सत्यमेव जयते

Goverment Of India

Department of Food & Public Distribution

Pilot Scheme

Fortification of Rice and its Distribution under Public Distribution System

OPERATIONAL GUIDELINES

सत्यमेव जयते

Foreword

Fortification involves addition of minute quantities of missing vitamins and minerals in our diet to commonly consumed staples such as rice, wheat flour, salt, and milk. Increased intake of micronutrients through fortification has contributed to the virtual elimination of several deficiency diseases.

Rice fortification has the potential to have a wide impact, as it is a staple food for 65% of the Indian population, reaching the most vulnerable and poorest sections of the country. It has the highest offtake in the Government safety net programs such as the Public Distribution System (PDS), the Mid-Day Meal program (MDM), the Integrated Child Development Services (ICDS) program with the potential to reach 800 million vulnerable people in India, especially women and children. The Government of India has included food fortification, including rice fortification, under the National Nutrition Mission (Poshan Abhiyan) as a complementary intervention to reduce the prevalence of anaemia and malnutrition in India.

The Department of Food and Public Distribution, Government of India has approved a Centrally Sponsored Pilot Scheme on Fortification of Rice & its Distribution under Public Distribution System. During the initial phase of the implementation, the Pilot Scheme will cater to the requirement of selected fifteen Districts in the country, one District per State/UT. The scheme will help to institutionalize rice fortification through the existing safety net programs in India.

To facilitate its effective implementation the Department, in consultation with other stakeholders has developed these Operational Guidelines, and I hope the States would find it very useful in effectively planning and implementing the Pilot Scheme.

I acknowledge the contribution of Shri S. Jagannathan, Joint Secretary for his strategic insight and Shri K.M.S. Khalsa, Deputy Secretary for his able leadership and programmatic insights along with dedicated efforts in developing and finalizing these guidelines.

As India is committed to the value of well-being of its population, I hope these efforts will translate into providing nutrition security and tangible health benefits to our citizens.

RAVIKANT

Secretary, Department of Food & Public Distribution

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Preface

Malnutrition manifests itself in many forms – deficiencies or excesses of macronutrients and micronutrients. Micronutrient or vitamin and mineral deficiencies affect more than 2 billion people worldwide and are especially prevalent in developing countries including India[1]. Conditions due to vitamin and mineral deficiencies account for 7.3 percent of the global disease burden[2].

The deficiencies of vitamins and minerals often go unnoticed. Hence, it is also referred to as 'hidden hunger'. Although hidden hunger rarely shows visible signs, its consequences are long lasting and devastating. Around the world, pregnant women and children under 5 years of age are at the highest risk of micronutrient deficiencies which contribute towards poor growth, intellectual impairment, prenatal complications, and increased risk of morbidity and mortality. Of greatest concern is the fact that the cycle of micronutrient deficiencies perpetuates across the generations, with far reaching consequences on the future population.[3]

India is home to about 60 percent of anaemic preschool children, 50 percent of anaemic pregnant women, and a quarter of anaemic men.[4] Anaemia is pervasive and continues to exist across the population, income quintiles and age groups. Iron deficiency anemia contributes to half of all anemia cases and results in 8 point lower intelligence quotient (IQ) in children. In addition to Iron deficiency, other vitamin mineral deficiencies such as Vitamin A, vitamin B_{12}, folic acid, zinc, continue to co-exist and have a devastating effect on the health and the productivity of the population. These nutrients also have an important role in preventing anemia and are termed as hematopoietic nutrients (Iron, folic acid, Vitamin B_2, Vitamin B_{12}, Vitamin B_6, Vitamin C).

Daily intake of micronutrients as against the Recommended Dietary Allowances (RDA) reflects a gap for most micronutrients for all age-groups and both sexes. As per the National Nutrition Monitoring report, more than 50 percent of the population across any age group consumes less than 50 percent of the recommended dietary allowance for iron, zinc, vitamin A, folate, and other B vitamins.[5]

Known strategies to address anaemia and micronutrient malnutrition include dietary diversification, food fortification, nutrition and health education, supplementation and public health measures. Food fortification has been used globally as a safe and effective measure to prevent micronutrient malnutrition in the vulnerable population. Food fortification is identified as one of the strategies used by the World Health Organization (WHO) and Food and Agriculture Organization (FAO) to help in decreasing the incidence of nutrient deficiencies at the global level.[6] More than 86 countries have mandated cereal grain (e.g., rice, wheat, maize, etc.) fortification. Fortification has minimal effects on taste and cooking properties, multiple micronutrients can be added to a single food to reduce multiple nutrient deficiencies, and minimal behaviour change is required as compared to supplementation. Considering these benefits, fortification presents an opportunity to address micronutrient malnutrition at a mass scale.

In India, rice fortification has the highest potential among staple food fortification programs as it is the staple food of 65 percent of the population and reaches the most vulnerable sections. Rice has the highest uptake in the government safety net programs such as, Integrated Child Development Services (ICDS), Public Distribution System (PDS), and the Mid Day Meal (MDM) program with a potential reach of 800 million vulnerable people in India, especially women and children. Annual allocation of rice through Targeted Public Distribution System (TPDS), Mid Day Meal (MDM) and Integrated Child Development Services (ICDS) amounts to more

than 316 Lakh Tons, 18 Lakh Tons and 5 Lakh Tons respectively. Department of Food & Public Distribution (DFPD) is primarily concerned with promoting food security at the household level; however, with the launch of the Poshan Abhiyaan, DFPD is now also, trying to explore the possibility and feasibility to support the ongoing efforts by different Ministries in promoting nutrition security in the country, especially through fortification of foodgrains distributed via Public Distribution System (PDS) directly to the household and to targeted population of Other Welfare Schemes like ICDS and MDM.

Over the past ten years evidences have been generated on the efficacy of fortified rice and various pilots have been conducted on rice fortification in multiple States on operational feasibility. Eighteen studies over two decades including 4 from India were conducted on infants, children and women demonstrating the efficacy and effectiveness of fortified rice in improving micronutrient status. These showed reduction in anemia [7-16]; increased Hb levels [7-14, 17-18]; improved Iron stores [11,14, 19,20]; Vitamin B12 [9]; Zinc [20,21]; multiple micronutrient stores [16,18,22-24]. One study reported a significant improvement in the physical endurance of the children who consumed high iron fortified rice for 6 months.[9]

Rice fortification standards were operationalized in 2016 and gazetted in 2018. Many States are exploring rice fortification scale up through various safety net programs.

The Government of India has included staple food fortification (including rice fortification) under the National Nutrition Mission (Poshan Abhiyan) as a complementary intervention to reduce prevalence of anaemia and under-nutrition in India. The “Anemia Mukt Bharat” (Anemia Free India) initiative under Poshan Abhiyan has highlighted the need for mandatory provision of iron and folic acid-fortified foods in public health programs in addition to deworming, food supplementation, and dietary diversification. The Department of Food & Public Distribution has formulated a Centrally Sponsored Pilot Scheme wherein financial commitment has been approved to commence rice fortification in 15 Districts through Public Distribution System program. Learnings from these pilots in 15 districts will support national level scale up.

The operational guidelines offer a ready tool to the State Governments to implement the Scheme. It describes in detail the operational processes for planning and implementing the rice fortification program at the State level and technical procedures for manufacturing, monitoring, and ensuring quality control (QC) of Fortified Rice (FR).

Contents

Introduction

Rice is the staple food of more than half of the world's population – more than 3.5 billion people depend on rice for more than 20 percent of their daily calories. Asia accounts for 90 percent of global rice consumption, and total rice demand continues to rise[1]. Not only is India one of the largest producers of rice, accounting for 22% of the world's rice production, but it is also the largest consumer of rice, with a per capita rice consumption of 6.8 kilograms per month.

Milled rice generally is low in micronutrient content because its nutrient-rich superficial layer is removed during rice milling and polishing operations. This makes the grain taste better and visually appealing but less nutritious. Rice fortification is a cost effective, culturally appropriate strategy to address micronutrient deficiencies in countries with high per capita rice consumption. Fortification of rice makes it more nutritious by adding vitamins and minerals, many of which are lost during the milling and polishing process. Rice fortified with the fortificant mix through extruded fortified kernels mixed with non-fortified rice in a ratio varying from 0.5% to 2% is called Fortified Rice.[2]

Extrusion is the preferred technology for rice fortification because of the stability of micronutrients in the rice kernels across processing, storage, washing, cooking, and in view of cost considerations. Fortified Rice Kernels (FRK) produced using extrusion technology are made with rice flour and micronutrients such as iron, folic acid, Vitamin B_{12} as mandatory and zinc, vitamin A, thiamine (vitamin B_1), riboflavin (vitamin B_2), niacin (vitamin B_3), and pyridoxine (vitamin B_6) as optional micronutrients.

Rice flour is pulverized and mixed with a premix containing vitamins and minerals. Fortified Rice Kernels are produced from this mixture using an extruder machine. Fortified Rice Kernels resemble milled rice in size, shape, and colour but contain additional vitamins and minerals that retain their micronutrient content when washed and boiled in water. When these kernels are blended with non- fortified rice, typically at a ratio of 1:100, the result is Fortified Rice that is nearly identical to non- fortified rice in aroma, taste, and texture. It is then distributed for regular consumption.

The Pilot projects for fortification of rice under MDM and ICDS schemes; have amply proven that use of rice as a vehicle for fortification is technically effective and operationally feasible in existing government systems and schemes. They provide useful insights into the desirability and challenges in rice fortification. However, no pilots under PDS have been undertaken so far, except for a small pilot program in a few Talukas of Gadchiroli District, Maharashtra. Experiences from these pilots also lend themselves to development of scale-up plans for the country.

The Fortified Rice Kernels (FRK) and Fortified Rice production facility is like any other food-processing facility. All standard manufacturing, quality-control, and food-safety guidelines should be followed during FRK production. Guidelines on good manufacturing practices (GMPs) should be mandatorily followed during Fortified Rice production. The manufacturing and food safety practices must comply with all the statutory and regulatory guidelines of FSSAI as provided in the FSS Act, 2006 and Regulations.

The Operational Guidelines explain:

- Operational procedures for planning and implementing the rice fortification pilot
- Production overview – Fortified Rice.
- Standard Operating Procedures (SOPS) including objectives, roles and responsibilities of employees, supervisors, and workers.
- Task procedures for plant operations.
- Quality checks procedures and quality plans.
- Hazard Analysis and Critical Control Points (HACCP).
- Audit and inspection guidelines.

Glossary

Administering authority: A certified organization that has the jurisdiction for certifying food safety and safety of manufacturing process. For example: a government department, local authority, or a body accredited by Indian national accreditation services such as Food Safety and Standards Authority of India (FSSAI).

Adulteration: Deliberate contamination of foods with materials of low quality.

Audit: A systematic examination involving professional judgment to determine whether food quality and safety activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Calibration: The demonstration that a particular instrument or device produces results within specified limits by comparison with those produced by a reference or traceable standard over an appropriate range of measurements.

Code of practice: It identifies the essential principles of food hygiene to ensure its safety for human consumption.

Conditioning: Standardization of the moisture content of flour and raw materials (RM) before extrusion.

Contamination: Incidence of any undesirable matter in the product so that it does not meet a standard or requirement determined by law, does not meet satisfactory food hygiene standards, or is unfit for human consumption.

Control measure: Any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level.

Corrective action: Any action to be taken when the results of monitoring at the critical control point (CCP) indicate a loss of control.

Critical control: Stages in a process where quality control (QC) can have a major effect on food quality.

Critical control point (CCP): A point in a step or procedure at which a control is to be applied to prevent or eliminate a hazard or reduce it to an acceptable level.

Critical limit: A value that separates acceptability from non-acceptability.

Cross-contamination: Contamination of a material or product with another material or product.

Decision tree: A series of questions that are applied to each step in the process in respect of an identified hazard to identify which steps are CCPs.

Detergent: A chemical that removes soils but does not sterilize equipment (see soils below).

Disinfection: Use of approved chemical agents, physical methods, or both to reduce the number of micro-organisms to a level that will not lead to harmful contamination of the food, without adversely affecting the food.

Equilibrium relative humidity (ERH): The moisture content at which a food does not gain or lose weight and is stable during storage.

Establishment: Any structure(s) or area(s) in which food is handled and the environment is under the control of the same management.

Fill-weight: The amount of food placed into a container or package and written on the label (also net weight).

Flow diagram: A systematic representation of the sequence of steps or operations used in the production or manufacture of a particular food item.

Food: Any substance consumed to provide nutritional support for the body. It is usually of plant or animal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals. The substance is ingested by an organism and assimilated by the organism's cells in an effort to produce energy, maintain life, or stimulate growth.

Food additive: Any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport, or holding of such food results, or may be reasonably expected to result (directly or indirectly), in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods. The term does not include contaminants or substances added to food for maintaining or improving nutritional qualities (Codex Alimentarius).

Food chain: All the stages through which food is handled, from primary production to processing, manufacturing, distribution, and retail to the point of consumption.

FFRC: Food Fortification Resource Centre

Food handler: A person who, in the course of his or her normal duties, comes into contact with food not planned for his or her own use.

Food handling: Any process in the growing, harvesting, preparation, processing, packaging, storage, transportation, distribution, and sale of food.

Food hygiene: All conditions and actions necessary to ensure the safety, soundness, and wholesomeness of food at all stages, from its production or manufacture through until its final consumption.

Food premises: A building, structure, stall, or other similar structure including a caravan, vehicle, stand, or place used for or in association with the handling of food.

Food safety: The guarantee that a particular food product will not cause injury to the consumer when it is prepared and / or eaten according to its proposed use.

Food spoilage: Any microbiological food deterioration.

Food suitability: The guarantee that a food is suitable for human consumption according to its intended use.

Fortificant: The nutrient that is being added to the food for enrichment purpose.

Fortification: The process of adding nutrients, such as micronutrients or macronutrients, to food. It can be a commercial choice to provide extra nutrients in a food, or sometimes it is a public health policy which aims to reduce incidence of dietary deficiencies in a population.

FRK: It is the acronym for"fortified rice kernel."

FR: The acronym for "fortified rice."

Good manufacturing practice (GMP): The combination of manufacturing and quality measures aimed at ensuring that a product is always manufactured to its specification.

General Manager (GM): Person responsible for the entire manufacturing process of Fortified Rice in the plant from selection and receipt of Raw Material (RM) to the final dispatch of the packaged grains.

Hazard analysis and critical control point (HACCP): A system which identifies, evaluates, and controls hazards which are significant for food safety.

HACCP plan: A written document accepted by the regulatory authority that delineates the formal procedures for following the HACCP system that identifies, evaluates, and controls hazards which are significant to food safety. It is based upon the Codex Alimentarius8 principles of HACCP and includes a generic hazard analysis for the process that results in a list of recognized hazards, which are then translated into a series of critical points and prerequisite programmes to support the wholesomeness of the safety system.

HACCP study: The process of applying the stages used to design the HACCP system.

Hazard: A biological, chemical, or physical agent in the food chain with the potential to cause an adverse health effect for animals or consumers.

Hazard analysis: The process of collecting and evaluating information on hazards and conditions leading to their presence in all steps in the establishment or production operation, in accordance with the appropriate HACCP principles, to decide which are significant for food safety11 and

therefore should be addressed in the HACCP plan and to elaborate the specific CCP and critical limit for each hazard as defined by Codex Alimentarius.

Hazard characterization: The qualitative assessment of the nature of any adverse result associated with any biological, chemical, or physical agents or a combination of these that might be present in food.

High-risk foods: Foods that are capable of transmitting food-poisoning micro-organisms to consumers.

Incoming material: A general term used to denote Raw Material (starting materials, reagents, and solvents), process aids, intermediates, and packaging and labelling materials.

Intermediate: Any product that has not yet been labelled as a final product, intended to be first placed on the market as a food additive.

Internal traceability: Traceability from inputs to outputs within an individual food production or processing site.

Lot: A specific quantity of material produced in a process or series of processes so that it is expected to be homogeneous within specified limits. In the case of continuous production, a lot may correspond to a defined Fraction of the production. A lot size may be defined either by a fixed quantity or the amount produced in a fixed time interval.

Lot number: A combination of numbers, letters and/or symbols which identifies a lot and from which the production and distribution history can be determined.

Manufacturing process: All operations of receipt of materials, production, packaging, repackaging, labelling, re-labelling, QC, release, storage, and distribution of food additives and premixes and the related controls.

Micro-organisms: Tiny forms of life, including moulds, bacteria, and yeasts, which are invisible until they are present in large numbers.

Minimum weight: All packages have a fill-weight equal to system or greater than that shown on the label.

Monitor: The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control.

Net weight: The amount of food filled into a container.

Non-conformity: Non-fulfilment of a particular requirement.

Operator: Any unit of producing or manufacturing food premixes prepared from additives and any person, other than the manufacturer or the person producing for the exclusive requirements of his holding, who holds additives or premixes prepared from additives.

Packaging material (PM): Any containers such as cans, bottles, cartons, boxes, cases and sacks, or wrapping and covering material, such as foil, film, metal, paper, wax-paper, plastics, and cloth.

Pest: Any animal competent of contaminating food directly or indirectly.

Potable water: Drinkable water that will not cause illness.

Premixes: Mixtures of food additives or mixtures of one or more food additives with food materials or water used as carriers, not intended for direct consumption by humans.

Prerequisite programme: Prerequisite programmes such as GAP, GMP, and good hygiene practices (GHP) must be working effectively within a commodity system before HACCP is applied. If these prerequisite programmes are not functioning effectively, then the introduction of HACCP will be complicated, resulting in a cumbersome, over-documented system.

Pulverizing: The process of reducing the size of material into fine particles using a mechanical device.

Quality assurance (QA): A management system which controls each stage of food production from RM harvest to final consumption.

Quality characteristics of a food: A set of descriptions that identifies the specific quality features.

Quality control (QC): A series of checks and control measures that ensures that a uniform-quality food is produced.

Raw material (RM): All materials which are in the final product.

Reworking: Any appropriate manipulation steps taken when the product does not comply with the specifications and when it is possible to follow corrective actions. The result of these actions must ensure a food additive or premix conforms to specifications.

Rice flour: A form of flour made from finely milled rice. Rice flour may be made from either white rice or brown rice. To make the flour, the husk of rice or paddy is removed and raw rice is obtained, which is then ground to flour.

Shelf life: The time that a processed food can be stored before changes in colour, flavour, texture, or the numbers of micro-organisms make it unacceptable.

Soils: Any material that contaminates equipment (e.g., grease, scale, burned food, or other food residues).

Standard operating procedures (SOP): Any manufacturing practice ruled by commonly accepted operational practices for the process.

Specification: A list of tests, references to analytical procedures, and appropriate acceptance criteria that are numerical limits, ranges or other criteria for the test described. It establishes the set of criteria to which a material should conform to be considered acceptable for its intended use. "Compliance to specification" means that the material, when tested according to the listed analytical procedures, meets the listed acceptance criteria.

Sanitation standard operating procedures (SSOP): To conduct cleaning and sanitation procedures as established by the GMP.

Total quality management (TQM): A management approach that is centered on quality, based on the participation of all members of the association and aimed at long-term achievement through customer satisfaction and through benefits to all members of the organization and of society.

Toxic: Harmful to human, animal or plant health.

Traceability: Ability to follow the movement of a food product through the food supply chain and within an individual company.

Tracking: Ability to follow the path of a specified unit and/or lot of trade items downstream through the supply chain as it moves between trading partners.

Validation: Obtaining evidence that the elements of the HACCP plan are effective.

Verification: The application of methods, procedures, tests, and other evaluations, in addition to monitoring to determine compliance with the HACCP plan.

Waste materials: Unused materials, or used materials subsequently disposed of, including cleaning materials, disinfectants, and hazardous materials.

Acronyms

CAR	Corrective Action Request
CCP	Critical Control Point
CDC	Centers for Disease Control and Prevention
CIP	Cleaning in Place
EHS	Environment Health Safety
ERH	Equilibrium Relative Humidity
FePP	Ferric Pyrophosphate
FG	Finished Goods
FSSAI	Food Safety and Standards Authority of India
FFRC	Food Fortification Resource Centre
FR	Blended Fortified Rice
FRK	Fortified Rice Kernel
GHP	Good Hygiene Practices
GM	General Manager
GMP	Good Manufacturing Practices Green
FBG	Green Ferric Bis Glycinate
HACCP	Hazard Analysis and Critical Control Point
HOD	Head of the Department
MSDS	Material Safety Data Sheet
NABL	National Accreditation Board for Testing and Calibration Laboratories
PM	Packaging Material
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
RM	Raw Material
RO	Reverse Osmosis
RPM	Revolutions per Minute
SOP	Standard Operating Procedures
SSOP	Sanitary Standard Operating Procedures
STPP	Sodium Tripolyphosphate
TDS	Total Dissolved Solids
TQM	Total Quality Management
µm	Micro Meter
WHO	World Health Organization


FORTIFIED
SAMPOORNA POSHAN
SWASTH JEEVAN

Section I

Operational Guidelines

This section will cover Operational Guidelines and Scheme details

1 Pilot Scheme on "Fortification of Rice and its Distribution under Public Distribution System"

Government of India has given approval to a new Centrally Sponsored Pilot Scheme for "Fortification of Rice and its Distribution under Public Distribution System". The Pilot Scheme has been approved for a period of 3 years beginning 2019-20.

The objective of this scheme is to start Pilot projects in States and Union Territories with rice consumption (in Districts with prevalence of micronutrient deficiency). Based on the experience and learnings gained from these pilot projects, the distribution of fortified rice will be scaled up. The key objectives of the scheme are:

- Distribution of fortified rice through Public Distribution System, to cater to 15 Districts in the country – preferably one District per State in the initial phase of implementation (To begin with, the States/UTs will have the option to implement the Pilot Scheme in a part of the selected District too).
- Coverage of all NFSA beneficiaries under the PDS with fortified rice in the selected Districts.
- Facilitate cross-learning and sharing of best practices among States/UTs and DoF&PD.
- An important Objective would be to evaluate the provision, coverage, and utilization of fortified rice by the target population as well as the efficacy/effectiveness of the consumption of fortified rice in reducing the targeted micronutrient deficiencies in different age and gender groups.

The States/UTs would need continued technical support for this purpose. Under the new Scheme manpower has been approved at different levels.

1.1 PROJECT MANAGEMENT STRUCTURE

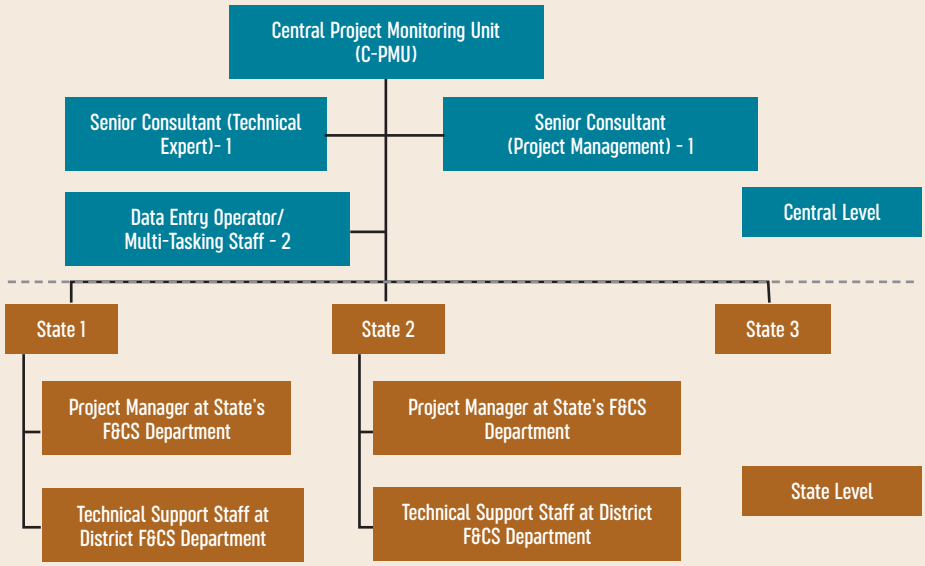
Central Project Monitoring Unit (C-PMU):

It is necessary to have a Central Technical Expert Team in Department of Food & Public Distribution for providing technical support in operationalization, management and monitoring of scheme for rice fortification in PDS, facilitate creation of effective Management Information System (MIS) for centralized monitoring, coordination with FSSAI and other technical agencies to ensure effective quality control and assurance, facilitate impact assessment of the scheme and other technical and administrative advice for resolving issues/ problems faced by the Department and States/UTs for smooth operation of rice fortification scheme in PDS.

State Project Monitoring Unit (S-PMU):

Technical support at State's Food & Civil Supplies Department for smooth operation of activities under the scheme is necessary. It has therefore been approved to have at least a Project Manager and a Technical Support Staff at headquarters of each State/UT.

