

# Formative Research to Understand the Rollout of Fortified Rice through Public Distribution System in India



ICMR-National Institute of Nutrition  
Hyderabad



# **Formative Research to Understand the Rollout of Fortified Rice through Public Distribution System in India**

## **Authors**

Dr. Samarasimha Reddy N      Dr. Mahesh Kumar Mummadi,  
Dr. Challa Sairam      Dr. Venkatesh K,  
Dr. Hemanth Mahajan      Dr. ER. Nandeep,  
Dr. Jayachandra Kadiyam      Dr. Raghu Pullakandham,  
Dr. II Meshram      Dr. Sreenu Pagidoju,  
Mr. Venkata Raji Reddy      Mr. Hrusikesh Panda,  
Dr. SubbaRao M Gavaravarapu      Dr. JJ. Babu Geddam  
Dr. Hemalatha R



**ICMR-National Institute of Nutrition**  
Hyderabad-500007, TS



# CONTENTS

|   |           |
|---|-----------|
| <b>Executive summary</b>                                | <b>1</b>  |
| <b>Introduction</b>                                     | <b>10</b> |
| <b>Objectives</b>                                       | <b>11</b> |
| <b>Methodology</b>                                      | <b>12</b> |
| <b>Results</b>  | <b>13</b> |
| <b>District officials in-depth interviews</b>           | <b>14</b> |
| <b>Food Corporation of India/State food corporation</b> |           |
| <b>Godown mangers/ Supervisors' interview</b>           | <b>24</b> |
| <b>Fair price shop dealers/owners</b>                   | <b>35</b> |
| <b>Beneficiaries' interviews</b>                        | <b>42</b> |
| <b>Conclusions</b>                                      | <b>49</b> |
| <b>References</b>                                       | <b>50</b> |
| <b>Annexures</b>  | <b>52</b> |



# EXECUTIVE SUMMARY

## 1. Current Status of Anemia Prevention and Control

- India has launched Anemia Mukht Bharat under the National Nutrition Mission to prevent and control anemia with six interventions (targeting six age groups, and six institutions): (a) Iron and folic acid (IFA) supplements, (b) Behaviour change communication; (c) Test and treat anaemia; (d) Fortification of food products with IFA; (e) Deworming; and (f) Addressing non-nutritional causes of anaemia such as malaria, fluorosis, hemoglobinopathies etc.
- The Indian government-initiated supply fortified rice (FFR) in every scheme of the Government of India (such as MDM, ICDS, PDS) throughout the country in a phased manner to achieve complete coverage by the year 2024.
- Phase-I covering ICDS, and PM POSHAN had been implemented during 2021-22 and 17.51 LMT (Lakh Metric Tons) had been distributed throughout India. Phase-II includes aspirational and high burden districts (total 291 districts) under Targeted Public Distribution System (PDS) and other welfare schemes in addition to Phase-I in all the States/UTs by March 2023. In Phase III, all the remaining districts of India will be covered by March 2024.

## 2. Rationale and Objectives

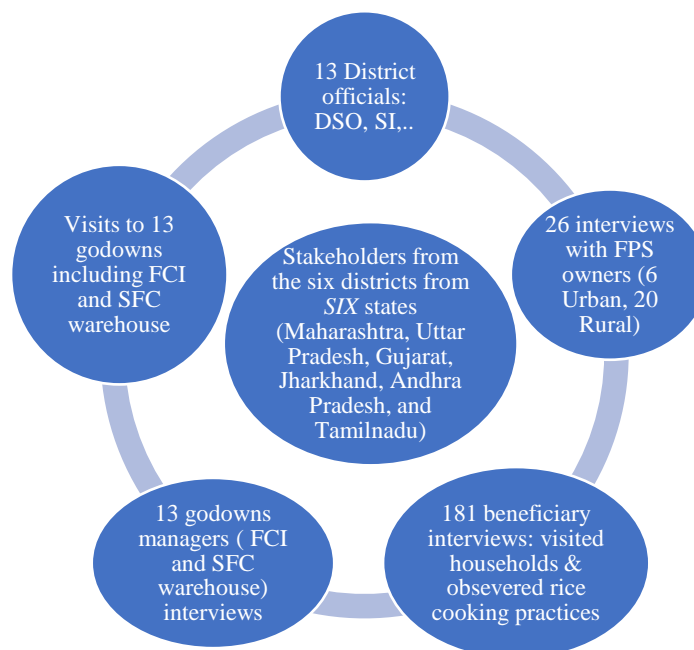
- Before scaling up FR distribution from 291 districts to remaining districts, it is crucial to gain insights of the functioning/utilization of existing scheme/provisions and related issues.
- The ICMR-NIN has conducted the situational analysis to understand:
  - What factors (context, experience, and skills of district supply officer (DSO), supply inspector (SI), fair price shops (FPS) owner, operational management, infrastructure, geography, beneficiary attitude and perceptions) facilitated or hindered implementation and acceptability of FFR through various schemes?
- The information generated through the situational analyses will help us to design a study to evaluate the effectiveness of FFR on anaemia at community level; This will help the government to take further policy decisions via mid-course corrections.

## Objectives

- a. To understand the rollout of FFR supply through TPDS from district to FPS and beneficiaries.
- b. To understand the storage and supply chain of FFR from food corporation of India (FCI) godowns to FPS and beneficiaries.
- c. To assess the access, availability, and utilization of FFR supplied through PDS by the beneficiaries of the program.

## 3. Methods

- After seeking necessary permissions from the ICMR-NIN ethics committee, ministry of civil supplies, GOI, and respective state governments, a multi-method approach (consisting of quantitative and qualitative research methods) was used for evidence synthesis. The formative research was conducted from 1<sup>st</sup> to 6<sup>th</sup> May 2023 at six randomly selected districts (from the list of districts given by ministry of civil supplies) from six different states where fortified rice was supplied through public distribution system in a pilot mode.
- In each district, the DSO was interviewed to understand the rollout of the program. A FCI or state food corporation (SFC) Godown managers were interviewed to understand the supply, storage, and transport of Fortified rice (FFR). Four FPS (one urban and three rural) dealers in each district were interviewed to understand the distribution of FFR to the beneficiaries.



**Figure 1. Stakeholders interviewed**



#### 4. Top line findings

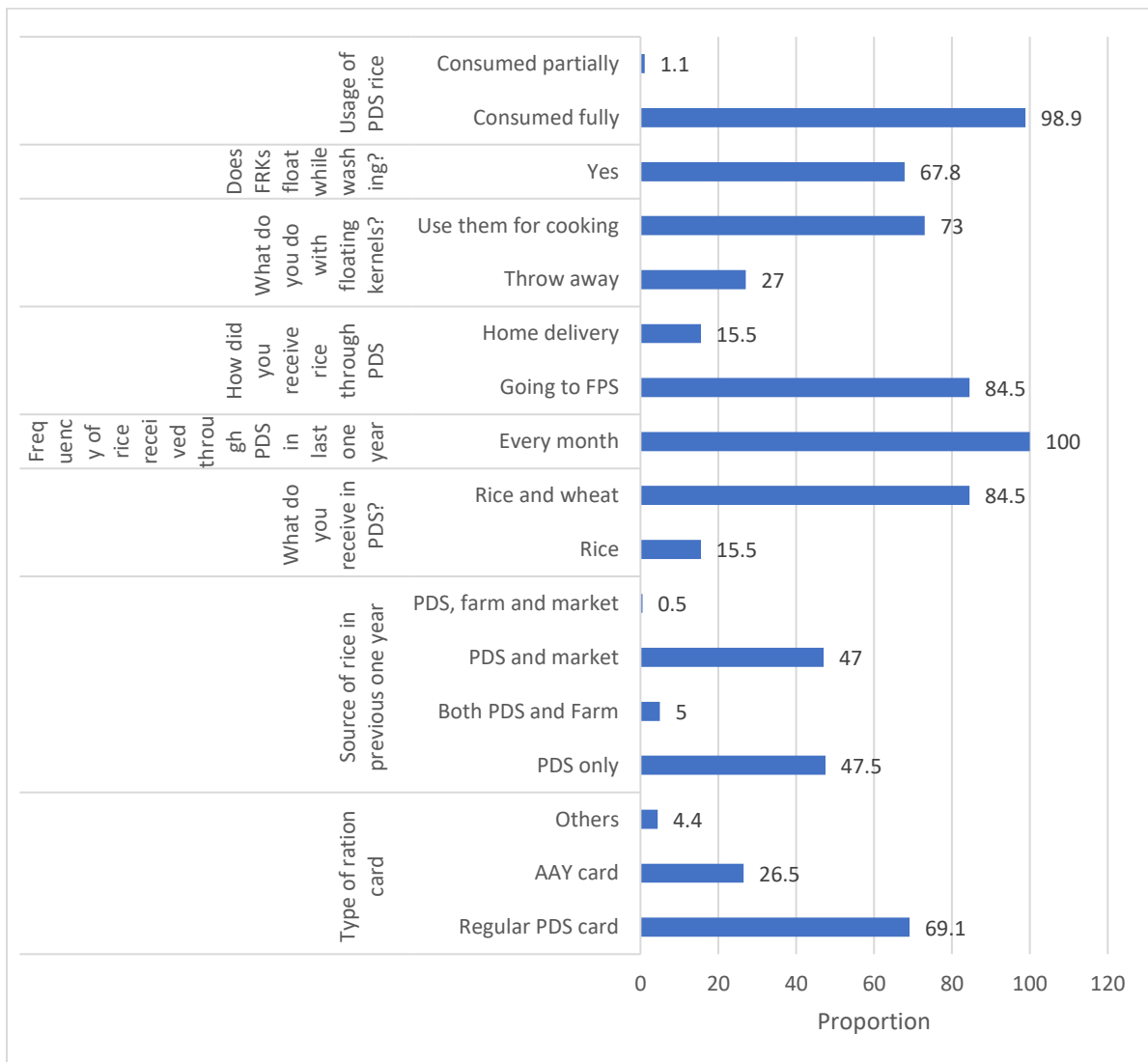
- All the selected districts were supplying FFR to beneficiaries through MDM, ICDS, TPDS.
- Stakeholders were aware about the roles and responsibilities to distribute FFR.
- Well established FFR distribution mechanisms across all districts.
  - Paddy procurement from farmers through minimum support program → Rice hauling and mixing with FRKs (blending) in a prescribed proportion at designated mills → Storage in FCI godowns or state warehouses → Supply to FPS → Supply to beneficiaries in allotted amount.
- ***Availability of rice and FRKs at state/district level***
  - In most of the visited districts, paddy is being supplied only to mills with inhouse blenders.
  - In most of the districts FRKs are being supplied from the central government - availability of good quality FRKs from the government.
  - Few districts are receiving raw rice, whereas other districts are receiving parboiled rice.
  - Thicker rice is being provided through PDS compared to rice available in market making it less palatable (Suboptimal quality of rice irrespective of being fortified or not).
  - The composition of fortified rice kernel (FRK): Iron (Ferric pyrophosphate, 35 mg/kg); Folic acid (Folate, 125 mcg/kg) and Vitamin B12 (Cyanocobalamin, 1.25 mcg/kg)
  - One FRK is being mixed with 100 grains of regular rice.
  - Some of the districts reported difference of colour as well texture between regular grain and FRKs.
- ***Storage of rice at FCI/SFC Godown and at FPS***
  - Mills supply regular as well as FFR to states/ districts, which is being stored at FCI or state warehouse.
  - Optimal storage of rice and other food items at FCI as well as state warehouses (regular fumigation and pest control)
  - Standardized guidelines are being issued for FCI as well as state warehouses regarding optimal storage of grains and other food items.

