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Review: Rice Fortification

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ABSTRACT

Rice, also known as *Oryza sativa* in whatever form, is one of the main staple crops farmed in India and is a common food in many developing nations where Hidden hunger is a problem. This Review Paper Addresses that it presents a special chance to boost nutrition through the fortification of rice. A type of rice that has been upgraded with added nutrients to address nutritional deficiencies in a particular population is referred to as fortified rice, also known as bio-fortified rice or enriched rice. Rice is one of the most extensively consumed foods in the world and is a staple in many cuisines all over the world. It can account for up to 70% of a person's daily calorie consumption in low-income countries. Despite being an energy source, it is a poor supplier of micronutrients and has little nutritional value overall outside carbohydrates and proteins. The widespread consumption of rice presents an opportunity to narrow the nutritional gap in rice-eating populations through enhancing the nutritional value of rice. Through post-harvest fortification of rice, a wide range of vitamins, minerals, and other nutrients, including amino acids and fibers, can be added. The Indian government is also intrigued by this. In order to successfully combat malnutrition and encourage sustainable development

KEYWORDS :- *Oryza sativa* , Staple crops, Hidden hunger, Fortified Rice, Malnutrition, Sustainable development

INTRODUCTION

Nutrient deficiencies in the population must be addressed and prevented, especially in areas where the average diet lacks key nutrients. These are some major justifications for fortification. The most prevalent micronutrient deficiencies worldwide are those related to iron, vitamin A, iodine, and zinc (WHO 2009).[1]

Fortified rice can help combat significant nutritional shortfalls and lower the risk of associated health issues. Iron fortification is one strategy to address iron insufficiency. While vitamin A fortification can aid in the prevention of anemia, vitamin A deficiency, a major contributor to blindness in impoverished nations, can also be prevented. [1-2]

This Review paper highlighted the techniques of Fortification of rice and positive impact of Fortified Rice in our daily lives and on our health

TERMINOLOGY

1. **FORTIFIED KERNEL PART-** Vitamin and mineral premix kernels: A fortified rice product that resembles a rice kernel. Fortified kernels are those that are 10% the length of a rice kernel.[3]
2. **FORTIFICANT** - A substance, either chemical or natural, that is added to a particular food vehicle to boost its nutritional content is known as a Fortificant. [4]
3. **PREMIX** - a product created by combining the food vehicle with a significant amount of fortificants (such as through coating, dusting, or cold extrusion).
4. **FORTIFIED PRODUCT** - A product that has a Fortificante or nutrient added to it in the form of a premix at a specific ratio is known as a Fortified Product.
5. **FORTIFIED PREMIX** - The grains must be blended with natural rice, which is typically 1 part fortified premix to 199 parts untreated milled rice, to form fortified rice. The grains contain high concentrations of vitamins and minerals fortificants.[4]

TECHNIQUES USED FOR FORTIFICATION

In order to fortify rice, a coating of vitamins and minerals is typically applied to the rice grains. Depending on the demands of the population, different nutrients may be included in rice that has been fortified. Fortified rice frequently contains iron, folic acid, vitamin A, and other B vitamins.[5]

Depending on the specific nutrient or nutrients being added, rice can be fortified utilizing a variety of methods.[5-6]

Here are a few methods frequently used to fortify rice:

- 1) **Vacuum impregnation**: This method involves submerging the rice grains in a solution that contains the desired nutrients. The rice grains can be enhanced because the vacuum conditions make it easier for nutrients to penetrate the rice grains' outer layer. The rice grains are dried after impregnation to eliminate extra moisture and yield fortified rice. [8]
- 2) **Rice Bran Fortification**: Rice bran, the outer layer of the grain, can be enriched with nutrients and then reintroduced back to polished rice. In this method, the rice bran is extracted from the rice grains, then supplemented with the appropriate nutrients, and then reintroducing to the polished rice. When the rice is milled, the fortified rice bran blends with the polished rice results into fortified rice
- 3) **Dusting**: involves simply adding a micronutrient powder to the rice, which sticks to the grains by electrostatic forces. This method hasn't been successful because most developing nations' customary washing and cooking practices result in the enrichment being washed away. [7-8]

To solve this issue, three more sophisticated methods have been created.

- 1) **Extrusion Technology**: Rice fortification with extrusion technology is a widely used practice. This technique involves coating the rice grains with a powdered nutritious premix that contains the desired vitamins and minerals. The next step involves using an extruder to treat the rice grains at high pressure and temperature. Rice that has been enriched as a result of the heat and pressure which causes the nutrient premix to stick to the rice grains. The even distribution of nutrients across the surface of the rice is ensured by this procedure. [9]
- 2) **Coating Technology**: Rice can also be fortified through coating. This method involves coating or spraying the rice grains with a nutritional solution that contains the appropriate vitamins and minerals. The nutrition mixture might be either a liquid or a powder. The coating is retained by the Surface of rice grains providing the additional nutrients
- 3) **Fortified Premix**: To create fortified rice, the grains must be mixed with natural rice, which is typically 1 part fortified premix to 199 parts untreated milled rice. The grains contain high concentrations of vitamin and mineral fortificants.[8]

Cost-effectiveness, scalability, nutrient stability, sensory features, and regulatory requirements must all be taken into account when choosing the optimum method for fortifying rice.