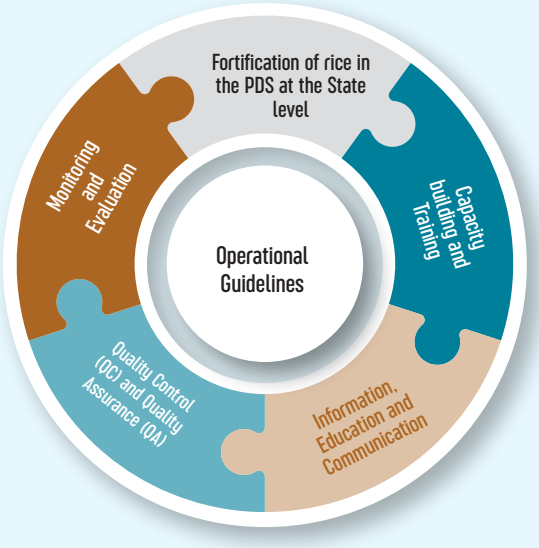
Figure 1: Project management structure



1.2 KEY COMPONENTS UNDER THE SCHEME:

The key components under the proposed scheme are briefly described as below:

Figure 2: Key components of the Scheme



Component I: Fortification of rice in the PDS at the State Level

The core elements for production of fortified rice are the Fortified Rice Kernels and its blending with regular rice in a ratio of 1:100. Fortification should not in any way interfere with the regular supply and availability of rice in the Fair Price Shops and this Scheme will therefore involve Supply Chain Management as well.

There are States which undertake MSP based procurement operations of paddy on behalf of Government of India, get it milled and also store and distribute rice under TPDS and Other Welfare Schemes. This arrangement of Government of India with States is termed as Decentralized Procurement Scheme and currently there are 15 States/UTs participating in the DCP scheme for rice. These are Andhra Pradesh, A&N Islands, Bihar, Chhattisgarh, Gujarat,

Jharkhand (5 Districts), Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Telangana, Uttarakhand and West Bengal.

In other States, termed as non-DCP states, procurement of paddy and its milling is handled mostly by the State Government agencies on behalf of FCI and the expenses borne by them are reimbursed by the Central Government. Rice so procured is handed over to FCI, which becomes part of Central Pool. FCI on its own procures only a small proportion of Paddy directly and gets it milled. FCI therefore basically plays the role of an aggregator.

The fortification of rice in PDS supply chain at District level by State Governments has been found to be the most feasible approach for distribution of fortified rice through PDS. Under this approach, fortification of rice will be done at milling stage, both in DCP and Non-DCP States. This will enable the District Collectors and other authorities to visit the mills more frequently to ensure better implementation and quality control. Further, it would be easier to track the source of fortified rice with appropriate markings when the fortification is undertaken at the milling stage.

For purposes of systemic efficiencies and cost effectiveness, the blending of the fortified rice kernels with the rice will take place as a continuous process during the rice milling stage. As per existing practice paddy procured from farmers in DCP States is sent to the government empanelled rice millers for processing and milling. Milled rice is then transported back to government godowns for storage and distribution under PDS. In non-DCP States, milled rice is sent to the FCI godowns and transported therefrom to the State storage depot or directly to Fair Price Shops in some cases. In all the States, therefore, fortification will be done at the rice mills. FCI will, however, make arrangements in case of non-DCP States to keep the fortified rice separately in its godowns for distribution. The payment to the rice mills against the cost of fortification shall be routed through State Government/UT Admn.

Component II: Capacity building and Training

Capacity building and training will be needed not only for the rice millers and their staff on the specifics of fortification, quality control etc. but also for the fair price shop owners on their roles/responsibilities vis-à-vis the mainstreaming of fortified foodgrains in the welfare schemes. Manpower requirements for fortification of rice at the mill will vary depending upon the milling capacity and level of automation at the mill; millers are however encouraged to ensure presence of staff dedicated to fortification of rice.

Component III: Information, Education and Communication

Given that the concept of availability of fortified foods especially through the food based safety nets will be new to the community; and that the success of the intervention is in the regular consumption of fortified rice; information, education and communication campaigns with the community is much needed.

Component IV: Quality Control (QC) and Quality Assurance (QA)

This will be an extremely important component of the Scheme and will need to be integrated at several levels. The role of FSSAI and its Food Safety Officers is critical. For purposes of efficiency and better control, it is advisable to focus up-stream on QC/QA during procurement of the Fortified Rice Kernels. The millers will procure the FRK directly from, State empanelled and FSSAI licensed/registered FRK manufacturers who will be required to submit Certificate

of Analysis (CoA) from independent third party FSSAI-notified NABL laboratories for FRK to respective State Food Safety Authorities and its district officers before the FRK is moved to the mills for blending. Only upon validation of the COA of FRK in terms of appropriate micronutrient levels and microbiological specifications, should their use for blending with regular rice be permitted. For these purposes, the State may empanel a set of FRK manufacturers and laboratories. At the level of the rice mill, QA/QC can be done through blending efficiency counts - for which the millers and their staff would need to be trained at regular intervals. Along with the same, samples of fortified rice can be lifted by the Food Safety Officers for analysis at independent third-party NABL laboratories already empanelled by the State. Lastly, to be able to produce fortified rice, the rice miller should have a valid milling license and a valid license for processing of fortified rice under Category 6.0 of Indian Food Categorization System (Food Safety & Standards Act, 2006) and should get the fortified logo endorsed by FSSAI.

Component V: Monitoring and Evaluation

Monitoring and Evaluation are essential components of any programme, systems which should be developed at the outset, ideally during the design and planning stages. Monitoring and Evaluation provide an opportunity not only to assess the quality of implementation and delivery of a programme, but also the degree to which it reaches its targeted households and individuals, and achieves its nutritional goals. More importantly, the results of monitoring and evaluation exercise will provide programme planners and policy-makers with the necessary information to take decisions about whether to continue or modify the programme.

1.3 Timelines for Implementation of the rice fortification scheme:

Given the size of the country, sheer volumes of rice involved in the food based safety nets; a phased approach towards integration of fortified rice in the PDS has been adopted. Accordingly, fortification of rice would be taken up on Pilot basis in one district in each State/UT with large rice consumption. To begin with, the States/UTs have the option to implement the Pilot Scheme in part of the selected District. While identifying a District for Pilot, it should be ensured that it is pre-dominantly a rural District. Districts can be identified with high prevalence of anaemia amongst children and women, for which reference to NFHS-4 data can be made. In case an Aspirational District meets the above conditions, then preference should be given to the Aspirational District. The selected districts in the States/UTs will create the much needed momentum on rice fortification in the country along with the necessary experience and will add to the readiness of States for the roll-out of the universal rice fortification at a larger scale.

1.4 Cost for Rice Fortification under PDS:

The incremental cost @ 60 paise per kg would be reimbursed to the rice millers through States/UTs for the total volume of fortified rice produced. The incremental charges will be shared between the Centre and the States/UTs in the ratio of 90:10 in case of North-East, Hilly and Island States and 75:25 in case of rest of the States. No reimbursement on account of procurement and maintenance of equipments at the rice mills would be admissible.

1.5 Blending of rice with FRK for production of fortified rice:

1.5.1 **Blending Efficiency:** Fortified rice is produced by blending fortified rice kernels with regular rice through use of various blending solutions in the ratio of 1:100.

1.5.2 **Point of blending FRKs with rice:** Fortification of rice in the Scheme has been approved to be done at source i.e. blending at milling stage. All rice (quantity required for distribution in the selected District) that is passed through the stages of milling and processing, must also be fortified by blending with FRKs before bagging rice for further distribution.

1.5.3 **Packaging and Distribution of fortified rice:** It is advised that fortified rice is bagged in the same 50 kg gunny bags provided/specified by FCI with proper labeling as per FSSAI guidelines to distinguish fortified rice from regular rice. Details of labelling are given in Annexure V. (For more details refer the chapter on Manufacturing Process).

1.6 Manpower requirement for rice fortification in PDS:

1.6.1 **Central Project Monitoring Unit (C-PMU):**

Central Project Monitoring Unit (C-PMU) at the Department level with following manpower has been approved to be set up:

S. No.	Position/Designation	No. of resources	Remuneration per month*
(i)	Senior Consultant (Technical Expert) – Fortification	1	3.0 lakh
(ii)	Senior Consultant - Project Management	1	2.0 lakh
(iii)	Data Entry Operator/ Multi-Tasking Staff	2	0.25 lakh
	Total	4	

1.6.2 **State Project Monitoring Unit (S-PMU):**

State Project Monitoring Unit (S-PMU) at the State and district level with following manpower has been approved to be setup:

S. No.	Position/Designation	No. of resources and Remuneration per month*
1.	Project Manager at State's F&CS Department	1 @ Rs.1.5 Lakhs per month
2.	Technical Support Staff at District F&CS Department	One in each District @ 30,000 per person per month

* Subject to maximum

1.7 Quality Assurance Mechanism:

Quality Assurance mechanism will operate at following levels:

1.7.1 **At the District level –** FRK producer will have to provide certificate of analysis with every batch of FRK supplied to rice millers. Rice millers will have to maintain batch wise record of FRK procurement and its usage for rice fortification. The officer in the State/District Food & Civil Supply Department responsible for quality control will have to verify the 'Certificate of Analysis' in respect of every FRK consignment/batch (refer Section-3 'Criteria for procurement of premix for FRK production' and Section-7.1 & 7.2 'Institutional support and role of other Departments').

1.7.2 **At every blending point –** The quality control method to test the homogeneity of blended rice will be done by the rice miller with the help of a toolkit (refer Annexure VI: Blending Efficiency Test).

1.7.3 **Post blending –** Random sampling of fortified rice should be done at the source / rice mills at least one sample in a quarter by the competent official in the State/District Food & Civil Supply Department responsible for quality control, from each blending point and will be sent for analysis at independent third-party NABL laboratory.

1.7.4 **Once the fortified rice is distributed** to Fair Price Shops, States/District authorities may consider collection of random sample each quarter from selected Fair Price Shops and its analysis through NABL laboratory.

1.7.5 As per Clause no. 2.4.1 of the Food Safety and Standards (Laboratory and Sample Analysis) Regulations, 2011, the sample shall be dispatched forthwith in the following manner:

a) The sealed container of one part of sample for analysis along with memorandum in Form VI shall be sent in a sealed packet to food analyst under appropriate condition to retain the integrity of the sample.

b) The sealed container of second and third parts of the sample and two copies of memorandum in Form VI shall be sent to Designated Officer by any suitable means.

c) The sealed container of the remaining fourth part of the sample and a copy of memorandum in Form VI shall be sent to an accredited laboratory along with fee prescribed by Authority, if so requested by the Food Business Operator, under intimation to the Designated Officer, provided that the fourth part also shall be deposited with Designated Officer if FBO does not request to send the sample to an accredited lab.

1.7.6 **Samples collected should be sent to NABL Accredited labs** for testing within a week of sample collection

1.7.7 **If required, random samples of FRK supplied** by FRK producers can also be sent for testing to NABL Accredited Labs. Samples to be collected from rice millers before FRK is used for fortification. (For more details on QA & QC, please refer to the chapter on the same – section 6 of Technical Guidelines and Annexure-XXVII)

1.8 Monitoring and Evaluation:

For successful implementation, regular supervision and monitoring through field visits and Management Information System (MIS) is necessary. Third party evaluation involving a baseline and end-line would also be conducted.

S. No.	Cost component	Cost (annual)
1.	Development & maintenance of MIS (one time cost)	10,00,000
2.	Field visits by Central Team	02,00,000
3	Third party evaluation	20,00,000

1.9 Capacity building and IEC:

Capacity building and training of millers, their staff and FPS dealers will be crucial for the success of the programme. Similarly success of the intervention will also depend on the information, education and communication campaigns with the beneficiaries about the benefits and right usage of fortified rice.

S. No.	Cost component	Cost per annum
1.	Capacity Building and Training	5 lakhs per State
2.	Information, Education and Communication campaigns	2 lakhs per State

1.10 Other expenses:

1.10.1 Funding for the new scheme and adjustment in Central Allocation:

1.10.1 The new scheme will be funded by Government of India in the ratio of 90:10 in respect of North Eastern, Hilly and Island States and 75:25 in respect of other States/UTs – both for production of Fortified Rice and other components of the Scheme.

1.10.1 The central allocation of rice will be adjusted for the extra portion of FRK supplied for blending with normal rice to produce fortified rice (FRK blending with rice in the ratio of 1:100).

1.11 Reimbursement to Mills for fortification and recovery of CAPEX:

An investment of around Rs.15-20 lakh would be required at a rice mill with operating capacity of 4-5 MT/Hr for upgradation of the existing facility for rice fortification operations. The cost, however, will vary from mill to mill depending on the volume of fortified rice produced. The miller is expected to recover its investment during the project period with an incremental cost of Rs. 0.60 per Kg (all inclusive and includes cost of FRK (with three micronutrients – Iron, Folic Acid and Vitamin B_{12}) procured by rice miller for rice fortification) paid by the government towards procurement of fortified rice. The rice millers will be reimbursed the incremental charges on per kg basis for the fortified rice produced. The incremental charges will be shared between the Centre and the States/UTs in ratio as indicated above.

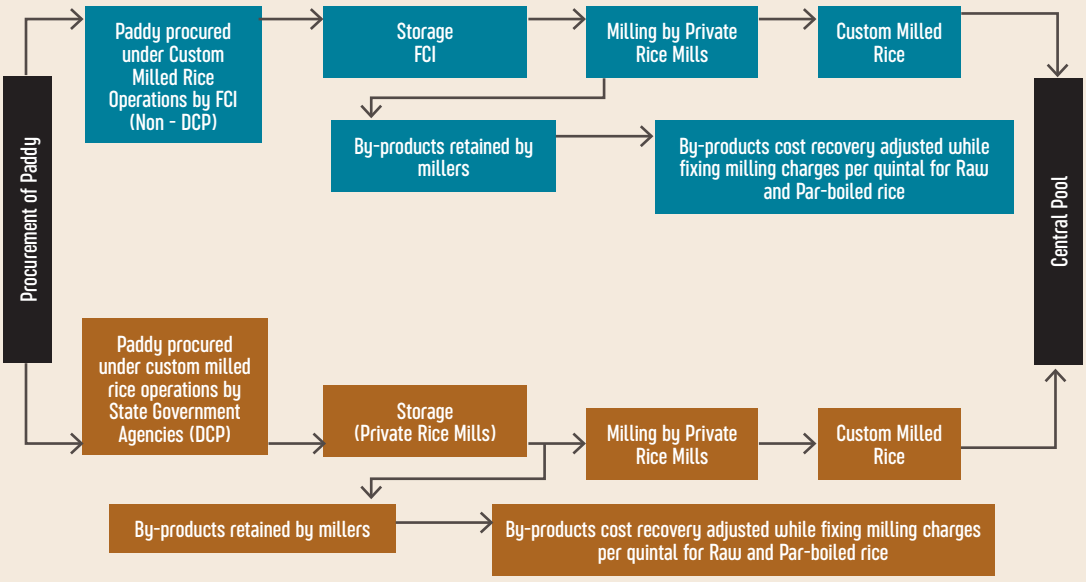
Indicative cost estimation for producing fortified rice and project management cost for rice fortification scheme through PDS is given in Annexure I

2 Existing Rice Value Chain

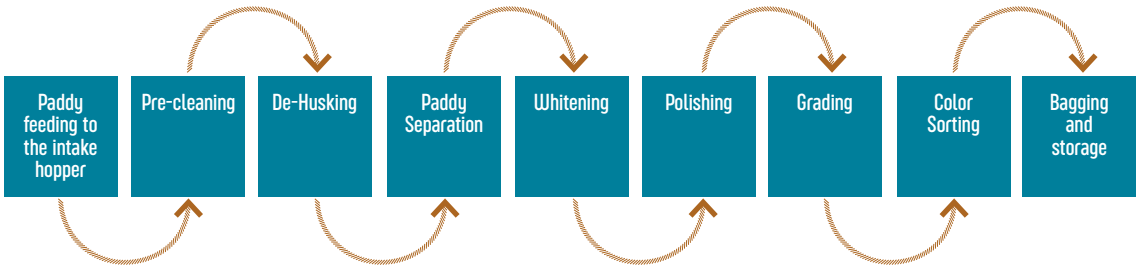
Existing arrangement for paddy processing at the state level:

As per the existing practice paddy procured from the farmers is sent to the State Government empanelled rice mills for processing and milling. The paddy is converted to rice through a series of steps involved in the milling process; and in case of production of parboiled milled rice, the paddy is parboiled and dried before milling. Milled rice is then transported back to the government go-downs for storage and distribution under PDS.

Figure 3: Current rice value chain



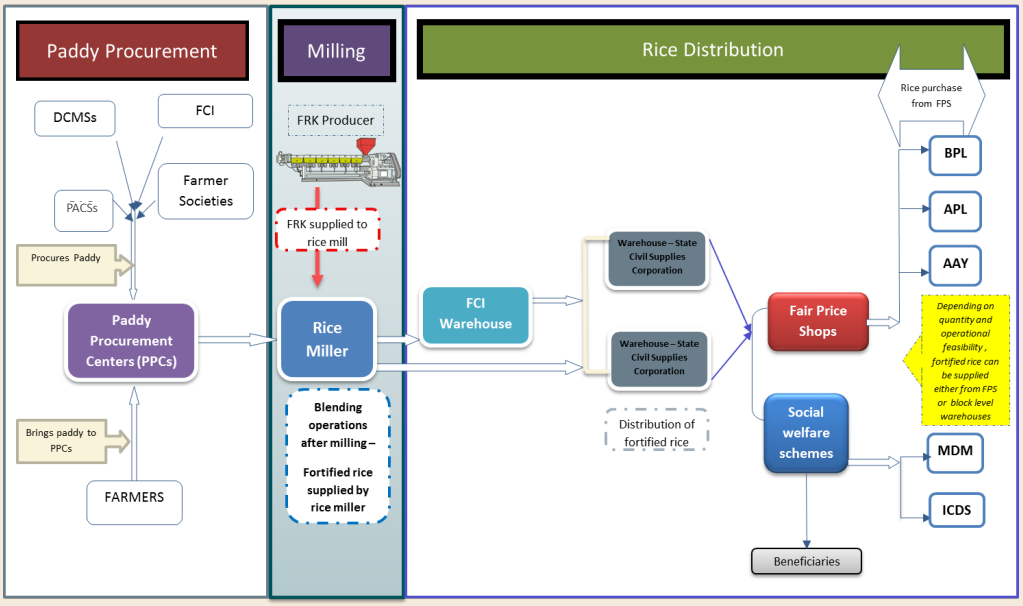
Regular process flow of a rice mill



3 Fortification of rice during milling of paddy

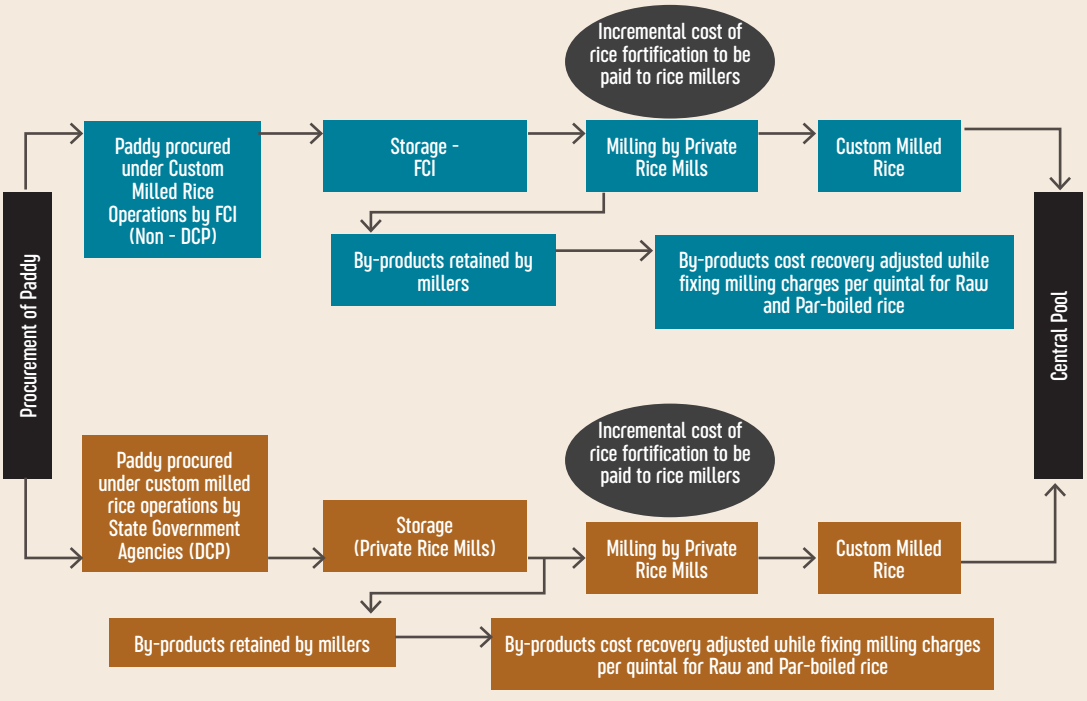
In the existing arrangement for paddy processing at the rice mill, the milled rice can be blended with fortified rice kernels (FRK) in a ratio of 100:1 to produce the fortified rice in a single continuous line without any break in the process.

Figure 4: Model- fortification of rice at rice mills

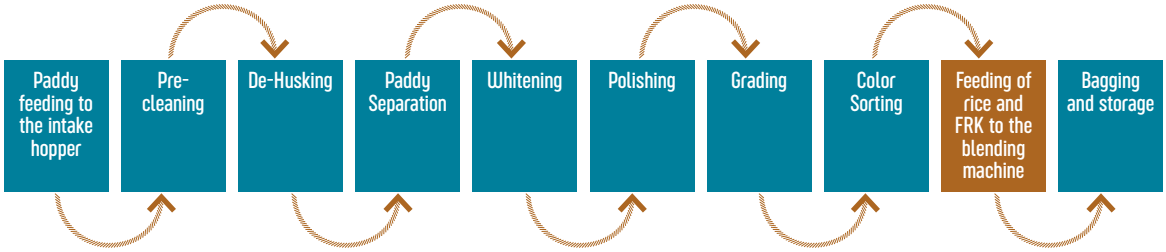


District Co-operative Marketing Societies (DCMSs); Primary Agricultural Cooperative Societies (PACSs)

Figure 5: Value chain of fortified rice



Process flow of a rice mill with blending operations for rice fortification



Delivery mechanism for Fortified Rice Kernels (FRK) to the miller:

FRK should be procured from the State Government empanelled FRK producers, who should be licensed/registered with FSSAI for the same. The criteria for empaneling the FRK manufacturers by a State should include the following:

(i) Licensed/registered with FSSAI for production of FRK

(ii) Quality Certifications such as ISO:22000, HACCP, GMP & GHP etc.

(iii) Half yearly test reports of FRK produced as per FSSAI guidelines.

(iv) Details of the premix used for production of the FRK.

Criteria for procurement of premix for FRK production:

FRK manufacturer should procure the premix for FRK production from the vendors having valid FSSAI license of 99.5 category. The chemical salt of the vitamin and minerals, used for FRK production, should be in line with the ones mentioned in FSSAI guidelines. Certificate of Analysis (COA) of the premix to be used for FRK production should also be shared with the respective State Food Safety Authorities and its District Officers for the final approval for its use for FRK production.

Quality inspection visits should be made at the FRK manufacturing site during the production by the Food Safety Officer (FSO) employed with FSSAI. FRK should be packaged in High-density polyethylene (HDPE) laminated bags of 20/25 Kg with the mandatory information printed on the bag based on the FSSAI guidelines on labelling of fortified foods. FRK should be delivered to the rice mill once the satisfactory COA is received from the 3rd party NABL accredited laboratory and the COA has been approved by the Committee at the District/State level so constituted under the chairmanship of Food Secretary/District Collector (refer section 7.1 and 7.2 trailing below). The report should mention the levels of all micronutrients which were added for FRK production. FRK should resemble the regular rice in its colour, sheen, consistency and texture. The sample of FRK should also be shared with Committee at State level for reference and record. Mode of delivery of FRK should be such that the material is delivered in the bags which are intact and without any physical damage.

Existing equipment at the mill which can be used for blending of Fortified rice:

Following is the list of equipments which is available at the rice mill and can be used for in-line blending:

(1) 2-3 nos. Bucket elevators with pits

(2) 2-3 nos. Silos (with slider)

(3) Storage hopper for Milled rice/FRK (with slider)

(4) 1 no. Weighing balance for weighment of rice/FRK/fortified rice (Least count:10g)

(5) 1 no. Weighing balance for conducting Blending efficiency test (Least count:0.1g)

Note: Modification of cylindrical grader (where ever available):

Cylindrical grader already available with the rice mills could be modified to a rotary blender by replacing the mesh of the grader with the solid non-porous metal sheet at the outer circumference and should be placed after the sortex step of the milling process

Additional equipment to be procured by the miller for blending of rice for proper and continuous operations:

(1) Few storage bins depending on the existing setup

(2) Load cells/flow balancers

(3) Flow balancer

(4) Vibratory feeder (Calibrated as per the desired quantity)

(5) Elevators

(6) Blender (for the mills where the modification of cylindrical grader is not feasible or cylindrical grader is not available)

(7) Programmable logical Controls - PLC (electrical)

Vendors for the additional equipments needed for in-line blending are available in the Indian market and terms of reference for its specification based on the type of the equipment needed, minimum guarantee period (as one year), Renewable Annual Maintenance contract (AMC) valid for 1-2 years post guarantee period should be shared with the vendor at the time of purchase.

