beliefs of Fortified Foods (Micronutrient added foods) amongst the General Population.

The Study is divided into two phases

In Phase 1, you will be asked to fill in the google form for the following information:-

1. General Information about your education, occupation, and income
2. Knowledge of Fortified foods and different micronutrients
3. Attitude for Fortified Foods
4. Practice for fortified foods.

Phase 2 is the intervention phase

1. wherein you will be given Education sessions using Smart Phones, WhatsApp Groups for the period of 1 month, daily. Your role is to just read those messages.

2. Every Sunday you will be required to fill in the short form of 10 questions regarding the change in your perception, knowledge, and purchasing habits of fortified foods.

3. Thereafter there will be a gap of 2 months, after which again a short form will be shared for assessment to know about the retention of messages regarding Knowledge, Attitude, and Practice shared with you during the 1 month of the education session.

The study will be conducted ONLY using WhatsApp groups, no personal meetings involved, thus keeping you safe from COVID-19. There will be no direct benefit to you, but your participation is likely to help us find out more about the Knowledge, attitude, and practice of fortified foods which eventually will help in overcoming the micronutrient deficiency that the country is currently facing.

All the Information shared with the Research Scholar will solely be used for Research Purposes and it will be confidential. If you agree and give consent, please fill in the form below, Thanks for Your Participation

Q1- Q12 are Mandatory Questions
Skip to Question19 if the response to question 12 is ' NO" (You do not know about Fortified Foods)
Q19- Q33- Micronutrients knowledge Mandatory
Q34-43- Mandatory

A 'tick' mark questionnaires will take just 5-8 minutes

इयह प्रपत्र गुजरात के बड़ौदा के महाराजा सयाजीराव विश्वविद्यालय से सार्वजनिक स्वास्थ्य और पोषण के क्षेत्र में सुश्री रिया आहूजा के डॉक्टरेट अनुसंधान का एक हिस्सा है। इस शोध का उद्देश्य सामान्य जनसंख्या के बीच फोर्टीफाइड फूड्स (सूक्ष्म पोषक तत्वों से भरपूर खाद्य पदार्थ) के ज्ञान, दृष्टिकोण और विश्वासों को निर्धारित करना है।

अध्ययन को दो चरणों में विभाजित किया गया है

चरण 1 में, आपको निम्नलिखित जानकारी के लिए Google फॉर्म भरने के लिए कहा जाएगा: -

1. आपकी शिक्षा, व्यवसाय और आय के बारे में सामान्य जानकारी
2. फोर्टीफाइड खाद्य पदार्थों और विभिन्न सूक्ष्म पोषक तत्वों का ज्ञान
3. फोर्टीफाइड फूड्स के लिए रवैया
4. फोर्टीफाइड फूड्स पदार्थों के लिए अभ्यास।

चरण 2 हस्तक्षेप चरण है

1. जिसमें आपको 1 महीने की अवधि के लिए स्मार्ट फोन, व्हाट्सएप ग्रुप का उपयोग करते हुए शिक्षा सत्र दिया जाएगा। आपकी भूमिका सिर्फ उन संदेशों को पढ़ने की है।

2. हर रविवार को आपको फोर्टीफाइड फूड्स, खाद्य पदार्थों की धारणा, ज्ञान और क्रय आदतों में बदलाव के बारे में 10 प्रश्नों के संक्षिप्त रूप को भरना होगा।

3. इसके बाद 2 महीने का अंतर होगा, जिसके बाद फिर से चरण 1 में साझा किए गए उसी फॉर्म को फिर से आपके साथ साझा किया जाएगा, जो कि 1 महीने के दौरान आपके साथ साझा किए गए ज्ञान, एटीट्यूड और प्रैक्टिस के बारे में संदेशों की अवधारण के बारे में जानने के लिए आपके साथ साझा किया जाएगा। शिक्षा सत्र का।

अध्ययन केवल व्हाट्सएप समूहों का उपयोग करके आयोजित किया जाएगा, इसमें कोई व्यक्तिगत बैठक शामिल नहीं है, इस प्रकार यह आपको COVID-19 से सुरक्षित रखता है। आपके लिए कोई प्रत्यक्ष लाभ नहीं होगा, लेकिन आपकी भागीदारी से हमें फोर्टीफाइड फूड्स खाद्य पदार्थों के ज्ञान, दृष्टिकोण और अभ्यास के बारे में और अधिक जानकारी प्राप्त करने में मदद मिलेगी, जो अंततः सूक्ष्म पोषक तत्वों की कमी को पूरा करने में मदद करेगा, जिसका देश अभी सामना कर रहा है।

रिसर्च स्कॉलर के साथ साझा की गई सभी जानकारी पूरी तरह से रिसर्च पर्पस के लिए उपयोग की जाएगी और यह गोपनीय होगी। यदि आप सहमत हैं और सहमति देते हैं, तो कृपया नीचे दिए गए फॉर्म में भरें,

थैंक्यू फॉर योर पार्टिसिपेशन

Q1- Q12 अनिवार्य प्रश्न हैं
प्रश्न 19 पर जाएं यदि प्रश्न 12 का उत्तर 'NO' है (आप फोर्टीफाइड फूड्स के बारे में नहीं जानते हैं)
Q19- Q33- सूक्ष्म पोषक ज्ञान अनिवार्य
Q34-43- अनिवार्य

Contact Details
Ria Ahuja (PhD Scholar) 7226065522
Prof. Mini Sheth (Guide) 9879359229
* Required

1. Email address *

2. I agree to participate in the study *

   Check all that apply.

   - [ ] Yes, i agree for both the phases of the study
   - [ ] yes, i agree for the 1st phase of the study only
   - [ ] I do not agreee to participate at all

If you agree, to participate in the first phase/both the phase of the study, please fill in the google form.

3. Q1. Name (व्यक्ति जो परिवार के लिए किराने का सामान खरीदने के लिए जिम्मेदार है, उसे फॉर्म भरना चाहिए) *

4. Q2. Gender *

   Mark only one oval.

   - ◯ Female
   - ◯ Male
   - ◯ Prefer not to say
   - ◯ Other:

5. Q3 Age in years *

Check all that apply.

- [ ] 20-30
- [ ] 31-40
- [ ] 41-50
- [ ] 51-60
- [ ] above 60

6. Q4 Residential Address, (please mention zone, North, South East or West) if Known to you *

_____

7. Q5 Educational Qualification *

Mark only one oval.