- Monitoring at FCI or state warehouse
  - *Routine parameters:*
    - Proper and legible stencilling/tag.
    - 100% weighment of rice consignment.
    - The size of each lot consignment: 27 MT (50 bags of 50 kgs packing).
    - Moisture content using moisture meter.
    - Percentage of broken grain, cracked grains, immature grains/kernel.
    - Rice breakability.
    - Average length of principle class/group of rice.
    - Level of discoloured/fermented grains and damaged grains.
    - Level of foreign material and infestation.
  - *Additional parameters to assess fortification.*
    - FRK counting.
    - Stenciling gunny bag tag as well showing F+ sign;
- Monitoring of FFR at FPS
  - FRK counting.
  - Monitoring of stenciling gunny bag tags as well showing F+ sign;
- ***Distribution of FR***
  - Continuous (uninterrupted) supply of FR across all districts through FCI or state warehouses.
  - FCI or state warehouse receives (at the time of delivery from mills) receipts depicting rice being fortified or not.
  - FR rice is being distributed to all talukas/blocks in the visited districts.
    - Rice mills distribute rice to FCI (as and when available).
    - FCI/state warehouses to FPS (usually on monthly basis; collector office/DSO raise orders).
    - FPS to beneficiary (usually on monthly basis; DSO receives online update about the rice and other food grain collection from the specified FPS).
      - Entitlement (per month) varies as per the card and the state:
  - *For Maharashtra:*
    - AAY – 25 kg rice (FFR), 10 kg wheat, and 1 kg sugar for a household.
    - Regular PDS – 3 kg rice (FFR) and 2 kg wheat per person;
  - *For Gujarat:*
    - AAY – 20 kg rice (FFR), 15 kg (wheat)

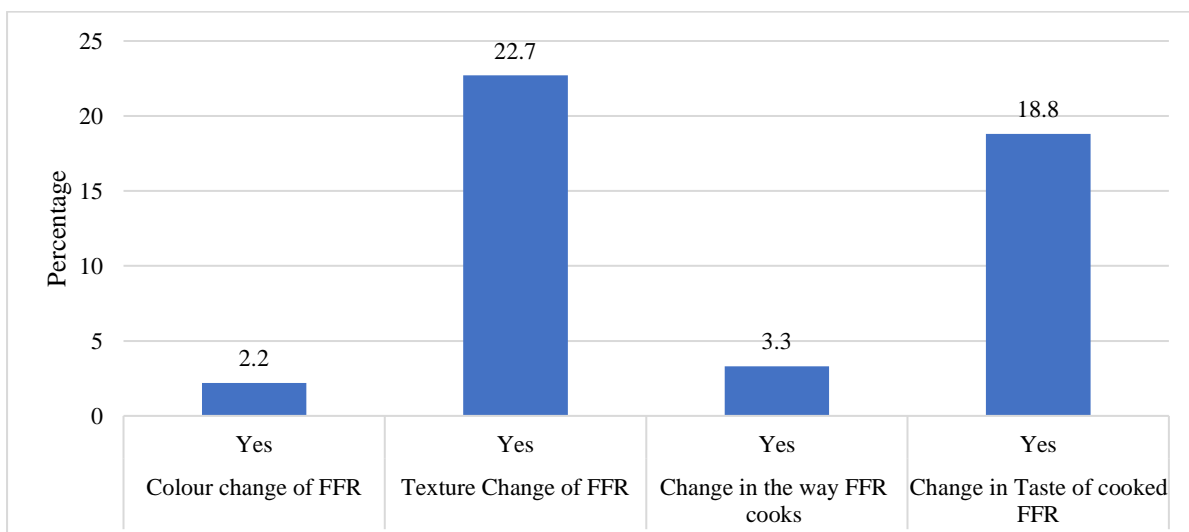
- Regular PDS – 3 kg rice (FFR) and 2 kg wheat and 1 kg sugar per person per month.
    - APL-1 card - 3 kg rice (FFR) and 2 kg wheat per person per month
  - *For Andhra Pradesh:*
    - AAY: 35 kg of rice (FFR); 25 kg rice (FFR), 10 kg wheat, and 1 kg sugar for a household.
    - Regular PDS: 5 kg rice (FFR) per person and Dal of 1 kg & sugar of 0.5 kg per household.
  - *For Tamil Nadu:*
    - AAY: 35 kg rice per household or 25 kg rice (FFR) & 10 kg wheat per household.
    - Regular PDS: 5 kg rice per person per month with a maximum ceiling of 25 kg rice (FFR) per household
  - *For Uttar Pradesh:*
    - AAY : 21 Kg rice (FFR) + 14 Kg wheat + 1 Kg Sugar per household;
    - Regular PDS: 3 kg rice (FFR) + 2 kg wheat per person;
  - *For Jharkhand:*
    - AAY: 28 kg rice (FFR), 7 kg wheat;
    - Regular card: 5 kg/person (FFR);
    - Green card: 5 kg/person/month (Non-FFR);
- ***Awareness about FR among DSO and FPS owner***
  - District officials as well as FPS owners were aware about FR being supplied to them by the government to supply through PDS.
  - However, not very aware about the purpose and importance of FFR being distributed through MDM, ICDS, or PDS.
- ***Awareness among beneficiaries:***
  - Beneficiaries are aware that they are receiving rice mixed with FRKs; They could figure out during rice examination before cooking or from few floating FRKs.
  - However, not very sure about the purpose and importance of FFR.
- ***Acceptability of FFR among beneficiaries***
  - Out of 181 beneficiary households interviewed, 125 (69%) of people are regular PDS card holders and 48 (26%) are AAY card holders.

- The source of rice in previous year was from PDS alone in 86 (47.5%) of households and 85(47%) households were getting rice from both PDS and market.
- Out of 181 households, 153(84.5%) of households received both rice and wheat, 28(15.5%) have got only rice.
- Out of 181 households, 153(84.5%) collected rice by going to FPS and 28(15.5%) received through home delivery.
- Out of 181 households, 179(98.9%) households consumed PDS rice fully and 2(1.1%) households consumed partially.
- Out of 180 households who responded, 122(68%) households said that FRKs float while washing and 58(32%) said they do not float while washing. Majority of responders said that only one or two FRKs float while washing.
- Out of 122 households who said that FRK'S float, 89(73%) said that they use floating kernels for cooking, 33(27%) responded that thy will throw away the floating kernels.
  
- Earlier
  - Severe hesitancy due to different colour as well as texture of FRKs compared to regular grain.
  - Community leaders confronted FPS owners for the mixture of FRKs.
  - FRKs were considered as 'Plastic Rice' being provided by China to kill people.
  - Columns/stories opposing the use of FRKs were published in newspapers.
- Now:
  - Optimal acceptability of FFR among beneficiaries.
  - No change in number of beneficiaries seeking PDS services.
  - Not separating and throwing away FRKs.

**Figure 2. Rice distribution and usage through PDS**



**Figure 3. Observation of beneficiaries about the usage of FFR**



- ***Awareness activities by DSO for SI and FPS owner***
  - Health awareness sessions with all SI and FPS owner at collectors' office to promote awareness about FFR during initial phases of implementation.
- ***Awareness activities by DSO and FPS owner for beneficiaries***
  - Health education sessions were organized to bust myths around usage of FRKs across all visited districts.
  - Recipes cooked using FFR were demonstrated and ate at community level.
  - Banners displaying the importance of FFR are being displayed in local language at community level in most of the visited districts.
  - House-to-house to visit by FPS owner to spread awareness about FRKs and FFR.
- ***Adverse events following intake of FFR***
  - None of the district reported any adverse events following intake of FFR.
- ***Other (less common) observations:***
  - At some of the visited districts, suboptimal monitoring at state warehouses for rice being fortified or not.
  - Missing stencilling as well as tags on gunny bags showing F+ sign.
  - Lack of mechanism at state warehouse to report about the poor fortification of provided rice (such as a smaller number of FRKs in the sampled rice).
  - Increased stickiness of cooked rice due to addition of FRKs.
  - At present suboptimal awareness activities about FFR at a community level.

## **5. Conclusion**

- Across visited districts, there was a continuous supply of fortified rice (FFR) in all talukas/blocks.
- The DSO, SI, FPS owners as well as beneficiaries were aware about the presence of FRKs in regular rice, although only few were aware about the importance of rice fortification.
- The beneficiaries were fully availing the services provided through targeted public distribution system (TPDS).
- After fortified rice (FFR) supply through TPDS has started, there is no reduction in the number of beneficiaries seeking services from TPDS.

- Out of 180 households who responded, 122(68%) households said that FRKs float while washing and 58(32%) said they do not float while washing. Majority of responders said that only one or two FRKs float while washing.
- Out of 122 households who said that FRK'S float, 89(73%) said that they use floating kernels for cooking, 33(27%) responded that thy will throw away the floating kernels.
- In three states, there is a practice of decanting the excess starchy water during cooking of fortified rice. 50% loss of Iron, 70% loss of vitamin B12 & Folic acid is reported if decanting of excess water is done.
- There was no reported adverse outcome following the intake of FFR.
- The monitoring systems may follow the Standard Operating Procedures (SOP) for FRK Production while drying the FRK at an Ideal temperature: below 65° C ( $\pm 5^{\circ}$  C) there by limiting the chances of puffed FRKs floating, minimizing the chances of being thrown away while washing the rice.
- There is a feasibility of conducting the effectiveness study to understand the effect of FFR on hemoglobin and iron storage at the community level as the program is successful being implemented on ground and public is utilizing the services.

# INTRODUCTION

Anemia is a severe public health concern in India, particularly among women and children (1). WHO has defined anaemia among women as a haemoglobin concentration of less than 12.0 g/dl for non-pregnant women and less than 11.0 g/dl for pregnant women(2). NFHS-5 (2019-21) shows that the prevalence of anaemia in women aged 15-49 years in India is 57.2% among non-pregnant women (Hb <12.0 g/dl) and 52.2% among pregnant women (Hb <11.0 g/dl). The prevalence of anaemia (Hb <11.0 g/dl) is also high among children aged 6-59 months as shown by the NFHS-5 data (67.1%)(3). Anaemia is associated with worse cognitive and motor development outcomes in children and worse pregnancy outcomes such as low birth weight and prematurity for the baby, and maternal and perinatal mortality(4). Although aetiology of anemia is multifactorial, iron deficiency followed other micronutrient deficiencies such as vitamin B12 and folic acid are found to be major causes (5). The Comprehensive National Nutrition Survey (CNNS) 2016-2018, showed that the prevalence of vitamin B12 deficiency is highest among adolescents aged 10-19 years at 31%, followed by children aged 5–9 years (17%) and pre-school children aged 1-4 years (14%). Folate deficiency also followed a similar pattern with the highest prevalence among adolescents aged 10-19 years (37%), followed by children aged 5-9 years (28%), and children aged 1-4 years (23%)(6).

Food fortification is the practice of adding essential nutrients, especially micronutrients to common food items during processing to improve the dietary intakes of specific target nutrients. It is considered a cost-effective strategy for the prevention and control of micronutrient deficiencies.(7) Fortification of rice with essential micronutrients has the potential to improve nutrition in rice-consuming countries like India. Rice fortification with iron alone or in combination with other micronutrients had an increase in mean haemoglobin concentration in the population above two years of age, despite having little or no difference in the risk of having anaemia based on a Cochrane review conducted with 17 studies(8). Two studies conducted in India showed that iron fortified rice supplementation through mid-day meal improves the body iron stores, reduces the prevalence of iron deficiency anemia, but the effects on mean haemoglobin levels compared to placebo remained negligible(9,10). Two meta-analysis that reviewed the effect of fortified rice (iron with or without micronutrients) consumption showed a significant but modest increase in mean haemoglobin (0.2g/dL to 0.53g/dL) levels in the population above two years of age,



with no or uncertain effects on prevalence of anemia or iron deficiency(11). A study in Bangladesh to assess the effectiveness of micronutrient fortified rice among vulnerable women showed that rice fortified with iron significantly improves haemoglobin (0.35g/dL) levels and reduces the prevalence of anemia by 11.5%(12).