Criteria for procurement of the blending equipment:

(1) Milling capacity of the Rice mill – The capacity of the blending unit procured should be aligned to the milling capacity of the rice mill.

(2) Tonnage of fortified rice to be produced.

All the equipment used in the rice fortification process should be of food grade mild steel with the enamel finish and should provide a blending efficiency of at least 90%. Supporting equipment/devices such as compressor, voltage stabilizer would be required for functioning of the blender / feeders. Specification of the same will depend on the capacity of the equipments for which it is required.

Production, Packaging and Quality Assurance of Fortified rice:

The milled rice will be tested for its compliance with Fair Average Quality (FAQ) specification. Post its conformation to FAQ standards, it will be blended with FRK. Milled rice and FRK stored in silo/ storage hoppers are discharged in the ratio of 100:1 through flow balancer/ vibratory feeders over the conveyer belt followed by blending in the continuous blender and then blended material is conveyed through the bucket elevator to the storage silo. The material is packaged, labeled and stitched. The fortified rice should be packaged in 50 kg jute bags. All the mandatory information as per FSSAI guidelines should be printed on jute bags as per details given in Annexure V. (For more details please refer the chapter on Manufacturing Process). Post its conformation to FAQ standards, it is blended with FRK. During the production of fortified rice, the blending efficiency test is performed to ensure the blending ratio of milled rice to FRK as 100:1. The Quality Assurance Mechanism has been explained in Para 1.7 above.

4 Standards of rice fortification

The Food Safety and Standards Authority of India (FSSAI) has released regulations called Food Safety and Standards (Fortification of Foods) Regulations, 2018. in the Gazette of India, Extraordinary, Part III, Section 4.

The details of rice fortification standards have been described in Annexure II- Section 5

5 Information, Education & Communication

Given that the concept of availability of fortified food, especially through the food based safety nets will be new to the community; and that the success of the intervention is in the regular consumption of fortified rice, information, education and communication campaigns among the community on the benefits of such intervention is necessary.

Involving a professional agency like the World Food Program, PATH, FFRC/FSSAI and others in Information, Education & Communication campaign about Fortified Rice to be distributed under TPDS, can help in sensitizing the local beneficiaries, local functionaries, millers and their staff, FPS dealers, etc. States/UTs are encouraged to contact Food Fortification Resource Centre (FFRC) to help create state- specific communication collaterals.

Target groups:

1. State and district level decision-makers of allied departments with role in the scheme
2. End-users: NFSA beneficiaries in the District

A suggestive framework for developing relevant IEC materials based on the target groups intended with specific objectives is provided below:

	Consumers	Health providers / influencers
Short-term objectives	Understanding Rice Fortification Accepting fortified rice Motivation to consume fortified rice provided through PDS Understanding relevant health benefits	Understanding rice fortification Motivation to discuss fortification with community
Mid-term objectives	Accepting and consuming fortified rice	Supporting and promoting fortified rice
Sustained behaviour (long-term objectives)	Continue eating fortified rice	Continue supporting and promoting fortified rice consumption

Types of IEC activities/ materials:

1. Print media and TV campaigns – popularization of the '+F' logo through TV advertisements, articles in leading newspapers, magazines, flyers, danglers etc
2. Use of community radio and social networking sites
3. Display of hoardings / banners / wall paintings at prominent locations in the villages including FPS shops, anganwadis, health centres, panchayat centres, etc
4. Display and use of +F logo on all bags of fortified rice

5. Community engagement activities and leveraging on the platform provided by Poshan Abhiyan esp. during Jan Andolan or during community engagement initiatives by other departments such as Jan Sunwai,
6. Information can also be provided during regular household visits of front-line workers

Various State specific communication collaterals need to be created by Food Fortification Resource Centre (FFRC) and these can be used by the States.

6 Capacity Building and Training

Capacity building and training will be needed not only for the millers and their staff on the specifics of fortification, quality control etc. but also for the fair price shop owners on their roles/responsibilities vis-à-vis the mainstreaming of fortified foodgrains in the welfare schemes. There will be a need to sensitize both State and District level officials including Food Safety Officers on rice fortification. Capacity building of Anganwadi Workers and Panchayati Raj Members may also be considered to generate awareness of the benefits of fortified rice.

All these stakeholders from the State down to the Fair price shop will need to be sensitized on the scheme. A series of sensitization workshops and training sessions will need to be organized:

Target audience:

1. Government counterparts – at the State, District, Block level officials and FPS shop owners
2. National and State Rice Millers Associations, Individual Rice millers and their staff

Capacity of Government counterparts – at the State, District and Block level officials, shall be built on the following topics:

i. Anaemia and Micronutrient deficiencies
ii. Rice fortification through the Targeted Public Distribution System (TPDS) as one of the strategies to address micronutrient malnutrition:
iii. The Food Safety and Standards Authority of India (FSSAI) standards for fortified rice
iv. Technology of rice fortification
v. Advantages of introducing fortified rice through the Public Distribution Scheme:
vi. Method of cooking fortified rice
vii. Specifics of the Centrally Sponsored Pilot Scheme on Fortification of Rice and its Distribution under Public Distribution System.
viii. Role of the given Govt. official in the implementation of the Centrally sponsored scheme

Capacity of Mill owners / State rice millers associations / related staff shall be covered on the following topics:

i. Installation of blending equipment and dosing system
ii. Appropriate calibration of the equipment and trials
iii. Appropriate blending of fortified rice kernels (FRKs) with regular rice in the ratio of 1:100 to produce fortified rice
iv. Quality assurance and quality control
v. Basic concepts in food safety and hygiene (contamination, cross-contamination, use of personal protective equipments, good manufacturing practices etc.)

vi. Guidelines for storage of fortified rice and FRKs in the rice mill

vii. Packaging and distribution of fortified rice at the mill

viii. Record maintenance

Food Safety & Standards Authority of India (FSSAI) through Food Fortification Resource Centre (FFRC) and Development Partners need to play a key role in training and capacity building of all stakeholders to fortify rice.

7 Institutional support and role of other Departments

7.1 To ensure the implementation of the components of the scheme, it has been decided to establish an Empowered Committee at the level of DoF&PD, Government of India as per following composition:

Secretary, Department of Food & Public Distribution	Chairperson
Jt. Secretary (BP&PD), DFPD	Member-Secretary
Jt. Secretary (Policy & FCI), DFPD	Member
Executive Director (Quality Control), FCI	Member
Representative of Food Safety & Standards Authority of India	Member
Representative of World Food Program, Country Office, India	Member
Deputy Secretary (BP), DFPD	Member
Representative of any Organization/Development Partner working in the field of rice fortification	Co-opted Member

7.2 Similar committees with State level representatives can be set up at the State level under the chairmanship of the Secretary, Department of Food and the District Collector at the District level. Each member of the Empowered Committee will also have a role to perform under the aegis of DoF&PD in the implementation of the scheme and in each of its components

7.3 Roles and responsibilities of the various stakeholders vis-à-vis rice fortification:

7.3.1 **Department of Food and Public Distribution, Government of India:**

1. Issue guidelines to States on fortification of rice
2. Ensure necessary financial provisions to States
3. Monitor the Scheme
4. Facilitate information exchange between States on fortification of rice
5. Develop plan for scale-up of the Scheme throughout the country
6. To organize periodic multi-stakeholder Workshops at National/State level to discuss on all issues related to rice fortification

7.3.2 **Department of Food, States/UTs:**

1. In order to meet-out the yearly requirement of fortified rice, rice millers with proper milling capacity and blending facilities are to be identified by State Food Departments for supply of required quantity of fortified rice.
2. A proper milling agreement is to be executed between State Food Departments and rice millers for milling of paddy with a separate clause to be inserted regarding packaging and stenciling of '+F' logo on jute bag and rexin slip.

3. Empanelment of FRK suppliers as well as NABL laboratories
4. Detailed planning of Supply Chain logistics at the District level to ensure quality supply of fortified rice to the beneficiaries.
5. To coordinate and ensure that required quantity of FRK is supplied to the identified millers for fortification of CMR stock as per the required proportion of 1:100
6. Ensuring fortification of the rice at the mills
7. Lifting of samples of Fortified Rice from every blending point (as well as Fair Price Shops), atleast once in a quarter; for quality analysis through NABL laboratory;
8. Linking of the identified millers to a particular depot to deliver the fortified custom milled rice stock
9. Monitoring of the scheme
10. Conduct information, education and communication campaigns. IEC Campaigns may converge with POSHAN Abhiyaan as Fortification is a vital part of the Mission
11. Conducting periodic evaluation.

7.3.3 Food Safety & Standards Authority of India (FSSAI) and its state counterparts:

1. FFRC, set up by FSSAI, which functions as a resource hub for fortification may provide technical and procurement assistance, and facilitate training and capacity building workshops and provide support to States to undertake IEC activities and monitoring and evaluation with support from development partners
2. Stipulate Quality Control and Quality Assurance Standard Operating Procedures on rice fortification
3. To ensure that there are independent NABL accredited labs in all States who could test Quality control of FRKs and fortified rice and mapping of NABL labs and building linkages with States and selected Districts
4. Mapping the supply of FRKs at the District/State level to ensure consistent supply of FRKs
5. Lifting of samples from the empanelled FRK manufacturers and rice mills for micronutrients analysis
6. Capacity building of the rice millers and their staff, FPS owners, Food Safety Officers on fortification. Capacity building of Anganwadi Workers and Panchayati Raj Members may also be considered to generate awareness of the benefits of fortified rice
7. Periodic evaluation of impact of fortification in coordination with Ministry of Health & Family Welfare, with concurrent modification, using NFHS-4 and Comprehensive National Nutrition Survey (CNNS) supported by MoHFW as baseline data for iron deficiency anemia, FSSAI may extend support to CPMU and SPMU to facilitate impact assessment and centralized monitoring of the scheme
8. Design Information, Education and Communication campaigns on fortified rice with the community in consultation with Department of Food & PD, NITI Aayog and Development Partners
9. Monitoring for compliance on labeling and use of +F logo
10. To organize periodic multi-stakeholder Workshops at National/State level to discuss on all issues related to rice fortification

7.3.4 Food Corporation of India and State agencies (as the case may be):

1. In case of non-DCP States, arrange for receipt of fortified rice from State Govt./Agencies
2. Arrange for separate and safe storage of fortified rice in its godown

3. Release of fortified rice back to the State for distribution under PDS
4. In order to address the issue of Shelf Life of Fortified Rice, FCI to undertake a study in association with Indian Grain Storage Management & Research Institute (Hapur) and FSSAI by actual storage of Fortified Rice in different geographical conditions

7.3.5 Rice Millers/Mills:

1. Rice mills will be used for fortification at source
2. Rice millers will invest towards upgradation of existing milling line for performing blending and fortification operations
3. Paddy will be supplied to rice millers by State Civil Supplies Departments or designated agencies for custom milling
4. The millers will procure the FRK directly from the FSSAI empanelled/authorized FRK manufacturers who will be required to submit Certificate of Analysis from independent third-party NABL laboratories for the FRK to the respective State Food Safety Authorities and its District officers before the FRK is moved to the mills for blending
5. Only upon validation of the Certificate of Analysis of FRK State Civil Supplies Departments, in terms of appropriate micronutrient levels and microbiological specifications, should their use for blending with regular rice be permitted
6. Custom milled rice will be fortified by rice millers. Paddy will be converted to rice and blending operations will be carried out immediately after it at the rice mill itself using a blending machine. FRK and CMR will be mixed in a ratio of 1:100 by rice millers
7. Rice millers will get incremental cost of rice fortification @ 60 paise per kg for the total quantum of fortified rice produced from State Civil Supplies Departments
8. They will be responsible for maintaining quality of fortified rice and packing of fortified rice
9. QA/QC should be done at the rice mills through blending efficiency counts - for which the millers and their staff should be trained
10. To be able to produce fortified rice the rice miller should have a valid milling license and a valid license for processing of fortified rice under category 6.0 of Indian Food Categorization System (Food Safety & Standards Act, 2006) and should get the fortified logo endorsed by FSSAI
11. +F logo to be used per the FSSAI standards and gazette notification on food fortification
12. Rice millers will be the key stakeholders in this whole initiative and will drive this initiative. In short they will be responsible for fortification and quality of fortified rice supplied

Section II

Technical Guidelines

This section will cover technical guidelines of rice fortification

1 Manufacturing process: blended fortified rice

This chapter provides an overview of the process to be followed for producing (Fortified Rice Kernels (FRK) and Fortified Rice (FR). It also highlights the roles and responsibilities of the staff responsible for producing FR at the production unit.

The objectives of this chapter are as follows:

- To familiarize the production staff on basic steps involved in production of Fortified Rice.
- To familiarize the employees at State/District Food Department and rice mills, with their roles and responsibilities.

What is Fortified Rice Kernel (FRK)?

Fortified Rice Kernel (FRK) is a reconstituted rice grain made from rice flour, vitamins, and minerals using hot extrusion technology. This process is relatively simple and comprises the following five steps:

1. Mixing of raw material
2. Passing raw material through extrusion process
3. Drying of finished product
4. Storage
5. Packaging

1. **Mixing of raw material:** FRK is a reconstituted rice grain made from rice flour, vitamins, and minerals. Rice flour, vitamins and minerals that form raw material for producing FRK along with specified additives are blended/ mixed together in appropriate proportions and the mixture is hydrated (using water treated by Reverse Osmosis process) for getting prescribed moisture content.
2. **Extrusion:** This uniformly hydrated mixture of raw material with agreed moisture content is passed through a twin-screw extruder where it takes the shape of tiny pellets resembling regular rice grains.
3. **Drying:** The next step in the production of FRK is slow drying at low temperature. This is done to bring down moisture to a safe level and production of high-quality FRK.
4. **Storage:** After the drying process is completed, the finished product (FRK) is stored in an intermediary storage bin before packing.
5. **Packaging:** FRK is packed in a special two-layer bag with inner poly lining (20/25/50 Kg bag depending on need). These bags are made up of two different layers to protect rice from moisture and rodents. The inner poly lining of this bag is made up of good quality food grade material.

2 Process of rice fortification

The major step for producing Fortified Rice include:

1. Sourcing/ Producing of Fortified Rice Kernels (FRK)

2. Blending FRK with 50 to 200 parts (generally 1:100) of raw milled rice polished raw or parboiled rice.
3. Quality assurance and control
4. Packaging

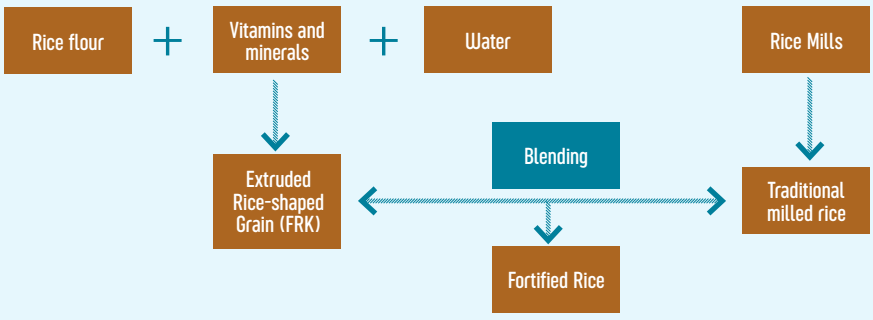
There are a number of ways in which rice can be fortified. Extrusion amongst dusting and coating is the most commonly used technology for fortification of rice. Extrusion technology provides the most robust method of adding additional vitamins and minerals to rice. Nutrients are added to kernels in a simple two - step process.

1. Broken rice grains are ground into rice flour and mixed with water and required micro-nutrients to produce a dough/pre-blend.
2. The fortified dough/pre-blend is then passed through an extruder to produce Fortified Rice Kernels (FRK) which are then blended with raw milled rice, most commonly in a ratio of 1% (1:100:: FRK:Raw Milled Rice).

These fortified kernels keep the nutrients intact even after cleaning, washing,and there are minimal nutrient losses in cooking as compared to other methods like dusting, coating etc. Rice, when fortified, should contain additional amounts of Iron, Folic Acid, and Vitamin B_{12}. The nutrients are added in slightly increased amounts to compensate for nutrient losses due to cooking and storage. Additionally, rice can also be fortified with Zinc, Vitamin A, Thiamine (Vitamin B_1), Riboflavin (Vitamin B_2), Niacin, and Pyridoxine (Vitamin B_6) at fortification levels directed by the Food Safety and Standards Authority of India (FSSAI).

The rice mill/warehouse, equipped with a dosing, and blending system, is essentially where fortified rice can be produced. These facilities shall comply with all Good Manufacturing Practices (GMP), and food-safety guidelines as FSSAI standard guidelines. The manufacturing and food safety practices must comply with all the statutory and regulatory guidelines of the country/state/region where the product is manufactured. Utmost care is to be taken in manufacturing and handling of fortified kernels as the finished product is mixed with rice and distributed for consumption to consumers.

Figure 6: Flow of Production Process of Fortified Rice Kernel



Raw Material Selection:

The first decisive step in making good fortified rice is the selection of appropriate raw material. The challenge in selecting a compatible specification of ingredients is very critical, as the rice produced should be strong enough to sustain the shelf life and meet the cooking quality of regular rice grains.

Major ingredients include:

i. Rice Flour

ii. Food Grade Vitamin and Mineral Premix per FSSAI guidelines

iii. FSSAI approved Acid regulators and emulsifiers (Pentasodium Triphosphate – INS 451 (i), Citric Acid INS 330 etc.)

iv. Potable Water (IS 10500 : 2012)

Rice Flour:

Clean Broken Rice at an initial moisture content of 11-12% is ground to flour using 30-60 mesh sieve. Rice flour is very hygroscopic in nature; hence, the raw material and final produce need to be handled to control moisture as per Good Manufacturing Practices (GMP).

Vitamin and Mineral Premix:

Composition of vitamin premix has to meet the recommended specifications as per Food Safety Standards (Fortification of Food) Regulations, 2018[1]. It can be of mandatory vitamins and minerals, namely, Iron, Folic Acid, and Vitamin B_{12}, or the optional ones which comprise Zinc Oxide, Vitamin A, Thiamine, Riboflavin, Niacin - Nicotinamide, and Vitamin B_6. The level of premix is determined in order to fulfil more than 30-50% of Recommended Dietary Allowance (RDA) or as recommended by FSSAI.

Emulsifier/ Acid regulator/ Antioxidants:

FSSAI approved emulsifiers/ acid regulators/ antioxidants (Pentasodium triphosphate IS 451 (i) / Citric Acid IS 330 etc.) shall be used as per the allowances prescribed in Food Safety Standards (Fortification of Food) Regulations, 2016.

Water:

Water is used in manufacturing of Fortified rice as a solute which penetrates the starch structure of the flour and helps in gelatinization of starch. Potable water[2] shall be used for mixing of ingredients.

Role and responsibilities of plant manager responsible for production of fortified rice

1. Production plant head (GM) is responsible for adhering to all the guidelines specified in production manual in principle and practice.
2. He /she is responsible for machine operations and should prepare back-up plans for machine maintenance and spare parts.
3. He /she should prepare working instructions needed for machine operations based on details provided in machine operation manual supplied by machine manufacturer.
4. He / she should be able to run the plant in such a way that high-quality product is made, ensuring correct sampling and checking of final product for lab results and conforming to quality parameters.
5. He/ she should take decisions on quality of raw material, intermediate product, and final product, and should reject or reprocess or hold material for inspection and checking by laboratory.
6. He/ she should ensure that no product goes out from factory without appropriate quality checks.
7. He/ she should ensure that the final product meets all quality and food safety norms as prescribed by concerned authority, e.g., food safety and standards authority.
8. He/ she should ensure that environment health safety (EHS) norms are followed properly.

1 as notified on 2-Aug-2018

2 complying Indian standards for Potable water standards IS 10500 : 2012 amended on 1st June, 2015

9. He/ she should prepare a preventive maintenance schedule to avoid major breakdown during production.
10. He/ she should ensure proper material, machine and product handling by the staff responsible for producing FR at the plant.

3 Choice of blending machine

Selection of blending equipment depends on a number of factors such as capacity of blending, type of pre-blending system i.e. Manual/ semi-automatic/ fully automatic rice cleaning and handling. Various blenders that tested, the efficient best unit selected

1. Stand-alone Blender
2. Batch type Blender
3. Continuous Blender

The detailed description of classified blender as below

Stand-alone blender

As per the application of blending requirement of a small decentralized kitchen or rice storage warehouse where there is a limited requirement of rice ranging from 400-2000 kg on daily basis, the best option is stand-alone blending system. Stand-alone is most economic semi-automatic blending system that required very minimal installation and operating cost.

The standalone blending system is constructed with stainless steel mixing drum and works independently on the principles similar to concrete mixer. The regular rice and fortified kernels are added in the specified ratio and the blending operation completes within 5 minutes of rotary mixing.

The mixing drum is made up of stainless steel and is capable of blending up to 150 kg of rice per batch. The stand-alone blender is easiest to operate and doesn't require much training, after feeding the required quantity of rice and respective FRK in the drum the operator need to rotate the steering wheel to adjust the angle of rotation of the drum and after completion of the batch time the drum is rotated back to release the rice using the same steering wheel.

Batch blender

Mechanically and ergonomically it is quite challenging for stand-alone blender to handle a large quantity of rice in a centralized kitchen and bigger warehouse sceneries. This arises the need of a medium capacity blending system (up to 500 kg / h) which is suitable for mixing in warehouse, centralized kitchens and small capacity rice mills.

The Forsberg® Batch mixer is the most common and effective batch blending system suitable for such medium capacity environments, and is capable of producing the fortified rice in small batches ranging from 100 kg to 500 kg per hour. Forsberg blender is a paddle type mixer that mixes the two rice types inside a closed chamber. The blending system includes a horizontal mixing drum with paddle arrangement, vibratory dozer, bucket elevator and conveyor. Metered quantities of the rice and FRK are fed into the blender and mixing occurs for 1-2 min resulting in a uniform blend of fortified rice. Post completion of the blending stem the fortified rice is released for final packing as per the requirement. This is fully automatic system though requires limited intervention from the manual labor to feed the FRK on regular intervals but require a special training to execute the operation using the PLC panel.

Figure: Vibratory Feeder with Frequency Controller

Continuous blender

To cater to huge demand there is a need to either enhance the capacity of the batch blending system or create a mechanism so that the blending operation can be accomplished at source. Possibility of capacity enhancement is very limited due to the mechanical and handling constraints. The other possibility is to develop a rice blending equipment that is compatible with the flow capacity of the modern rice milling system and also can produce the fortified rice which can meet the quality parameters of the blended fortified rice.

After several research trials few systems have been identified which can fit in the two conditions of the flow capacity and quality. The first type of system that has been identified is the simplest combination of industrial rice length grader (as Blender) and electronic dozer to handle the uniform feeding as per the gravity flow of rice mill. This system has been tested and the blending uniformity found satisfactory with a need to establish a system to match the flow inconsistency of rice during milling.

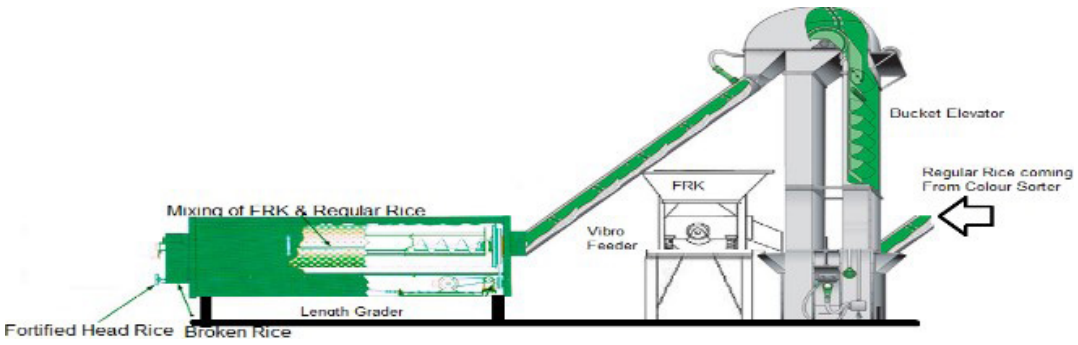
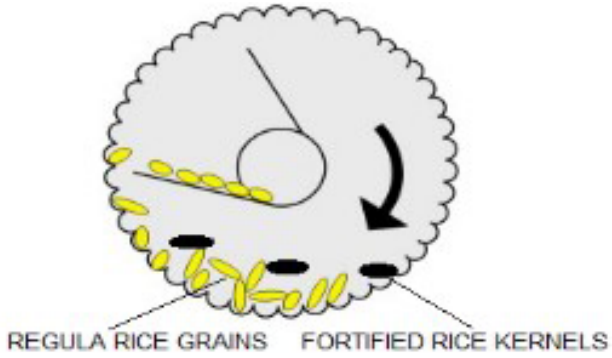


Figure: Rigorous churning of FRK with regular rice inside the grading cylinder

Blending is carried out with existing rice graders in the traditional rice-milling system. Because of the virtue of operation rice length-grading cylinders work as blenders. FRK is fed before the rice goes to grading cylinder using a pre-calibrated vibratory feeder (dozer) to the same rate of the flow of regular rice that is flowing to the length grader, the mixture of rice and FRK stirs inside the length grader a number of times to properly intrude the fortified rice kernel in the rice mass. The most critical part of the mixing is calibrated feeding using the dozer and the agitating mechanism. The mixing mechanism makes this blending process the most economical and effective as well. Vibratory dozer/feeder needs to be calibrated to match the desired flow capacity of the regular rice. The outlet of vibratory feeder (FRK) is attached to one inlet of the bucket elevator.