- ◯ 1. Profession or honors
- ◯ 2. Graduate or Postgraduate
- ◯ 3. Intermediate or high school
- ◯ 4. High school certificate
- ◯ 5. Middle school Certificate
- ◯ 6. Primary school
- ◯ 7. Never Attended School

8. Q6 Occupation *

Mark only one oval.

- ◯ Profession
- ◯ Semi-Profession
- ◯ Clerical, shop –owner
- ◯ Skilled worker
- ◯ Unskilled worker
- ◯ Unemployed

9. Q7 Do you belong to Nutrition/health/Medical Background?

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Other: _____

10. Q8 Monthly Income of Family *

Mark only one oval.

- ◯ >75,063
- ◯ 39,033–78,062
- ◯ 29,200 –39,032
- ◯ 19,516–29,199
- ◯ 11,708–19,515
- ◯ 3,908–11,707
- ◯ ≤ 3,907

11. Q9 Family Type *

Mark only one oval.

- ◯ Joint Family
- ◯ Nuclear Family

12. Q10 Active WhatsApp Phone Number (Only for Study Purposes) *

_____

13. Q11 From where do you buy Grocery Items *

Mark only one oval.

- ◯ 1. Malls (spencer, big bazaar, D-Mart)
- ◯ 2. Traditional Kirana Store
- ◯ 3. Online Application (Amazon , Big Basket)
- ◯ 4. 1 & 2
- ◯ 5. 2 & 3
- ◯ 6. 1, 2 & 3
- ◯ Other: _____

Questionnaire on Knowledge

14. Q12 क्या तुमने कभी फोर्टीफाइड खाद्य पदार्थों के बारे में सुना है? Have you ever heard about fortified foods? *

Mark only one oval.

- ◯ Yes
- ◯ No

If the answer for Q12 is yes, please continue else skip to question 19

15. Q13 If yes, आपने फोर्टीफाइड खाद्य पदार्थों के बारे में कहां से सीखा?From where you learn about Fortified foods?

Mark only one oval.

- ◯ 1. प्रिंट मीडिया (समाचार पत्र, पत्रिका) 1. Print Media (Newspaper, Magazine)
- ◯ 3. घर के बाहर या बाहर मीडिया (बिल बोर्ड, पोस्टर, डैंगलर्स) Outdoor Media
- ◯ 4. इंटरनेट Internet

16. Q14 फोर्टीफाइड फूड्स के बारे में आप क्या जानते हैं? वे आपके अनुसार क्या हैं?What do you know about Fortified Foods? What are they according to you?

Mark only one oval.

- ◯ 1. सूक्ष्म पोषक खाद्य पदार्थ/ 1. Micronutrient rich foods
- ◯ 2. कम चीनी वाले खाद्य पदार्थ/2. Foods with less sugar
- ◯ 3. जोड़े गए संरक्षक के साथ खाद्य पदार्थ/3. Foods with added preservatives
- ◯ 4. खाद्य पदार्थ जो कमी पर काबू पाने में मदद करते हैं/4. Foods that help in overcoming deficiency
- ◯ 5. पता नहीं/5. Don't Know
- ◯ Other: _____

17. Q15 आपके अनुसार फोर्टिफिकेशन का 'लोगो' क्या है?According to you what is the logo for Fortification? *

Mark only one oval.

Option 1

Option 2

Option 3

18. Q16 क्या आप जानते हैं कि खाने के पैकेट पर फोर्टिफिकेशन 'लोगो' कहाँ पाया जाता है?Do you know where Fortification logo is found on the food packet? *

Mark only one oval.

- 1 फ्रंट लेबल/ front Label
- 2. बैक लेबल/ Back Label
- 3. लेबल के पक्ष/ sides of the label
- 4. पता नहीं/ Don't know

19. Q17 आपके मौजूदा ज्ञान के अनुसार, FSSAI 2018 विनियम के तहत मुख्य फोर्टीफाइड फ़ूड क्या हैं (आप एक से ज़्यादा जवाब चुन सकते है)According to your existing knowledge, what are the MAJOR food that is being fortified from the following under FSSAI 2018 Regulations? (You can choose multiple answers) *

Check all that apply.

- [ ] 1. चावल/ Rice
- [ ] 2. बिस्कुट/ Biscuit
- [ ] 3. चीनी/ Sugar
- [ ] 4. गेहूं का आटा/ Wheat Flour
- [ ] 5. परिष्कृत आटा/Refined Flour
- [ ] 6. नमक/ Salt
- [ ] 7. दूध/ Milk
- [ ] 8. शीतल पेय/ Soft Drinks
- [ ] 9. तेल/ Oil
- [ ] 10. उपरोक्त में से कोई नहीं/ None of the above

20. Q18 फोर्टिफाइड फूड्स का सेवन किसे करना चाहिए:Fortified Foods should be consumed by: *

Mark only one oval.

- ◯ 1. महिलाओं / Females
- ◯ 2. नर/ Males
- ◯ 3. बूढ़े लोग/ Elderly
- ◯ 4. सब लोग/ Everyone
- ◯ 5. किशोर/ Adolescent girls and boys
- ◯ 6. पता नहीं/ Don't Know

Part B- Knowledge of various micronutrients (
Knowledge about various vitamins and nutrients

21. Q19। आपके अनुसार विटामिन ए के सेवन से क्या लाभ होते है?What according to you is the health benefit of consuming Vitamin A? *

Check all that apply.

- [ ] 1. रतौंधी के खिलाफ मदद करता है 1. Helps against Night blindness
- [ ] 2. मजबूत हड्डियों का समर्थन करता है/ 2. Supports strong bones
- [ ] 3. एनीमिया पर काबू पाने में मदद करता है/3. Helps in overcoming anemia
- [ ] 4. तंत्रिका तंत्र और रक्त गठन के सामान्य कामकाज/4. normal functioning of nervous system and blood formation
- [ ] 5. भोजन से ऊर्जा जारी करने के लिए आवश्यक है/5. Necessary to release energy from food
- [ ] 6. पता नहीं Don't Know

22. Q20 आपके अनुसार विटामिन डी का सेवन करने का स्वास्थ्य लाभ क्या है?What according to you is the health benefit of consuming Vitamin D? *

Check all that apply.

- [ ] 1. रतौंधी के खिलाफ मदद करता है/ Helps against Night blindness
- [ ] 2. मजबूत हड्डियों का समर्थन करता है/Supports strong bones
- [ ] 3. एनीमिया पर काबू पाने में मदद करता है/Helps in overcoming anemia
- [ ] 4. तंत्रिका तंत्र और रक्त गठन के सामान्य कामकाज/normal functioning of nervous system and blood formation
- [ ] 5. भोजन से ऊर्जा जारी करने के लिए आवश्यक है/ Necessary to release energy from food
- [ ] 6. पता नहीं

23. Q21 आपके अनुसार विटामिन B 12 का सेवन करने का स्वास्थ्य लाभ क्या है?What According to you is the health benefit of consuming Vitamin B12? *

Check all that apply.

