
Introduction

CHAPTER 1

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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