Figure: Principle of Blending inside the Rice Length Grader



FRK added through the vibratory feeder are mixed with regular rice flowing into the bucket elevator from the colour sorter, and the mix goes to the length grader. The length grader, by virtue of its grading mechanism, churns out the mix separating the broken grains from the mix, and this churning helps in the uniform distribution of FRK in the final fortified rice obtained at the head rice outlet of the length grader. The vibratory feeder should be synchronized with the flow of regular rice in the inlet bucket elevator. It is recommended to Pre-calibrate the vibratory feeder and assess the quality of blend regularly during operation to verify the blending homogeneity.

The second type of system that allows a high degree of blending homogeneity and is capable to handle extensively large quantities in a rice mill setting is continuous plow shear mixer. The stainless steel construction allows a rotating shaft fitted with a number of plow assemblies. The regular rice is fed through the rice bin and FRK through a vibratory feeder mounted below a FRK hopper. The operation is carried out for a specified time. The blended fortified rice will flow out of the blending system through an outlet at the other section of the equipment.

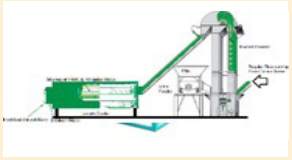
The other type of blending equipment is the zig-zag blender that allows a continuous mixing of fortified rice along with highest level of homogeneity. The said blender is under development stage and soon to be installed at various locations.

Initially tests were carried out for one ratio in available blenders. The other ratios were tried in the identified efficient units. The following are the test parameters of the trials in order to achieve highest level of mixing efficiency:

- Standardization of rpm required for proper mixing
- Standardization flow rate.
- Increasing the capacity of mixing

Among various blenders that tested, the efficient best unit selected based on accuracy of Mixing index and It has been observed that the zig-zag blending system results in highest mixing index for Fortified rice blending. If required slight modifications made for further improvement.

Efficiency of various blending machines

Particulars	Zigzag Blender	Drum Blender	Rice Length Grader
Type	Continuous	Continuous	Continuous
Application	Rice Milling	Rice Milling	Rice Milling
Capacity	5 MT/ hr	1-10 MT/hr	1-1.5 MT/hr
Ratio	100 to 1	100 to 1	100 to 1
Mixing index (Blender Efficiency)	0.94-0.96	0.99855	0.70-0.80
Blending System Efficiency	0.846-0.864	0.89865	0.63-0.72
Power Consumption (Blender)	3 kW	3 kW	1 kW
Appearance			
Cost of Operation	In the rice mill environment, the cost of operation will be low as this blender will be installed post final sorting and whenever required this system will operate	In the rice mill environment the cost of operation will be low as this blender will be installed post final sorting and whenever required this system will operate	Primary purpose of the length grader is grading the rice and segregate the broken rice from the head rice. If we use the length grader for the purpose of blending of fortified rice we will need to run the blending again after grading. While the normal grading of rice is happening, the fortified rice production cannot happen and to produce fortified rice grading system need to be operated separately and require full operation of the rice milling system hence the cost of operation will be high
Compatibility	Manual/ Semi Auto/Fully auto rice mill with color sorter	Manual/ Semi Auto/ Fully auto rice mill color sorter	Manual/ Semi Auto rice mill without color sorter. Since the length grader is commonly used before the color sorter and FRK will be separated out of fortified rice when this rice passes through the color sorter
Possibility to control the flow control	The system is self sustainable to control the flow of rice and subsequent blending	The system is self sustainable to control the flow of rice and subsequent blending	Flow balancer and rice hopper to be included before the elevator to maintain the flow consistency of rice and further calibration of vibratory feeder is required matching the flow of rice in the ratio of 100:1
Limitation	N/A since the buffer hopper is installed	N/A since the buffer hopper is installed	Uniform feeding of the Regular Rice and FRK is a major limitation. In case of plant break down the feeding needs to be readjusted and will impact the blending index

4 Maintaining overall safety and hygiene during the manufacturing of blended fortified rice

Several factors are involved in the processing of safe and hygienic food. The process involves all activities and responsibilities for preventing product adulteration, as well as the implementation of actions to prevent the occurrence of some of the hazards that can harm consumers. Providing a clean and sanitized environment and equipment for food processing is essential for producing safe foods, but that is not the limit of responsibility. Personnel practices, plant facilities, equipment and operations designed to prevent contamination, pest control and warehousing practices are all equally important. It is imperative that all of these considerations be addressed in the design of a comprehensive sanitation programme and a subsequent HACCP system. GMPs are intended to provide criteria for complying with the provisions of the government regulations requiring that all human foods be safe and free from adulteration. The requirements of the GMPs included in this section will help the staff responsible for producing FR to understand and ensure biological, chemical, and physical safety of the finished products.

The objectives of food safety are to help the staff who operate the plant to know and learn the following:

- The key steps to maintaining food hygiene and safety.
- The precautions they need to take whilst handling food ingredients.
- An understanding of the possible hazards that may occur whilst handling food ingredients.
- How to understand and exercise precautionary steps to maintain food safety.

In order to ensure high-quality production of FR, the standard food-safety guidelines will need to be followed stringently. The staff will need to know and learn the following in relation to food safety.

The most commonly reported food preparation practices that contributed to food borne disease are:

- Improper holding temperatures.
- Poor personal hygiene.
- Inadequate cooking.
- Contaminated equipment.
- Food from an unsafe source.

Food becomes hazardous by contamination (unintended presence of harmful substances or micro-organisms in food). Food can become contaminated from chemical, physical, or biological sources.

- **Microbiological hazards:** Microbiological hazards come mainly from micro-organisms, including bacteria, viruses, and parasites.
- **Chemical hazards:** Chemical hazards include substances such as cleaning solutions and sanitizers.
- **Physical hazards:** Physical hazards are foreign particles, like glass or metal.

Cross-contamination is one of the most common causes of food poisoning. It happens when harmful germs are spread into food from other food, surfaces, hands, or equipment. It's very important to prepare food safely, to help stop harmful germs from spreading and growing. Cross-contamination of food may be due to:

- Hands that touch raw foods (such as chicken) then touch food that will not be cooked (like salad ingredients).

- Surfaces (like cutting boards or cleaning cloths) that touch raw foods, are not cleaned and sanitized, then touch ready-to-eat food.
- Raw or contaminated foods that touch or drip fluids on cooked or ready-to-eat foods.

The most important tool to prevent food-borne illness is good personal hygiene. Personal hygiene is the way people maintain their health, appearance, and cleanliness. Not only can one become the victim of illness, but one can also be the carrier. A cough or sneeze can transmit thousands of micro-organisms that may cause disease.

Food safety includes handling, preparation, and storage of food in ways that prevent foodborne illness. This includes several practices that should be followed to avoid potentially severe health hazards. Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning.

The five key principles of food hygiene, according to WHO, are:

- Prevent contaminating food with pathogens spreading from people, pets, and pests.
- Separate raw and cooked foods to prevent contaminating the cooked foods.
- Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens.
- Store food at the proper temperature.
- Use safe (RO) water.

Government of India has set up Food Safety & Standards Authority of India (FSSAI) to take care of the regulatory guidelines on food safety.

Local food regulatory authority

The manager of operations and staff responsible for producing FR should follow guidelines on food safety and ensure necessary approvals from FSSAI for finished products.

Food safety standards for producing Fortified rice (FR)

FRK premix grain is produced using hot extrusion technology. Even though FRK and FR are safe products, as they are under the low moisture category and are stable products, the manufacturing process needs to follow GMP/GHP principles prescribed under Schedule 4 of the FSS (Licensing and Registration of Food Businesses) Regulations, 2011, and should maintain HACCP.

5 Good Manufacturing Practices (GMPs)

Task procedures for pre-requisite programmes:

GMPs are the procedures that should be followed from plant set-up until final product dispatch to assure food wholesomeness. GMP refers to the minimum sanitary and processing conditions required in a properly built processing plant. GMP includes cleanliness and sanitary requirements for personnel, building and facilities, and equipment and utensils, in addition to food-processing requirements and controls.

Cleaning and sanitation are a multi-step procedure that involves first cleaning and then sanitizing the food-processing plant. Food processing refers to the actual manufacturing operations, such as mixing, extrusion, drying, and packaging. When implemented properly, GMP not only reduces new forms of biological, chemical, and physical contamination, but eliminates existing contamination. Food-processing plants must be constructed with these practices in mind. Processing plants must be set-up with approved materials and maintained

under hygienic and sanitary conditions. Construction materials should be safe, non-toxic, and approved for use in a food-processing facility. All of the equipment, walls, floors, doors, windows, and fixtures must meet approved standards. The plant layout should be such that it can avoid accumulating dirt and can be easily cleaned and sanitized.

The following GMPs are to be used by the staff manufacturing FR :

GMP 1: Prerequisite programme – personal hygiene and employees' facility.

GMP 2: Prerequisite programme – sanitation and waste disposal.

GMP 3: Prerequisite programme – pest control.

GMP 4: Prerequisite programme – water.

GMP 5: Prerequisite programme – preventive maintenance.

GMP 6: Prerequisite programme – traceability.

GMP 7: Prerequisite programme – storage.

The above-mentioned GMPs are general safety guidelines that any manufacturing company involved in production of FR should follow. In addition, it is mandatory to follow all regulatory guidelines and specific requirements governed by law of land with regard to product registration, food safety, quality, EHS, and other applicable law at state and national levels.

GMP 1: Pre-requisite programme – personal hygiene and employees' facility

Personal hygiene is the basic concept of cleaning, grooming, and caring for our bodies. Whilst it is an important part of our daily lives at home, it is important for worker health and safety in the workplace. Workers who are aware of the importance of personal hygiene and follow the rules can prevent the spread of germs and disease, reduce their exposures to chemicals and contaminants, and avoid developing skin allergies, skin conditions, and chemical sensitivities.

The first principle of good hygiene is to avoid an exposure by providing a barrier over the skin with personal protective equipment (PPE) such as gloves, coveralls, and boots. It is important to check the PPE often for excessive contamination, wear, tears, cuts, or pinholes. Workers should clean, decontaminate, or replace protective equipment frequently to make sure it does not collect or absorb irritants. If protective equipment becomes dirty, the worker should stop and replace it with clean equipment.

Basic hand-washing and skin care can prevent work exposures and disease. Proper washing and scrubbing with water and soap helps to remove germs, contaminants, and chemicals. It also prevents exposure by ingestion and cross-contamination of the surfaces and objects workers touch.

Workers should periodically wash their hands during the day. In some jobs, regular hand-washing is required by law. Hand-washing is important before and after using the restroom and before or after certain activities. Workers should wash their hands before, during, and after preparing food and before they take breaks at work to eat, drink, or smoke. To control the spread of germs that can cause the flu or common cold, workers should wash their hands whenever they cough, sneeze, or blow their noses, and whenever they are around someone that is sick.

Hand-washing involves more than just rinsing under a tap. To wash hands properly, workers should first wet them under the tap and then use liquid or bar soap. Hands should be held out of the water until all skin surfaces are scrubbed and lathered for at least twenty seconds. Workers can then rinse with clean water and dry their hands with a disposable towel. Whilst using a hand sanitizer, workers should apply sufficient amounts of sanitizer into the palm of the hand, and then rub hands together until they are dry, being careful to cover all surfaces of the hands. For some job activities, hand sanitizers are not an acceptable means of hand-

cleaning. Showering and face-washing after work is also a good idea. Proper personal hygiene and hand protection can help keep workers productive and on the job.

Objective:

This section describes the requirements and importance for personal hygiene applicable in the facility.

Scope:

Depending on the physical, chemical, and/or microbiological hazard analysis that can have a negative effect on product, safety is classified into:

1. Food safe zones
    a. Process
    b. Packaging
    c. Loading point
2. Non-food safe zones (other areas which are not covered above)

    Process controlled: Personal hygiene of employees /contract workmen.

    Hazard(s) controlled: Chemical, physical, microbiological.

Requirements:

Below mentioned are the necessary requirements to be followed by the staff at the manufacturing plant whilst working in food safe zones:

1. Wear clean and trim clothes. Shirts/tops should not have pockets.
2. Hairnets should be used to cover hair.
3. Employees should not wear any jewelry, watches, decorations, heavy make-up, or strong perfume. (Wearing wedding rings without stones may be permitted with proper protection.)
4. Any lost items should be reported to the plant management immediately.
5. Personnel should wash hands with soap thoroughly whilst entering food safe zones and after using toilet/restroom or whenever their hands could be contaminated.
6. Hand-washing facilities should be located such that they are convenient and accessible to employees during operation.
7. Employees should keep lockers and work areas clean. Food should not be allowed to be stored inside the lockers and/or in food safe zones.
8. Food items, medicines, tobacco, and tobacco-related products should not be permitted inside plant. However, canteen, engineering office, and administration office are permanently exempted from above.
9. Personnel having wounds and cuts should not be permitted to work inside food safe zones.
10. Personnel suffering from infectious diseases like typhoid, hepatitis a, tuberculosis, giardiasis, infectious skin deceases, acute pneumonia, bronchitis are prohibited from working inside food safe zones.
11. Spitting is an offence inside the plant premises.
12. All above conditions are also applicable to visitors.
13. Visitors are expected to self-declare their health-related information on visitor's slip.
14. Employees' facility will be maintained and provided as per the attachment.

Frequency of inspection:

Visual inspection of the process, packaging room, and load point should be conducted weekly by executive.

Responsibility:

Area supervisor.

Corrective action:

Any deficiency must be corrected immediately with the consent of GM.

File location:

Respective control rooms.

Verification:

Verification should be done by respective HOD on a monthly basis. GM should review records for documentation of incidences/changes once a month.

GMP 2: Pre-requisite programme – sanitation and waste disposal

Housekeeping

Cleaning operations must be conducted by the staff in a manner that will minimize the possibility of contaminating screws, nuts & bolts and equipment surfaces that come in contact with RM. Cleaning removes the visible soil and organic matter and most of the harmful bacteria.

The washroom sink area in the processing facility should have adequate hot water, soap, hand towels, and signs reminding employees of the requirement to wash hands before going to work. It is also necessary that this area should be maintained as immaculately clean. Plant personnel should use brooms, brushes, high-pressure air, and low- and high-pressure water to remove visible soil and organic matter from:

- Plant floors
- Plant walls

Equipment and utensils must be kept in a sanitary condition through frequent cleaning and, when necessary, sanitizing. If necessary, such equipment must be taken apart for thorough cleaning. Cleaning is done on a pre-planned, regular schedule. Most cleaning operations are conducted at the end of the workday or at a prescribed time before the shift begins.

Sanitation requires that a sanitizing compound, such as chlorine, be applied to the cleaned surfaces so that the amount of bacteria can be reduced to an acceptable level. Sanitation is done at different times for various parts of the plant. The following is a recommended schedule of sanitation for the various parts of a processing plant:

- Plant floors every day and during mid-shift.
- Plant walls every day before each shift.
- Equipment before use for every batch.
- Other utensils prior to use.

Objective:

This section describes the requirements for maintaining sanitation in plant and operational areas.

Scope:

This procedure applies to general sanitation in the plant premises.

Process controlled: General sanitation.

Hazard controlled: Physical, chemical, and microbiological.

Responsibility:

Shift executive.

Monitoring:

Written cleaning procedures for mixing vessels, in process machines (extruder), and filling equipment will be maintained and periodically reviewed. Cleaning in place (CIP) procedures will be maintained as per manufacturer's recommendation. A master sanitation schedule has to be in place for all areas of process, packaging, and load points.

Requirements:

1. Master sanitation schedule.
2. Description of areas and equipment to be cleaned.
3. Detailed cleaning procedures of critical equipment.
4. All cleaning tools / chemicals placed at designated area.
5. Wooden brooms, brushes, etc. are not permitted in the filling operation.
6. All tools must be clean and in good repair.
7. Floors and floor drains must be properly sloped, placed, and maintained to prevent standing water and oil. Floor drains must be cleaned on a regular basis to prevent plugging.
8. All samplers for finished product sampling should be maintained in good sanitary conditions. This includes dippers, sample bombs, etc.
9. Approved cleaners and sanitizers with material safety data sheets (MSDS) will be used for cleaning.
10. No unlabeled containers will be permitted. All cleaners and sanitizers will be properly labelled and stored in a segregated area away from exposed product.

Frequency of inspection:

Daily.

Report title:

Master cleaning schedule.

Corrective action:

Redo cleaning and correct deficiency.

File location:

Shift executive office.

Instruction files location:

Production supervisor.

Verification:

The GM should do the verification as part of Professional Residential Property (PRP) inspection.

Department in-charge must review records for documentation of incidences/ changes.

Monthly review/ verification.

Refer:

Annexure XXII (hand-washing procedures).

GMP 3: Prerequisite programme – Pest Control

Food plants must have structures to control insects, rodents, birds, cats, and other animals. Flies, bees, rats, and mice invade the food plants in search of food. Cats and other animals enter the plant in search of rats and mice. All structures and equipment should be secured against them. Doors, windows, and other openings must be secured. Openings that are typically left open for ventilation should have screens. Installation of air curtains, fans, and insecticutors at strategic locations will be extremely helpful. Snap traps, glue boards, and bait stations must be placed around the immediate building exterior and interior walls to trap these pests.

Objective:

This section describes the requirements for pest-control management in the facility to prevent infestation.

Process controlled: Pest control.

Hazard(s) controlled: Microbiological, physical, chemical hazards.

Monitoring: Pest control contract.

Requirements:

The pest-control contractors shall perform the following:

1. Every chemical used in the plant should have an itemized list of its technical name, trade name, classification, concentration for application, and area where it is applied.
2. MSDS must be provided for chemicals used for pest control.
3. The plant must have service schedule.
4. Service contractor must have valid license for the work.
5. Poisonous bait stations must be kept outside of processing/ production building.
6. Mechanical traps can be placed within the plant; each trap should be numbered and fixed.
7. The pest-control contractor is not allowed to store any chemicals on plant premises.
8. Restricted chemicals cannot be used in plant.
9. Management should take steps to reduce pest entry and its harborage.
10. Trash bins should be placed in every corner, easily accessible, and should be regularly emptied.

Frequency of application:

As per existing schedule at the manufacturing facility.

Responsibility:

Production in charge.

Corrective actions:

Immediately after detection of deficiency.

Report title:

Pest-control service reports.

File location:

GM / production in charge.

Verification:

The quality manager / GM should do the verification.
Review records for documentation of incidences / changes.

GMP 4: Prerequisite programme – Water

Water is important to the food-processing industry because it is extensively used in most food plants as a processing aid and for cleaning operations. As a food ingredient, its quality (if impurities present) can affect the properties of the food, including texture, shelf life, appearance, aroma, and flavour. As a processing component, water may be used for conveying, heating, cooling, rinsing, dissolving, dispersing, blanketing, diluting, separating, steam-generation, and other activities. Purity of the water will affect its performance. For example, if water is hard (water with >120 ppm of hardness), salt may deposit on equipment surfaces or reduce water's ability to dissolve and disperse food ingredients. Cleaning activities in the food industry involve the use of water as a carrying agent, dispersant, solvent, and diluent. Hard water reduces foaming of soaps and effectiveness of rinsing.

The two primary sources of fresh water are surface and ground water. Food processors generally obtain water from municipal sources or owned wells. Knowledge of the water source and how it was obtained will help to indicate any required in-house treatment(s). The turbidity, mineral content, temperature fluctuations depend mostly on the source of water, and necessary steps can be taken.

Objectives:

This is a general guideline to ensure the quality of direct-contact water as per the local rules, regulations, and standards of IS 10500/IS4251.

Scope:

This procedure is applicable to water used for manufacturing of all products at extrusion plant.

Process controlled:

Direct-contact water at any stage.

Hazard controlled:

Physical, chemical, and microbiological.

Monitoring:

Filters, storage tank.

Requirements:

1. Production of potable water at facility where there is use of some of the chemicals for treatments to meet the local rules, regulations, and standards of IS 10500/ IS 4251.
2. All chemicals which are being used for water treatment should be of food grade.
3. Use of potable water as an ingredient for product during the processing, steam-generation, drinking purpose, and as well as for internal cleaning purpose.

4. Once a year, water sample should be sent for outside lab test to check its potability as per IS: 10500 requirements.
5. Water flow diagram is present.
6. Backflow preventive maintenance devices should be used in main water system.
7. Food-grade boiler additives and resins (certified by supplier) should be used in the boiler.
8. All water used directly in food or food-contact equipment should be treated by de-mineralized water plant.

Corrective actions:

1. Any deficiency must be corrected as soon as possible.
2. Any non-compliance should be reported to the facility management for further action.

Frequency:

Water to be sent to independent labs annually for verification.

Responsibilities:

Purchaser has to ensure the quality of resins / boiler chemicals are as per the requirement.

Laboratory manager has to ensure testing of the samples.

File location:

Shift manager's office.

Verification:

Verification should be done by the QA manager/ GM. Review records for documentation of incidences/changes.

GMP 5: Prerequisite programme – Preventive Maintenance

Preventive maintenance is not only a prerequisite programme, but also one area where a well-documented programme can provide a company not just with significant cost-savings, but also with data for future savings. Well-maintained equipment will ensure that a facility runs smoothly, works properly, helps ensure the production of safe foods, and provides a means to document performance.

A number of foodborne outbreaks have been directly attributed to failure to properly maintain equipment under sanitary conditions. Improper equipment maintenance was once a major cause of foreign materials complaints. However, with increased use of metal-detection systems and an enhanced commitment to maintenance programmes, foreign material complaints are now fewer.

Preventive maintenance also protects equipment, extends said equipment's life, and enhances operating efficiencies. The bottom line is that preventive maintenance provides peace of mind to food processors, and is one programme where benefits, both quality and economic, can be calculated.

Objectives:

This programme is designed to help machine operator to inspect and prepare/maintain equipment to ensure precise performance.

Scope:

The scope of this programme is to protect the customer from the possible event of a product safety failure by removing all suspect products from the distribution channels in the least amount of time, once a product recall or withdrawal is warranted and initiated.

Requirements:

Programme should include, but not be limited to:

1. An assigned person/position responsible for managing the programme.
2. Tracking of equipment undergoing maintenance and temporary repairs.
3. Preventative maintenance schedule with frequencies and verification.
4. A tools and parts control/reconciliation programme.
5. Preventive maintenance instructions should include a cleaning/sanitation step and/or inspection procedure before machine is put back into production.
6. Calibration of all major equipment and scales.
7. All preventive maintenance procedures should be documented.

Frequency of application:

As per existing maintenance schedule at the manufacturing facility.

Responsibility:

QC and QA managers.

Corrective actions:

Immediately corrected/maintained after detection of deficiency.

File location:

Managing director's office.

Verification:

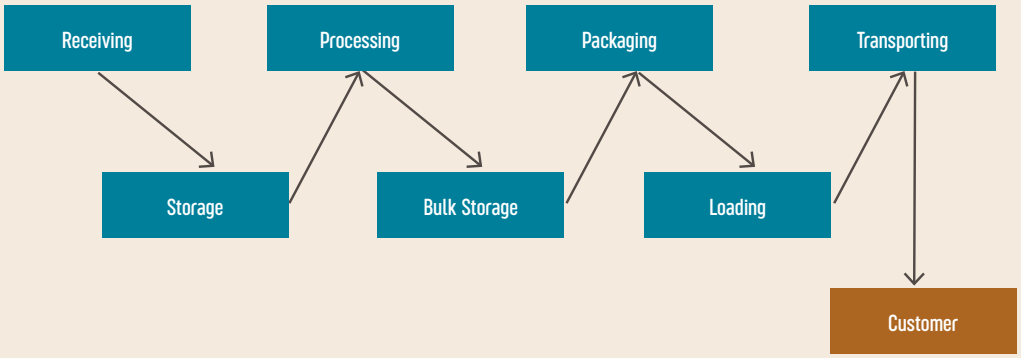
QC and QA managers should do the verification.

Review records for documentation as per schedule.

GMP 6: Prerequisite programme – Traceability

Traceability is the ability to follow the movement of a food product through the food supply chain and within an individual company. Its most obvious use is helping to make food recalls faster and more complete. Traceability includes all activities and processes that allow a food processor to track their food products and associated materials. This includes writing procedures and labelling or identification systems, then using computer hardware and software to give information about the location of different foods. The most important part of traceability is the record keeping, whether written or electronic.