- [ ] 1. रतौंधी के खिलाफ मदद करता है/ Helps against Night blindness
- [ ] 2. मजबूत हड्डियों का समर्थन करता है/ Supports strong bones
- [ ] 3. एनीमिया पर काबू पाने में मदद करता है/Helps in overcoming anemia
- [ ] 4. तंत्रिका तंत्र और रक्त गठन के सामान्य कामकाज/normal functioning of nervous system and blood formation
- [ ] 5. थायराइड और मस्तिष्क का कार्य/ Necessary to release energy from food
- [ ] 6. पता नहीं

24. Q22 आपके अनुसार आयरन का सेवन करने का स्वास्थ्य लाभ क्या है?What According to you is the health benefit of consuming iron? *

Check all that apply.

- [ ] रतौंधी के खिलाफ मदद करता है/Helps against Night blindness
- [ ] 2. मजबूत हड्डियों का समर्थन करता है/ Supports strong bones
- [ ] 3. एनीमिया से लड़ता है/Helps in overcoming anemia
- [ ] 4. तंत्रिका तंत्र और रक्त गठन के सामान्य कामकाज/normal functioning of nervous system and blood formation
- [ ] 5. थायराइड और मस्तिष्क का कार्य/Thyroid and proper brain functioning
- [ ] 6. भोजन से ऊर्जा जारी करने के लिए आवश्यक है/ Necessary to release energy from food
- [ ] 7. पता नहीं

25. Q23 आपके अनुसार आयोडीन के सेवन से स्वास्थ्य लाभ क्या है?What According to you is the health benefit of consuming Iodine? *

Check all that apply.

- [ ] 1. रतौंधी के खिलाफ मदद करता है/ Helps against Night blindness
- [ ] 2. मजबूत हड्डियों का समर्थन करता है/Supports strong bones
- [ ] 3. एनीमिया से लड़ता है/Helps in overcoming anemia
- [ ] 4. तंत्रिका तंत्र और रक्त गठन के सामान्य कामकाज/normal functioning of nervous system and blood formation
- [ ] 5. थायराइड और मस्तिष्क का कार्य (Thyroid and helps in brain functioning)
- [ ] 6. भोजन से ऊर्जा जारी करने के लिए आवश्यक है/ Necessary to release energy from food
- [ ] 7. पता नहीं

26. Q24 आपके अनुसार निम्नलिखित में से विटामिन ए के स्रोत कौन से हैं?What according to you are the sources are the source of vitamin A, from the following? *

Check all that apply.

- [ ] 1. हरी पत्तेदार सब्जियां/ Green Leafy Vegetables
- [ ] 2 अंडे/ Eggs
- [ ] 3. घी/ Ghee
- [ ] 4. सेब/ Apple

27. Q25 आपके अनुसार विटामिन डी के स्रोत क्या हैं?What according to you are the sources of Vitamin D? *

Check all that apply.

- [ ] 1. दूध/ Milk
- [ ] 2. हरी पत्तेदार सब्जियां/ Green leafy Vegetables
- [ ] 3. घी/ Ghee
- [ ] 4. चीनी/ Sugar

28. Q26 आपके अनुसार विटामिन B 12 के स्रोत क्या हैं?What according to you are the sources of Vitamin B12? *

Check all that apply.

- [ ] 1. टमाटर/ Tomato
- [ ] 2. दूध/ Milk
- [ ] 3. घी/ Ghee
- [ ] 4. गेहूं का आटा/ Wheat Flour

29. Q27 आपके अनुसार लोहे के स्रोत क्या हैं?What according to you is the sources of iron? *

Check all that apply.

- [ ] 1. हरी पत्तेदार सब्जियां/ Green Leafy Vegetables
- [ ] 2. दूध/ Milk
- [ ] 3. घी/ Ghee
- [ ] 4. चीनी/ Sugar

30. Q28 आपके अनुसार आयोडीन के स्रोत क्या हैं?What according to you are the sources of Iodine? *

Check all that apply.

- [ ] 1. आलू/ Potato
- [ ] 2. चीनी/ Sugar
- [ ] 3. गेहूं का आटा/ Wheat Flour
- [ ] 4. दूध/ Milk

31. Q29 आपके अनुसार विटामिन ए की कमी के संकेत क्या हैं?What according to you are the sign of Vitamin A deficiency? *

Check all that apply.

- [ ] 1. मंद प्रकाश में देखने में असमर्थता/ 1. Inability to see in dim light
- [ ] 2. हड्डियों और जोड़ों में दर्द/ 2. Pain in bones and joints
- [ ] 3. कमजोरी और चक्कर आना, एकाग्रता की कमी/ 3. Weakness and dizziness, lack of concentration
- [ ] 4. वजन बढ़ना / वजन कम होना/ 4. Unexplained weight gain/Weight loss

32. Q30 आपके अनुसार विटामिन डी की कमी के लक्षण क्या हैं?What according to you are the signs of vitamin D deficiency? *

Check all that apply.

- [ ] 1. हड्डियों और जोड़ों में दर्द/ 1. Pain in bones and joints
- [ ] 2. कमजोरी और चक्कर आना, एकाग्रता की कमी/2. Weakness and dizziness, lack of concentration
- [ ] 3. अस्पष्टीकृत वजन बढ़ना / वजन कम होना/3. Unexplained weight gain/Weight loss
- [ ] 4. मंद प्रकाश में देखने में असमर्थता/4. Inability to see in dim light

33. Q31 आपके अनुसार विटामिन बी 12 की कमी के लक्षण क्या हैं? What according to you are the signs of deficiency for Vitamin B12? *

Check all that apply.

- [ ] 1. हड्डियों और जोड़ों में दर्द/ 1. Pain in bones and joints
- [ ] 2. कमजोरी और चक्कर आना, एकाग्रता की कमी/ 2 Weakness and dizziness, lack of concentration
- [ ] 3. अस्पष्टीकृत वजन बढ़ना / वजन कम होना/ Unexplained weight gain/Weight loss
- [ ] 4. मंद प्रकाश में देखने में असमर्थता/ Inability to see in dim light

34. Q 32 आपके अनुसार लोहे की कमी के संकेत क्या हैं?What according to you are the signs of deficiency for iron? *

Check all that apply.

