A Review: Food Fortification and their Role in Iron Fortification

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***Abstract*— Fortification is a vital method in improving the nutritional status in certain population. The well-known example for fortification is the addition of iodine in the salt to prevent iodine deficiency disorder. Iron deficiency anaemia (IDA) is the most noticeable emergence across globally. Still, it is not a well-solved condition in developed and developing countries. Anaemia is a condition of red blood cells deficiency (haemoglobin) results in decrease of oxygen carrying capacity. Iron compounds vary in function such as oxygen transportation, DNA synthesis, metabolism and some essential function. Food fortification in such micronutrient is a valid technology that involves the most successful strategies in function to prevent those micronutrient deficiencies.**

***Index Terms:* Food Fortification, Iron deficiency anaemia, Iron fortificants, Iron fortification, Supplementation.**

I.INTRODUCTION

Fortification is a process of incorporating micronutrients to the food products. The world has been urged in the work of generation of the fortified and well processed nutrient diet. The three approaches for food fortifications are mass, targeted, and market driven. The incorporation of micronutrients to the desired products that are given to the people is called as mass fortification. The fortification of foods specifically designed for a particular population aimed for the target nutrient achievement. The process that the incorporation of desired micronutrients to the food by the manufacturer for the purpose of increasing sales and profit [2]. Food fortification is more demanded in all developing countries to prevent against deficiencies of micronutrient, but the establishment is too difficult. Most of the fortified food became successful in large scale food production. The 6-month efficacy trials have been established that fortification of fish sauce with iron can improve iron content and reduce iron deficiency[1]. This review paper approaches the outline regarding the food fortification and their affiliate.

II.FOOD FORTIFICATION

Food fortification refers to adding of nutrient rich compounds the processed foods which are preferred to consume. By the World Health Organization (WHO) and Food and Agriculture Organization (FAO), the food fortification is recognized as one of the top methods for the decrement of micronutrient deficiency at global level [1]. It is also absolutely need a use of fortificants which are well absorbed by the foods without affecting the sensory properties of foods. In many cases, the usage of food vehicles which are processed centrally were preferred and to shave the aid of the food industry. In the surrounding where the existing supply of food and the access which was limited were unsuccessful to meet the daily nutritional requirements of the population, Food fortification emerge as a valid technology to narrow down the micronutrient deficiencies. Food fortification strengthens the environment by supporting the actions that improve the nutrition in foods and thereby playing a major role in the prevention of micronutrient deficiencies and improving the health status of the targeted population. Particularly in the zone having epidemiological evidence of lack of nutrition, food fortification can be seen as a restorative medicinal approach [2].

III.ENRICHMENT VERSUS FOOD FORTIFICATION

Food fortification is the incorporation of desired and essential nutrients to the food products to deliver. Food fortification aims at reducing the deficiencies of nutrient [3]. The main purpose of food fortification may be looking public health policy to minimize and overcome all nutrient deficiencies, or it may be a commercial reason to produce a new product with innovation. In some cases, the regions that people live influence their health with some deficiency. The four main methods of food fortification are: 1) Bio-fortification 2) Synthetic biology 3) Commercial and industrial fortification 4) Home fortification [3].

Enrichment can be defined as a process of adding micronutrients when they are destroyed while processing food. In case of enrichment, the micronutrients such as vitamins etc., which are already present in the food, but they are vanished because of many processing food products.

IV.DIETARY DIVERSIFICATION

Dietary diversification is the increase in the variety of nutrient rich foods. Therefore, by accelerating this dietary diversification we could escalate the quantity of nutrient food consumption. Escalating dietary diversification is the most recommended way of increasing the nutrients in individual since it has the capability to increase the intake of variety of micronutrient rich foods. Abiding researches suggests that these micronutrients rich food could prevent people from the non-communicable diseases since these foods supply with a range of antioxidants and probiotic substances which enhance the immunity function in individual. However, as a control measures that is used to fight the battle against the micronutrient deficiencies by increasing the dietary diversification, it has its own limitations, the major issue is that one should possess the behaviour of adopting to the fortified foods and the education about the nutritive values of the fortified foods. Therefore, we should ensure that enough programs were conducted to know about the dietary diversification and food fortification[24].The animal source foods in dietary are being recognized widely and initiatives should be taken to increase their production and ensure the availability for the poorer targeted populations. For infants, the sure-enough way that protect from the nutrient deficiency is providing a diet of breast milk. Moreover, the mothers feeding the infants with their breast milk should consume a healthy diet as much as possible, which in-turn reflects in milk secreted. Moreover, dietary diversification is generally considered as the most advisable and long-lasting option to overcome micronutrient deficiencies among targeted population [25].