Extrusion technology is the optimum technique for the following two categories of projects, according to these factors.[9-10]

1. Hot Extrusion

- a) Hot extrusion involves shaping a dough made of rice flour, a vitamin and mineral mix, and water into partially precooked grain-like structures that resemble rice grains;
- b) The structures are then combined with natural polished rice at a ratio of about 1:200 to produce fortified rice.
- c) This process uses steam-heated barrel jackets to transmit heat at relatively high temperatures (70 to 110 °C), or either preconditioning or both [10]

2) Cold Extrusion

- a) A similar procedure is followed in this method also at low temperatures (below 70 °C), which doesn't largely involve adding heat and results in opaque, uncooked enriched premix grains with a somewhat softer consistency.
- b) This is then combined with organic polished rice at ratio of about 1:200 to produced fortified rice [10-11]

It is frequently regarded as one of the most efficient and widely applied methods for fortifying rice. When determining the most effective method

1. Even Nutrient Distribution: Rice grains with nutrient premix are distributed evenly thanks to extrusion technology. The nutritious premix adheres to the surface of the rice grains uniformly as a result of the high temperature and pressure used in extrusion. As a result, the rice batch is consistently fortified, lowering the possibility of nutrient imbalance.

2. Scalability: Extrusion is a very scalable method that enables the mass manufacturing of rice that has been fortified. It makes it simpler to satisfy the demands of a large population because it is ideal for industrial-scale operations.

3. Nutrient Stability: Extrusion preserves the added nutrients' stability.

Typically, the heat and pressure used during extrusion do not harm the fortified vitamins and minerals ensuring that the nutrients remain bio-available and retain their nutritional value[12.]

4. **Cost-effectiveness:** When compared to various other fortification techniques, extrusion technology is thought to be more affordable. It enables effective production and may be easily integrated into current rice processing lines, lowering additional costs.

IMPORTANCE OF FORTIFIED RICE FOR INDIA

India has traveled a commendable journey from food deficit to food surplus, But they have to address malnutrition or food nutrition security. As in the recent Global Hunger Report (2023). Prepared by Concern Worldwide and Welthungerhilfe on the basis of following categories : Undernourishment , Child Stunting , Child Wasting, Child Mortality.

India Ranked 111 out of 125 countries or say Scored 28.7 on 100 point score which is a serious concern, thus we must take steps to move towards 0 (zero) hunger score (no hunger) and the Rice Fortification can play a major role in fulfillment of hunger with nutrition . [13]

1. **Malnutrition prevalence:** Malnutrition, including undernutrition and micronutrient deficiencies, is a serious problem in India. The National Family Health Survey-4 (2015–16) found that more than 35% of Indian children under the age of five have stunted growth (low height for age) and more than 50% have anemia.[14] By including vital nutrients, fortified rice can help address these shortages, By providing essential micronutrients like Iron, Vitamin A, Zinc and Folic acid .Which are crucial for healthy growth and development. [15]

2. **Rice consumption Patterns:**

In 2022, the domestic consumption volume of milled rice was over 109 million metric tons in India. A significant majority of the Indian population, notably in areas like West Bengal, Bihar, Odisha, and parts of South India, eats rice as a staple diet. Due to its widespread consumption and acceptance, rice can be fortified to serve as a potent delivery system for vital nutrients to the populace. With the use of fortification, specific dietary interventions can be made to improve nutrient intake while avoiding significant dietary modifications.[16-17]

3. **Effect on vulnerable groups:** Since children, pregnant women, and nursing mothers are particularly prone to nutrient shortages, fortified rice may have a significant impact on these particular populations. To combat the issue of anemia in children and women, a program for the distribution of fortified rice with prescribed micronutrients was introduced in October 2021. And also vitamin A insufficiency can lead to the major cause of blindness are serious concerns.[18]

4. **Government initiatives:** As a nutrition intervention, fortified rice is important, and the Indian government has acknowledged it. The Food Safety and Rules Authority of India (FSSAI) has established rules and recommendations for fortifying rice and promotes its use. [19] In April 2022 Cabinet Committee on Economic Affairs approved the utilization of fortified rice to improve the nutritional value through initiative like the Mid-Day Meal Scheme and Integrated Child Development Services (ICDS), Pradhan Mantri Poshan Shakti Nirman-PM POSHAN (erstwhile Mid-Day Meal Scheme) and other welfare schemes in all states by 2024 in a phased manner. [20]

5. **Effect on public health:** In India, the widespread use of fortified rice could have a positive impact on the nation's health. Malnutrition-related ailments, such as anemia, vitamin A deficiency disorders, and delayed cognitive development, can be prevented and their impact lessened by better nutrition. And Thus fortified rice helps in improving the population's general health and productivity, leading to healthier and more prosperous nation [21-22]

CONCLUSION

Fortification is the process of blending Fortified Rice Kernel (FRK), which contains FSSAI-prescribed micronutrients like iron, folic acid, and vitamin B12, in a ratio of 1:100 mixing 1 KG FRK with 100 KG custom milled rice (regular rice).

Fortified rice helps in fighting nutritional deficiencies and lower the risk of associated health issues. Lack of proper nutritional intake or absorption affects a large number of people worldwide. This may be as a result of restricted access to a variety of nutrient-dense foods or particular dietary behaviors. Deficits in certain nutrients can raise the chance of developing chronic diseases, stunt growth and development, weaken the immune system, and cause additional health problems.

It's important to note that the impact of fortified rice is most significant when it is part of a comprehensive approach to addressing nutrition and public health. Fortification should be combined with other strategies such as promoting a diverse and balanced diet, nutrition education, and improved access to healthcare and sanitation facilities to maximize its effectiveness. And also that regardless of the technique used, strict quality control measures and testing protocols are implemented to ensure the accurate and consistent fortification of rice with the desired nutrients, Fortification is a modern solution for Combating Malnutrition.

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