- [ ] 1. हड्डियों और जोड़ों में दर्द 1. Pain in bones and joints
- [ ] 2. कमजोरी और चक्कर आना, एकाग्रता की कमी/Weakness and dizziness, lack of concentration
- [ ] 3. वजन बढ़ना / वजन कम होना/Unexplained weight gain/Weight loss
- [ ] 4. मंद प्रकाश में देखने में असमर्थता/ Inability to see in dim light

35. Q33 आपके अनुसार आयोडीन की कमी के लक्षण क्या हैं?What according to you are the signs of deficiency for iodine? *

Check all that apply.

- [ ] 1. हड्डियों और जोड़ों में दर्द/ 1. Pain in bones and joints
- [ ] 2. कमजोरी और चक्कर आना, एकाग्रता की कमी/ 2. Weakness and dizziness, lack of concentration
- [ ] 3. वजन बढ़ना / वजन कम होना/Unexplained weight gain/Weight loss
- [ ] 4. मंद प्रकाश में देखने में असमर्थता/ Inability to see in dim light

Attitude Questions फोर्टीफाइड फूड्स के बारे में विचार . Questions below have some fact statements, please tell us your views about it / नीचे दिए गए प्रश्नों में कुछ तथ्य कथन हैं, कृपया हमें इसके बारे में अपने विचार बताएं

36. Q34 नियमित रूप से फोर्टिफाइड फूड्स का सेवन शरीर को नुकसान पहुंचा सकता है। आपकी क्या राय है? बयान करे. Consumption of Fortified staples regularly can harm the body. What is your opinion regarding the statement? *

Mark only one oval.

- ◯ 1. Agree/ सहमत
- ◯ 2. Disagree/असहमत
- ◯ 3. Neutral/Uncertain/तटस्थ / अनिश्चित

37. Q35 फोर्टीफ़िएड फूड्स की कीमत बहुत कम है, थोड़ा खर्च करने से आपकी सेहत को लाभ मिल सकता है और एनीमिया जैसी बीमारिया मिट सकती है, आपका क्या विचार है ? The incremental cost of food fortification is minimal .By incurring these minimal costs, the disease burden of widely prevalent problems like anemia can be reduced. What is your opinion regarding the statement? *

Mark only one oval.

- 1. Agree/ सहमत
- 2. Disagree/असहमत
- 3. Neutral/Uncertain/तटस्थ / अनिश्चित
- Don't know

38. 36 फोर्टीफाइड फूड्स सूक्ष्म पोषक तत्वों की कमी को दूर करने में मदद करेंगे। आपकी क्या राय है? Fortified Foods will help in overcoming micronutrient deficiency. What is your opinion regarding the statement? *

Mark only one oval.

- 1. सहमत / Agree
- 2. असहमत/ Disagree
- 3. तटस्थ / अनिश्चित / Uncertain
- Don't Know

39. Q37 फोर्टीफाइड फूड्स का सेवन हर किसी को करना चाहिए चाहे वह कीसी भी उम्र, या लिंग का हो। क्या है आपकी राय? Fortified foods should be consumed by everyone irrespective of age, sex and gender. What is your opinion about the statement? *

Mark only one oval.

- 1. सहमत / Agree
- 2. असहमत/ Disagree
- 3. तटस्थ / अनिश्चित / Uncertain
- Don't Know

40. Q 38 , नॉन फोर्टिफाइड की तुलना में फोर्टिफाइड फ़ूड का अलग स्वाद /गंध होगा ,आपकी क्या राय है? Fortified foods will have different taste, smell as compared to Non-fortified foods *

Mark only one oval.

- 1. हां, ऐसा हो सकता है / Yes, its possible
- 2. नहीं, मुझे ऐसा नहीं लगता/ I don't Think so
- 3. अनिश्चित / Unsure
- Don't Know

41. Q39 यदि पसंदीदा ब्रांड में फोर्टिफाइड फ़ूड उपलमब्ध नहीं है । दूसरे ब्रांड में शिफ्ट होना अच्छा है जहाँ फोर्टिफाइड खाद्य पदार्थ उपलब्ध हैं। आपकी क्या राय हैं?If the preferred brand is not fortifying its product. It is a good idea to shift to other brands where fortified staples are available. What is your opinion *

Mark only one oval.

- 1. सहमत/ Agree
- 2. असहमत/ Disagree
- 3. तटस्थ / अनिश्चित/ Unsure

Practice Questions

42. Q40 क्या आप वर्तमान में अपने दैनिक आहार के हिस्से के रूप में फोर्टिफाइड स्टेपल खरीद रहे हैं?. Are you currently purchasing Fortified staples as a part of your daily diet? Foods with +F logo *

Mark only one oval.

- 1. हां/ yes
- 2. नहीं/ no
- 3. कभी-कभी/ sometimes
- Don't Know aht are they

43. Q41 यदि हाँ, तो कौन से फोर्टिफाइड स्टेपल या + F उत्पाद आप वर्तमान में खरीद रहे हैं? (कई विकल्प चुन सकते हैं)If yes, which fortified staples or +F products are you purchasing currently? (Can choose multiple options

Check all that apply.

- [ ] 1. चावल/ Rice
- [ ] 2. गेहूँ/ Wheat Flour
- [ ] 3. दूध/Milk
- [ ] 4. नमक/ Salt
- [ ] 5. तेल/ Oil

Other: [ ] _____

44. Q42 Are you consuming any Multivitamin tablets currently? क्या आप वर्तमान में किसी भी मल्टीविटामिन गोलियों का सेवन कर रहे हैं? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ sometimes

45. Q43 Do you Purchase and store any of the following staples for a year. क्या आप एक वर्ष के लिए निम्नलिखित स्टेपल में से किसी को खरीद और स्टोर करते हैं *

Mark only one oval.

- ◯ Rice
- ◯ Wheat Flour or Wheat
- ◯ Salt
- ◯ Oil
- ◯ I do not store/मैं स्टोर नहीं करता

46. Any Suggestions for this questionnaire

_____

ANNEXURE - II

PERMISSION LETTER

Date: 8th Dec 2020

To
Dean
Faculty of Family and Community Sciences
The M.S. University of Baroda

Respected Ma'am

This is Ria Ahuja, PhD Scholar from the Foods and Nutrition Department pursuing Doctoral Research on ***Action Research on Advocating Use of Fortified Foods in the Free-Living Population of Urban Vadodara using Diffusion of Innovation Model*** 'Under Prof. Mini Sheth.