Figure 7- Internal traceability flow chart



Objectives:

This is a general guideline to ensure the traceability of the produce. With this programme, the management would understand the critical role of traceability and set up the traceability system.

Scope:

The scope of this programmeis to protect the customer from the possible event of a product safety failure by removing all suspect products from the distribution channels in the least amount of time, once a product recall or withdrawal is warranted and initiated.

Requirements:

Programme should include but not be limited to:

1. Programme should follow internal traceability system.
    a. RM and ingredients inventory and tracking.
    b. Batch coding plan for final product.
2. An assigned person/position responsible for managing the programme.
3. Mock recall should be performed (forward to the customer and backward to the RM) at least annually in which lot/batch traceability is maintained.
4. Mock recall should include the following items:
    a. Scope/summary of the recall (e.g., what was the product, lot information, time, percentage recovery; was the recall successful and did it meet expectations; and the recall procedure).
    b. Inventory/shipment and processing records.
    c. Recall and notification procedures including contact information.
    d. Action plans.
    e. Product disposition and guidelines.
    f. Hold area procedures.
    g. Contact information for customers and regulatory agencies.

Frequency of application:

As per existing schedule at the manufacturing facility.

Responsibility:

QC and QA managers.

Corrective actions:

Immediately after detection of deficiency.

File location:

Managing director's office.

Verification:

Managing director should do the verification.

Review records for documentation as per schedule.

GMP 7: Prerequisite programme – Storage

Storage of RM and finished products is of utmost importance in a food-processing facility to achieve good-quality product. It is appropriate to maintain the moisture content of RM and finished products to the prescribed levels during storage. For storage under warmer temperatures or for storage times longer than six months, however, the recommended moisture content is 11%. In general, whole grains can be stored better than grounded flour. During FRK premix production, the finished product can be handled better. Rice flour, the primary RM, needs careful handling. During storage, the RM should be protected against moisture and insects by using all measures available at the site such as good environment, cleaning, storage control, ventilation, etc. This is true for the storage of finished products. Pierced sample bags attract and can lead to the proliferation of pests, which are a source of contamination. It is important to ensure that the RM are stored in appropriate places during the storage duration.

Objectives:

This programme is designed to help staff prepare and maintain storage of RM, ingredients, and FRK and FR premix.

Scope:

The scope of this programme is to ensure proper storage of the RM and ingredients before processing to maintain the quality and proper storage of FRK premix before leaving the processing facility.

Requirements:

Programme should include but not be limited to:

1. An assigned person/position responsible for managing the programme.
2. Dedicated and marked places for storage.
3. Maintenance of the records of inventory.
4. Maintenance of the records of cleaning processes.
5. Maintenance of the records of pest control.

Frequency of application:

As per schedule.

Responsibility:

QC and QA managers.

Corrective actions:

Immediately corrected/maintained after detection of any storage lapses.

File location:

Managing director's office.

6 Quality Assurance and Quality Control

Fortified rice should be regularly checked at a defined frequency and should be inspected at all levels. To ensure the quality of the fortified rice, controls need to be applied at various levels. It is also imperative to inspect the quality of the fortified rice throughout the supply chain.

1. Quality management of the FRK
2. Food Safety and Quality Management at the mill
3. External testing - Lab empanelment

1. Quality management of the FRK

As it has already been mentioned above that FRK should be procured from State empaneled manufacturer and the manufacturer should submit Certificate of Analysis (COA) for FRK and the premix used for production of the FRK before the dispatch of the consignment to the mill for fortification and before production of FRK respectively, to the State officials for clearance. The report should mention the levels of all micronutrients, along with salt names, which were added for FRK production. The chemical salt of the Vitamin and Minerals, used for FRK production, should be in line with the ones mentioned in FSSAI guidelines. Test parameters should be performed by NABL accredited laboratory external to both the FRK manufacturer as well as the premix producer. FRK should resemble the regular rice in its colour, sheen, consistency and texture.

Thus, FRK supplier should submit the below documents before dispatching the consignment:

- COA from an external NABL accredited laboratory, for each consignment
- COA of the premix used for manufacturing FRK, for each consignment
- Details of the quantity of FRK being supplied along with COA
- Valid FSSAI license to be submitted annually

2. Food Safety and Quality Management at the mill

Incoming Raw material and finished goods storage:

a. All the incoming raw materials should be visually examined for any kind of abnormalities or deviation from the FAQ/FSSAI specification. It needs to be ensured that the FRK which is proposed to be mixed with the CMR rice exactly looks like a sound grain in size, shape, colour and texture so that during analysis they are treated as sound grains.

b. At present the CMR is procured at up to 15% moisture content and its issuable limit is up to 16%. It therefore needs to be ensured that, the FRK remains stable/ does not disintegrate and does not absorb moisture at this moisture level. Since some of such fortified rice may be stored at areas having high rainfall or high humidity it also needs to be ensured that the FRK remains stable and does not become soft/ powdered at such atmospheric moisture.

c. During procurement of CMR, the rice grains having more than 2.5 length: breadth ratio is treated as Grade A rice and grains having less than 2.5 ratio is treated as Common rice. In case of Grade A rice as per uniform specification an admixture of lower class of rice kernel (common rice) of more than 6% is not allowed and such stocks are treated as BRL (beyond rejection limit) . To prevent such a situation, it is suggested that the length breadth ratio of FRK is kept at more than 2.5 in case of such FRK is to be mixed with Grade A CMR.

d. COA of FRK, quality of FCI rice should be checked. The food material should not be stored directly over the floor, but it should be stored over the pallets or tarpaulin sheet. The material should be stacked away from the wall. Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) must be followed such as staff involved in manufacturing and packaging unit should use Personal Protective Equipment (PPE's) to prevent cross-contamination, pest control should be done on regular interval, special emphasis on cleaning of equipment's which are in direct contact with the food must be taken, Capacity building of the Mill staff should be done on Standard Operating procedures (SOP's). Food handlers should be vaccinated against specific diseases (communicable). Adequate numbers of handwashing area should be constructed in the facility to facilitate good hygiene practices. Designated areas for eating and drinking should be marked. SOPs for storage of FRK, raw FCI and fortified rice should be developed, displayed in local language and diligently followed.

Blending Efficiency Test (BET): To validate the effective mixing of FRK and raw rice, blending efficiency test should be performed every hour by preparing a composite sample. The composite sample should be collected from 10-15 bags randomly every hour during production and blending efficiency test should then be performed. BET is performed by segregating and counting the FRK from 100g of fortified rice.

BET = No. of FRK per 100g of Fortified rice

Note: Sample should always be taken before the weighment and stitching.

All the instruments before use should always be calibrated for better results. For better understanding, detailed procedure for blending efficiency test has been outlined at Annexure-VI.

Iron Spot Test: Mill should have an in-house facility to perform test parameters and record daily data. In-house test such as iron spot test to be conducted on regular frequency to further validate the blending efficiency. A detailed procedure of iron spot test is placed at Annexure-VII

Regulatory compliance: The miller should comply to all the regulatory requirements for manufacturing and storing fortified rice. License should carry appropriate category. The package should contain +F logo and miller is required to get their product endorsed by +F logo through FSSAI's website. All the aspects regarding the food fortification standards should be met.

Documentation management: Log books should be well maintained to build a robust and transparent system. All records of incoming raw material and outgoing finished products should be maintained which includes COA and lab reports of FRK manufacturer. Test results of in-house lab and of external laboratory should also be documented and examined. Miller should maintain records of pest control and staff training. CAPA (Cause and Prevention Action) document format should be maintained and recorded whenever there is a deviation in finished product and root cause analysis should be identified and mentioned.

Food Safety Audits: Provision for internal audit on yearly basis will aid in maintaining the quality management system. The Food Safety Officer (FSO) should pick random samples from the mill and from fair price shops to ensure the quality of fortified rice (such that it covers all the shops and mills under his/her supervision in a quarter). Also, a surprise audit from an external body would further build a robust system to ensure that food quality is maintained throughout the supply-chain all year round.

3. External testing - Lab empanelment

External Testing of fortified rice

Vitamin and Mineral content of the fortified rice for defined parameters in FSSAI should be tested monthly from an external NABL accredited laboratory by the miller. On quarterly basis pathogenic microbial parameters should also be sent to NABL accredited laboratory to ensure the safety of the fortified rice. Miller would also be required to get the fortified rice tested for complete FSSAI parameters applicable to fortified rice half-yearly.

Criteria for empanelment of external testing lab:

For selection of an external testing lab for parameters related to food safety and quality, following criteria should be met:

- The lab should hold a valid NABL license
- Should be listed in FSSAI approved laboratories
- Iron, folic acid and vitamin B_{12} should be covered under the NABL scope of the lab
- Should have trained personnel for sample collection

Technical documents and FAQs on rice fortification have been created by Food Fortification Resource Centre (FFRC) and are also available on the FFRC website http://ffrc.fssai.gov.in/ffrc/home. This will assist businesses to ensure Quality Assurance (QA)/Quality Control (QC).

7 Packaging and stenciling of fortified rice bags

While executing milling agreement by State Food Departments with rice millers for custom milling of paddy stock following clauses, as per FSSAI Packaging and Labelling Guidelines, related to packaging and stenciling for proper identification of fortified rice stock are to be inserted:

1. All fortified food shall be packaged in a manner that takes into consideration the nature of the fortificant added and its effect on the shelf life of such food.
2. Every package of fortified food shall carry the words "**Fortified with** (name of the fortificant)" and the +F logo, (specified in Schedule -II of these regulation), on its label. It may also carry a tag line "**Sampoorna Poshan Swasth Jeevan**" under the logo.
3. Provisions of the Food Safety and Standards (Packaging and Labelling) Regulations, 2011, shall also apply to the fortified foods.
4. Every package of food fortified with iron shall carry a statement "People with Thalassemia may take under medical supervision".
5. All manufacturers and packers of fortified food complying with the provisions of the Act and rules or regulations made thereunder on fortified food shall be permitted to make a nutrition claim in relation to an article of fortified food under the Food Safety and Standards (Packaging and Labelling) Regulations, 2011.

8 Linking of depot/stack allocation

In order to maintain proper identity of fortified rice stocks and to avoid any kind of mixing with the normal stock, the district head of the procuring agency should link the identified millers to a particular depot to deliver the fortified custom milled rice stock. A separate stack is to be allocated to all the millers identified and who executed the custom milling of fortified stock enabling them to deliver fortified stock without any mixing with the normal stock.

9 Acceptance of fortified custom milled rice

The lot size of such stock will be same i.e. 540 Bags to be offered to procuring agencies for acceptance. The other instructions regarding delivery of fortified stock will remain the same as regular Custom Milled Rice (CMR).

10 Quality analysis of fortified rice consignments

The fortified rice consignments are to be checked by the quality control personnel of procuring agencies as per the existing procedure for analysis of food grains (BIS methods with up to date amendments). The analysis of food grains may also include verification the proportion of fortification i.e. 1:100 (FRK:Raw Rice). During acceptance of such consignments, the officials should also check the stencil mark of +F on every bag and on its rexin slips as per existing instructions.

11 Record keeping

The stack cards attached to fortified rice stacks should have an identification mark i.e. +F for maintaining separate identity. In the book of records stock position of fortified rice stocks (variety and grade-wise) is to be maintained separately for issuance under different schemes of Government of India.

12 Transportation of fortified rice stocks

In case of dispatch/issue either through road or rail movement, separate loading of fortified rice bags in the trucks/wagons with clear demarcation is to be ensured to avoid any kind of mixing of stocks with the normal stock while transportation.

13 Creation of priority list for issuance of fortified rice stocks

A separate priority list of fortified rice stock is to be drawn every month and to be followed for issuance under different schemes of Government of India.

14 Costing sheet of fortified CMR stock and revised Out Turn Ratio (OTR)

The incremental cost @ 60 paise per kg would be reimbursed to the rice millers through States/UTs for the total volume of fortified rice produced. The incremental charges will be shared between the Centre and the States/UTs in the ratio of 90:10 in case of North-East, Hilly and Island States and 75:25 in case of rest of the States.

15 Rice Recovery

The corresponding quantity of regular rice to the quantity of FRK procured by the rice millers should be recovered / adjusted after receipt of consignment of fortified rice by the procuring agency.

16 Monitoring and Evaluation

Background

Given that the primary role of the Food Departments at the National and State level is the distribution of grains, therefore the introduction of fortified rice does not foresee much change in this function. The TPDS scheme already has in place a robust monitoring mechanism, the same can be leveraged while introducing fortified rice as well with minimum alteration however a few changes will need to be brought in the monitoring mechanisms of the process of procurement of fortified rice.

Monitoring

Monitoring of rice fortification in the PDS

For the rice fortification scheme to be effective, fortified rice needs to be available, in the specific geographical areas targeted by the programme. In practice, this means that the product must be available for regular purchase from the fair price shops that are accessible to the targeted segments of the population. Furthermore, the fortified rice has to be purchased by the target families and consumed with sufficient frequency and in appropriate amounts by the targeted individuals. Throughout this process, that is to say, from the rice mill to the fair price shops, and right up until the time of consumption by the PDS beneficiaries, it is vital that the product maintains its expected quality. Thus, to ensure that the planned impact is achieved, the scheme's operational performance (or implementation efficiency) must be monitored; this is best accomplished through a system of continuous data collection at key points as described below. When bottlenecks or operational inefficiencies are identified, information must be directed to the Ministry / State Departments of Food responsible for implementing remedial actions and for re-directing the programme as needed. Details of monitoring required of the premix used in the production of the FRK as well as the FRK have already been discussed in the quality assurance and control.

For successful monitoring of the pilot scheme, all stakeholders in the scheme will need to play their role as there are areas of monitoring and indicators which are beyond the mandate of the Department of Food & Public Distribution and Food Departments in the States.

Monitoring at the rice mill

The monitoring at the rice mills where fortification of rice will be carried out along with paddy processing needs to be the joint responsibility of the State Food & Civil Supplies Department and Food Safety Officers. Regular visits to the rice mills; in some cases joint visits need to be made to ascertain the following:

1. Compliance to the standard operating procedures for procurement of the FRK, equipment used for the blending of rice,fortification of rice (adherence to effective blending operations and related SOPs) and storage of FRK and fortified rice.
2. Compliance to the Quality Control and Assurance mechanism. Maintenance of the records of Certificate of Analysis of the premix used for production of the FRK as well as the FRK, in-house blending efficiency and qualitative testing reports, shelf life of the FRK procured etc.
3. Compliance to the FAQ standards new FAQ standards for rice will need to be devised in view of fortification. Check list can be prepared for these areas.
4. Information on the following indicators should be regularly reported by the millers to the Procurement authority and the Food Safety Officer depending on the frequency at which the fortified rice is provided to the FCI and State corporations:
    a. Tonnage of rice fortified
    b. Tonnage of fortified rice lifted and delivered to the storage godowns
    c. Tonnage of FRK procured, date and source of procurement.
    d. Tonnage of FRK used for fortification
    e. Report of sample of fortified rice analyzed by an independent laboratory

Monitoring at the Storage godowns

The monitoring of fortified rice at the storage godown should focus on the following:

1. Compliance to the storage SOPs for fortified rice. In case the concerned go-down is storing both fortified and non-fortified rice, monitoring for compliance to storage SOP as well as segregation of stock becomes all the more important.
2. Compliance to First in and First Out (FIFO) rule to ensure that fortified rice is delivered to the community within its shelf life period.

Monitoring of rice during lifting from the godowns, transit and at the community level

Lifting of foodgrains by States: Aligned to the stipulations of the TPDS (Control) Order, 2015, the following need to be in place and further strengthened for delivery of fortified rice:

Before taking delivery of foodgrains, an officer of the State Government not below the rank of Food & Civil Supplies Inspector shall inspect the stocks of foodgrains intended for issue to ensure that the stocks conform to the prescribed quality specifications.

The following stipulations for monitoring of the TPDS scheme hold and will require quality implementation for fortified rice.

The State Government shall ensure regular inspections of fair price shops not less than once in three months by the designated authority. The State Government shall issue orders specifying the inspection schedule, list of check points and the authority responsible for ensuring compliance with the said orders.

Any authority or any person authorized by it in this behalf or any other person, who is engaged in the distribution and handling of foodgrains under the Targeted Public Distribution System

shall not indulge in substitution or adulteration or diversion or theft of stocks at any stage till delivery to the ration card holder.

Meetings of the Vigilance Committees shall be held at least once every quarter at all levels and the date and periodicity of the meeting shall be notified by the State Govenments and given wide publicity. Discussions on fortified rice shall be an important agenda item for all such meetings held.

The internal grievance redressal mechanism notified by the State Government which includes Toll Free Call Centres and use of State web portal shall also be used to register any acceptability or quality issues related to fortified rice. The same shall be widely publicized by the State Government. The State Government shall furnish a report on quarterly basis to the Central Government regarding the handling of any Grievances related to fortified rice.

The State Government shall ensure monitoring of the end-to-end operations of the Targeted Public Distribution System through the electronic platform.

The State governments should report to the Centre on a regular basis on the following indicators:

- Tonnage of fortified rice distributed by the State
- No./Name of Districts distributing fortified rice through the PDS
- No. of acceptability issues reported through the grievance redressal mechanism

The Fair Price Shop owners and further upstream State Food Department staff should continue to report on as currently done; however specific emphasis needs to be given to reporting of acceptability issues.

Evaluation of the distribution of fortified rice through the PDS:

Evaluation of the scheme would be done on an on-going basis at the Central Level by CPMU and at the State Level by the respective SPMUs and other internal officers designated by DoFPD/State Governments. Evaluation of the scheme would be done in conjunction with third-party evaluation agencies as well as the internal officers designated by DoFPD at both beneficiary and systemic level. Concurrent Evaluation of the program can also be done besides evaluation after one/two years of the program. The Evaluation agency may be selected by the Government based on its procurement procedures.

Given that fortified rice is being introduced into the PDS with the intention of reducing the prevalence of anemia and micronutrient deficiencies amongst the target population, the evaluation should focus on providing evidence that the Scheme is indeed reaching its nutritional goals. However, the evaluation should not be undertaken until Scheme in the given district has been shown – through appropriate monitoring over a substantial period – that it has been implemented as planned and is operating efficiently. A poorly implemented scheme is unlikely to achieve its desired impact, and thus, resources should not be wasted in undertaking evaluations until programme operational inefficiencies have been corrected.

The outcomes of the pilot scheme are in consonance with the goal of POSHAN Abhiyaan which is committed to reduce stunting by 2%, under-nutrition by 2%, anaemia (among young children, women and adolescent girls) by 3% and low birth weight by 2% per annum respectively. Districts may be identified with high prevalence of anaemia amongst children and women, reference from the NFHS-4 data can be considered by States/UTs while identifying Districts. The NFHS now provides district specific data and can be relied upon to provide data on anemia levels etc. for the pilot district. Data for other micronutrient deficiency can also be considered if available for a particular district.

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Preface

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Annexures

Annexure I - Indicative cost estimation for producing fortified rice and project management cost through PDS

Table: Indicative cost estimation for producing fortified rice in medium sized mill

(Milling capacity (in MT)/hr = 8; Working hours/day = 20; Working days/year = 300, producing full capacity -48,000 MT)

1	**Cost of FRK procurement/ production/ transportation**	Cost (in Rs.)
1.1	FRK (480 MT FRKs required @ INR 53.04/kg)	2,54,59,200
1.2	Transportation of FRKs (@INR 2000/MT – minimum 500 kms considered)	9,60,000
	Total	**2,64,19,200**
2	**Equipment (one time)**	
2.1	Equipment- Blending system cost (For large scale operations, a flow-balancer based dosing system equipped with a blending equipment has been considered) [i]	51,87,000
2.2	Other equipment (Weighing scales, moisture meter etc.)	50,000
	Total	**52,37,000***
3	**Other operational cost**	
3.1	Power consumption @ 10kW-H, unit cost INR 9/kW-H	5,40,000
3.2	Equipment maintenance @3% per annum	1,55,610
	Total	**6,95,610**
4	**Quality Control** (laboratories test, collection charges etc.)	50,000
	Grand Total (2,64,19,200 + 52,37,000 + 6,95,610 + 50,000)	**3,24,01,810**

Note:

i. Mills with low capacity of producing fortified rice may opt for blending system with a lower capacity. Cost of blending system may be as low as INR 6,00,000 and increases with higher capacity and automation.

ii. Keeping in view the above estimates, the State Governments may nominate the appropriate mill for this purpose.

iii. * However, Section-1.12 above may be referred for latest estimates

Table: Annual indicative cost estimation for project management components of scheme of Rice fortification in PDS

	Components	**Cost (in Rs.)**
	Central level	
1.	**Manpower- Central Project Management Unit***	
1.1	One Senior Consultant (Technical Expert) – Fortification- @ 3.0 lakhs /month	36,00,000
1.2	One Senior Consultant - Project Management- @ 2.0 lakhs /month	24,00,000
1.3	Two Data Entry Operator/ Multi-Tasking Staff (MTS) @ 0.25 lakhs /month	06,00,000
	Total	**66,00,000**
2	**MIS and Monitoring**	
2.1	Development & maintenance of MIS (one time cost)	10,00,000
2.2	Field visits by Central Team	02,00,000

	Total	**12,00,000**
	Total – Central level (66,00,000 + 12,00,000)	**78,00,000**
	State level	
1	**Manpower- State Project Management Unit***	
1.1	Project Manager at State's F&CS Dept. @ 1.5 lakhs /month	18,00,000
1.2	Technical Support Staff at District F&CS Dept. @ 0.3 lakhs /month	03,60,000
	Total (per State)	**21,60,000**
2	**Capacity building and IEC** (per State) **#**	
2.1	Capacity building and Training (per State)	5,00,000
2.2	Information, Education & Communication campaigns (per state)	2,00,000
	Total (per State)	**7,00,000**
3	**Third party Evaluation**	**20,00,000**
	Total – State level (21,60,000 + 7,00,000 + 20,00,000)	**48,60,000**
	GRAND TOTAL (78,00,000 + 48,60,000)	**1,26,60,000**

* Subject to maximum

If so required / subject to actual, as FSSAI consented to partner in Capacity Building & IEC

Annexure II - Terms of Reference for identification of a potential vendor for supply of Fortified Rice Kernels (FRK)

Project details:

It is a pilot project in States and Union territories with large rice consumption and in the districts with prevalence of micronutrient deficiency exists. Based on the experience and learnings gained from these pilot projects, the distribution of fortified rice will be scaled up.

Objectives:

Main objective of this project are:

1) Distribution of fortified rice through Public Distribution system, in one district each in 15 State/UTs to address anaemia and micronutrient deficiencies
2) Coverage of all NFSA beneficiaries under the PDS with fortified rice in the selected Districts.
3) Facilitate cross learnings and sharing of best practices among States/UT's and DFPD.
4) An important objective would be to evaluate the provision, coverage and utilization of fortified rice by the target population as well as the efficacy /effectiveness of the consumption of fortified rice in reducing the targeted micronutrient deficiencies in different age groups.

Project Location: One District each in 15 States/UTs

Duration of the Project: 3 years (36 months)

Quantity of Rice to be Fortified:

Through these Terms of Reference, the rice miller will procure Fortified Rice Kernels (FRKs) from prospective vendors for further use and blending with regular rice to form fortified rice to be distributed under the PDS Scheme in States and Union Territories of India.

Expectations from FRK suppliers:

1. **Production and delivery:** Produce and deliver FRK as per the delivery schedule shared by State Food Department/Rice Miller to the successful bidder.
2. **Delivery Address:** Government empanelled Rice Mills located in States and Union Territory of India.
3. **Packing instructions:** FRK to be delivered in appropriately labeled 20 Kg woven HDPE bags with an inner LDPE lining. The packaging material to comply with the specifications given below:

   Outer Packaging Material: Woven HPDE

   Outer bag: 80gms

   Inner Liner Packaging Material: LDPE

   Liner Thickness: 250 gauge

   Packaging Size: 20 kg
4. **Marking instructions:** The markings on the bag should mention the below. The draft label shall be shared with State Food Department well in advance for approval.
   i. Name of the Product
   ii. Intended Consumption
   iii. Ingredients
   iv. Vegetarian logo

v. Net weight

vi. Detailed address of Manufacturer

vii. Instructions for Use

viii. Storage Conditions

ix. Batch Number/ Lot Number/ Date & Time of Manufacturing/Shelf Life

5. **Production of FRK:** The FRK shall be manufactured using extrusion technology which involves dry mixing of rice flour & premix followed by addition of water. This blend is passed through a twin-screw extruder with heating zones, which produces kernels similar in shape and size of rice. These kernels are dried in multilayer dryer and passed through cooling conveyor and packaged.