Anemia Mukht Bharat (AMB) was launched in March under the National Nutrition Mission in India. The AMB has a comprehensive approach to prevent and control anemia with 6 interventions, targeting 6 age groups, and 6 institutions (6). The interventions include iron and folic acid (IFA) supplements, behaviour change communication (BCC), Test and Treat anaemia, fortification with IFA, deworming and addressing non nutritional causes of anaemia such as malaria, fluorosis, hemoglobinopathies. One of the programs under intervention is the mandatory provision of iron and folic acid fortified foods in government-funded health programs(13).

The Indian government plans to supply fortified rice through various social welfare schemes in entire country in a phased manner by 2024. The fortification of rice is by using Fortified Rice Kernels (FRKs) which will contain micronutrients such as Iron (28-42 mg/kg), folic acid (75-125 mcg/kg) and Vitamin B12 (0.75-1.25 mcg/kg). Phase-I covering ICDS, and PM POSHAN had been implemented during 2021-22 and 17.51 LMT (Lakh Metric Tons) had been distributed throughout India. Phase-II includes aspirational and high burden districts (total 291 districts) under Targeted Public Distribution System and Other Welfare Schemes in addition to Phase-I in all the States/UTs by March 2023(14). In Phase III, all the remaining districts of India will be covered by March 2024. Therefore, with the government planning to roll out rice fortification throughout India, the evidence for its effectiveness on anaemia at community level and data on the cost-effectiveness of the programme will help the government to take further policy decisions via mid-course corrections. This formative research was conducted among the districts where fortified rice was supplied through public distribution system in a pilot mode to understand the programme to design a study to evaluate the effectiveness of fortified rice.

## OBJECTIVES

- To understand the rollout of the fortified rice supply through PDS from district to fair price shops and beneficiaries.

- To understand the storage and supply chain of fortified rice from FCI godowns to Fair price shops and beneficiaries.
- To assess the access, availability and utilization of fortified rice supplied through PDS by the beneficiaries of the program.

## METHODOLOGY

An ethical committee approval was taken from the institutional ethical committee of ICMR- National institute of nutrition (02/II/2023). The list of districts in which the with fortified rice rollout through PDS as a pilot project was given by the ministry of civil supplies (Table-1). From the list of districts given by ministry of civil supplies, six districts were randomly selected for conducting the formative research (Table-2).

A mixed method study involving the different stakeholders and beneficiaries of the targeted public distribution system (TPDS) was conducted from May 1 to 5<sup>th</sup> in the six districts of the country. Necessary approvals were taken from ministry of civil supplies, Government of India, and state governments before the conduct of the study. In each district, the district supply officer of the targeted public distribution system was interviewed to understand the rollout of the program. A food corporation of India Godown manager or state food corporation Godown managers were interviewed to understand the supply, storage, and transport of fortified rice. Four fair price shops (FPS) dealers in each district were interviewed to understand the distribution of distribution of fortified rice to the beneficiaries. While selecting the fair price shop (FPS), care was taken that one urban FPS and three rural FPS were selected. Under Each FPS, seven-eight beneficiary Households were visited. The selection of households within each PSU was random. An in-depth interview guide was used for interviewing the different stakeholders. A structured questionnaire was used for the beneficiaries. Written informed consents were taken from all the stakeholders and beneficiaries before the interview. Prior Consent was taken from all the stakeholders for audio-recording the interviews.

All the interviews were transcribed and translated to English. The analysis of in-depth interviews was conducted for each state separately by forming the themes for different stakeholders. Beneficiary data using a structured questionnaire was entered and analyzed using Microsoft excel 2016.

**Table 1. The list of districts and rollout dates of fortified rice through PDS**

| Sl. No | State          | District                 | FR distribution starting month |
|--------|----------------|--------------------------|--------------------------------|
| 1      | Maharashtra    | Gadchiroli               | February 2020                  |
| 2      | Gujarat        | Narmada                  | February 2020                  |
| 3      | Andhra Pradesh | Vizianagaram             | April, 2020                    |
| 4      | Tamil Nadu     | Tiruchiraplli            | October, 2020                  |
| 5      | Chattisgarh    | Kondagaon                | October, 2020                  |
| 6      | Uttar Pradesh  | Chandauli                | January, 2021                  |
| 7      | Odisha         | Malkangiri               | July, 2021                     |
| 8      | Telangana      | Jayashankar Bhupalapalli | September, 2021                |
| 9      | Uttarakhand    | Udam Singh Nagar         | September, 2021                |
| 10     | Madhya Pradesh | Singrauli                | September, 2021                |
| 11     | Jharkhand      | East Singhbhum           | October, 2021                  |

**Table 2. List of districts randomly selected for conducting the formative research**

| Sl. No | State          | Districts       | Dates of visit |
|--------|----------------|-----------------|----------------|
| 1      | Maharashtra    | Gadchiroli      | May 1-5, 2023  |
| 2      | Gujarat        | Narmada         | May 1-5, 2023  |
| 3      | Andhra Pradesh | Vijayanagaram   | May 1-5, 2023  |
| 4      | Tamil Nadu     | Tiruchirappalli | May 1-5, 2023  |
| 5      | Uttar Pradesh  | Chandauli       | May 1-5, 2023  |
| 6      | Jharkhand      | East Singhbhum  | May 1-5, 2023  |

## RESULTS

A total of 13 district level officers, 13 FCI/SFC Godown managers, 26 fair price shop owners or dealers and 181 beneficiary Households were covered during the study.

**Table 3. Details of the stakeholders and beneficiaries interviewed in the formative research**

| State name            | District name   | No. of district officials interviewed | No. of FCI/SFC Godown mangers interviewed | Name of FPS dealers interviewed | No. of Beneficiary HHs covered |
|-----------------------|-----------------|---------------------------------------|---|---------------------------------|--------------------------------|
| <b>Maharashtra</b>    | Gadchiroli      | 5                                     | 3   | 4                               | 30                             |
| <b>Gujarat</b>        | Narmada         | 1                                     | 1   | 4                               | 28                             |
| <b>Andhra Pradesh</b> | Vijayanagaram   | 1                                     | 3   | 4                               | 28                             |
| <b>Tamil Nadu</b>     | Tiruchirappalli | 1                                     | 3   | 5                               | 34                             |
| <b>Uttar Pradesh</b>  | Chandauli       | 3                                     | 1   | 5                               | 29                             |
| <b>Jharkhand</b>      | East Singhbhum  | 2                                     | 2   | 4                               | 32                             |
|                       | <b>Total</b>    | <b>13</b>                             | <b>13</b>                                 | <b>26</b>                       | <b>181</b>                     |

# DISTRICT OFFICIALS IN-DEPTH INTERVIEWS

## Maharashtra

### Initiation of fortified rice in the district

- Across all talukas of Gadchiroli from January 2021.
- Pilot phase was initiated in 2018-2019 in two talukas: Kurkheda & Bhamragad; FRKs were being supplied by Tata Trust.

### Acquisition of fortified rice

- *Mechanism of 'Fortified Rice' (FR) distribution in the Gadchiroli District:*

Paddy is directly procured from the farmers by the district administration at the government designated centres throughout the district at the *minimum support price* and supplied to authorised millers having facilities (blenders) for mixing raw rice with FRK → Authorised Millers produce custom milled rice and mix FRKs (received only from government) at the rate of 1:100 (250 gm FRK in 25 kg rice) and packed in 50 kg gunny bags → from Millers, fortified rice is being supplied to government designated godowns in the district (base depot) to store it → Base depot transfers to state warehouse (available at every taluka (sub districts)) → From state warehouse, FR is being supplied to FPS → FPS distributes FR to beneficiaries as per the government norms every month (Currently 3 kg rice and 2 kg wheat for regular PDS; 25 kg rice and 10 kg wheat for AAY)

- **Distribution of fortified rice**

- The distribution of FR is being carried out across all talukas in Gadchiroli since January 2021;

- **Usage of fortified rice & feedback from public**

*Feedback from Public:*

- The texture of FRKs are different from that the regular rice grain. So there was initial hesitation to consume it. People were separating it and throwing it away before cooking. Moreover, the FRKs have tendency to float; so beneficiaries were throwing it away along with water. For many beneficiaries, test of goodness of rice is 'the Floating test' - The rice which sink is a good rice; whereas, the rice/FRKs which floats are bad rice (unhealthy to eat).
- Also, many beneficiaries find increased stickiness in rice (after cooking) due to addition of FRKs.

- Community leaders visited FPS to confront FPS owners;
- Newspaper column opposing use of FRKs were published in local newspapers.
- FR rice being thicker than unfortified rice.
- **Activities conducted to bring awareness:**
  - During the pilot phase (2018-19), Tata trust people demonstrated few recipes such as Masala rice to promote the acceptance of FRKs and FR;
  - District collector office had conducted sessions with various supply inspectors and FPS shop owners to explain the importance of fortification;
  - FPS owners are putting FRK and FR awareness banners in their shops;
  - FPS owner meeting beneficiaries in their houses to explain about FRKs and FR;
- **Any other concerns**
  - District official claimed about gunny bag being labelled with (+F) on the FR bags, this was not observed in several of the visited blocks.
  - Sample FRK being distributed in Gadchiroli



## **Gujarat**

### **Initiation of fortified rice in the district**

In Narmada district of Gujarat, the date of announcement of fortified rice was December 2019 but the distribution started from February 2020. Since then, the entire district has been receiving Fortified rice only.

### **Acquisition of fortified rice**

The Fortified rice comes from the FCI godowns to the State godowns which are present in each Taluka of the district. The rice comes once every month to state godowns from the FCI godowns. If fortified rice is not available in your district, it will be taken from the neighbouring secondary base depots at Barod and Chhani.

### **Distribution of fortified rice**

The rice to FPS go from the State godowns once every month (rarely twice). The beneficiaries receive the fortified rice once every month as well. The program is rolled out in the full district of Narmada.

### **Usage of fortified rice & feedback from public**

Earlier there was a misconception about FR being slightly pink in colour, floating while cooking, called it plastic rice, from China etc. Beneficiaries used to fight with FPS owners as well previously with the same complaints. Now, it is all good feedback. Now, there are no such problems because of IEC activities at village level. There has been posters, live experiments, and talks carried out by Food Research Laboratory and Nutrition International to remove the myths about Fortified rice and Double fortified salt. So, now all the feedback has been good.

## **Andhra Pradesh**

### **Initiation of fortified rice in the district**

In Vizianagaram district, the fortified rice distribution is initiated from April 2020 at Bobbili mandal and later extended to Parvathi Puram mandal in May 2020. From June 2021, entire district has been covered with distribution of fortified rice.

### **Acquisition of fortified rice**

FRKs (Fortified Rice Kernals) are being procured centrally by state and distributed to respective districts headquarters.

Initially, fortified rice has been received from state head-quarters from Vijayawada, due to lack of blending facilities at local rice mills. Later on in 2022, around 68 rice mills, in 2023, a total of 119 rice mills have installed facilities for FRKs blending in the district. All

these mills also have 'SORTEX' facility, which is used to sort the rice based on color and to remove the dust and particles.

At the district level, the FRKs along with Paddy (procured locally) is allocated to rice mills, where milling, sorting, blending with FRKs and packaging with F+Logo labelled gunny bags takes place. These were then shifted to buffer godowns (State) and FCI godowns (Central). From the buffer godowns, the fortified rice is being shifted to MLS points and thereafter sent to local Fair Price Shops (FPS). The Mobile Dispensing Units (MDUs) collect the fortified rice from FPS and delivers the rationed rice directly to beneficiaries at their door step through Aadhaar Verification system.