For the study purpose, I would like to acquire contact details of all the students enrolled in the 'Faculty of Family and Community Sciences' from the respected departments. Students will be approached through call /emails from the contact details listed below:
Contact No. 7490029622/7226065522
Email Id: Ria.ahuja-fnphd@msubaroda.ac.in

This is to request you to kindly allow me to gather the contact details of the students, which will remain confidential with me and will be used only for the research purposes.

Thanking you
Ria Ahuja

Guide
Prof. Mini Sheth
F.N. Dept

Dean
Dean
Faculty of Family and Community Sciences
The M. S. University of Baroda
Vadodara

Prof. & Head
Dept. of Foods and Nutrition

ANNEXURE - II

Post Assessment Form-Fortification Study

Post- Assessment Form

Contact Details
Ria Ahuja (PhD Scholar) 7226065522
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* Required

1. Email

_____

2. Name

_____

3. Contact Number that you have shared with us

_____

4. Q1. Name (व्यक्ति जो परिवार के लिए किराने का सामान खरीदने के लिए जिम्मेदार है, उसे फॉर्म भरना है) मुझे लगता है कि अब मैं फोर्टीफाइड फूड्स खरीदूंगा

_____

Questionnaire on Knowledge

5. Q1 आपने फोर्टीफाइड खाद्य पदार्थों के बारे में कहां से सीखा?From where you learn about Fortified foods?

Mark only one oval.

- ◯ 1. प्रिंट मीडिया (समाचार पत्र, पत्रिका) 1. Print Media (Newspaper, Magazine)
- ◯ 3. घर के बाहर या बाहर मीडिया (बिल बोर्ड, पोस्टर, डैंगलर्स) Outdoor Media
- ◯ 4. इंटरनेट Internet
- ◯ 5. From This Study इस स्टडी से

6. Q2 फोर्टीफाइड फूड्स के बारे में आप क्या जानते हैं? वे आपके अनुसार क्या हैं?What do you know about Fortified Foods? What are they according to you?

Mark only one oval.

- ◯ 1. सूक्ष्म पोषक खाद्य पदार्थ/ 1. Micronutrient rich foods
- ◯ 2. कम चीनी वाले खाद्य पदार्थ/2. Foods with less sugar
- ◯ 3. जोड़े गए संरक्षक के साथ खाद्य पदार्थ/3. Foods with added preservatives
- ◯ 4. खाद्य पदार्थ जो कमी पर काबू पाने में मदद करते हैं/4. Foods that help in overcoming deficiency
- ◯ 5. पता नहीं/5. Don't Know
- ◯ Other: _____

7. Q3 आपके अनुसार फोर्टिफिकेशन का 'लोगो' क्या है?According to you what is the logo for Fortification? *

Mark only one oval.

◯ Option 1

◯ Option 2

◯ Option 3

8. Q4 क्या आप जानते हैं कि खाने के पैकेट पर फोर्टिफिकेशन 'लोगो' कहाँ पाया जाता है?Do you know where Fortification logo is found on the food packet? *

Mark only one oval.

- 1 फ्रंट लेबल/ front Label
- 2. बैक लेबल/ Back Label
- 3. लेबल के पक्ष/ sides of the label
- 4. पता नहीं/ Don't know

9. Q5 आपके मौजूदा ज्ञान के अनुसार, FSSAI 2018 विनियम के तहत मुख्य फोर्टीफाइड फ़ूड क्या हैं (आप एक से ज़्यादा जवाब चुन सकते है)According to your existing knowledge, what are the MAJOR food that is being fortified from the following under FSSAI 2018 Regulations? (You can choose multiple answers) *

Check all that apply.

- [ ] 1. चावल/ Rice
- [ ] 2. बिस्कुट/ Biscuit
- [ ] 3. चीनी/ Sugar
- [ ] 4. गेहूं का आटा/ Wheat Flour
- [ ] 5. परिष्कृत आटा/Refined Flour
- [ ] 6. नमक/ Salt
- [ ] 7. दूध/ Milk
- [ ] 8. शीतल पेय/ Soft Drinks
- [ ] 9. तेल/ Oil
- [ ] 10. उपरोक्त में से कोई नहीं/ None of the above

10. Q6 फोर्टिफाइड फूड्स का सेवन किसे करना चाहिए:Fortified Foods should be consumed by: *

Mark only one oval.

- 1. महिलाओं / Females
- 2. नर/ Males
- 3. बूढ़े लोग/ Elderly
- 4. सब लोग/ Everyone
- 5. किशोर/ Adolescent girls and boys
- 6. पता नहीं/ Don't Know

Attitude Questions फोर्टीफाइड फूड्स के बारे में विचार . Questions below have some fact statements, please tell us your views about it / नीचे दिए गए प्रश्नों में कुछ तथ्य कथन हैं, कृपया हमें इसके बारे में अपने विचार बताएं

11. Q7 नियमित रूप से फोर्टिफाइड फूड्स का सेवन शरीर को नुकसान पहुंचा सकता है। आपकी क्या राय है? बयान करे. Consumption of Fortified staples regularly can harm the body. What is your opinion regarding the statement? *

Mark only one oval.

- 1. Agree/ सहमत
- 2. Disagree/असहमत
- 3. Neutral/Uncertain/तटस्थ / अनिश्चित

12. Q8 फोर्टीफ़िएड फूड्स की कीमत बहुत कम है, थोड़ा खर्च करने से आपकी सेहत को लाभ मिल सकता है और एनीमिया जैसी बीमारिया मिट सकती है, आपका क्या विचार है ? The incremental cost of food fortification is minimal. By incurring these minimal costs, the disease burden of widely prevalent problems like anemia can be reduced. What is your opinion regarding the statement? *

Mark only one oval.

- 1. Agree/ सहमत
- 2. Disagree/असहमत
- 3. Neutral/Uncertain/तटस्थ / अनिश्चित
- Don't know

13. Q9 फोर्टीफाइड फूड्स सूक्ष्म पोषक तत्वों की कमी को दूर करने में मदद करेंगे। आपकी क्या राय है?Fortified Foods will help in overcoming micronutrient deficiency. What is your opinion regarding the statement? *

Mark only one oval.

- 1. सहमत / Agree
- 2. असहमत/ Disagree
- 3. तटस्थ / अनिश्चित / Uncertain
- Don't Know

14. Q10 फोर्टीफाइड फूड्स का सेवन हर किसी को करना चाहिए चाहे वह कीसी भी उम्र, या लिंग का हो। क्या है आपकी राय? Fortified foods should be consumed by everyone irrespective of age, sex and gender. What is your opinion about the statement? *

Mark only one oval.