   FRKs to contain the following micronutrients: (i) Iron, (ii) Vitamin B_{12} (iii) Folic Acid

   The FRK manufacturer is expected to develop and maintain Standard Operating Procedures (SOPs) for the production of the kernels for the given composition which includes details on – (i) Process for manufacture of FRK; (ii) Cleaning of plant & equipment; (iii) testing protocols for in-process and finished goods. Details of the SOP and other aspects of information as mentioned below are to be maintained by the vendor for review and sharing with State Food Department as and when required:-

   i. Certificate of Analysis (CoA) for each batch of premix received for production of the FRK

   ii. Extrusion Temperature

   iii. Dryer Temperature

   iv. Kernel length, width and density

   v. Cooking quality

   vi. Deviation & Corrective Action Records

Table: Standards of Fortification per kg for Nutrients or as specified by FSSAI

S.No.	Nutrient	Level of fortification per kg
1.	Iron - a) Ferric Pyrophosphate	28 mg - 42.5 mg*
	or b) Sodium Iron (III) Ethylene Diamine Tetra Acetate Trihydrate (Sodium feredetate - Na Fe EDTA);	14 mg - 21.25 mg
2.	Folic Acid - Folic acid;	75 µg - 125 µg
3.	Vitamin B_{12} - Cyanocobalamine or Hydroxycobalamine	0.75 µg - 1.25 µg

Note: *added at a higher level to account for less bioavailability

To ascertain above levels, given below are the finished product specifications:

Table: Finished Product specifications

Ingredient	Parameter	Specification	Reference	Frequency
Fortified Rice Kernels **(Minimum Levels of micronutrients /10g of FRK which is required for blending with 1kg regular rice to produce Fortified Rice)**	Shape	Manufactured grain should resemble the normal milled rice as closely as possible	Milled rice from the rice mill at state/UT	Each consignment
	Average Grain Length	To match with milled rice produced at the Rice Mill. Average Length to be around 5 mm.	Milled rice from the rice mill at state/UT.	Each consignment
	Average Grain Breadth	To match with milled rice produced at the Rice Mill. Average Breadth to be around 2.2 mm.	Milled rice from the rice mill at state/UT.	Each consignment
	Moisture	12% w/w (Max) at the time of receipt.	ISO 712-2009	Each consignment
	Extraneous Matter	Free from organic and inorganic extraneous matter	Visual Observation	Each consignment
	Kernel Count per g	50 – 75	Weighing	Each Consignment
	Color	White to Off-white	Visual Observation	Each consignment
	Iron	47.22 mg	AOAC 944.02 or AACC 40-70.01 (total iron present in ferric form) using Atomic Absorption Spectrophotometry or AOAC 984.27 using ICP Emission.	Each consignment
	Folic Acid	250 mic g	AOAC 992.05 or EN 14131 using microbiological extraction	Each consignment
	Vitamin B_{12}	2.5 mic g	AOAC 2011.10, 960.46 or AACC 86-40.01 using HPLC at 550 nm wavelength	Each consignment
	Mesophilic aerobic bacteria	10,000 cfu per gram (Max)	ICC no. 125, AACC 42-11	Each consignment
	Yeasts and Moulds	100 cfu per gram (Max	ICC no. 146, AACC 42-50	Each consignment
	Cooking test	FRK to retain physical properties and micronutrient levels after being subject to washing and cooking Cooking characteristics to be similar to FCI rice.	Cooking characteristics of FCI rice.	Each consignment

6. **Quality assurance and control:** A Certificate of Analysis (CoA) for the produced FRK covering the micronutrient levels and microbiological levels from an external FSSAI notified NABL accredited laboratory should be shared with the State Food Department at least 1 week in advance of the date of dispatch of the FRK to ensure a detailed review and

feedback to the CoA. The supplier is also expected to share with State Food Department a 500 g sample of the FRK from the consignment under production before its dispatch. The CoA for the premix should also be shared with State Food Department in advance of the production of the FRK.

7. **Shelf life:** The FRK produced should have a shelf life of minimum 12 months when the consignment is received at the delivery location.

8. **Food safety and risk assessment at manufacturing premises:** The manufacturer must be FSSAI licensed/registered under category 99.5 and should have a valid license for production of FRKs. For compliance with food safety standards, the processor must be able to demonstrate by principle and practice the adoption, implementation and recording of:
    - Good Manufacturing Practice
    - Hazard Analysis Critical Control Point program
    - Quality Management System

In this context an appointed Food Safety Officer/ Inspector / Quality Surveyor/ Official of **State Food Department** is entitled to visit the factory without prior notice during any period when the product is being manufactured to check that the GMP and HACCP systems are in place. The Inspector / Quality Surveyor may request to see:

- Records (i.e. names of Production and Quality Assurance In charge)
- Records of in process control parameters such as temperature inside the extruder in all three zones, dryer and cooler. Moisture content in Raw rice flour, Rice flour + Premix, just extruded kernel, Kernel after drying and Kernel before packaging.
- Record on FRK testing reports on cooking characteristics, Time & Temperature, Length & width
- Procedures (e.g. cleaning, personnel hygiene, HACCP, sampling and analysis).
- Work Instructions (e.g. process instructions, cleaning instructions).
- Quality manual for the FRK manufacturing process
- Records on Pest control treatment.
- Test Report on water analysis

9. **Specifications for Milled Rice (Broken):** Broken rice to comply with the following specifications;

Product	Parameter	Specification	Reference	Frequency
Rice Broken	Moisture	12% (Maximum)	ISO 712-2009	Batch-wise
	Organoleptic (Smell, Color)	Pleasant smell, Typical color (White to Off-White)	Visual Observation	Batch-wise
	Extraneous Matter	Free from all physical impurities.	Visual Observation	Batch-wise
	Mesophillic aerobic bacteria	100,000 cfu per gram (Max)	ICC no. 125, AACC 42-11	Batch-wise
	Yeasts and Moulds	1000 cfu per gram (Max	ICC no. 146, AACC 42-50	Batch-wise

10. **Specifications for Potable/Drinking Water:** The potable drinking water to comply with IS 10500:1991 standards. The water should be tested at least once in quarter and reports should be kept in the records.

Recommendations: Fortified rice shall comply, in terms of raw materials, composition or manufacture, except when specified otherwise in this contract with the following guidelines or standards:

i. (5) Rice, (1) Food Grains meant for human consumption, Regulation 5.4.6 Food Grains, Part 5.4 Cereal & Cereal Products Food Safety and Standard Regulations (2011)
ii. Codex Standard for Rice (CODEX STAN 198-1995)
iii. Recommended International Code of Practice: General Principles of Food Hygiene CAC/RCP 1-1969 Rev 4 - 2003 including annex "Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its application"
iv. General Principles for addition of essential nutrients to foods: CAC/GL 09-1987 (amended 1989, 1991) of the Codex Alimentarius

Other considerations:

The FRK manufacturer shall also ensure that each consignment of FRK matches with milled rice produced in the mill in terms of length, width, color and cooking qualities. To help the manufacturer with that samples of milled rice will be shared in advance along with the production schedule.

Annexure III - Terms of reference for supply of equipment for blending of rice with fortified rice kernel in an ecosystem of traditional rice mill

Project details:

It is a pilot project in States and Union territories with large rice consumption and in the districts with prevalence of micronutrient deficiency exists. Based on the experience and learnings gained from these pilot projects, the distribution of fortified rice will be scaled up.

Objectives:

Main objective of this project are:

1) Distribution of fortified rice through Public Distribution system, in one district each in State/Union Territory selected by State/UTs to address anaemia and micronutrient deficiencies
2) Coverage of all NFSA beneficiaries under the PDS with fortified rice in the selected Districts.
3) Facilitate cross learnings and sharing of best practices among States/UT's and DFPD.
4) An important objective would be to evaluate the provision, coverage and utilization of fortified rice by the target population as well as the efficacy /effectiveness of the consumption of fortified rice in reducing the targeted micronutrient deficiencies in different age groups.

Project Location: One District each in 15 States/UTs

Duration of the Project: 3 years (36 months)

Quantity of Rice to be Fortified:

Through these Terms of Reference (TOR), the rice miller seeks proposals from suppliers of equipment such as flow balancer / vibratory feeder and blender/mixer to support fortification of rice as an integral part of milling in the Government empanelled rice mill.
The objective of the requirement is limited to the supply, augmentation, deployment / installation and maintenance of necessary equipment within the existing eco-system of milling of rice for blending of FRK therewith.

Background:

Details (tentative) of equipment currently available at Government Empanelled Rice Mill:

The rice mill should have the following equipments for processing of fortified rice. Some of them should be already available with the rice mill and if not, then would be designed and manufactured through the mill's in-house fabrication unit. Material of these equipment should be food grade mild steel.

1. Bucket elevators for regular rice (with pit): 8-10 Ft.
2. Bucket Elevator for fortified rice (with pit): 8-10 Ft.
3. Pits: Pits for bucket elevator with minimum volume of 27 cu ft.
4. Silos (with slider for controlled output)
    i. For regular milled rice: 3-4 MT
    ii. Storage hopper for regular milled rice/ FRK with sliders:500Kg -750 Kg
    iii. For Fortified rice: 3-4 MT
    iv. Conveyor (Belt): 4-5 meters long made up of food grade material.

5. Additional structures such as attachments, pipes, chutes etc. should be procured as appropriate for setting up of rice fortification unit.

It is expected that, while installation of flow balancer / vibratory feeder and blender/mixer, the above list of equipment should be available at the miller's facility and will be utilized for production of fortified rice.

Scope of work

Procure the following equipments with the specifications given in Annexure III for reference:

1) Flow balancer/Vibratory feeder for dosing regular milled rice (1no.)
2) Flow Balancer/Vibratory feeder for dosing fortified rice kernels (1no.)
3) Blending Equipment (Blender/mixer) (1 no.)

Delivery Location:

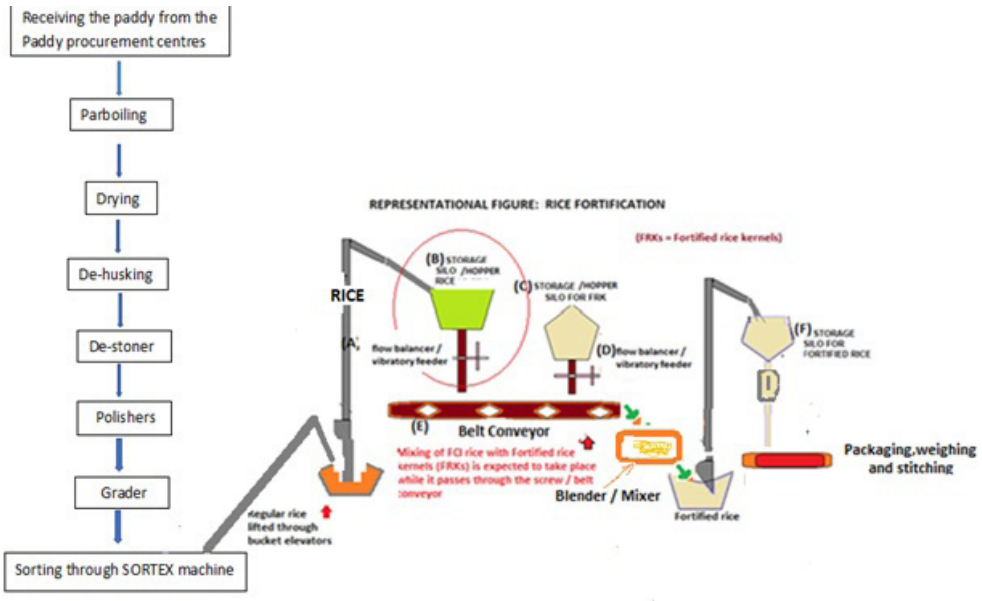
Government Empanelled Rice Mill, in selected location in States and Union territory of India.

Date of delivery and installation: DD/MM/20YY

Purpose:

Flow balancer / vibratory feeder need to be utilized for automatic release of 100 parts of regular milled rice and 1 part of FRK during the process of rice fortification ensuring continuous automatic release of rice with minimal human interface during the process followed by blending the two rice in a blender/mixer through the continuous blending operation. A representation of rice fortification after paddy processing is shown in the figure below:

Two flow balancers / vibratory feeders (one for FCI rice and one for FRK) are required to automatically weigh and dispense over belt conveyor the 100 parts of regular milled rice and 1 part of FRK stored in the respective silo /hopper. The material from the feeders should be



discharged over the conveyor directly or through a chute or any other similar arrangement (to be provided by the suppliers). From the belt conveyor, mixed rice will be passed to the blender/ mixer where mixing of both FRKs and rice will be done continuously and finally the blended fortified rice will be collected in silo through a bucket elevator for storage and packaging.

Note: The miller will send the sample of milled rice for its testing for compliance to FAQ (Fair Average Quality) rice and once certified it will be blended with FRK to produce blended fortified rice.

The blended fortified rice collected in a silo through a bucket elevator will be packaged in the bags provided by the government. The bags should bear the +F logo and label claims as per FSSAI guideline should be put on the bags.

i. Procure flow balancer / vibratory feeder with provision for automated weighing-dosing of regular milled rice and Fortified rice kernels and procure a blender/mixer. The vendors shall specify the maximum and minimum output (in MT/hr. or Kg/hr. as applicable) for the proposed set of equipments.

ii. The supplier is expected to provide detailed description of all the components of the flow balancer / vibratory feeder, Blender/mixer with labelling of each part. This should specifically mention the drawings, floor & vertical space requirements, material of construction, capacity, additional components etc. as part of the technical proposal.

iii. Mention upfront any pre-installation requirement to be fulfilled prior to installation & commissioning such as electrification, civil work or equipment's such as compressor, voltage stabilizer etc. or any other requirement with its detailed technical specification.

iv. The supplier shall provide a declaration on the accuracy of weighment through the flow balancer / vibratory feeder with the supporting documentary evidence. **Declaration on Efficiency of the blending equipment along with the evidence that the system worked anywhere.**

v. The supplier shall provide a declaration on the percentage precision of the blending equipment with necessary supporting documents

vi. The supplier is also required to submit the calibration certificate of the Flow balancer / vibratory feeder from a third party NABL accredited laboratory tested not more than 6 months from the date of submission of the bid.

vii. Locally contracted miller will be responsible for the blending of the rice with FRK. The supplier is expected to provide information on the actual power requirement of the equipment, details of the blending setup (flow balancer/feeders, blender etc.) and rate of blending rice per hour.

viii. Install, commission the flow balancer / vibratory feeder and blender/mixer and conduct the trials to validate the output from feeder and blending efficiency of the blender/mixer at Govt empanelled rice mill. (the address will be provided once the mill is approved by DoF&PD)

ix. The supplier of flow balancer / vibratory feeder is expected to train the DoF&PD supported rice miller's team to operate, maintain and trouble shoot the system. They should provide with the handbook /manual at the time of installation and commissioning for flow balancer / vibratory feeder, blender/mixer with the details of the parts of the machine properly labeled. They should also provide with Do's and Do not's, Preventive and corrective action to be taken.

x. The Flow balancer / vibratory feeder, blender or mixer should have the annual maintenance service for a period of 1 year which should start after the completion of one-year warranty and guarantee period.

Note: If vendors have any other solutions / equipment's apart from the one mentioned in the terms of reference, the same must be communicated and justified in the technical proposal. The vendors shall be available for any clarifications required.

A. Specifications for flow balancer/Vibratory feeder for dosing regular milled rice (1no.)	
Type	Twin Weigh Hoppers or other type as appropriate in case of vibratory feeder
Weighment capacity	TPH* of regular milled rice (if suppliers have flow balancer / vibratory feeder with higher capacity, please provide justification in the technical proposal regarding the feasibility and applicability of requirement)
Interim Time Period	Continuous stock discharge twin weigh-hoppers to give continuous discharge. Time between the two discharges of regular rice to be suggested by the vendor to achieve the best weighment efficiency.
Total FRK required for blending.	XX MTs of regular milled rice will be blended with YY MT of FRKs per quarter (i.e. 3 months)
Bulk density of regular milled rice	0.7 gm/ml
Proposed Components of Flow balancer/ vibratory feeder system:	1. Automatic weighing system, 2. Control panel, 3. Compressor, 4. Voltage Stabilizer, 5. Supporting structure
Material of construction	SS 304 (food-grade) (supported with documents)
Measuring Hoppers of flow balancer / vibratory feeder	Two Hoppers inside the flow balancer / vibratory feeder (suggestive)
Measuring Hoppers of flow balancer	Two Hoppers as a part of the flow balancer / vibratory feeder made with SS 304 (food grade) material
Work principle / mechanism	Gravimetric proportioning with automatic control
Features	Constant capacity, High operational reliability, Low space requirement, Low maintenance
Weighing Process	Incoming grains fills the first measuring hopper. Then incoming grain is diverted to the second hopper. While the second hopper is being filled, the grain in the first hopper is measured and discharged. Incoming grain is diverted to the first hopper. The grain in the second hopper is weighed and discharged. The two measuring hoppers are thus alternately filled, measured and discharged and the accumulated weight and throughout are calculated. (Please note that above mentioned process is recommended weighing process, however vendors can submit flow balancer /vibratory feeder with alternate weighing principle provided with necessary technical evidence and documentation)
Feeding	SS 304 food grade hopper
Ventilation	1 vent flange
Discharge	1 discharge opening at the bottom and should be surrounded by an outlet chute with inspection cover.
B. Specifications forflow balancer/Vibratory feeder for dosing fortified rice kernels (FRK) (1no.)	
Type	Twin Weigh Hoppers or other type as appropriate in case of vibratory feeder
Weighment capacity	Kg per hr.* of FRK (if suppliers have flow balancer / vibratory feeder with higher capacity, please provide justification in the technical proposal regarding the feasibility and applicability of requirement)
Interim Time Period	Continuous stock discharge twin weigh-hoppers to give continuous discharge. Time between the two discharges of regular rice to be suggested by the vendor to achieve the best weighment efficiency.
Total FRK required for blending.	Approx. XX MTs of regular rice will be blended with YY MT of FRKs per quarter (i.e. 3 months) in a selected District
Bulk density of FRKs	0.65 gm/ml

Proposed Components of Flow balancer/ vibratory feeder system:	1. Automatic weighing system, 2. Control panel, 3. Compressor, 4. Voltage Stabilizer, 5. Supporting structure
Material of construction	SS 304 (food-grade) (supported with documents)
Measuring Hoppers of flow balancer / vibratory feeder	Two Hoppers inside the flow balancer / vibratory feeder (suggestive)
Measuring Hoppers of flow balancer	Two Hoppers as a part of the flow balancer / vibratory feeder made with SS 304 (food grade) material
Work principle / mechanism	Gravimetric proportioning with automatic control
Features	Constant capacity, High operational reliability, Low space requirement, Low maintenance
Weighing Process	Incoming grains fills the first measuring hopper. Then incoming grain is diverted to the second hopper. While the second hopper is being filled, the grain in the first hopper is measured and discharged. Incoming grain is diverted to the first hopper. The grain in the second hopper is weighed and discharged. The two measuring hoppers are thus alternately filled, measured and discharged and the accumulated weight and throughout are calculated. (Please note that above mentioned process is recommended weighing process, however vendors can submit flow balancer /vibratory feeders with alternate weighing principles provided with necessary technical evidence and documentation)
Feeding	SS 304 food grade hopper
Ventilation	1 vent flange
Discharge	1 discharge opening at the bottom and should be surrounded by an outlet chute with inspection cover.
C. Blending equipment (Blender / mixer) 1 No.	
Blending Capacity	TPH (supported by technical documentation from the vendor, with regards to the blending efficiency and capacity)
Blending Time & Blending process	Continuous blending with uniform blending of 1 part of FRK with 100 parts of milled rice.
Total Tonnage of rice to be blended per annum	Approx. XX MT of regular rice to be blended with YY MT of FRK per annum.
Material of construction	Food-grade (Preferably SS-304)
Mixing elements	Twin shaft with paddles in food grade, (Note: It is recommended that the mixing elements in the blender consist of twin shaft paddles, however vendors can submit alternative mixing elements provided with necessary technical documentation)
Mixing Process	Mixing principle to be based on use of 2 counter rotating paddles (Note: It is recommended that the blending element follow a fluidized mixing principle, however vendors can submit blenders with alternate mixing principles provided with necessary technical evidence and documentation)
Mixing Shell	Horizontal with two semi-circular troughs in food grade construction (preferably SS-304)
Seal for mixer shaft	Self-lubricant & water-resistant design
Ventilation	1 vent flange
Discharge	1 discharge opening on the side at the opposite end to the drive. Discharge opening to be surrounded by an outlet chute with inspection cover and bottom flange

Other Electrical equipment

Control Cabinet	ON/OFF starter for motor emergency switch, indicating lamps, ammeter, voltmeter, interface contacts and terminals for connecting to remote control system and others as applicable
Electricals	All electrical components like limit switches, motor etc. to be duly wired and terminated in a junction box mounted on a mixer and others as applicable
Compressor (if required)	(as deemed appropriate by the vendor)
Voltage Stabilizer (if required)	(as deemed appropriate by the vendor)

(Note: In addition, supporting structures, engineering etc are also required)

*Final Capacity of flow balancer / vibratory feeder/blending equipment required to be procured and installed for dosing of regular milled rice might vary, hence vendors are required to provide flow balancer / vibratory feeder which allow sufficient range in capacity.

Note for submission of technical proposal: (Documents / information required)

1. Maximum and minimum output (in MT/hr capacity) for the proposed flow balancer / vibratory feeder and blender/mixer.
2. Detailed description of all the components of all the set of equipments (Flow balance/ feeder and blender) with labelling of each parts in its diagram.
3. Floor & vertical space requirements, material of construction, capacity, additional components etc. as part of the technical proposal.
4. Pre-installation requirement if any, must be mentioned.
5. Declaration on the accuracy of weighment through the flow balancer / vibratory feeder and blending efficiency of blender/mixer with the supporting documentary evidence
6. Calibration certificate of the all the equipments from a third party NABL accredited laboratory tested not more than 6 months from the date of submission of the bid.
7. Steps to operate the equipment.

Annexure IV - Proper measures should be taken to prevent the infestation of FRK from insects, rodents and their droppings.

i. Food & Non-Food material should not be stored in the same area. Storage of fuel, disinfectants, cleaning agents, stationary or other items should be strictly away from the stored finished materials

ii. The empty HDPE bags should be secured separately in tied bundles and should not be discarded or used for any other purpose.

Incorrect storage method

Stacking of HDPE bags by Brick layer method

Annexure V – Sample label of fortified rice packaged in Jute Bag

FORTIFIED RICE

FORTIFIED
SAMPOORNA POSHAN SWASTH JEEVAN

Fortified with multiple micronutrients

Fortified rice meant for supply under Public Distribution System only
(Not for Sale in the Open Market)

STORAGE PROCEDURE	**COOKING DIRECTION**
Unopened bags of fortified rice should be kept in a cool and dry place, away from direct sunlight. Fortified rice bags once opened should be stored in same bags after tying close with a string	Cooking of fortified rice do not require any special cooking procedures. The regular steps of cleaning and washing to be followed. Rice should be cooked strictly using **water tight** method of cooking

Ingredients: regular rice kernels and fortified rice kernels

Each 100g of Fortified Rice contains:

Iron = 4.25 mg

Folic Acid = 12.5 mcg

Vitamin B_{12} =0.125mcg

Net weight -50Kg
Batch no.
Date of Packaging:
BEST BEFORE X MONTHS FROM DATE OF PACKAGING
Note: Use fortified rice within Y days of opening of bag

Manufactured by:

FSSAI License no.

Annexure VI - Blending efficiency test

Quality Control (QC) method to test homogeneity of Blending at rice mill/ blending site - Instruction Manual

This quality control method tests the presence of fortified rice kernels in a blended batch of fortified rice and the homogeneity of the fortified rice.

What is in the kit?