Each beneficiary in the household is being given 5 kg rice per person at free of cost and dal of 1 kg & sugar of 0.5 kg per household at a subsidized cost per month. For AAY households the amount of rice is fixed at household level for 35 kgs/month, irrespective of number of beneficiaries.

### **Distribution of fortified rice**

Initially the rice fortification was launched in Bobbili Mandal in April 2020, and in May 2020, it was then extended to Parvathipuram Mandal. By June 2021, entire district has been covered with the programme.

### **Usage of fortified rice & feedback from public**

Initially, there was a severe backlash by beneficiaries, FPS owners, few local leaders along with few media channels of perceived plastic rice distribution by the Government. However, awareness campaigns were conducted by state, district and local authorities from health and civil supplies departments and local leaders, which led to gradual acceptance of fortified rice among the public.

In few scenarios, officials even carried rice cookers and demonstrated and consumed fortified rice along with beneficiaries. Further they also demonstrated Iodine test of fortified and unfortified rice to improve confidence.

All the FPS shops also have banners indicating information and benefits of fortified rice.



### **Any other concerns**

District official noted that the use of SORTEX at the rice mills improved overall quality (uniform colour, reduction in dirt & broken rice quantity) of rice and thus its consumption among beneficiaries was increased. Also, it has been opined that there is a shortage of FRKs during the month of December, although manageable now.

### **Rice blending and packaging in a mill in Andhra Pradesh**



## **Tamil Nadu**

### **Initiation of fortified rice in the district**

In the Tiruchirappalli district, regular supply of fortified rice was initiated in 2020. Details regarding the exact date and duration are awaited from the district PDS official who has taken over the post very recently. There was a break in the fortified rice supply during nationwide lockdown. The supply to beneficiaries was restarted in the district from 01-04-2023. According to the PDS official, fortified rice is being rolled throughout the state from April 2023 onwards. The supply of fortified rice to ICDS and Midday meal schemes was uninterrupted even during the break when general beneficiaries received unfortified rice.



Special PDS card holders (e.g. Police, Prison and Forest staff member cards) continue to receive unfortified rice even now.

### **Acquisition and Distribution of fortified rice**

Paddy is procured from farmers and sent to mills. State Government procures FRKs through tendering process. The FRKs are tested for various parameters including iron, folic acid and B12 and then supplied to millers. Blending of parboiled or raw rice is done with FRKs in the mills. After blending the fortified rice batches are again retested for all the parameters in an NABL accredited lab. The rice bags are labelled (+F) and sent to TNCSC godowns for distribution to PDS shops. In all the batches of fortified rice the label mentions the maximum limit prescribed by FSSAI for Iron. But when the lab reports were verified, we inferred that the values for iron in different batches of fortified rice were within the range recommended by FSSAI but not always the maximum.

The program is rolled out fully. But there is some pending stock of unfortified rice which is also supplied in few shops. Since the fortified rice distribution is reinitiated regularly only from April 2023, the officials are yet to receive the complete feedback from the beneficiaries.

### **Usage of fortified rice & feedback from public**

There is no resistance from beneficiaries in getting fortified rice from the shops. In Tamil Nadu, the beneficiaries predominantly use parboiled rice and hence fortified parboiled rice is predominantly supplied through PDS although some pockets receive fortified raw rice. The district collector had once organised a public awareness meeting on fortified rice.

## **Uttar Pradesh**

### **Initiation of fortified rice in the district**

The District Chandauli is called the Rice Bowl of Uttar Pradesh (UP). It has been chosen as the Pilot District in January 2021 for rolling out Fortified Rice. On 9<sup>th</sup> January 2021 2 blocks (out of 9 blocks) FRK of NFSA/PDS Chandauli was initiated. By March 2021, 100 percent District was covered including PDS, ICDS and MDM.

## **Acquisition and Distribution of fortified rice**

Paddy is procured from the farmers at MSP (Minimum Supporting Price) through Procurement centres and sent to rice millers. Rice mills do hulling and blending (between 1<sup>st</sup> Nov-February end). Automatic blending machines with two hoppers do the blending in 100:1 (Normal rice: FRK rice). Blended rice is packed into 50 Kg Gunny bags (with 1% FRK). Prior to this FRK Manufacturers are informed about the size shape and colour of the rice that will be distributed through the system and the care is taken that the FRK matches the vehicle rice. Supplier of FRK is empanelled by the Regional Food Controller. Rice miller can take FRK from any regionally empanelled FRK Manufacturer in UP. 1 Lot = 290 Quintals / 580 bags of 50 Kg jute gunny bags packed ready for dispatch. They are sent to FCI Godown/ depot. One godown is present in Chandauli, Vyasnagar (FSG Vyasnagar). From Chandauli to rice is sent to Varanasi, Sombhadra, Gazipur depots. Allotment is made at district level based on the number of cards based on the two schemes:

- a. AAY: Anthyoday : Red card: 21 Kg rice + 14 Kg wheat + 1 Kg Sugar / family/ month irrespective of number of persons.
- b. PPH: White card: Priority Household: 3kg rice + 2 kg wheat/ Unit (person)/ month

Distributors (transporter) in the FCI are provided with distribution plan across the FPS of the District based on the block wise allotment. Truck goes from FCI Godown to FPS straight tracked by GPS (Eg 3-4 fps by one truck). Supply side (District Supply Officer) gives schedule of distribution to the FPS. One nodal officer (appointed by DM) sits at FPS and monitors distribution. Biometric system is used for the fool proof distribution at the FPS to the beneficiary /consumer.

## **Awareness creation in the district**

The district officials and the UN World Food Program members have done SBCC (Social and Behaviour Change Communication) and awareness programs at village and household level about importance of eating FRK and cooking practices (Avoiding excess washing, retaining the kernels if they float and retaining the water).

The Launch was difficult initial 2 months (early 2021) till awareness camps were organised by WFP and the system and public demonstrations were made of cooking and eating in front of the public.

## Quality Control

GOI issues guidelines periodically on QC. Food safety licences are monitored. Quality controller shares the list of empanelled Government and Private Labs. .Samples are sent for QC at 3 levels.

1. FRK Manufacturer: FRK premix and FRK
2. Rice Miller: FRK Rice for Distribution
3. FCI Godown: FRK Rice for Distribution

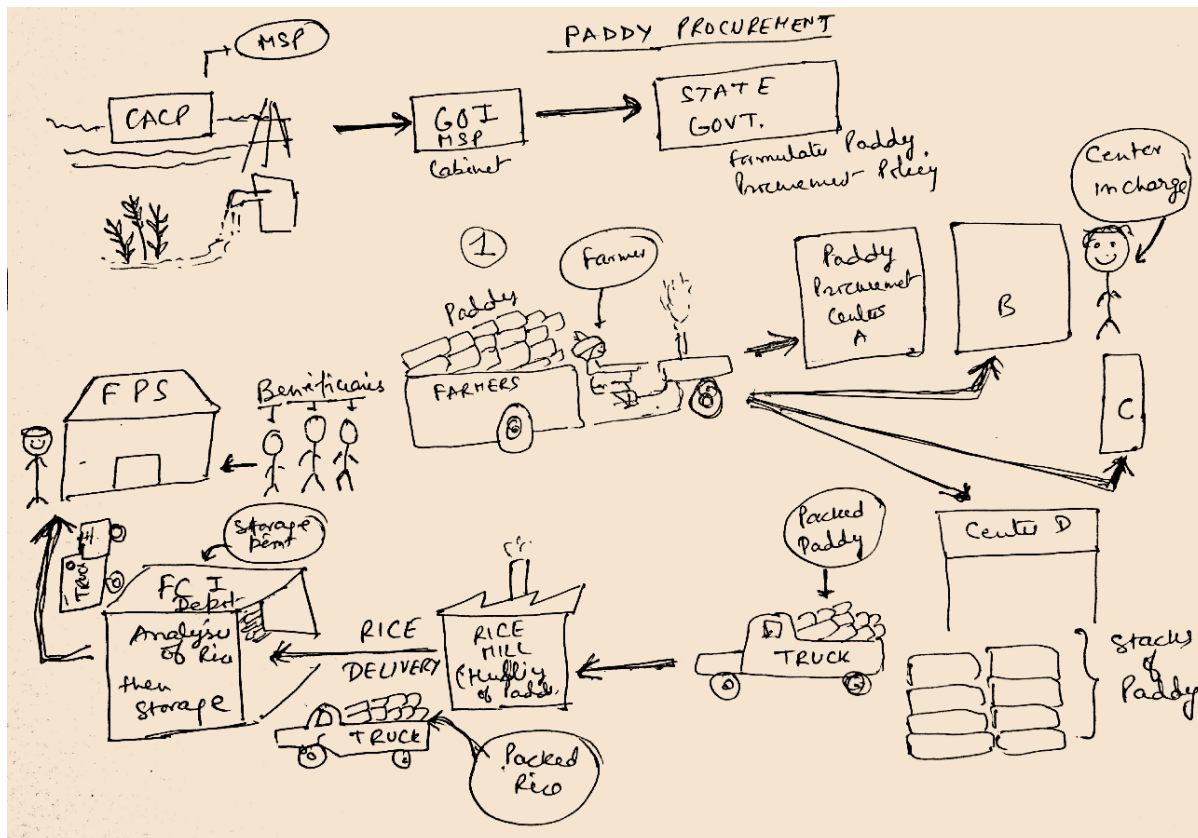
## Usage of fortified rice & feedback from public

No side effects reported in the last two years. The DFO informs that they were told by a Doctor from AIIMS, Delhi who works on Anaemia that the fortificants' dose is very low to cause any adverse effects. The media is very alert to catch any untoward even and that has not happened in the last 2 years, even though initial confusion prevailed that this is a plastic rice. Nor any official or unofficial complaint was launched. Rice millers, DM inspectors everybody tasted and have not complained in the last two years. The Card holders used to get 2 lots every month during COVID-19 time. But now only one lot a month. Now though there is no study, there is a possibility of buying from outside based on number of members in the family. District officials have expressed that there is a need for impact study as they feel they have been implementing a fairly well-designed program and they will be happy to know its impact.

### Visit to Rice Mill, FRK Manufacturer and FRK Sac at the manufacturer



**Figure 4: Illustration of the FRK Rice Life Cycle by District Food Marketing Officer (DFMO), Chandauli, Uttar Pradesh**



## Jharkhand

### Initiation of fortified rice in the district

FFR started in the month of October 2021. In East Singhbhum district, the date of announcement of fortified rice is October 2021 but the FCI godowns started receiving fortified rice from November 2021. By May 2022, 60% fortified rice and 40% non-fortified rice was being supplied to district. From October 2022, 100% fortified rice is supplied in the district.

### Acquisition and Distribution of fortified rice

State govt. purchases grains from FCI, DM, SFC issue RO to FCI as per district allocation block wise. Lifting in charge insures lifting of grains through state level transporter as per block requirement. SFC depo which is situated of each block receive grains from FCI

and thereafter AGM who is in-charge of SFC depo issues grains to FPS dealer as per their allotment through SIO. Finally, FPS dealer distribute grains among beneficiary as their entitlement. This is how supply mechanism of fortified rice distributed through PDS. We are getting fortified rice every month. Currently FCI is providing fortified rice, we are getting every month. FFR is being provided in entire district.

### **Usage of fortified rice & feedback from public**

Initial rollout had some complaints from public and FPS dealers that “This is plastic rice”. District supply office through block marketing officers and political parties conducted awareness campaigns through posters, banners, meetings to clarify about the rice. Training on fortified rice is given by Indian Learning Management Service to all the district level officials about FFR. The govt. has provided banners regarding benefits of fortified rice to each FPS dealers to display it on the shop. DSO felt that 80% of the public in the urban region and 95% of the public in the rural region are consuming FFR supplied through PDS. It took six months for public to understand and use FFR as per the DSO. FPS are open on all days in a week except Monday in rural area, and Tuesday in urban area.