- 1. सहमत / Agree
- 2. असहमत/ Disagree
- 3. तटस्थ / अनिश्चित / Uncertain
- Don't Know

15. Q 11 , नॉन फोर्टिफाइड की तुलना में फोर्टिफाइड फूड का अलग स्वाद /गंध होगा ,आपकी क्या राय है?Fortified foods will have different taste, smell as compared to Non-fortified foods *

Mark only one oval.

- 1. हां, ऐसा हो सकता है / Yes, its possible
- 2. नहीं, मुझे ऐसा नहीं लगता/ I don't Think so
- 3. अनिश्चित / Unsure
- Don't Know

16. Q12 यदि पसंदीदा ब्रांड में फोर्टिफाइड फूड उपलमब्ध नहीं है । दूसरे ब्रांड में शिफ्ट होना अच्छा है जहाँ फोर्टिफाइड खाद्य पदार्थ उपलब्ध हैं। आपकी क्या राय हैं?If the preferred brand is not fortifying its product. It is a good idea to shift to other brands where fortified staples are available. What is your opinion *

Mark only one oval.

- 1. सहमत/ Agree
- 2. असहमत/ Disagree
- 3. तटस्थ / अनिश्चित/ Unsure

Practice Questions

17. Q13 क्या आप वर्तमान में अपने दैनिक आहार के हिस्से के रूप में फोर्टिफाइड स्टेपल खरीद रहे हैं?. Are you currently purchasing Fortified staples as a part of your daily diet? Foods with +F logo *

Mark only one oval.

- ◯ 1. हां/ yes
- ◯ 2. नहीं/ no
- ◯ 3. कभी-कभी/ sometimes
- ◯ Don't Know What are they

18. Q14 यदि हाँ, तो कौन से फोर्टिफाइड स्टेपल या + F उत्पाद आप वर्तमान में खरीद रहे हैं? (कई विकल्प चुन सकते हैं)If yes, which fortified staples or +F products are you purchasing currently? (Can choose multiple options

Check all that apply.

- ☐ 1. चावल/ Rice
- ☐ 2. गेहूँ/ Wheat Flour
- ☐ 3. दूध/Milk
- ☐ 4. नमक/ Salt
- ☐ 5. तेल/ Oil
- ☐ Other: _____

19. Q15 Are you consuming any Multivitamin tablets currently? क्या आप वर्तमान में किसी भी मल्टीविटामिन गोलियों का सेवन कर रहे हैं? *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ sometimes

20. Q16 फोर्टिफाइड स्टेपल के बारे में जानने के बाद। फोर्टिफाइड के लिए आपका क्रय अभ्यास क्या होगा*After knowing about fortification. What's going to be your purchasing practice for fortified foods *

Mark only one oval.

- 1. इसे नहीं खरीदेंगे/ Will not Buy
- 2. जल्द ही इसे खरीद लेंगे और कोशिश करेंगे/ Will soon Purchase
- 3. पहले से ही खरीद शुरू/ Already purchasing

21. Q17 यदि आप फोर्टीफाइड फूड्स खरीदने के पक्ष में नहीं हैं, तो इसका क्या कारण है? (परसेप्टिव बैरियर)If you are not in favor of purchasing Fortified Foods, What is the reason?

Mark only one oval.

- will Purchase
- Will not Purchase
- Already Purchasing
- Other: _____

22. Q18 Since when you started buying fortified products? आपने फोर्टीफ़िएड फूड्स का सेवन कबसे शुरू किआ

Mark only one oval.

- After our study इस स्टडी के बाद
- Before our study इस स्टडी से पहले

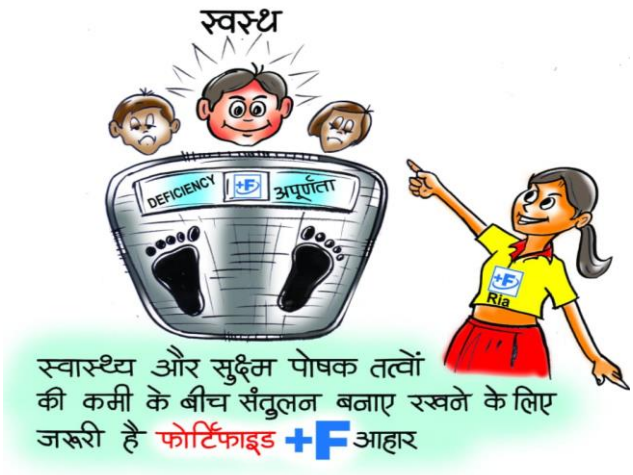
23. Q19 If after study, please answer when . अगर स्टडी के बाद, तो बताये कबसे

Mark only one oval.

- 1st week
- 2nd week
- 3rd week
- 4th week
- 5th week

Annexure IV

Graphics Designed for the Intervention for Promoting Fortified Foods amongst the subject