1. 250 ml beaker
2. 50 ml beaker calibrated to measure 50 grams of rice depending on the variety being used for blending
3. 100 ml bottle of Chemical Reagent (Povidone Iodine solution)
4. Dropper
5. Tray
6. QC method instruction manual
7. Standard Operating Procedures
8. Bag

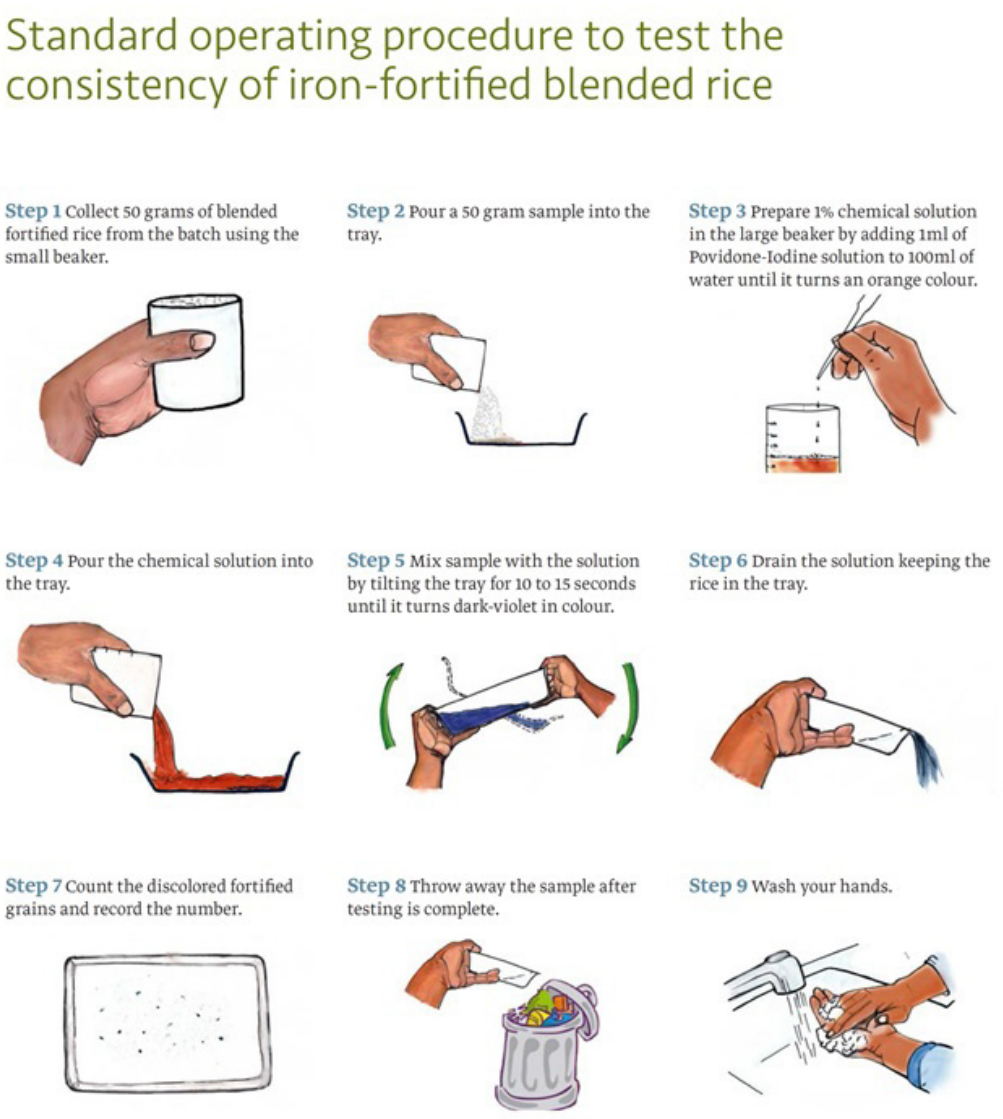
Who can use the kit?

1. Rice miller: to test the level of blending in different batches.
2. Regulatory Authorities: to monitor the blending homogeneity at rice mills/warehouses.

How to use the kit?

1. Collect a sample of 200-500 grams from 10% of the blended fortified rice consignment using the BIS method.
2. Take 50 grams of rice from the collected sample using standard sample reduction techniques
3. Spread the 50g rice sample onto the tray.
4. Prepare a 1% chemical reagent (Povidone Iodine solution) in water using these steps:
    a. Fill 250 ml beaker with 100 ml of water
    b. Add approximately 1 ml of the chemical reagent (Povidone Iodine solution) to the water, using the dropper.
    c. Stir until the solution turns bright orange in colour.
5. Pour the 1% chemical reagent (Povidone Iodine solution) into the tray and mix with the rice sample by tilting the tray or mixing with the dropper. Break-up any lumps that form.
6. Mix the sample until the solution turns from orange to violet-blue (10-15 seconds).
7. Carefully drain most of the chemical solution into the 250ml beaker. Keep the kernels in the tray.
8. Fill 50 ml beaker with water and add it to the kernels in the tray.
9. Count all of the discolored fortified rice kernels and document the findings. Re-count to confirm findings.
10. Discard the tested sample and wash hands.
11. Sign the records after noting the results.

Pictorial representation is given below



Homogeneity test (of fortified rice at Rice mill – template)

Sample number	Collected On		Tested by	Number of grains	Recorded by	
	Date	Time			Name	Signature

Annexure VII - Iron spot test

Aim	To determine the presence of Iron in fortified rice
Apparatus required	Dropper, watch glasses
Reagents and Solutions	1. H2O2 - 3%: Add 9 ml concentrated H2O2 (30%) to 81 ml distilled water 2. Thiocyanate reagent - Dissolve 10 g KSCN in 100 ml water. Mix with equal volume 2N HCl just prior to use
Procedure for fortified rice	» Place at least 50 grams of fortified rice in a plastic cup, tray, or similar container. » Pour Reagent 1 (2N HCl) on the rice until all the rice kernels are wet. » Pour a similar amount of Reagent 2 (10% KSCN) on the wet rice sample. » Immediately, fortified kernels will turn red to dark red (black upon drying) indicating the presence of iron fortified kernels

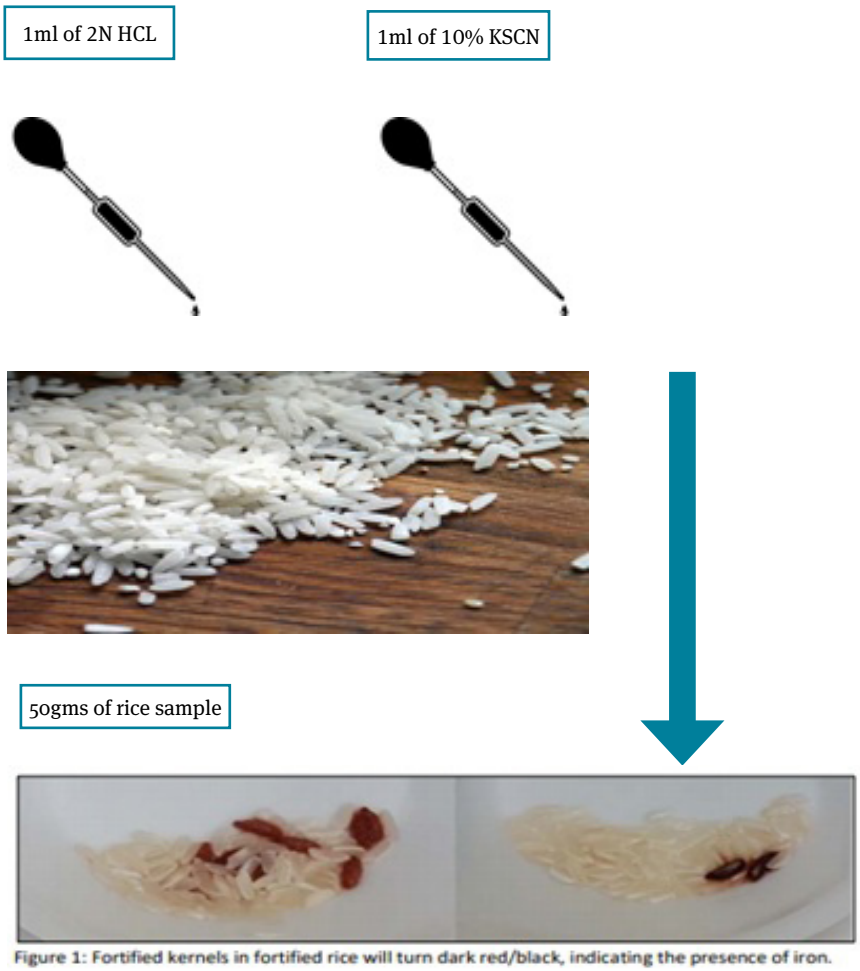


Figure 1: Fortified kernels in fortified rice will turn dark red/black, indicating the presence of iron.

Annexure VIII - Guidelines for storage of packing material required for packing fortified rice kernel and fortified rice

Purpose:

To store the packing material in such a manner that it does not get contaminated during the storage.

Scope:

It applies to all the packing material in which the rice is packed for dispatch to the customers.

Responsibility:

Head of packaging.

Procedure:

1. All the packing material is kept in designated areas.
2. Material planning is done in such a manner that the inventory levels are kept to the minimum to ensure rapid turnover.
3. Wherever practical, the incoming packing material is kept in the original packing so that dust, etc., does not settle on it.
4. Where it is not practical to keep them in the original packs, the consignments are covered by cloth or some other means.
5. The packing material is used as far as is possible on first-in first-out principle.
6. These stocks are regularly inspected. If there is any indication of infestation, they are subject to fumigation.

Record:

Record of fumigation of the packaging Godown.

Annexure IX - Guidelines for maintaining personnel health and safety during fortified rice kernel and fortified rice manufacturing process

Purpose:

To ensure that the personnel maintain proper hygiene and sanitation to prevent any contamination of the food items.

Scope:

It applies to all the personnel who handle the rice.

Responsibility:

Head of Department (Production)

Procedure:

1. No person who is suffering from any contagious or infectious disease is permitted to enter the packing area or touch Fortified Rice.
2. Workers inform their superiors if any member of their immediate family is suffering from any such disease; such workers are deputed to alternate jobs.
3. No worker with open wound or skin disease is allowed touch rice.
4. Once a year, personnel are medically examined to ensure that they are not suffering from any infectious condition, contagious condition and/or skin diseases.
5. Supervisors check the workers on a daily basis. If any of them is suspected to have any of the above-mentioned problems, he is permitted only if he is cleared.

Record:

Annual medical check-up record.

Annexure X - Guidelines for preventing foreign object entry into the fortified rice kernel and fortified rice manufacturing process

Purpose:

To ensure that there is no chance of foreign objects falling into Fortified Rice as a result of processing.

Scope:

It applies to the personnel handling the Fortified Rice.

Responsibility:

Head of Department (Production)

Procedure:

1. Personnel who handle or pack the rice are not allowed to wear the following:
    a. Glass bangles
    b. Rings
    c. Wrist watches
2. The above are either removed before entering or if, due to sentimental/religious reasons, they have to be worn, the cloth is filed around them.
3. Personnel are not allowed to carry loose items in the pockets, particularly breast pockets from which they may fall out. These include but are not limited to the following:
    a. Coins
    b. Pens
    c. Tokens
    d. Medicine
    e. Tablets
4. Magnetic arrestors are fitted in all the processing machines to catch magnetic particles in the Fortified Rice.
5. A weekly check is done of these arrestors.

Record:

Magnetic arrestor check record.

Annexure XI - Guidelines for Pest Control at the Manufacturing Facility

Purpose:

To take suitable measures to ensure that there is no infestation of the rice stored in the unit.

Scope:

It applies to all the rice that is delivered to the customers.

Responsibility:

Head of Department (Utilities).

Description / procedure:

1. **Pest control agency**
   a. Selection and appointment of the pest control agency is done by factory GM.
   b. The criteria for selection are that the agency is government-approved.
   c. A formal contract is entered with the agency-identified commercial terms and its scope of activities.
   d. For ensuring that the agency is government-approved, a copy of its approval letter is kept on record.
2. **Frequency and dosage of pest control**
   a. The frequency of pest-control measures like fumigation depends upon the requirements and customer specification.
   b. Since weevils develop and grow faster during the hot season, during the summer months, the frequency is higher.
   c. Methyl bromide pesticide is used in the plant.
   d. Whilst deciding on the type of pest control or its dosage levels, any requirement laid down by the customers or their government is also given due consideration.
3. **Rodent control**
   a. For this purpose, baits/traps are kept at different points.
   b. These baits' positioning points are slightly changed from time to time, lest the rodents get accustomed to them and avoid those areas.
   c. A record is kept of all the places where anti-rodent traps are placed.

Records:

Record of fumigation

Record of bait/traps placed

Annexure XII - Training of workers involved in manufacturing and packing process

Preamble:

Training is provided to personnel whose work affects product quality, production, and food safety. Training ensures that personnel possess the necessary competence for their work and are aware about the documentation as well as hygiene and sanitation measures.

Responsibility:

Primary: State/District Food Department and FSSAI

Description:

1. **Identification of training**
   a. Training is identified for each individual as per the job need.
   b. In identifying the need, it is ensured that at least one person per unit is to be trained on production operation, GMP, and SOP.
   c. Training is also imparted to bring awareness to the work force about the various food safety and quality practices adopted by the unit.
   d. Training is also imparted to the concerned personnel about the provisions of the unit's hygiene and sanitation measures along with importance of complying with them.
2. **Implementation of training**
   a. Once the training need is identified, action is taken to impart the necessary training.
   b. Training may be given in-house or by deputing personnel outside.
   c. In-house training may be from internal or external faculty.
3. **Training effectiveness**

   After each training, suitable means are adopted to judge whether the training was effective. Following are some of the measures adopted in this regard:
   a. Improvement in performance.
   b. Assessment of the superiors.
   c. Assessment of the tutors.
   d. Feedback from the trainees.
4. **Training records**

   Records of all training should be retained with the District Food Department/Rice Miller.

Annexure XIII - Uniform for workers involved in the manufacturing process

Purpose:

To ensure that there is no cross-contamination from the clothing of the personnel.

Scope:

Applies to the clothing of all personnel who handle rice.

Responsibility:

Hygiene and sanitation officer.

Procedure:

1. All personnel to wear an overall or apron over their street clothes.
2. Whilst entering the packing area, personnel must wear dedicated rubber slippers/socks and cover their heads with a cap/cloth.
3. These dedicated slippers and socks are not used outside the packing area (e.g., for going to toilet or other facilities of the unit).
4. The overalls/aprons are not used outside the unit premises.
5. If the overalls have Velcro/zippers, they are always to be closed and not kept open.
6. In addition, the workers wear gloves whilst touching the rice.
7. The gloves are disposable, and non-disposal gloves are washed in detergent on a daily basis and dried before re-use.
8. The overalls and aprons are washed twice per week with detergent and dried before use.
9. The slippers are washed in clean running water once a week, rinsed in potassium permanganate solution, and dried before use.
10. These dedicated slippers are of a distinctive shape or given a distinctive marking to prevent their misuse.
11. The head covering cloth/caps are washed on a weekly basis in detergent.

Records:

Clothes and slippers cleaning register.

Annexure XIV - General Hygiene and Sanitation at the Manufacturing and Storage Facility

Purpose:

To describe the general hygiene and sanitation conditions in the factory.

Responsibility:

Hygiene and sanitation officer

Procedure:

A: General hygiene and sanitation:

1. All processing areas are no-smoking zones.
2. All the premises are cleaned and swept on a daily basis.
3. All the garbage is collected in designated places and disposed of on a regular basis.
4. Spitting is strictly forbidden. Spittoons to be positioned at different places and cleaned regularly.
5. All broken windowpanes are repaired to prevent ingress of animals and birds.
6. All the exhaust fans are checked for proper functioning.
7. No street shoes are allowed inside the packing areas.
8. All the grooves in the walls are filled up to prevent the breeding of insects, vermin, etc.
9. The premises are cleared regularly to remove cobwebs.
10. Garbage cans are positioned at convenient spots. These must be cleaned regularly.
11. All the sewage drains/go-downs are fumigated/cleaned to prevent breeding of insects.
12. No stagnant water is allowed inside the premises that may result in breeding of insects.
13. Anti-rodent measures are adopted in the go-downs and production area at the specified places.

B: Personal hygiene for personnel handling finished product:

1. Medical examination once a year.
2. Must not have any cuts on their hands.
3. Wash and dry hands after each visit to the toilet.
4. Wear an apron/coat over the street clothes.
5. Wear gloves.
6. Cover the head.
7. Wear a facemask.
8. Inform their supervisors, if they or any members of their families suffer from any infection diseases.

Records:

Annual medical check reports; records as per individual procedures

Annexure XV - Standard and sanitary standard operating procedures

SOP: Receiving, handling and storage of fortified rice kernel and blended fortified rice

Receiving RM, ingredients, and packing material

1. The plant operator should inform QA laboratory as soon as any RM, ingredients, and packing materials are received at the store.
2. QA will check physically and record the following information:
    i. Approved supplier
    ii. Certificate of analysis (to be retained by QA lab)
    iii. Quantity
    iv. Batch number, date of manufacturing
    v. Expiry date
3. Store will accept material after QA inspection and verification is completed.

Storage – handling of RM, ingredients, and packing material

1. The store keeper will maintain inventory of raw material with expiry dates.
2. All material should be stored on plastic pallets and away from heat and moisture.
3. All material should be stored 1.5 feet away from wall.

Storage – handling of finished goods (FG)

1. FG should be stored on pallets and 1.5 feet away from wall.
2. Area should be free from any pest/weevil infestation.
3. Stock should be kept batch wise and first-in, first-out method needs to be followed.
4. QA will inspect and verify the product for compliance before dispatch.
5. Only QA-approved batches are loaded.

The above-mentioned SOPs for manufacturing FR should be strictly followed by the staff responsible for production of FR to ensure high-quality product.

Annexure XVI - Template for manufacturing process and food safety quality check

Company: _____

Address: _____

_____

Form completed by (name): _____ Date: _____

Use this checklist once a month to evaluate your compliance with local laws.

Keep a copy for the records.

(1) not addressing the issue (2) no standard system (3) system needs improvement (4) good system (5) great system (N/A) not applicable

(2)

Employee health, hygiene, and training	1	2	3	4	5	N/A	Corrective action needed	Date completed
Employee illness log maintained								
Employees follow proper hand-washing procedures								
Employees restricted from eating, drinking, or tobacco use in the processing areas								
Employees' personal items stored away from food storage/processing areas								
Employees trained in food safety								
Protection from contamination								
Food protected and separated from cross-contamination								
Wiping cloths properly used and stored in sanitizing solution								
Hand-washing facilities properly stocked and accessible								
Approved source								
Purchase products from reputable commercial supplier								
Supplier records maintained on site and readily available								
Products inspected for tampering prior to preparation and service chemicals								
Toxic chemicals properly used, labelled, and stored								
MSDS for each chemical available and accessible								

Proper use of equipment									
	Equipment properly stored and handled								
	Proper cleaning of equipment								
	Calibration of equipment as per schedule								
Physical facility									
	Physical facility properly cleaned, maintained, and aisles clear of obstruction								
	Unauthorized people kept out of food and records areas								
	Contractors/vendors monitored when they are in the food facility								
	Integrated pest management programmein place for pest management								
	Doors opening to the loading dock locked when not in use								
	Proper lighting for all areas of the facility								
	Cameras and alarm operated for high-risk high traffic areas (e.g., buffet to protect from contamination and tampering)								

Date

Signature of the Supervisor

Annexure XVII -Template for Monitoring of Cleaning Task at Facility

What item/area	How often			How to clean, equipment needed	Cleaning product to use	Who is responsible	To be checked by	Special handling instructions and protective clothing or refer to MSDS sheets
	Daily	Weekly	Monthly					

Date

Signature of the Supervisor

Annexure XVIII - Template for maintaining records of cleaning task at facility

What is to be cleaned	
How to clean	
How often	
Detergents and sanitizers	
Equipment	
Who will clean	

Date

Signature of the Supervisor

Annexure XIX - Template for maintaining records of calibration of equipment

Piece of equipment	Name of calibration contractor (write 'self' if doing your own check)	Date of service	Pass or fail	Corrective actions taken (if any)

Date

Signature of the Supervisor

Remember: To make sure equipment readings are reliable and accurate. Write down the test results on the record form. Check temperature probes and temperature-measuring equipment frequently (at least twice a year). Some equipment, such as thermometers and weighing scales, needs calibration or adjustment from time to time. Replace or repair equipment if you find a defect. Use an equipment-calibration specialist to check some equipment. Note on this record if the contractor provided a service report and where it can be located, if required.

Annexure XX - Template for maintaining records of goods received

Complete these details for all goods received. For new suppliers, check and record the condition of all deliveries until you are confident the supplier is delivering correctly.

Date	Time	Supplier (who transported the food)	Food type	Date code Use-by (u) best-before (b)	Accept (a) or reject (r)	Initials	Problems and corrective action

Date

Signature of the Supervisor

Remember: For all existing suppliers of high-risk foods, check and record at least one in every five deliveries. Check a sample of items within this one delivery. If a food's packaging is damaged and you think this has affected the food's safety and suitability, you should reject the delivery.

Annexure XXI - Template for maintaining records of preventive maintenance and housekeeping of extrusion and blending machines

Complete these details as soon as you receive a product. Update it when you use a new supplier or stop using an existing supplier. Use the record whether someone delivers the food to your business or you pick the food up from a supplier.

Product supplied	Supplier trading name	Supplier address and phone number	Date supply started	Other information

Date

Signature of the Supervisor

Tip: You can also use this record as a supplier contact list. This is very useful if there is a problem or if there is a recall of one of the foods you use–it will help you to quickly act on the recall instructions, find out where you got the food from, and check if it needs to be removed from use because it is a public health risk.

Annexure XXII – Hand washing guidelines for production staff

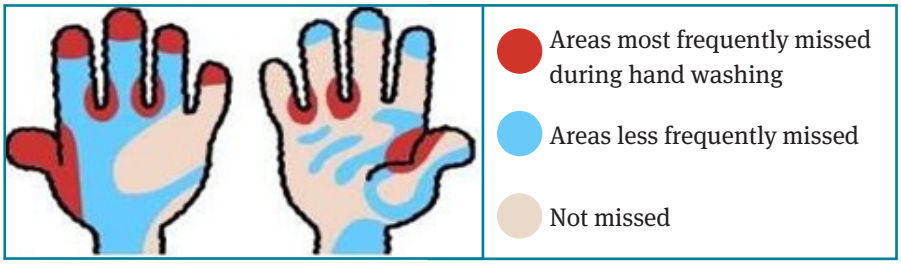
How easily can germs spread?

Germs easily spread through poor hygiene, cross-contamination between raw and ready-to-eat foods, and animal handling.

Correct Cleaning is the Key!

Did you know?

The number of germs on fingertips doubles after using the toilet. Yet up to half of all men and a quarter of women fail to wash their hands after they've been to the toilet!



When should I wash my hands?

Did you know? 1,000 times as many germs spread from damp hands than dry hands.

- Before touching and eating food.
- After handling raw foods such as meat, poultry, fish, eggs, fruit, and vegetables and before touching any other food or kitchen utensils.
- After touching or emptying rubbish bins.
- After going to the toilet or changing nappies.

Simply rinsing the tips of fingertips under cold water does not count.

- After playing with pets or farm animals.
- After coughing, sneezing, or blowing your nose.

How to wash your hands:

- We all think we know how to wash our hands—but many of us don't do it properly.

Here are some reminders:

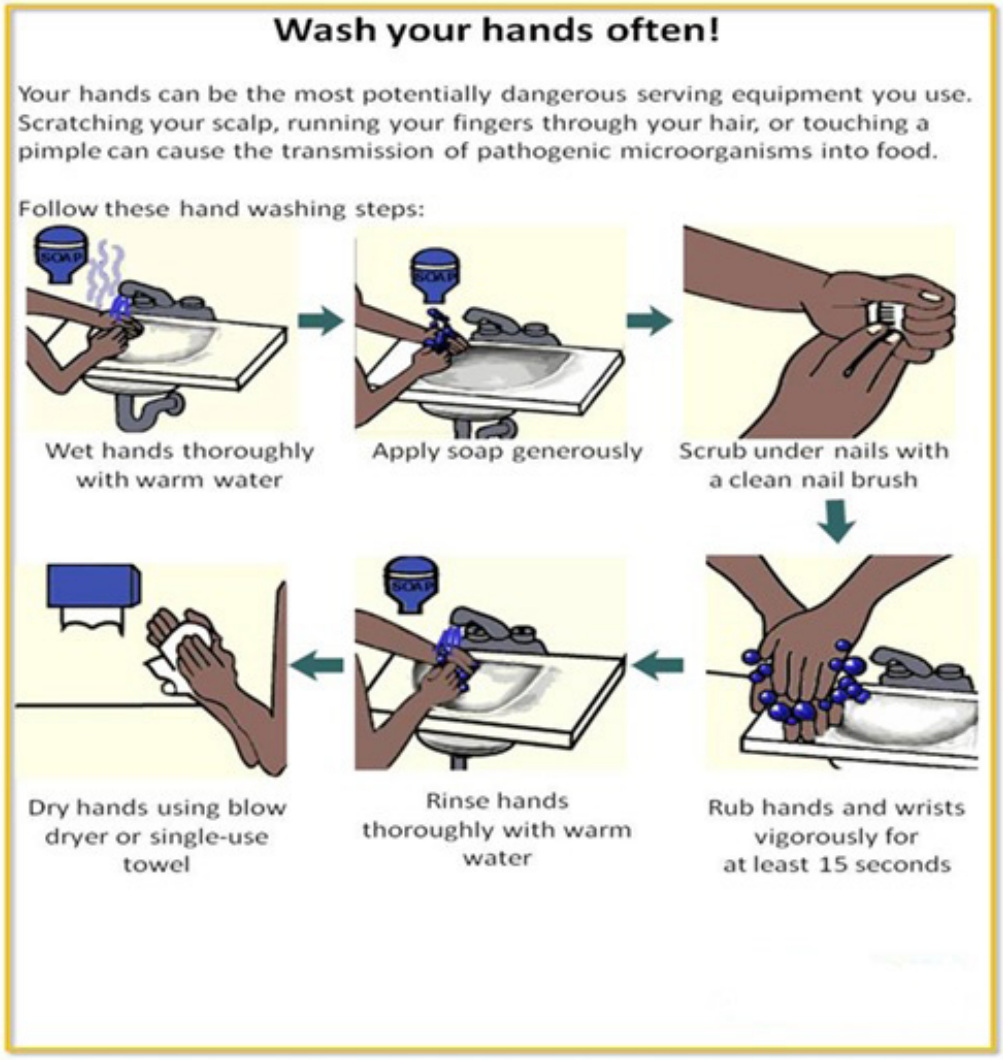
- Always use soap and warm water. It's better to wet hands before applying soap as this prevents irritation.
- Rub hands together vigorously for about 15 seconds, making sure both sides of the hands and wrists are washed thoroughly, around the thumbs, between each finger, and around and under the nails.
- Rinse with clean water.
- Dry hands thoroughly with a clean dry towel, paper towel, or under a hot air dryer.
- Germs spread more easily if hands are wet, so dry them thoroughly.
- Use a clean dry towel, paper towel, or air dryer; it doesn't matter which.