### **Any other concerns**

The miller sends FRK to the laboratory situated at Ranchi. After getting the approval certificate, fortified rice is distributed.

There are three types of PDS cards available in the district:

- A. AAY (35 kg per month per family-28 kg rice, 7 kg wheat)-FFR
- B. Regular card (PHs) (5 kg/person/month)-FFR
- C. Green card (5 kg/person/month)-Non-FFR given by Jharkhand state government.

# FOOD CORPORATION OF INDIA/STATE FOOD CORPORATION GODOWN MANAGERS/SUPERVISORS' INTERVIEW

## Maharashtra

- **Time from initiation to full supply of fortified rice in the district**
  - Varied based on the scheme (MDM, ICDS, through FPS etc.)
  - From FCI godown Nagpur division, Gadchiroli generally procures wheat and not rice. Gadchiroli district uses its own Rice. Gadchiroli is a paddy producing district. It uses custom milled rice, which is manufactured by milling paddy that the state government procures at the minimum support price from farmers. Gadchiroli DSO supply FRKs to rice mills having blending machine to mix FRKs and rice in recommended proportions. After mixing rice is being stored in Base depots → transfer to state warehouses → supply to FPS → supply to beneficiaries.
  - Gadchiroli district also export the surplus FR to other districts in Maharashtra;
  - If Gadchiroli district's FR storage is exhausted then they raise a request to FCI Nagpur division, which send FR to FCI godown depo at Vadsa and Brahmapuri. The FCI Nagpur division have had always provided requested amount of FR (by DSO Gadchiroli district) since the beginning (Jan 2021).
- **Type of rice**
  - FCI Nagpur division godown are receiving Raw FR from Haryana, Punjab, and Chhattisgarh since 2021
- **Distribution of fortified rice**
  - Supplying to Nagpur Urban and Nagpur Rural, Chandrapur, Bhandara, Gondia, Gadchiroli, Wardha
- **Storage of fortified rice**
  - Capacity of 52000 MT; Regular storage; No special precautions compared to non-fortified rice;
- **Quality check of fortified rice**
  - A dedicated team of officers' conducts quality assessment of stored rice on monthly basis: Proper and legible stencilling/tag;
  - 100% weighment of rice consignment;
  - The size of each lot consignment: 27 MT (50 bags of 50 kgs packing)



- Moisture content using moisture meter;
- Percentage of broken grain, Cracked grains, Immature grains/kernal;
- Rice breakability;
- Acceptable average length of principle class/group of rice;
- Discoloured/fermented grains and damaged grains
- Level of foreign material and infestation
- **Perception on usage**
  - Initial hesitation among beneficiaries;
  - After implementing awareness campaign, good acceptance and consumption of fortified rice;
- **Any other suggestions/ concerns**
  - Stringent monitoring to maintain the recommended proportion of rice grains and FRKs during blending;
  - Government should strive to supply thin rice grains over thick rice grains to promote the acceptability and utility (Supply of good quality raw rice)
  - Strengthen the IEC activities and IEC materials to increase awareness among community people;

### Gunny bag logo/tag



## State warehouse & gunny bag stencilling



## Gujarat

### Time from initiation to full supply of fortified rice in the district

The FCI Bharuch Godown Manager told us that the supply of fortified rice started from December 2019 in FCI godowns and since then they have been providing fortified rice to all the state godowns of the 2 districts of Narmada and Bharuch.

### Type of rice

Type of rice they are receiving (Raw/single parboiled/parboiled) are raw rice and not parboiled.

### Distribution of fortified rice

Stock comes from Punjab and Haryana via Railways monitored by the Regional Office in Ahmedabad. Intent is placed based on the vacant space in the godown and daily stock positions. This godown has a capacity of 5100 MT. When the stock goes below 2700 MT, they place an intent. Once an intent is placed, the stock arrives in about 3 days. The frequency of the indent is about once per week. This godown supply to 2 districts in Gujarat: Narmada and Bharuch. The FCI sacks are not exactly 50kg. In the State Civil Supplies Godowns, they make it exactly 50kg of FR and then supply to respective FPS.



## Storage of fortified rice

Storage of fortified rice is done in the godowns, and since this is a small godown, the stocks barely last 3 days, and maximum for a week. They send out stocks according to FIFO (First-In First-Out) basis.

## Quality check of fortified rice

Quality check of fortified rice is done only manually. They are stored based on the protocol, and fumigation of the entire godown is done every three months. Pest control is done every week.

## Any other suggestions/ concerns

Every Godown is called a Base Depot. The neighbouring 2 godowns act as their reserve depots. In case, any temporary shortage occurs, the FR is channelled from the reserve depots and the issue is notified.

## NIN Team visit of Bharuch FCI Godown, Gujarat



## Andhra Pradesh

### Time from initiation to full supply of fortified rice in the district

In Vizianagaram district, the date of announcement of initiation of Fortified rice is from April 2020 at Bobbili mandal and later extended to Parvathi Puram mandal by May 2020. From June 2021, entire district has been distributed with fortified rice.

## **Type of rice**

They are receiving raw polished and SORTEXED rice from millers which is fortified and labelled.

## **Acquisition of fortified rice**

Fortified Rice is being supplied directly from the designated rice mills, all of which have both SORTEX and FRK blending facilities. There was also F+ Logo along with statutory label on each rice bag.

## **Distribution of fortified rice**

In Vizianagaram there are 10 buffer godowns and 11 MLS points. Fortified Rice from buffer godown is being transported by trucks to MLS points for temporary storage. From MLS points, the fortified rice is transported to FPS shops. The MDUs pick up the rice from FPS, and deliver the fortified rice to the beneficiaries at their door step. It is also noted that fortified rice from FCI godowns of Vizianagaram district is also being transported to other states.

## **Storage of fortified rice**

The fortified rice packed in gunny bags and labelled is being stored in Buffer godowns and/or FCI godowns, and are also stored temporarily at MLS points (3-7 days).

## **Quality check of fortified rice**

Periodically prophylactic and curative treatment is being given at buffer godowns and FCI godowns. It was also reported that the disinfectant protocols are being followed at godowns as prescribed by FCI, and no special measures are being taken for fortified rice. It was noted that in buffer godowns, they randomly collected 250g of rice, from which 50g of rice will be taken tested for FRKs. If this does not match 0.8 to 1.2%, the rice is rejected and sent back to the miller.

## **Perception on usage**

There was initially a backlash from the public, as it was perceived to be mixed with plastic rice. Over a period of two years with frequent IEC activities, the usage of fortified rice among the public is now reported as Very Good.

## Any other suggestions/ concerns/themes

District manager felt that a colour based detection to count the FRKs to check the quality is needed, as they might miss some FRK when done manually.

### Label on a rice bag in an FCI Godown in Andhra Pradesh



## Tamil Nadu

The state owns the TNCSC godowns while there is one FCI godown in the district. From April 1<sup>st</sup>, 2023, Fortified rice is regularly distributed to PDS shops. Before April, only ICDS and MDM schemes received fortified rice. Fortified rice is obtained from millers and FCI. Both Parboiled (mostly) and raw fortified rice are distributed.

The quantity of rice supplied to each PDS shop is prefixed by the Commissioner of civil supplies based on number and types of cards attached to each shop. Unfortified rice is supplied to special cards like Police, Prison and Forest service personnel cards. Sixty percent of rice for the following month is supplied from 20<sup>th</sup> to 30<sup>th</sup> of the previous month (Advanced movement). The remaining 40% is supplied from 1<sup>st</sup> to 20<sup>th</sup> of the month (Regular movement).

Storage of fortified rice is done in so that aeration and moisture are controlled and monitored. The accessibility to pests/rodents is prevented. There are no special precautions for storing fortified rice. But fortified rice has a validity period of one year only hence immediately distributed to the shops after fortification.

## Visit to an FCI Godown and Fair price shop in Tiruchirappalli, Tamil Nadu



### Uttar Pradesh

#### Time from initiation to full supply of fortified rice in the district

On 9<sup>th</sup> January 2021 2 blocks (out of 9 blocks) FRK of NFSA/PDS Chandauli was initiated. By March 2021 100 percent District was covered including PDS, ICDS and MDM

#### Type of rice

Raw rice Nati Masoori.

#### Acquisition of fortified rice (Refer Figure 1) and Distribution of fortified rice

The Commission for Agricultural Costs & Prices (CACP) based on the survey of rainfall, irrigation, expenses etc will suggest an MSP (Minimum Support Price). GOI along with the Cabinet fixes the MSP. Eg: for KMS (Khareef Market Scheme) MSP will be Rs2060/Quintal of Grade A Rice while Common variety Rs. 2040/Quintal. State government formulated Paddy Procurement Policy. UP State government has a policy of direct procurement from the cooperative societies and millers (no middle men). The farmer supplies the raw rice to Paddy Procurement Centres. FCI is involved in performance appraisal of paddy procurement centres. PPCs stacks the paddy. Packed paddy is sent in trucks to Rice mills for hulling of paddy. During the Hulling, 100:1 (Rice : FRK) Rice 50 Kg jute bags are delivered from the Rice mills to FCI Depots /Godowns. FCI Depot does the analysis of rice by lot quality and stores the rice. From here rice is transferred to FPS directly. The delivery

process is monitored by the DSO office through GPS tracking system. The beneficiaries take their quota of rice from the FPS.

FCI Depot of Chandauli has two linked depots (Chandauli and Varanasi).

### **Storage of fortified rice**

1. Scientific staking is done for air circulation between gunny bags. Staking is criss-cross to prevent any fall of the bags (locking)
2. Two types of treatment; preventive and curative
  - a. Preventive: Delta methrin is a contact poison is used
  - b. Curative treatment : by fumigation with Phosphine or warfarin
3. Monkey gates prevent monkeys allowing the air circulation while there are no rodents

### **Quality check of fortified rice**

1. Physical QC: Blending analysis if 100: 1 Ratio is being maintained. If not maintained then the supply is rejected.
2. Chemical QC
  - a. Aging analysis to see if it is fresh stock or not.
  - b. De-husk stage, if Bran is >13% the stock is rejected, as bran this point is prone for oxidation and become rancid.
3. Standards maintained: Length: Width of the rice grain should be 1.5; full length should be 75%; Damage <3%.
4. Three levels of quality check. Will prevent any conflict of interest between different parties involved.
  - a. Premix for fortificant powder: By the authorities and FRK Manufacturer
  - b. FRK: Spike sample is sent to NABL accredited lab.
  - c. Fortified rice: FCI Depot

### **Perception on usage**

Well accepted by the public and other parties.



**Quality Control Methods: SOPs for age determination of Rice and Universal Moisture Meter for measuring Moisture in the Rice**



FCI Godown visit by the team, Wind Ventilator Stainless Steel Industrial Roof Exhaust Fan, For Ventilation , Monkey gate to allow air circulation Report from Universal Moisture Meter showing the moisture content of the rice



## Jharkhand

### Time from initiation to full supply of fortified rice in the district

We have started receiving FFR in our Godown from 29-12-2021. By April, 2022, we were receiving 60% of FFR and 40% non-FFR. From 9<sup>th</sup> October 2022, all the rice received is FFR.

### Type of rice

Parboiled Rice

### **Acquisition of fortified rice**

FCI Godown receives rice from different parts of the country in trains. The Godown located in Jamshedpur is having a capacity of 13000 metric tons and rice gets stored there based on the releasing order (RO) received from the state govt., FFR will be transported in the lorries to the state food corporation Godowns. Form the SFC godowns, based on the SIO (Supply Issue Order), through door-step transport mechanism, rice will be delivered to FPS, from FPS rice will be distributed to public.