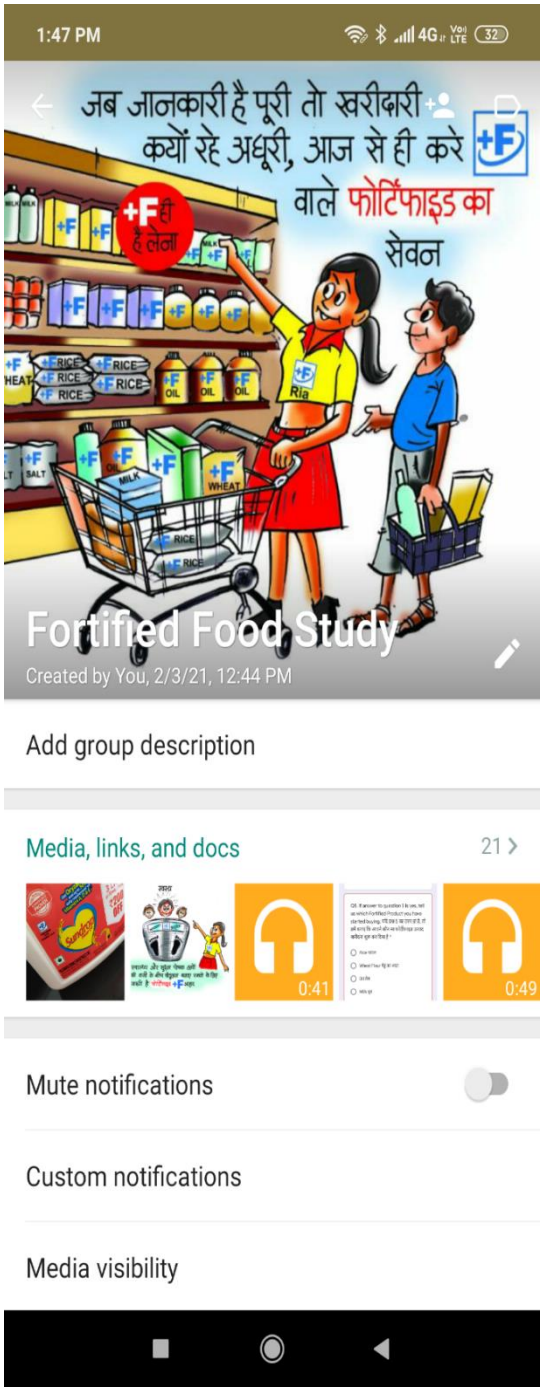


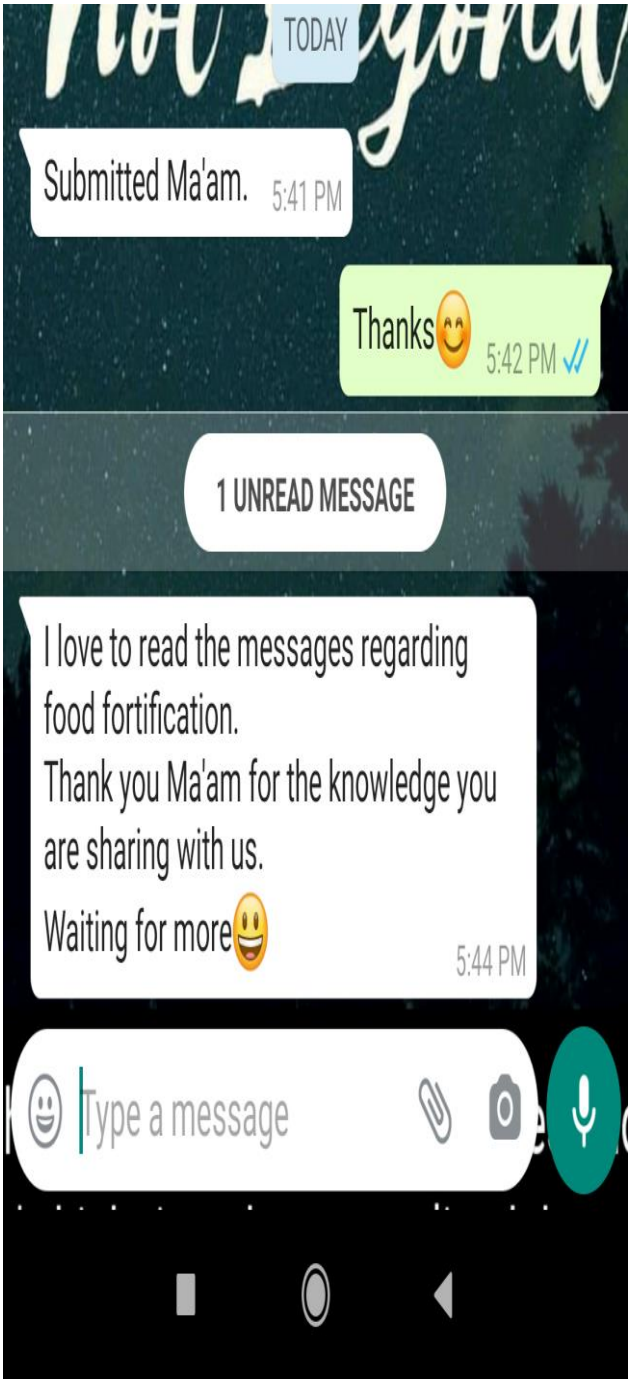
Annexure IV (cotd.)

Graphics Designed for the Intervention for Promoting Fortified Foods amongst the subject

Annexure V

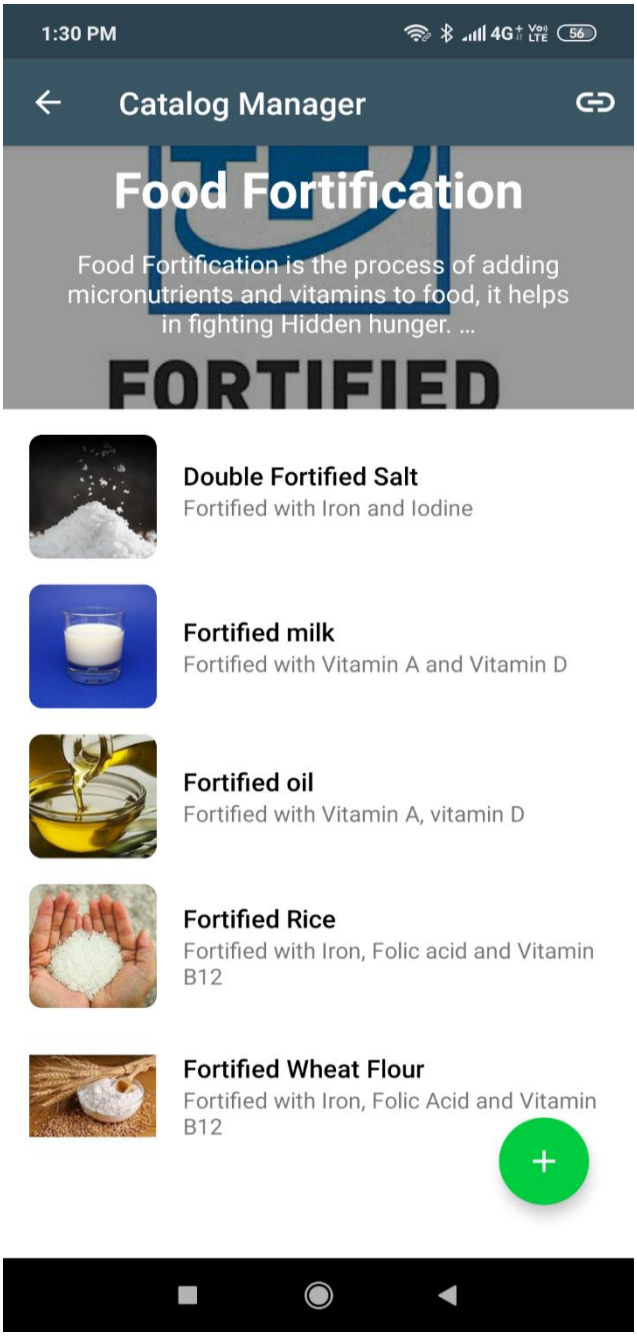
Glimpses of Intervention Chat group and Messages