V. STEP TO INCREASE FOOD FORTIFICATION

Food fortification has decreased the occurrence of micronutrient deficiencies which was a former common issue and help people to sustain their dietary requirements. Countries need to take up and meet with a compendious approach that the reasons for malnutrition are “hidden hunger” which results in poverty [22].

Government policies and programmes must include the steps and strategies which are food based to ensure the decrease in the deficiencies of micronutrients such as food fortification. The three options dietary diversification, food fortification and supplementation, which are intended at increasing by the consumption of micronutrients, programmes that deliver the fastest improvement in the health status of the targeted people who suffers from micronutrient deficiencies and to enjoy a healthy and fruitful life. In India, to safeguard nutritional crisis several steps have been taken such as the development of nutria-farms concept which includes the farming of rice, maize, wheat, pearl millet and finger millet and the Mid-day meal Scheme which was served with increased content of micronutrients, proteins, vitamins and minerals to the targeted population and several schemes that promote the healthy life of people such as Integrated Child Development Scheme, development of efficient public distribution system[23].

VI.FOOD VEHICLES SELECTION

The selection of food vehicles is broadly classified into three (a) consumption (b) processing/storage (c) marketing.

The consumption should support the following: It should cover the high proportion of the population and consumption in constant certain amounts. The serving size of the micronutrient to diet is the main part in consumption. It should not relate any socio-

economic status and the potential of the excessive should be low and stable to avoid any probable toxicity. Substances which restrict the iron absorption would not be suitable vehicles [21]. So that the vehicle should not contain other nutrients and affected by the added iron.The processing should have the following: It should be processed and centralized and the low-cost technology [18]. Good masking qualities are approached to slight changes I n the original colour and odour. It should possess the high stability and bioavailability in the micronutrient added to the final product, and the segregation of fortification and vehicle should be minimal. It should be the property of good stability while storing and ensure in the interaction of the micronutrient added [5].

The marketing should have the following: to ensure stability in the standard labelling and packaging.

VII. IRON FORTIFICANTS

Iron fortificants are classified on the basis of solubility, such as (a) water soluble; (b) poorly water soluble but soluble in dilute acids; and (c) protected iron compound [4].The more soluble in gastric juice or water, the higher the rate of bioavailability in iron fortificants.

The bio available iron fortificants often cause flavors and colors which cannot be accepted in many food vehicles. Iron fortificants may cause organoleptic problems in food vehicles in cases. Ferrous sulphate is the most commonly used bioavailability in Iron fortificants which is water soluble fortificants. It is chemically reactive and unacceptable flavors and colors in food vehicles. Ferric orthophosphate, ferric pyrophosphate which are not cause an organoleptic problems, they are water soluble but poorly soluble in dilute acids. Ferrous citrate, ferrous fumarate ferrous tartrate, ferrous succinate causes fewer organoleptic problems; they are come under the compounds of poorly soluble in water and insoluble in dilute acids.

VIII. STRATEGIES FOR IMPLEMENTATION OF IRON FORTIFICATION

Procter and gamble were worked on implementation and ensuring iron fortification foods and products. They have proposed a model called “Sustainable Food Fortification Program”.

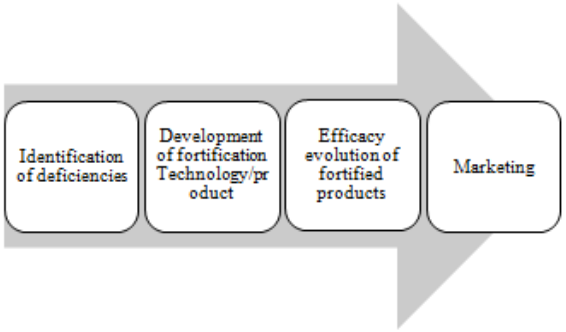

Fig1: Progress of food fortification program [26].

The progress of success key elements for sustainable food fortification program was listed. They were 1. To know the high rate deficiencies. By identifying the deficiencies in the target people, the steps can be rise accordingly. 2. Fortification technology and their products have been developed for the deficiencies. 3. Evaluating the fortified food effects among the consumer. 4. The fortified foods were produced and distributed in the market. 5. Educating the people about the iron fortified foods. 6. Marketing the products for all the target people.