Rice from the farms will be bought by large area multipurpose society (LAMPS) which will be sent to mills for customised milling rice as per the SFC Godown manager statement. For every 100 kg of paddy 68 kg rice will be given, there are 22 rice mills in the district of East-Singhbhum and everyone has installed the blending machines to mix fortified rice kernels with the raw parboiled rice. For every 50 kg rice bag 500 grams of FRKs will be mixed.

### **Distribution of fortified rice**

FCI Godown receives rice from different parts of the country in trains. The Godown located in Jamshedpur is having a capacity of 13000 metric tons and rice gets stored there based on the releasing order (RO) received from the state govt., FFR will be transported in the lorries to the state food corporation Godowns. Form the SFC godowns, based on the SIO (Supply Issue Order), through door-step transport mechanism, rice will be delivered to FPS, from FPS rice will be distributed to public.

### **Storage of fortified rice**

Storage of FFR, fumigation is done in the Godown every month with Aluminium Phosphide and Malathion spray for pest control.

### **Quality check of fortified rice**

Quality of rice will be checked locally in the FCI godown by testing the rice for grading.

### **Perception on usage**

SFC Godown manager feel that all the beneficiaries will consume rice given through PDS.

## Any other suggestions/ concerns/themes

Eg: FCI Manger in East Singhbhum suggested about quality check of FRKs supplied to millers.

Millers once in a month transport the rice to FCI Godowns.

1. FCI Godown manager felt that the FFR rice should be distributed very fast as FRKs will start dissolving and become chalky. The rice type supplied in Jharkhand state is parboiled.

### Visit to FCI/SFC Godowns



### Label on Rice bag



### Fortified rice kernel bag



### Testing Fortified rice kernels in water





# FAIR PRICE SHOP DEALERS/OWNERS

## Maharashtra

- No. of Fair price shops visited in the district: (N=4)
- **Awareness about fortified rice**
  - Well aware about FR distribution and importance;
  - Received the health education from supply inspector and DSO at the beginning;
- **Issues related to distribution**
  - Continuous supply of FR to beneficiaries across all talukas of Gadchiroli since the inception (Jan 2021);
  - No experience of FR supply interruption till date;
  - Have not observed the changes in number of beneficiaries seeking FPS services after the roll out of FR;
- **Feedback from public regarding fortified rice**
  - At the beginning:
    - Community leaders visited to FPS to confront owners to seek clarification on FRKs' different texture;
    - Newspaper column opposing use of FRKs were published in local newspapers;
    - Beneficiaries requested FPS owner to avoid mixing of rice with FRKs;
  - Currently
    - Not observed any changes in color, texture, or taste of FRKs compared to regular rice;
    - Don't have any negative as well as positive feedback related to FR;
- **Activities related to creating awareness among public regarding fortified rice**
  - FPS owners have explained the benefits of FR to beneficiaries;
  - Have put health awareness banners in the shop;
  - Paid home visits to discuss about FRKs in rice;
- **Any other issues/concerns**
  - Few of the FPS owners as well as beneficiaries are not happy with the quality of regular rice (irrespective of its fortified status). They avoid eating thicker rice being provided through FPS and therefore sell it in the market at lower price (@10-12 INR per Kg). To eat, either they grow (in their farms) or purchase thin rice from market.

## FPS shop & owner interview



## Gujarat

We interviewed 4 FPS owners/dealers (three in rural and one in urban area). All of them were aware of the fortified rice and were able to pick the FRK separately from the rice. Most of them do manual check of FR mostly while distributing them. Currently there are no issues related to fortified rice. However earlier people used to say it as ‘plastic rice’ and used to complain about the changes in color (light pink) and the floating of kernels. But now, the feedback is all good. None of them have faced any issues related to distribution. A lot of activities at both block and village level had been carried out by politicians and experts to remove the misconceptions including live experiments like burning plastic and rice at the same time to show the difference and prove that it is not plastic. They do not see any reduction in the number of beneficiaries taking rice after it has been fortified.

## FPS shop & owner interview



## IEC Poster at a FPS in Narmada



## **Andhra Pradesh**

### **Awareness about fortified rice**

Initially, when programme was introduced in April 2020, both Fair Price Shop Owners and beneficiaries perceived it as plastic rice. With many IEC activities over time, the awareness among fortified rice is improved. It is now believed that fortified rice is healthier than regular rice purchased from markets.

### **Issues related to distribution**

The beneficiaries are receiving fortified rice through mobile dispensing units (MDUs) with Aadhaar verification at their door steps. Hence, there are no issues related to distribution of fortified rice.

### **Feedback from public regarding fortified rice**

Initially, when programme was introduced in April 2020, there were apprehensions by public complaining of plastic rice. Later, with many IEC activities, public are accepting fortified rice. The beneficiaries reported that now they are aware of the fortified rice and is being given to improve their health.

### **Activities related to creating awareness among public regarding fortified rice.**

Many IEC activities reported be conducted to clarify the misconceptions of fortified rice. The banners indicating what is fortified rice and its benefits are displayed in FPS shops, and MDU vehicles. Majority of the beneficiaries reported that they are exposed to IEC activities conducted by the government.

### **Any other issues/themes/concerns**

NA

### **Interview with Fair Price shops in Andhra Pradesh**

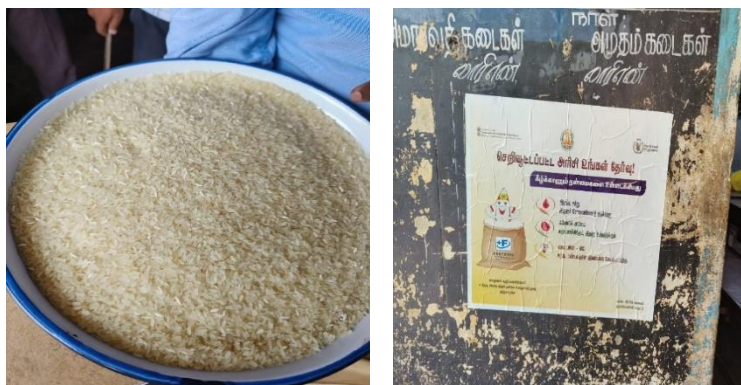


## Tamil Nadu

There are two types of fair price shops. One type is run by the PDS department and the other by Cooperative department. The shop employees are aware of the fortified rice. Posters about fortified rice in Tamil was found in all the shops. Few shop owners are yet to recognize the fortified rice labels printed on the bags. They did not find any difference in the distribution of fortified rice in comparison with unfortified rice. Of the five PDS shops visited, only one shop beneficiaries complained that fortified rice was not good for preparing fermented foods like Idly etc. They mentioned that cooked fortified rice on fermentation became sticky. The PDS official opined that the salt water used for cooking in this region could be a reason for such an observation which is not reported elsewhere.

Some of the beneficiaries have the habit of winnowing the rice which separates the FRKs. The FRKs lost during winnowing is not used for cooking. Similarly, while soaking the rice, the FRKs float for a while. Some beneficiaries exclude the floating FRKs while others include them. It was also observed that when rice is soaked for a longer duration of time the FRKs sink/dissolve in the water. There is also a practice of removing the starchy water used for boiling rice which is likely to decrease the iron content. But studies need to be undertaken to understand the bioavailability of iron when varied cooking practices are employed.

### Fortified rice and IEC material in a Fair price shop in Tamil Nadu



## Uttar Pradesh

### Awareness about fortified rice

Awareness is there in general. They had many issues during the launch which they have overcome by now. They demonstrated the F+ sign and make out visually if the bag has FRK.

### **Issues related to distribution**

No major issues could be identified regarding as the procurement as there is a system of two backup depots when there is any shortage (1.Vyasnagar, 2.Pahadia, 3.Maduvadi Varanasi). Monthly distribution date is shared by District Supply office and Distribution Inspector monitors the distribution process. The UPePDS is a fool proof system with Biometry based secure distribution system maintains a real-time record of collection, demand of the FRK Rice.

### **Feedback from public regarding fortified rice**

There is good demand and most often rice get collected within few days (2-3 days usually) from 5th of every month.

### **Activities related to creating awareness among public regarding fortified rice**

Efforts to clarify issues related to awareness is apparent apart from the state level systems.

### **Any other issues/themes/concerns**

Some FPS Owners expressed their concerns regarding the location of FPS on prime locations demand more rent. Hence, they locate themselves in remote places, often of insufficient spaces.

Some dealers expressed that the term FRK Rice is difficult to use and expressed a need is there for simpler terminology.

They expressed that while selling away of FRK Rice by the customers cannot be ruled out completely it is very rare as per their knowledge in Chandauli. The marketing inspector suggested that the FRK should be of different colour like yellow so that they can identify it immediately if seen in private setup. The example he gave is blue kerosine oil.

### **SBCC: Program Policy Officer (Nutrition), UNWFP, Lucknow, Mr Niranjan Bariyar**

Conducted training programs for Rice Millers, District officials. In 2022 a District level workshop was conducted for DM, ICDS, Panchayat Raj, MDM, PHU faculty, FPS Owners for, Demand generation among people. Salient features of SBCC included:

- Mobile Van for IEC in 2 villages per block including message from the PM.
- Cooking demonstrations during outreach programs: Khichdi and Kheer with FKR.



- Visitors from BMGF, Bangladesh etc to see the success of the program.
- Training of millers, started with 25, completed 96 millers across the District.

Challenges: FRK Manufacturing that can pose a challenge affecting the quality is that kernels float when the rice kernels get puffed at 80 degrees centigrade to increase the production whereas the norm is to do drying at 60-65-degree centigrade

For SBCC Plain WhatsApp messages will not help, need more concrete methods

### Fair price shop in Uttar Pradesh and IEC poster at a Fair price shop, UpePDS with biometry and AAY & PPH Cards



## Jharkhand

We visited four fair price shop in East Singhbhum district located in Jamshedpur notified area committee, Gandhi ashram, Devnagar (Urban), Mahulia village (Rural), Amdanga (Rural), Hiraganj (rural).

### Awareness about fortified rice

1. From the past 6-9 months, we have noticed a change in the variety of rice they receive as we have seen few chalky white grains mixed in the rice. When we enquired the officials, we came to know about the fortified rice.
2. We are also receiving non-fortified rice as 5 kg packets from the state government which will be given to Green card holders.

## Issues related to distribution

The FPS is opened all days of the week except on Tuesday. The distribution of the rice is as per the type of the card they hold. For AAY card, we give 28 kg rice, and 7 kg wheat for PH card, we give 4 kg rice, and 1 kg wheat per person per month.

He said we received the rice from state food corporation Godown based on the allotment from the state government.

We test, if the rice supplied is fortified by taking a sample into hands and searching for chalky white kernels.

## Feedback from public regarding fortified rice

The feedback from public was that “Taste is good compare to previous rice”.

- Initial two months was difficulty in making people understand about this fortified rice, but after creating awareness through mouth publicity and posters displayed at FPS, then people started using the fortified rice.
- No negative feedback about fortified rice from the public.
- Initially, people used to pick FRKs and throw away before cooking thinking it has plastic rice. But awareness was created through posters displayed at FPS shop.
- It took 2-3 months for people to understand about this rice.
- We did not get either negative or positive feedback after the initial 2-3 months about the fortified rice.

## Any other issues/themes/concerns

No other fortified products except rice is supplied to us.

## Fair price shop in East Singhbhum district



## IEC poster displayed outside FPS shop



## BENEFICIARIES' INTERVIEWS

A total of 181 beneficiary households were interviewed across all the six states. Out of 181 beneficiary households interviewed, 125 (69%) of people are regular PDS card holders and 48 (26%) are AAY card holders. The source of rice in previous year was from PDS alone in 86 (47.5%) of households and 85(47%) households were getting rice from both PDS and market.