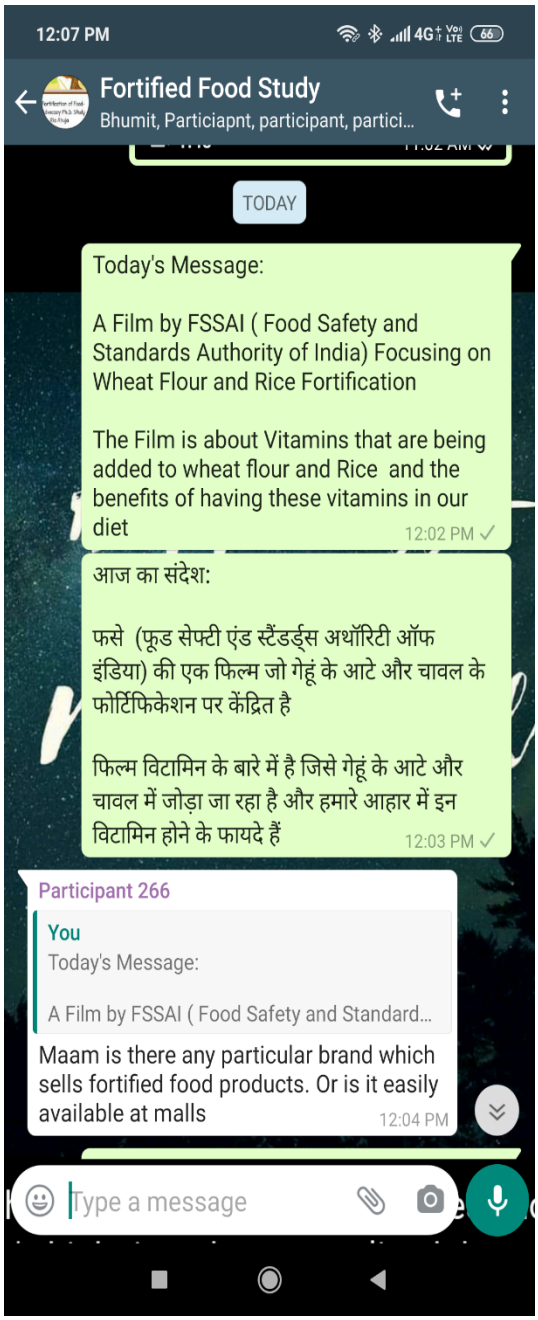




Annexure V (cotd.)

Glimpses of Intervention Chat group and Messages





Purchase of Fortified Foods- Washout

Hello Everyone

I hope you all remember that i shared messages on WhatsApp with you regarding Fortified Foods.
This is in continuation to know that whether you are still purchasing fortified foods or not
Please help us to know about your purchase of fortified foods by filling this 3 question form

i will be thankful to you and remember you for being a wonderful participant of my Ph.D. Journey

Regards
Ria Ahuja

सभी को नमस्कार

मुझे आशा है कि आप सभी को याद होगा कि मैंने आपके साथ व्हाट्सएप पर फोर्टिफाइड फूड्स के बारे में संदेश साझा किए थे।
यह जानने के लिए जारी है कि क्या आप अभी भी गरिष्ठ खाद्य पदार्थ खरीद रहे हैं या नहीं
कृपया इस 3 प्रश्न फ़ॉर्म को भरकर अपनी गढ़वाले खाद्य पदार्थों की खरीद के बारे में जानने में हमारी मदद करें

मैं आपका आभारी रहूंगा और अपने पीएच.डी. का एक अद्भुत प्रतिभागी होने के लिए आपको याद करूंगा।
सफ़र

सादर
रिया आहूजा

* Required

1. Email *

2. Are you currently Purchasing any Fortified Food?क्या आप इस समय कोई फोर्टिफाइड फूड खरीद रहे हैं? *

Check all that apply.

- [ ] Yes हां
- [ ] No नहीं
- [ ] sometimes कभी - कभी

3. If yes, which Fortified Food are you Purchasing?यदि हां, तो आप कौन सा फोर्टिफाइड फूड खरीद रहे हैं? *

Check all that apply.

- [ ] Fortified Rice चावल
- [ ] Fortified Wheat Flour गेहूं का आटा
- [ ] Double Fortified Salt नमक
- [ ] Fortified Oil तेल
- [ ] Fortified Milk दूध
- [ ] Not Buying ख़रीद नहीं
- [ ] Other: _____

4. Please Choose the Correct Fortification Logo used in India कृपया भारत में उपयोग किए जाने वाले सही किफोर्टीफ़िएड लोगो का चयन करें *

Check all that apply.

- [ ] Option 1

- [ ] Option 2

Annexure - VI (a)

Sunday Assessment Form

* Required

1. Email *

2. Contact Number that you have shared with us. संपर्क नंबर जो आपने हमारे साथ साझा किया है *

3. Q1. The messages that are being shared with you on Whatsapp are insightful. व्हाट्सएप पर आपके साथ साझा किए जा रहे संदेश आपको ज्ञानवर्धक हासिल करने में मदद कर रहे हैं *

Check all that apply.

- [ ] Yes
- [ ] No

4. Q2. I have Learnt about Fortified Foods from the messages shared on whatsapp मैंने व्हाट्सएप पर साझा किए गए संदेशों से फोर्टीफाइड फूड्स के बारे में सीखा है *

Check all that apply.

- [ ] Yes
- [ ] No

5. Q3. I think i will now buy Fortified Foods. मुझे लगता है कि अब मैं फोर्टीफाइड फूड्स खरीदूंगा *

Check all that apply.

- [ ] Yes
- [ ] NO

6. Q4.I have already started buying Fortified Foods मैंने फोर्टीफाइड फूड्स खरीदना शुरू कर दिया है *

Check all that apply.

- [ ] Yes
- [ ] NO

7. Q5. If answer to question 4 is yes, tell us which Fortified Product you have started buying. यदि प्रश्न 5 का उत्तर हां है, तो हमें बताएं कि आपने कौन सा फोर्टीफाइड उत्पाद खरीदना शुरू कर दिया है

Mark only one oval.

- ◯ Rice चावल
- ◯ Wheat Flour गेहूं का आटा
- ◯ Oil तेल
- ◯ Milk दूध
- ◯ Double Fortified Salt नमक

Annexure VII

Glimpses of Intervention Videos

Annexure VII (cotd.)

Glimpses of Intervention Videos

Annexure VII (cotd.)

Glimpses of Intervention Videos