



## Fortification of Rice

**For Prelims:** [Fortification of Rice](#), [Food Safety and Standards Authority of India \(FSSAI\)](#), [World Health Organization](#), [Public Distribution System](#), [Nanotechnology](#).

**For Mains:** Benefits of Iron Fortification of Rice, Risks Associated with Iron Fortification of Rice.

### Why in News?

In a response to the **recent wave of criticism surrounding the distribution of iron fortified rice**, the Union Food Ministry has released an official statement dismissing the allegations levelled against the iron fortified rice.

### What is Fortification of Rice?

#### ▪ About:

- **Fortification** is the process of adding nutrients to food products that are not naturally present or are present in insufficient amounts.
- Fortification of rice can be **done by coating the rice grains with a premix of micronutrients, or by producing extruded rice kernels that are enriched with micronutrients and then blended with regular rice.**
  - According to [Food Safety and Standards Authority of India \(FSSAI\)](#) norms, 1 kg fortified rice shall contain **iron (28 mg-42.5 mg), folic acid (75-125 microgram) and Vitamin B-12 (0.75-1.25 microgram).**

#### ▪ Purpose:

- India has **very high levels of malnutrition among women and children.** According to the Food Ministry, every second woman in the country is anemic and every third child is stunted.
- Rice is a **source of protein and contains various vitamins.** Some nutrients, including **vitamin E, magnesium, potassium, and manganese, are lost during milling and polishing** (the process by which brown rice becomes white or polished rice).
  - **Rice** is one of the most **widely consumed staple foods in the world**, especially in Asia and Africa.
  - Per capita rice consumption in India is 6.8 kg per month. Therefore, **fortifying rice with micronutrients is an option to supplement the diet** of the poor.
- **Iron deficiency** also is a major public health problem that **affects more than two billion people globally**, causing anaemia, weakness, fatigue, impaired learning and increased risk of infections and maternal mortality.
  - To address this problem, **some countries have adopted the strategy of fortifying rice with iron and other micronutrients, such as folic acid and vitamin B12.**
  - Most of the iron we need comes from meat, which gets absorbed 50% by our body. Through vegetables, there is limited intake and only 3% absorption. **This is the reason why iron deficiency is a major problem in India.**

## Vitamin B12

- **Vitamin B12**, also known as **cyanocobalamin** is synthesized by most bacteria and algae with the help of enzymes.
  - It is synthesized in microorganisms that enter the human food chain through incorporation into food of animal origin.
  - It is also crucial to the **normal function of the brain and the nervous system**.
- **Deficiency of Vitamin B12 causes pernicious anaemia**. It is rarely caused due to lack of Vitamin B12 in the diet but because of the **absence of the intrinsic factor in the stomach leading to failure of absorption of Vitamin B12**.

## Folic Acid

- **Folate is the natural form of vitamin B9**, water-soluble and naturally found in many foods. It is also added to foods and **sold as a supplement in the form of folic acid**.
- Folic acid needs to be taken by pregnant women before conception.
  - Deficiency of folic acid in pregnant women leads to **Neural Tube Defects in the baby such as Spina Bifida**.
    - Spina bifida is a condition that **affects the spine and is usually apparent at birth**.
- **India & Southeast Asia & some parts of Africa** have the highest cases of neural Tube defects (4.7-9 per 1000 in Punjab & Haryana).
  - In the developed world, **it is less than 1 per 1000**.

## What are the Benefits of Iron Fortification of Rice?

- According to the [World Health Organization \(WHO\)](#), fortification of rice with micronutrients can be an **effective, simple and inexpensive strategy to improve the nutritional status and health outcomes** of populations that consume rice regularly. Some of the benefits of iron fortification of rice are:
  - **Improved Cognitive Development:** Iron plays a crucial role in **brain development and function**.
    - Adequate iron intake during early childhood is essential for optimal cognitive development and learning abilities.
    - By **fortifying rice with iron, particularly in regions where rice is a primary dietary staple, the potential for cognitive impairment due to iron deficiency can be reduced**, leading to improved cognitive performance and better educational outcomes.
  - **Enhanced Maternal and Infant Health:** Anemia is prevalent among pregnant women and can increase the risk of complications during [pregnancy and childbirth](#).
    - Iron fortification of rice can help **improve the iron status of pregnant women**, reducing the occurrence of maternal anemia and the associated risks. Additionally, adequate iron intake during pregnancy is essential for fetal development and can contribute to healthy birth outcomes.

## What are the Risks Associated with Iron Fortification of Rice?

- **Chances of Ineffectiveness:**
  - It **may not be sufficient to meet the iron requirements of all individuals**, especially those with high needs or **low bioavailability of iron**.
  - Bioavailability of iron refers to the **proportion of iron that is absorbed and utilised by the body**, which depends on several factors such as the **type and amount of iron compound used for fortification**, the **presence of enhancers or inhibitors of iron absorption in the diet**, and the physiological status and genetic variation of the individual.

- **Adverse Effects on Sensitive Individuals:**
  - It may cause **adverse effects in some individuals who have excess iron intake or accumulation**. Excess iron can be toxic to the body and cause **oxidative stress, inflammation, organ damage** and increased risk of infections and chronic diseases.
    - Some groups that may be at risk of excess iron intake or accumulation are those with **genetic disorders such as hemochromatosis or thalassemia**, those with liver diseases or infections such as hepatitis or **malaria**, and those who consume other sources of fortified foods or supplements.
- **Barriers Abound:**
  - It may face **technical, regulatory or social barriers to implementation**.
    - Technical barriers include ensuring the **quality, stability and safety of the fortified rice products**;
    - Regulatory barriers include **establishing and enforcing standards, guidelines and monitoring systems for fortification**;
    - Social barriers include ensuring the **acceptability, affordability and accessibility of the fortified rice products** among consumers and stakeholders.

## Way Forward

- **Deploying Nanotechnology:** There is a need to **explore the use of nanotechnology to encapsulate iron particles and enhance their bioavailability**.
  - Nanoparticles can be engineered to **increase iron absorption by improving solubility and preventing interactions with inhibitors present in rice**.
- **Blending Iron Fortification with Biofortification:** There is a need to combine iron fortification with **biofortification strategies**.
  - Biofortification involves **breeding crops with higher nutrient content**, including iron, through **conventional breeding techniques**.
  - By integrating iron fortification and biofortification, we can **develop rice varieties that are naturally enriched with iron**.
- **Public-Private Partnerships:** There is a need to foster collaborations between **governments, research institutions, private sector entities, and NGOs to promote and scale up iron fortification efforts**.
  - These partnerships can facilitate the development of innovative technologies, funding mechanisms, and distribution networks for iron-fortified rice.
- **Continuous Research and Development:** There is a need to encourage ongoing research and development to explore **new technologies, formulation methods, and fortification techniques**.
  - Regularly assessing the efficacy and impact of iron fortification programs is required to identify areas for improvement and innovation.

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