Out of 181 households, 153(84.5%) of households received both rice and wheat, 28(15.5%) have got only rice. Out of 181 households, 153(84.5%) collected rice by going to FPS and 28(15.5%) received through home delivery. Out of 181 households, 179(98.9%) households consumed PDS rice fully and 2(1.1%) households consumed partially. Out of 180 households who responded, 122(68%) households said that FRKs float while washing and 58(32%) said they do not float while washing. Majority of responders said that only one or two FRKs float while washing. Out of 122 households who said that FRK'S float, 89(73%) said that they use floating kernels for cooking, 33(27%) responded that thy will throw away the floating kernels.

Regarding Fortified rice, 177(97.8%) households said there is no colour change, and 175 (96.7%) of households said there is no change in the way the rice cooks. 41(22.7%) households said there is a change in the texture of the rice, and 34(18.8%) households said there is a change in the taste of the rice.



Table-4: Beneficiary responses regarding the access, availability, and utilization of fortified rice

| Variable  | Response               | Mahara<br>shtra<br>(N=30) | Gujarat<br>(N=28) | Andhra<br>Pradesh<br>(N=28) | Tamil<br>Nadu<br>(N=34) | Uttar<br>Pradesh<br>(N= 29) | Jharkhan<br>d (N=32) | Total<br>(N=181) |
|---|------------------------|---------------------------|-------------------|-----------------------------|-------------------------|-----------------------------|----------------------|------------------|
| Type of ration card                                     | Regular PDS card       | 19(63.3%)                 | 11(39.3%)         | 26(92.9%)                   | 31(91.2%)               | 22(75.9%)                   | 16(50%)              | 125(69.1%)       |
|   | AAY card               | 11(36.7%)                 | 9(32.1%)          | 2(7.1%)                     | 3(8.8%)                 | 7(24.1%)                    | 16(50%)              | 48(26.5%)        |
|   | others                 | -                         | 8(28.6%)          | -                           | -                       | -                           | -                    | 8(4.4%)          |
| Source of rice in previous one year                     | From their farms       | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | From market            | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | PDS only               | 17(56.7%)                 | 14(50%)           | 28(100%)                    | 18(52.9%)               | -                           | 9(28.1%)             | 86(47.51%)       |
|   | Both PDS and Farm      | 7(23.3%)                  | 2(7.1%)           | -                           | -                       | -                           | -                    | 9(4.97%)         |
|   | PDS and market         | 5(16.7%)                  | 12(42.9%)         | -                           | 16(47.1%)               | 29(100%)                    | 23(71.9%)            | 85(46.96%)       |
|   | PDS, farm, market      | 1(3.3%)                   | -                 | -                           | -                       | -                           | -                    | 1(0.55%)         |
| What do you receive in PDS?                             | Rice                   | -                         | -                 | 28(100%)                    | -                       | -                           | -                    | 28(15.5%)        |
|   | Wheat                  | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | Both                   | 30(100%)                  | 28(100%)          | -                           | 34(100%)                | 29(100%)                    | 32(100%)             | 153(84.5%)       |
| Frequency of rice received through PDS in last one year | Once                   | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | Two times              | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | 3-6 times              | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | Every month            | 30(100%)                  | 28(100%)          | 28(100%)                    | 34(100%)                | 29(100%)                    | 32(100%)             | 181(100%)        |
|   | Never                  | -                         | -                 | -                           | -                       | -                           | -                    | -                |
| How did you receive rice through PDS                    | Going to FPS           | 30(100%)                  | 28(100%)          | -                           | 34(100%)                | 29(100%)                    | 32(100%)             | 153(84.5%)       |
|   | Home delivery          | -                         | -                 | 28(100%)                    | -                       | -                           | -                    | 28(15.5%)        |
| How did you receive the rice supplied through PDS       | In sealed pack         | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | In a sack              | 30(100%)                  | -                 | 28(100%)                    | 34(100%)                | 29(100%)                    | 32(100%)             | 153(84.5%)       |
|   | In own bag             | -                         | 28(100%)          | -                           | -                       | -                           | -                    | 28(15.5%)        |
| Usage of PDS rice                                       | Consumed fully         | 28(93.3%)                 | 28(100%)          | 28(100%)                    | 34(100%)                | 29(100%)                    | 32(100%)             | 179(98.9%)       |
|   | Consumed partially     | 2(6.7%)                   | -                 | -                           | -                       | -                           | -                    | 2(1.1%)          |
|   | Sold                   | -                         | -                 | -                           | -                       | -                           | -                    | -                |
|   | Did not consume at all | -                         | -                 | -                           | -                       | -                           | -                    | -                |
| Does FRKs float while washing?                          | Yes                    | 21(70%)                   | 12(46.4%)         | 27(96.4%)                   | 33(97.1%)               | 29(100%)                    | -                    | 122(67.8%)       |
|   | No                     | 9(30%)                    | 15(53.6%)         | 1(3.6%)                     | 1(2.9%)                 | -                           | 32(100%)             | 58(32.2%)        |
| What do you do with floating kernels?                   | Throw away             | 19(90.5%)                 | 7(58.3%)          | 2(7.4%)                     | 5(15.2%)                | -                           | -                    | 33(27%)          |
|   | Use them for cooking   | 2(9.5%)                   | 5(41.7%)          | 25(92.6%)                   | 28(84.8%)               | 29(100%)                    | -                    | 89(73%)          |
| Color   | Yes                    | -                         | 1(3.6%)           | -                           | -                       | 1(3.4%)                     | 2(6.25%)             | 4(2.2%)          |

|   |     |                 |                 |                 |                 |             |              |             |
|---|-----|-----------------|-----------------|-----------------|-----------------|-------------|--------------|-------------|
| <b>Change of FFR</b>  | No  | 30(100%)        | 27(96.4%)       | 28(100%)        | 34(100%)        | 28(96.6%)   | 30(93.75%)   | 177(97.8%)  |
| <b>Texture Change of FFR</b>  | Yes | 5(16.7%)        | 2(7.1%)         | 27(96.4%)       | 6(17.6%)        | -           | 1(3.1%)      | 41(22.7%)   |
|   | No  | 25(83.3%)       | 26(92.9%)       | 1(3.6%)         | 28(82.4%)       | 29(100%)    | 31(96.9%)    | 140(77.3%)  |
| <b>Change in the way FFR cooks</b>                                    | Yes | -               | -               | -               | -               | -           | 6(18.75%)    | 6(3.3%)     |
|   | No  | 30(100%)        | 28(100%)        | 28(100%)        | 34(100%)        | 29(100%)    | 26(81.25%)   | 175(96.7%)  |
| <b>Change in Taste of cooked FFR</b>                                  | Yes | 1(3.3%)         | -               | 26(92.9%)       | 7(20.6%)        | -           | -            | 34(18.8%)   |
|   | No  | 29(96.7%)       | 28(100%)        | 2(7.1%)         | 27(79.4%)       | 29(100%)    | 32(100%)     | 147(81.2%)  |
| <b>Mean (SD) (Kgs) amount of rice received through PDS last month</b> |     | 17.97<br>(6.1)  | 17.97<br>(6.1)  | 16.07<br>(5.61) | 18.75<br>(6.18) | 20.85(6.18) | 16.38 (4.02) | 22.63(6.15) |
| <b>Mean (Kgs) amount of PDS rice consumed last month</b>              |     | 16.97<br>(6.09) | 16.97<br>(6.09) | 16.07<br>(5.61) | 18.75<br>(6.18) | 20.85(6.18) | 16.38 (4.02) | 22.63(6.15) |

\*One or two kernels float while washing & In Gujarat, one person did not respond

## Observations noted during the beneficiary interviews

### Maharashtra

- Different texture of FRKs;
- FRKs floats on water;
- Increased stickiness of cooked rice due to addition of FRKs;
- Rice distributed through FPS are thicker compared to rice purchased in the market;

Few of the beneficiaries in the tribal area of Dhanora expressed disbelief in the governments initiative: *“the plastic rice (FRKs) is being provided by the government to kill poor people”*- Beneficiary G23, F, 65 years

### Strengths of the scheme

- Well established distribution system: from paddy procurement till delivery to beneficiaries;
- Stakeholders well aware about the roles and responsibilities to distribute FR;
- Availability of good quality FRKs from the government;
- Continuous (uninterrupted) supply of FR;
- Optimal storage at state warehouses;
- Near independence from the FCI rice supply;
- Optimal acceptability of FR among beneficiaries;

## Weaknesses of the scheme

- Suboptimal awareness activities: Lack of banners (health education materials) at DSO office, FPS shops, as well as in communities.
- Poor awareness among beneficiaries about FFR;
- Suboptimal quality of rice (irrespective of being fortified);
- Suboptimal monitoring at state warehouses for rice being fortified or not: Lack of stencilling and tags on gunny bags.

## Gujarat

- Wheat, Tur dal, Chana, Salt, Sugar are the other items received through PDS. However, APL-1 families do not get sugar. 1 litre of Double filtered oil (groundnut oil fortified with Vit A and D) is given to all families twice a year for Diwali and Janmashtami.
- One respondent didn't know if the FRK floats or not as he was not involved in cooking. Some other complaints received were that the FRK were hard to chew (two people) and the color of FRK change to black while cooking.
- 
- We ourselves tested at all FPS if the rice kernels float. We found that they do not, and only a very few broken kernels and the dirt in the rice floats. Also, we found that the kernels leave a white chalky deposit on hands after soaking in water.
- 
- It is interesting to note that most people of one FPS didn't know that the rice was fortified in the first place.

### IEC activities at Narmada, Gujarat



## Andhra Pradesh

Detailed Interview with individual beneficiaries was done, particularly women taking care of the household cooking. The beneficiaries reported that now they are aware that fortified rice does not contain plastic rice, and it is being given to improve their health (blood improvement). Majority of them informed that govt officials, local leaders and FPS shop keepers educated them on this.

All the beneficiaries reported that they do consume fortified rice and they also purchase additional rice from local market (~10kg/month in a four-member family or use the rice produced in their land). Most of the beneficiaries felt there is also slight change in texture and taste of fortified rice when compared to normal rice supplied two years back.

At the household level, most of the beneficiaries are using fortified rice for cooking while few reported that they also mill it to flour for making breakfast and snacks.

All the households reported floating of rice kernels when it is being washed prior to the cooking, but the number of floating grains were reported 10-20 grains at each cooking session (approximately 500g fortified rice). The beneficiaries felt that the number of these floating rice grains are low, and therefore, are not making an effort to collect them.

All the households reported that they wash the rice 2-3 times, and cook in open vessels, and decant the excess starchy water. This starchy water is mainly fed to the cattle's, house hold animals or thrown out, but few also reported they consume. When probed further, on why they are not using water tight cooking methods such as cooker, the beneficiaries responded that the PDS rice being supplied is relatively new and forms sticky rice when cooked without decanting, and decanting the starch helps in improving the texture of the rice particularly when this rice is to be consumed in the next meal. Also few beneficiaries reported that they will have stomach problems when cookers are used.

### Interview with beneficiary Households in Andhra Pradesh





## Uttar Pradesh

Everyone heard of rumours of plastic rice initially. After proper SBCC, almost everyone knew that it is 'Vitamin Rice'/Medicated Rice and people are eating. Every household is buying extra rice from market. An approximate of 30 % rice is purchased from market. During corona they were getting double the quantity on 2 occasions a month and did not purchase from outside. During corona they got home delivery. Those who become richer, they stop eating according to some feedback. One of the respondent has narrated how it is culturally imbibed to throw away whatever floats while washing grains hence in spite of repeated messages from the authorities, there is a tendency to throw what floats.