IX.IRON FORTIFIED FOODS – DISTRIBUTION

Recently, the industrial and food fortified programs mainly focused on iron fortification on the basis of development, research and evaluation. When IDA alleviate it tends to increase the fortified product to the target people. It is not planned to distribute earlier, this leads to give more attention in the manufacturing, packaging, quality control and distribution. Therefore, the fortified foods become unrecognized and the barriers to the victory and sustainable to the iron fortified program.

Industry and production sector play an important role in the manufacturing and processing of the fortified foods specifically. It should always retain their standards in production. They should take the responsibility in the production of fortified food in their quality, time acquired, level of standards, level of iron claimed in the food package and the stability of product’s shelf life [6].

X.REDUCTION OF IRON DEFICIENCIES IN INFANTS THROUGH FOOD FORTIFICATION

Infancy is the period where rapid physical, immunological and mental growth takes place.

Therefore, it is very essential to make sure that the required nutrition is provided during their first year. The infant's nutritional requirement is supplied through breast milk for the first six month, and afterwards the required nutrients are supplied with the external intake of foods. There are several reasons such as their food choices, amount of nutrients intake which in turn leads to malnutrition. Therefore, the efficient strategy to eliminate the malnutrition and deficiency among the targeted population is to supply with fortified foods. The infant should be fed with the iron fortified foods around 9 to 12 months. Fruit juices should be provided along with cereal grain to improve the absorption of iron [15]. It is recommended to avoid cow's milk and to provide the infant with breast milk as long as it possible, since the cow's milk has low iron content and lacks in iron absorption. They can also be supplied with iron fortified cereals which results in greater iron storage. The use of these iron fortified foods among the targeted infants is advised by the health professional of authoritative organization.

XI.IMPORTANCE OF RICE AND WHEAT IN IRON FORTIFICATION

In India, the anaemia rates are higher among children and women at their reproductive age than compared to men. In order to overcome this anaemic condition among the targeted people, measures needed to be acquired. In our country rice and wheat are the major staple crops consumed. International Rice Research Institute (IRRI) and the International Maize and Wheat Improvement Centre (CIMMYT) were being bred of rice and wheat for higher iron content in the Harvest Plus Programme. In northern states, wheat consumption is higher whereas in southern states consumption of rice is higher. Therefore, iron fortification programs through rice and wheat should be implemented. Among the other cereals and grains, the staple food such as rice and wheat account for about 50% to 60% of the total consumption. So, bio fortified rice and wheat lower the cases of anaemia. In this case we have to confirm that we have the enough production of bio fortified foods to meet the demands. The improvements of the iron intakes through bio fortified rice and wheat rely on the production these iron crops. Therefore, it has been planned to increase the iron trait and it will be bred more in rice and wheat crops in the forthcoming years.

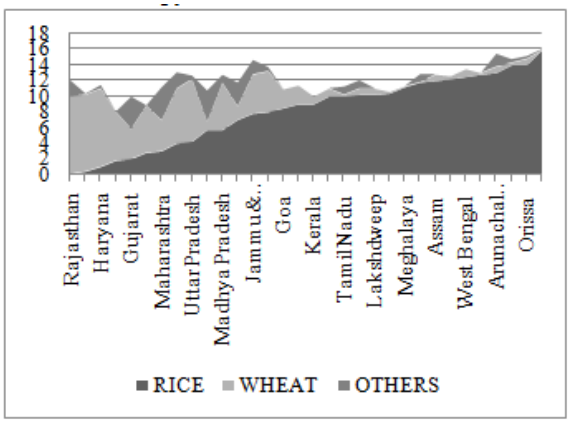

Fig 2: Cereal consumption in rural India [5].

XII. CONCLUSION

There are several factors that drive into degeneration of nutrients; thereupon befitting technology to reduce losses has to be executed. Food fortification help in managing micronutrient intakes and maintaining dietary patterns. Food fortification is very essential to national health as well as individual health to increase the nutritional level, and therefore, adoption of guidelines and regulations to minimize the losses is mandatory and in this adoption of regulation and guidelines, we should ensure apt implementation, to use processes that drives minimal losses, and choose packaging materials wisely that provide maximum protection [7]. Food fortification by government authorization and regulation is necessary along with cooperation from the food manufacturers and several private sectors and non-governmental organizations holding the policies such as the reduction of poverty and reforming agriculture. Food fortification and nutritional enrichment programs should be implemented targeting specific population and the effect of these programs is measured by making a report and this report should make sure that, whether the enriched foods are being accepted, purchased, and consumed by the targeted population.The achievement of the nutritional enrichment program is that, the improvement in the health status of the targeted population.

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