Other personal hygiene tips:

- If you are ill, especially with any gastrointestinal problems, avoid handling foods for others.
- Cover all cuts, burns, and sores and change dressings regularly—pay extra attention to any open wounds on hands and arms.

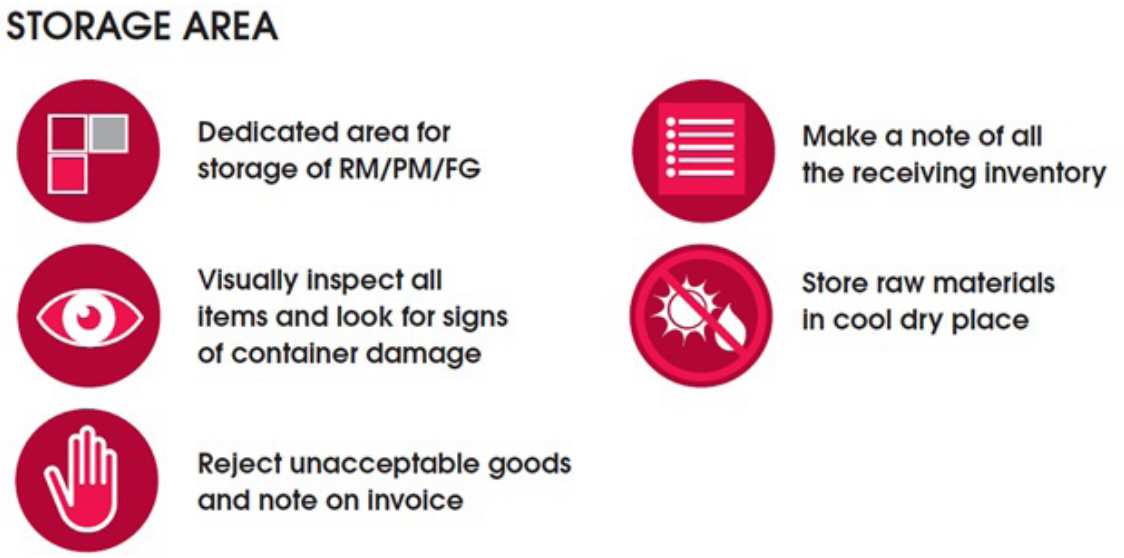
- Avoid working in the kitchen in soiled clothing—when cooking, use a clean apron, but don't use it to wipe your hands.
- If you are preparing lots of food—for a family meal perhaps—take off your watch, rings, and bracelets as well as washing your hands and wrists before you start. There could be as many germs under a ring as there are people in Europe. Millions of germs can also hide under watches and bangles.
- Don't brush or comb your hair when you are in the kitchen or near food—a 1-mm hair follicle can harbour 50,000 germs.
- Don't cough, sneeze, spit, or smoke near food and avoid touching your nose, teeth, ears, and hair, or scratching when handling food.

Hand Wash:



Annexure XXIII - Instructions for safety and hygiene in fortified rice production area

Annexure XXIV - Guidelines for storage of fortified kernels and fortified rice



Annexure XXV - Guidelines for prevention of physical hazards

Annexure XXVI - Determination methods for micronutrients

S.No.	Mandatory Micronutrients	Reference for Determination Methods
1.	Iron	AOAC 2011.14 (ICP), AOAC 985.35, AOAC 999.10 (AAS), AOAC 2015.06 (ICP-MS)
2.	Folic Acid	IS 7234:1974
3.	Vitamin B_{12}	AOAC 2014.02, AOAC 2011.10 & 2011.09 – safety precaution is to be taken while using KCN

S. No.	Optional Micronutrients	Reference for Determination Methods
1.	Zinc - Zinc Oxide	IS 1699:1995
2.	Vitamin A	AOAC 20th Ed. 2016 2001.13
3.	Thiamine (Vitamin B_1) - Thiamine Hydrochloride, Thiamine Mononitrate	AOAC 20th Ed. 2016, 957.17
4.	Riboflavin (Vitamin B_2) - Riboflavin, Riboflavin 5' - Phosphate Sodium	AOAC 20th
5.	Niacin - Nicotinamide, Nicotinic Acid	IS 5400:1969
6.	Pyridoxine (Vitamin B_6) - Pyridoxine Hydrochloride	IS 7530:1975

Source: *Manual of Methods of Analysis - Fortificants in Foods, Food Safety and Standards Authority of India, 2016*

Instrumentation based methods for analysis for Fortification in Foods

Commodity	Parameter	Test Method	Brief of Sample size & extraction process, Mobile Phase solvent	Instrument & Detector/ Method
Rice	Iron	AOAC 2011.14 (ICP), AOAC 985.35 and AOAC 999.10 (AAS), AOAC 2015.16 (ICP-MS)	Microwave assisted inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)	AAS / ICP-OES/ICP-MS (wave length 259.94)
	Vit. B_{12}	AOAC 2014.02, AOAC 2011.10 and 2011.09 – safety precaution is to be taken while using KCN	Sample extracted in KCN buffer (pH 4.5). Post autoclave and centrifugation, supernatant was syringe filtered prior to RP-HPLC using methanol – water gradient to resolve Vit.B_{12} peak. Sample concentration and purification using SPE further improved peak resolution and removal of interfering peaks. Use of immune-affinity cartridges help in selective concentration and extraction. Mobile phase: A) 0.025% TFA in water B) Acetonitrile	HPLC / UPLC UV (DAD) detector at 361 nm Use of Immunoaffinity column, NaCN followed by UPLC – UV HPLC, requiring potassium cyanide

Source: *FSSAI Order No.1-90/FSSAI/SP (MS&A)/2009, dated 12th March, 2019 regarding Methods for analysis of fortificants in food products*

Annexure XXVII - Quality Assurance (QA)/Quality Control (QC) Plan for Rice Fortification for FRK producer and Fortified Rice Producer

(Refer Section 1.7, 7.1 & 7.2)

QA/QC plan for FRK Supplier / Fortified rice producer / State/District Authorities						
S. No.	**Products**	**Test Details**	**Testing Frequency**	**Agency responsible**	**Place of Testing**	**Place of sampling**
1.	Fortified Rice Kernel	Microbial load, Micronutrient content Heavy metal contaminants	Every Consignment	FRK Producer	NABL/FSSAI Accredited Laboratory	FRK Production Unit
2.	Blended Rice	Blending Ratio	Every Batch	Fortified Rice producer	Fortified Rice blending unit	Fortified Rice Production Unit
3.	Fortified Rice	Micronutrient Analysis	Atleast once in each quarter	State/Dist. Competent official	NABL/FSSAI Accredited Laboratory	Fortified Rice Production Unit
4.	Fortified Rice	Micronutrient Analysis	Atleast once in each quarter	State/Dist. Competent official	NABL/FSSAI Accredited Laboratory	Selected Fair Price Shops

Note:

(i) FRK producer will have to provide certificate of analysis with every batch of FRK supplied to rice millers

(ii) Rice millers will have to maintain batch wise record of FRK procurement and its usage for rice fortification

(iii) Three samples should be drawn at once form a batch and sealed by the collecting authorities.

FSSAI's standard sample collection protocol to be followed:

a. One sample to be given to the rice miller

b. One sample to be sent to the NABL Lab for testing

c. The inspecting authority for future use if required should keep one sample for 3 months at least (in case rice miller or fair price shop wants to challenge the results, this may be used for re-testing at an independent lab mutually agreed)

(iv) Samples collected should be sent to NABL Accredited labs for testing within a week of sample collection

(v) If required, random samples of FRK supplied by FRK producers can also be sent for testing to NABL Accredited Labs. Samples to be collected from rice millers before FRK is used for fortification

(vi) Cost of testing 3 micronutrients (Iron, Folic Acid and B_{12}) is around Rs 5,000/-. The cost would be even lesser in government labs.

(vii) Instant iron detection kits may be used by inspecting authorities to detect presence of iron in the sample.

Annexure XXVIII - Frequently Asked Questions (FAQs)

Q: What is Food Fortification?

A) Food fortification refers to adding vitamins and minerals missing in the daily diet to commonly consumed foods to prevent nutritional deficiencies. Food fortification has shown to have a positive impact on the micronutrient status of the vulnerable population particularly when implemented in conjunction with other public health measures and strategies.

Q: What is Rice Fortification?

A) Rice fortification is the process of increasing the nutritional content of rice by adding essential micronutrients to it. The micronutrients are chosen keeping in mind various public health concerns.

Q: Why fortify rice?

A) India is a leading rice producer and consumer, with 22 percent of the total global rice production and 65% of India's population consumes rice on a daily basis; the per capita rice consumption in India is 6.8 kilogram per month. Rice is a good source of carbohydrates; however, core component of agriculture and nutrition in most of India is low in micronutrients. Milling of rice removes certain key nutrients like fat and the micronutrient-rich bran layer to produce commonly consumed white rice. Polishing further removes 75-90% of Vitamin B_1, Vitamin B_6, Vitamin E, and Niacin. Fortifying rice provides an opportunity to add back the lost micronutrients like Iron, Zinc, Folic acid, Vitamin B_{12}, and Vitamin. A.

Q: Does fortified rice improve people's health and nutritional status?

A) There are more than 17 scientific publications in over 25 countries including India which demonstrate that consumption of extruded fortified rice is safe and effective in women and children. It can also significantly address hemoglobin status, iron-deficiency anemia, iron deficiency (i.e., ferritin levels), and improve status of other critical micronutrients including Vitamin A, Zinc, Folic Acid, Vitamin B_{12}, among others. It is also known to improve cognition and physical performance.

Q: What is a Fortified Rice Kernel (FRK)?

A) Rice, when extruded with a premix containing vitamins and minerals is shaped into partially cooked grain-like structures that resemble rice grains, which are called FRKs.

Q: Can any variety of rice be fortified?

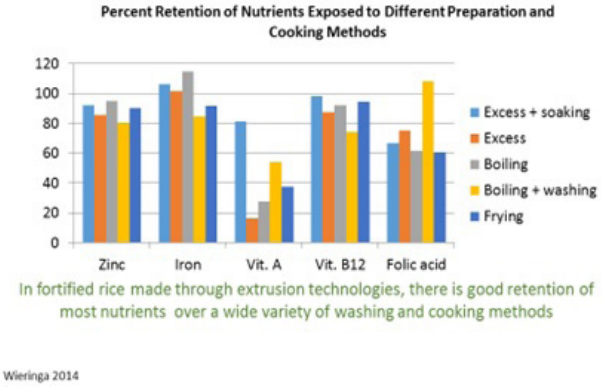
A) All varieties of rice can be fortified. However, it will require tailoring of fortified rice kernels accordingly.

Q: What is the level of acceptance of fortified rice among consumers?

A) The graph below shows that there are no significant differences between the acceptance levels of fortified and non-fortified rice among consumers.

Q: Are the nutrients in fortified rice retained after cooking?

A) The graph below indicates the percentage-wise retention of nutrients in fortified rice after cooking:



Q: What are the standards that have been put in place by FSSAI for fortified rice?

A) Raw Rice, when fortified, must contain added Iron, Folic Acid and Vitamin B^{12} at the levels given in the table below:

S.No.	Nutrient	Level of Fortification per Kg
	Iron - (a) Ferric pyrophosphate	28 mg - 42.5 mg*
	(b) Sodium Iron (III) Ethylene diamine tetra Acetate, Trihydrate (Sodium Feredetate-Na Fe EDTA)	14 mg - 21.25 mg
	Folic acid - Folic acid;	75 µg - 125 µg
	Vitamin B_{12} - cyanocobalamin or hydroxocobalamin;	0.75 µg - 1.25 µg

*Note: added at a higher level to account for less bioavailability

In addition, rice may also be fortified with following micronutrients, singly or in combination, at the level given in the table below:

S.No.	Nutrient	Level of Fortification per kg
1.	Zinc - Zinc Oxide	10 mg - 15 mg
2.	Vitamin A- Retinyl Palmitate;	500 µg RE - 750 µg RE
3.	Thiamine (Vitamin B_1)- Thiamine hydrochloride, Thiamine mononitrate;	1 mg - 1.5 mg
4.	Riboflavin (Vitamin B_2)- Riboflavin or Riboflavin 5'-phosphate sodium	1.25 mg - 1.75 mg
5.	Niacin (Vitamin B_3) - Nicotinamide or Nicotinic acid	12.5 mg - 20 mg
6.	Pyridoxine(Vitamin B_6)-Pyridoxine hydrochloride;	1.5 mg - 2.5 mg

Note – In the Pilot Scheme only three micronutrients – Iron, Folic Acid & Vit.B_{12} approved

Q: What are the various technologies available for fortification of rice?

A) There are various technologies available to produce fortified rice, namely, Coating, and Dusting.

In the Coating method, the nutrient (vitamin or mineral mix) is combined with ingredients such as waxes and gums. It is then sprayed on the surface of rice grains in several layers. This is then blended with polished rice at a ratio of about 1:100.

In the Dusting method, micronutrients in the form of fine particles are blended with bulk rice. This method makes use of the electrostatic forces between the rice's surface and the micronutrients.

Q: What is the best technology to fortify rice in India?

A) In India, rice is primarily fortified using extrusion technology. In this technology, milled rice or broken rice is pulverized and mixed with a premix containing selected vitamins and minerals. Fortified rice kernels (FRK) are produced from this mixture using an extruder machine. The extrusion technology for production of Fortified Rice Kernels (FRKs) is the technology of choice given the stability of micronutrients in the rice kernels across processing, storage, washing, and cooking. It is also the preferred method because of its financial feasibility.

Q: What are the different types of extrusion technology available for fortification of rice?

A) Depending on the temperature at which extrusion is done, the extrusion may be referred to as hot or cold. Hot extrusion (7° - 110° C) produces the highest quality kernels. Cold extrusion (70° C) is less expensive but might not have a high level of acceptability among consumers demanding uniformity in each grain's shape, color, translucency, size, and texture. A hybrid method called warm extrusion is also used by various manufacturers.

Q: What is the equipment required for the production of fortified rice kernels through extrusion technology?

A) Extrusion processing requires an extrusion assembly with a dryer to produce fortified rice kernels (FRKs). The function of various parts of extrusion set-up is as follows:

- Blender/Mixer: To uniformly blend the rice flour and premix.
- Preconditioning Unit: To hydrate the raw material and help in maintaining the homogeneity of raw materials.
- Extruder Barrel: To heat and cook the dough. Ideally, a twin-screw extruder is the most suitable for this purpose.
- Knife Assembly and Die Plate: To cut the dough/pre-blend and facilitate movement to the

die plate, which is responsible for the formation of FRKs.

- Vibratory Conveyor: To separate kernels from each other.
- Dryer: To dry the end product to the desired moisture content.
- Cooling : To cool FRK by passing it over a conveyer

Q: What would be the approximate cost of an extruder line?

A) A good quality extrusion line may cost up to INR 13.5 crores. Utility costs like purified water plant, steam generator, air compressor, and packaging lines are not included here.

Q: How are FRKs blended with normal rice?

A) Two types of blending are applicable for the production of fortified rice – Continuous and Batch.

1. **Continuous Blending:** This form of blending is applicable for large scale blending of the fortified rice. A typical continuous blending assembly involves bins/hoppers for fortified rice kernels and normal rice, bucket elevators for transport, blending, air locks/flow balancers to regulate the flow or Fortified Rice Kernels/Regular Rice.
2. **Batch Blending:** Batch blending is mixing of pre-weighed 1 part of FRK and 100 parts of regular rice in a blender and blending both the rice for a fixed time to produce one batch of 101 parts Fortified Rice.

Q. How is fortified rice produced?

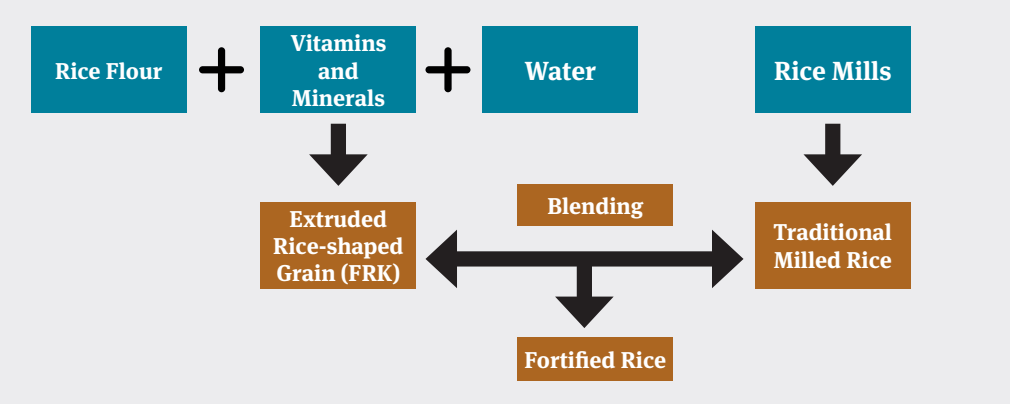
A) Production of Fortified Rice is a two-staged process:

In stage 1, the rice shaped grains will be produced using rice flour, vitamins & minerals and water passing the dough through an extrusion machine.

In stage 2, FRK (rice shaped grain) is added to traditional rice in ratio ranging from 1:50 to 1: 200 resulting in fortified rice nearly identical to traditional rice in aroma, taste, and texture. It is then distributed for regular consumption.

The blended rice is called fortified rice which includes the prescribed amounts of nutrients.

The production of fortified rice is explained pictorially below:



A) The following factors need to be considered while selecting a blending system:

1. Quantity of rice to be fortified
2. Feasibility of installation
3. The blending unit should ensure that the FRKs are not broken in the process
4. Cost of the blending unit

Q: What are blender options available for uniform blending of FRK with regular rice?

A) Equipment with variable flow mechanisms and modern mixing systems guarantee uniform mixing of the FRKs with rice and are used for blending. The different blenders available are – Ribbon/Paddle blenders, Rotary Batch Blenders, Vee Cone Blenders and Fluidized Bed Blenders.

Q: What is the per kg incremental cost on account of fortification?

A) The cost of fortification is determined by a multitude of context-specific variables such as the structure and capacity of the rice industry, the complexity of the supply chain, the policy and regulatory environment, and the scale of the relevant programme. The retail price increase for fortified rice ranges from an additional 1% to 10%. As rice fortification expands, production and distribution achieve economies of scale, and costs are expected to reduce. Rice fortification is cost-effective - the additional cost to the consumer inclusive of all associated costs is expected to vary between INR 0.3 - 0.4 per kg depending on the above factors as well as the nutrients added.

Q: When can the premix be blended into regular rice?

A) Blending of premix with rice can be done at various stages in the supply chain, depending on the type of programme. The optimal blending method will vary from government safety net programmes to a commercial retail store distribution. However, blending of rice can be done during the milling process in large centralized mills, which are well-equipped for blending operations. Blending can also happen at large warehouses, where rice is stored prior to distribution.

Q: Are there any other countries where fortified rice is consumed?

A) There are five countries where rice is mandated to be fortified by law, namely, Costa Rica, Nicaragua, Panama, Papua New Guinea, and the Philippines. Costa Rica has implemented the most successful rice fortification programme. In addition to these countries, rice is also fortified voluntarily in Brazil, Dominican Republic, Colombia, South Africa and the United States of America.

Q: What could be the delivery options for fortified rice?

A) Fortified rice could be delivered through the social safety nets programmes of the government, namely Targeted Public Distribution System, Mid-day Meal scheme, and Integrated Child Development Services (ICDS). Additionally, fortified rice can also be made available in the open market.

Q: What is the shelf life of premix?

A) According to studies done across various countries the shelf life of premix is between 3 months and 2 years,

Q: What is the shelf life of fortified rice?

A) The shelf life of fortified rice is at least 12 months.

FAQs on Labeling of Fortified Rice

Q: Is it mandatory to declare the micronutrients levels in Nutritional Information?

A) Yes, it is mandatory to declare the levels of Iron, Folic Acid, and Vitamin B_{12} in Nutritional Information for Fortified Raw Rice. Additionally, any commodity fortified with Iron carry a statement, "Not recommended for people with Thalassemia and people on low iron diet."

Q: Which unit should be used to declare the levels of vitamins and minerals?

A) Units such as milligram (mg), and microgram (µg) can be used to declare the level of vitamins and minerals used for fortification of rice.

Nutrient		Level of Fortification per Kg
Iron (a) or (b)	(a) Ferric pyrophosphate Or,	28 mg - 42.5 mg*
	(b) Sodium Iron (III) Ethylene diamine tetra Acetate, Trihydrate (Sodium Feredetate-Na Fe EDTA)	14 mg - 21.25 mg
Folic acid	- Folic acid	75 µg - 125 µg
Vitamin B_{12}	cyanocobalamin or hydroxocobalamin	0.75 µg - 1.25 µg

*Note: added at a higher level to account for less bioavailability (Or as specified by FSSAI)

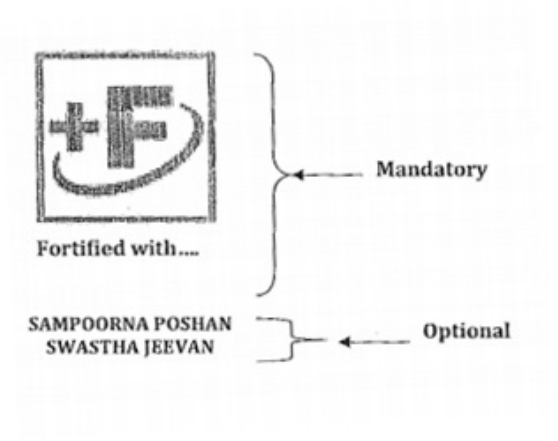
◊ **Details about the +F logo on fortified products pack:**

- +F logo and "**Fortified with Iron, Folic Acid, and Vitamin B_{12}**" to be mandatorily displayed on the pack and to be used as indicated below.
- Every package of food fortified with Iron shall carry a statement "**Not recommended for people with Thalassemia and people on low iron diet.**"
- The tagline "**Sampoorna Poshan, Swastha Jeevan**" is optional and may be displayed under the logo.

Q: How to mention the micronutrients below the +F logo?

A) Added micronutrients to be mentioned in the "Fortified with Iron, Folic Acid, and Vitamin B_{12}" statement and can be written in any format, keeping intact the position i.e. below the +F logo

Below is the suggested usage:



Fortified with Iron, Folic Acid,

and Vitamin B_{12}

Q: What are the color variations to be used for the +F logo?

A) The following norms should be followed for color variations for the +F logo:

- The +F logo should be used only in blue color.
- "Fortified with Iron, Folic Acid, and Vitamin B_{12}" should be written only in black color.

Color Codes to be used as per the below table:

COLOR CODES
PANTONE 3005 C
C-100, M-46, Y-2, K-0
R-0, G-116, B-200
Web - 0074CB

COLOR CODES
PANTONE BLACK
C-0, M-0, Y-0, K-100
R-35, G-31, B-32
Web - #231F20

COLOR CODES
PANTONE BLACK
C-0, M-0, Y-0, K-100
R-35, G-31, B-32
Web - #231F20

Fortified with Iron, Folic Acid, and Vitamin B_{12}

Q: What is the size of the logo including the minimal size that can be used?

A) Below is an indicative size of the logo. Keeping the aspect ratio intact it can be used in any size.

All dimensions in millimeters

A	B	C	D	a	E (w x h)	F (w x h)	G (w x h)
20	20	2.2	3.1	0.8	7.27 x 9.15	5.67 x 5.84	16.98 x 10.93
40	40	4.4	6.3	1.7	14.54 x 19.03	11.35 x 11.68	33.96 x 21.87
80	80	8.9	12.5	3.4	29.08 x 38.07	22.7 x 23.36	67.92 x 43.75
160	160	17.9	25.4	6.9	58.17 x 76.14	45.39 x 46.72	135.85 x 87.5
320	320	35.6	50.6	13.8	116.35 x 152.29	90.77 x 93.44	275.25 x 175.01

Q: What should be the placement of the +F logo?

A) The +F logo should be placed in a way to ensure high noticeability by the consumer. It should preferably be placed in the front of the pack (either on the top or middle).

Q: How to use the +F logo on a colored pack?

A) The logo unit has a transparent background and thus can be used on any packet.