### Interview with beneficiaries at Uttar Pradesh, the raw and cooked FRK rice



## Jharkhand

1. Few people said that the rice given is not sufficient and extra rice should be given as this not sufficient for our family, we are buying extra rice from market for consumption.
2. When we interviewed one beneficiary, we asked do you consume this rice? and his response was, do you want me to die hungry? of course, I will eat this what else, do you expect me to eat?
3. People liked the taste of this rice compared to the previous non-fortified rice.

4. Initially, we used to pick the chalky-white kernels from the rice and used to throw away. But later we got information from fair price shop dealer and posters were displayed at FPS shops by which understood about the this rice and its benefits, and started eating.
5. One or two white coloured rice grains float over water while washing and they will go when we drain the water.
6. During cooking of rice, the excess water is drained, and that water will be fed to cattle or goats or throw away.
7. No one complained about any kind of discomfort in terms of abdominal pain or diarrhoea after they started eating fortified rice.

#### **Interview with beneficiaries at East Singhbhum district, Jharkhand**



## CONCLUSIONS

- Across visited districts, there was a continuous supply of fortified rice (FFR) in all talukas/blocks.
- The DSO, SI, FPS owners as well as beneficiaries were aware about the presence of FRKs in regular rice, although only few were aware about the importance of rice fortification.
- The beneficiaries were fully availing the services provided through targeted public distribution system (TPDS).
- After fortified rice (FFR) supply through TPDS has started, there is no reduction in the number of beneficiaries seeking services from TPDS.
- Out of 180 households who responded, 122(68%) households said that FRKs float while washing and 58(32%) said they do not float while washing. Majority of responders said that only one or two FRKs float while washing.
- Out of 122 households who said that FRK'S float, 89(73%) said that they use floating kernels for cooking ,33(27%) responded that thy will throw away the floating kernels.
- In three states, there is a practice of decanting the excess starchy water during cooking of fortified rice. 50% loss of Iron, 70% loss of vitamin B12 & Folic acid is reported if decanting of excess water is done.
- There was no reported adverse outcome following the intake of FFR.
- The monitoring systems may follow the Standard Operating Procedures (SOP) for FRK Production while drying the FRK at an Ideal temperature: below 65° C ( $\pm 5^{\circ}$  C) there by limiting the chances of puffed FRKs floating, minimizing the chances of being thrown away while washing the rice.
- There is a feasibility of conducting the effectiveness study to understand the effect of FFR on hemoglobin and iron storage at the community level as the program is successful being implemented on ground and public is utilizing the services.



## REFERENCES

1. Rai RK, Fawzi WW, Barik A, Chowdhury A. The burden of iron-deficiency anaemia among women in India: how have iron and folic acid interventions fared? *WHO South-East Asia J Public Health*. 2018 Jan 1;7(1):18.
2. World Health Organization. Nutritional anaemias: tools for effective prevention and control [Internet]. Geneva: World Health Organization; 2017 [cited 2022 Aug 11]. 83 p. Available from: <https://apps.who.int/iris/handle/10665/259425>
3. India.pdf [Internet]. [cited 2022 Aug 5]. Available from: [http://rchiips.org/nfhs/NFHS-5\\_FCTS/India.pdf](http://rchiips.org/nfhs/NFHS-5_FCTS/India.pdf)
4. Balarajan Y, Ramakrishnan U, Ozaltin E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. *Lancet Lond Engl*. 2011 Dec 17;378(9809):2123–35.
5. Suarez T, Torrealba M, Villegas N, Osorio C, Garcia-Casal MN. Iron, folic acid and vitamin B12 deficiencies related to anemia in adolescents from a region with a high incidence of congenital malformations in Venezuela. *Arch Latinoam Nutr*. 2005 Jul 1;55:118–23.
6. 1405796031571201348.pdf [Internet]. [cited 2022 Aug 11]. Available from: <https://nhm.gov.in/WriteReadData/1892s/1405796031571201348.pdf>
7. Olson R, Gavin-Smith B, Ferraboschi C, Kraemer K. Food Fortification: The Advantages, Disadvantages and Lessons from Sight and Life Programs. *Nutrients*. 2021 Mar 29;13(4):1118.
8. Peña-Rosas JP, Mithra P, Unnikrishnan B, Kumar N, De-Regil LM, Nair NS, et al. Fortification of rice with vitamins and minerals for addressing micronutrient malnutrition. *Cochrane Database Syst Rev*. 2019 Oct 25;2019(10):CD009902.
9. Radhika MS, Nair KM, Kumar RH, Rao MV, Ravinder P, Reddy CG, et al. Micronized ferric pyrophosphate supplied through extruded rice kernels improves body iron stores in children: a double-blind, randomized, placebo-controlled midday meal feeding trial in Indian schoolchildren. *Am J Clin Nutr*. 2011 Nov;94(5):1202–10.
10. Moretti D, Zimmermann MB, Muthayya S, Thankachan P, Lee TC, Kurpad AV, et al. Extruded rice fortified with micronized ground ferric pyrophosphate reduces iron deficiency in Indian schoolchildren: a double-blind randomized controlled trial. *Am J Clin Nutr*. 2006 Oct;84(4):822–9.
11. Ramaswamy G, Yadav K, Goel AD, Yadav V, Arora S, Vohra K, et al. Effect of iron-fortified rice on the hemoglobin level of the individuals aged more than six months: A meta-analysis of controlled trials. *J Fam Med Prim Care*. 2022 Dec;11(12):7527.

12. Ara G, Khanam M, Rahman AS, Islam Z, Farhad S, Sanin KI, et al. Effectiveness of micronutrient-fortified rice consumption on anaemia and zinc status among vulnerable women in Bangladesh. Ghose B, editor. PLOS ONE. 2019 Jan 10;14(1):e0210501.
13. 6 Interventions of the Anemia Mukht Bharat Programme [Internet]. Anemia Mukht Bharat Dashboard. [cited 2023 Feb 7]. Available from: <https://anemiamukhtbharat.info/home/interventions/>
14. One Year of Announcement of Rice Fortification. [Internet]. [cited 2022 Aug 12]. Available from: <https://pib.gov.in/pib.gov.in/Pressreleaseshare.aspx?PRID=1850981>

# ANNEXURES

## IN-DEPTH INTERVIEW GUIDE for Stakeholders and structured questionnaire for beneficiaries

### For District level officials

1. Is the fortified rice made available through PDS in this district?
2. If yes, to Q1, when did the fortified rice supply through PDS start in your district?
3. Is the fortified rice through PDS is in entire district or few selected blocks/Mandals of the district?
4. Can you briefly tell us about the supply mechanism of fortified rice supplied through PDS?  
*How regularly the fortified rice supply through PDS in your district?*  
*Who raises demand?*
5. From where will you get the fortified rice to be supplied through PDS in your district?  
How frequently you will get the fortified rice?
6. How is the fortified rice supplied from district level to the fair price shops and beneficiaries?
7. How frequently do you send fortified rice from district level to peripheral Fair price shops?
8. Do you test the quality of fortified rice supplied to the district? If yes, how?
9. What is your experience in distribution of fortified rice compared to unfortified rice in the district?  
*Any training provided regarding usage of fortified rice?*  
*Did you receive any feedback from public?*  
*Did you receive any feedback from FPS owners?*  
*Is it acceptable by the beneficiaries?*
10. What do you do if fortified rice is not available in your district?

## **For FCI Godown Managers**

1. Is the fortified rice made available through PDS in this district?
2. If yes, to Q1, when did the fortified rice supply through PDS start in your district?
3. Is the fortified rice through PDS is in entire district or few selected blocks/mandals of the district?
4. Does FCI godowns stock enough fortified rice to supply through PDS? Are there any issues related to the supply of Fortified rice to and fro from FCI godowns?
5. From where will you get the fortified rice to be supplied through PDS in your district?  
How frequently you will get the fortified rice?
6. Where do you store the fortified rice to be supplied through PDS in your district? What precautions are followed during the storage?
7. How frequently do you send fortified rice from district level to peripheral Fair price shops?
8. What do you do if fortified rice is not available in your district?

## **For Fair price shop owners**

1. How many families are registered under your FPS?
2. How frequently do you distribute rice for families registered under your FPS? How many kilograms you are distributing to each person?
3. From where do you receive the rice for distribution?
4. Did you notice any change in the variety of rice that is provided to you? If so, what it is?
5. Are you getting the supply of Fortified rice (local name)?

*Is all the rice you receive is fortified or do you sometimes get other type of rice too?*

6. How do you test if the rice supplied is fortified or not? Or do you check every time the rice is supplied to you?
7. What are your experiences in distribution of fortified rice compared to unfortified rice? Or Are all the beneficiaries taking this rice or are there any issues in distribution of this rice compared to the earlier variety you used to get?

*Did you receive any positive or negative feedback?*

8. Do all the HH's registered under your FPS take rice or is there any a reduction in the number of beneficiaries?

Any other fortified products? (Wheat flour (fortified or not fortified))

## Questionnaire for Beneficiaries

| S. No. | Household proforma   | Code   | Response |
|--------|--|--|----------|
| 1.     | Date of Data Collection  |  |          |
| 2.     | District Name  |  |          |
| 3.     | Block Name   |  |          |
| 4.     | Village Name   |  |          |
| 5.     | Type of Ration Card  | 1. Regular PDS card<br>2. AAY<br>Others, Specify   |          |
| 6.     | Name of the Head of Household  |  |          |
| 7.     | Gender of Head of Household  |  |          |
| 8.     | Name of the respondent   |  |          |
| 9.     | Type of Family   | 1. Nuclear.....01<br>2. Joint.....02<br>3. Extended Nuclear...03   |          |
| 10.    | Total number of family members (including children)                            | 1. Two.....01<br>2. Three.....02<br>3. Four.....03<br>4. Five.....04<br>5. Six.....05<br>6. Seven.....06<br>7. Eight.....07<br>8. Nine.....08<br>9. Ten-----09<br>10. More than ten (specify)..... |          |
| 11.    | Source of rice for your family in the previous one year?                       | 1. From their farms<br>2. From Market<br>3. PDS  |          |
| 12.    | What do you receive from PDS?  | 1. Rice<br>2. Wheat flour<br>3. Rice and wheat flour   |          |
| 13.    | Frequency of Rice received in last one year from PDS?                          | 1. Once<br>2. Two times<br>3. 3-6 times<br>4. Every month<br>5. Never  |          |
| 14.    | How do you receive the rice through PDS?                                       | 1. By going to FPS<br>2. Home delivery in Vehicle  |          |
| 15.    | How did you receive the rice supplied through PDS? (Mode of packaging of Rice) | 1. In sealed pack<br>2. In sack brought from FPS/<br>In your own bag<br>3. Other pack  |          |

|     |   |   |  |
|-----|---|---|--|
| 16. | Amount of Rice received (Kg) last month through PDS in your family?         |   |  |
| 17. | Use of PDS Rice   | 1. Consumed fully<br>2. Consumed partially<br>3. Sold<br>4. Did not consume at all<br>5. others...explain     |  |
| 18. | Amount of PDS Rice consumed by the household members in the last month?     |   |  |
| 19. | While washing the rice, does some rice kernels float over water?            | 1. Yes<br>2. No   |  |
| 20. | If Response to Q. 19 is Yes, what do you do with the floating rice kernels? | 1. Throw away<br>2. Use them for cooking  |  |
| 21. | In the recent past, did you notice any change in the rice you receive?      | Color 1. Yes<br>2. No<br>Texture 1. Yes<br>2. No<br>The way it cooks 1. Yes<br>2. No<br>Taste 1. Yes<br>2. No |  |
| 22. | Apart from rice, what else do you receive through PDS?                      |   |  |