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Assessment of **Rice Fortification Scheme** in Malkangiri District, Odisha

2021-2023

Endline Assessment Report



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Acknowledgements

The evaluation team is grateful to all respondents for their time and support during the data collection and being part of the endline evaluation study. We thank the support received from the Food Supplies and Consumer Welfare Department, Government of Odisha, for their valuable and timely inputs and support in undertaking this evaluation. We thank the Department of Food and Public Distribution, Government of India, for their

valuable feedback. We are also thankful and acknowledge the guidance and support of WFP programme team led by Dr. Shariqua Yunus Khan. Our special thanks to Mr. Himanshu Bal from WFP Odisha, and the District Officials in Malkangiri for supporting the data collection activities. Last but not least, we acknowledge the entire team of TRIOs who extended their support in execution of this assignment.







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Acronyms

AYY	Antyodaya Anna Yojana
CSS	Centrally Sponsored Scheme
FCI	Food Corporation of India
FPS	Fair Price Shop
FR	Fortified Rice
FRK	Fortified Rice Kernel
GoO	Government of Odisha
Hb	Haemoglobin
ICDS	Integrated Child Development Scheme
IEC	Information Education Communication
IDI	In-Depth Interviews
IFA	Iron Folic Acid
IRB	Institutional Review Board
MDM	Mid-Day-Meal
NABL	National Accreditation Board for Testing and Calibration Laboratories
NFSA	National Food Security Act
OECD DAC	Organisation for Economic Co-operation and Development -Development Assistance Committee
PDS	Public Distribution System
PHH	Priority Household
QA	Quality Assurance
QC	Quality Control
SFSS	State Food Security Scheme



Executive Summary

ABOUT THE ASSESSMENT

Despite several efforts, the burden of anaemia remains high and its growing prevalence (between 2015–2016 and 2019–2021) is an area of concern. To combat anaemia, various interventions including iron supplementation and promotion of dietary diversification have already been implemented. Most recently, Government of India approved the Centrally Sponsored Pilot Scheme on “Fortification of Rice & its Distribution under Public Distribution System” for a period of three years beginning 2019-20. Eleven State Governments including the Odisha have consented and identified their respective Districts (1 District Per State) for implementation of the Pilot Scheme. The pilot project was implemented in Malkangiri district of Odisha from July 2021 with preparatory activities undertaken in 2019-20. Baseline assessment was performed using NFHS-5 data since it coincided with the pre-implementation phase of the pilot project of Rice Fortification. Subsequently, an endline assessment was conducted in April 2023 to evaluate the provision, coverage, and utilization of Fortified Rice (FR) by the target population as well as the efficiency/effectiveness of the consumption of FR in reducing the targeted anaemia level in different age and gender groups. This endline assessment report highlights keys findings in terms of enablers and barriers to effectively implementing the pilot project.

ASSESSMENT METHODOLOGY

An endline assessment was conducted using a mixed method approach i.e., quantitative, and qualitative methods, with a cross-sectional ex-post study design. Quantitative tools such as cross-sectional household survey was used to capture individual level information regarding, access, regular acceptability and consumption of FR, Iron Folic Acid (IFA) consumption, consumption of iron rich food, etc. A total of 1,054 households were sampled for quantitative assessment in Malkangiri district, Odisha. The required sample of 358 children

(6-59 months), 251 adolescent (15-19 years), 957 women (20-49 years) and 645 men (20-49 years) were selected from these listed households using stratified random sampling. Blood sample was also collected from these target respondents and analysed for haemoglobin level to compare prevalence of anaemia with the baseline data. In-depth interviews (using qualitative tools) were conducted with key stakeholders including government officials, rice millers, Public Distribution System (PDS) shopkeepers and Anganwadi Worker (AWW) members to identify gaps in the production, allocation, and distribution of FR. In-depth interviews were also conducted with key stakeholders to understand the knowledge, perception and practices related to FR and its consumption.

KEY FINDINGS

The endline evaluation of the pilot project revealed that Malkangiri district possesses ample capacity for producing and distributing FR, with multiple quality checks in place to ensure that high-quality FR reaches the intended beneficiaries. However, the assessment also identified a lack of awareness and knowledge among the beneficiaries and nearest distribution stakeholder (PDS Shop) regarding the benefits of FR and the appropriate cooking methods to be employed. There existed a perception among the beneficiaries that FR was akin to “Plastic Rice” in the initial phase of pilot project resulting in their reluctance to consume it. Nevertheless, as the pilot project progressed and district administration along with local Non-Government-Organizations (NGOs), under the supervision of the World Food Programme (WFP), implemented information, education, and communication (IEC) initiatives, the beneficiaries’ understanding, and acceptance of FR experienced significant growth. The following are some of the noteworthy findings from the study:

Production of FR: Endline assessment found that the district has sufficient capacity for production of FR. Initially, the Government of Odisha directly purchased FR

kernel (FRK) from suppliers. In the financial year 2021-2022, till July the government procured FRK and rice miller blended it with normal rice, which was then supplied to government depots. However, In the post July 2021 and in F.Y. 2022-2023, the government permitted millers to procure FRK with provision of subsidy and supply FRK rice to various. Currently 30 mills are producing FR in the district of Malkangiri, and no issues related to production have been reported in district stakeholder interviews.

Distribution of FR: Despite difficult terrain, a well laid out supply chain mechanism has been established for distribution of rice under the Civil Supply Department. The roll out of distribution of FR under the PDS has been done since July 2021. Currently, the entire beneficiary group under the National Food Security Act (NFSA) comprising of ration card holders under Antodaya Yojana (AAY), Priority Households (PHH), State Food Security Act (SFSA) are covered for regular distribution of FR and there is no supply of non-FR in the district of Malkangiri. Around 31,008 metric tonnes of FR has been supplied in F.Y. 2022-23 to around 1.54 lakh families in the district i.e., around 5.35 lakh consumers. FR has also been introduced in SNP scheme of ICDS as well as MDM in schools in 2022.

Capacity Building: There was sufficient capacity building across the supply chain. All stakeholders including staff of mill owners, Civil Supplies officials, Quality Assurance (QA) officers, FPS owners and Godown in-charges underwent comprehensive capacity building training. Training sessions were conducted by the Government of Odisha and WFP, both through workshops at the block level and on-the-job training. The mill owners and supporting staff received technical training for production and QA as well.

Quality Assurance (QA): The QA mechanisms in production, supply chain and distribution are being followed as laid by Government of Odisha at multiple levels of production and storage through National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited laboratories enlisted by the Government of India. The reports accessed through millers show FR samples maintaining Food Safety Standards Authority of India (FSSAI) standards of fortification. These tests are being conducted through accredited laboratories. After procuring FR from miller, QA tests are performed at multiple levels including by Civil Supply Officials (CSO) for estimating the level of 3 micronutrient namely Iron, Vitamin B12 and Folic Acid.

As per the interviews of CSO official during endline assessment, samples have been found to be fit for distribution with micronutrients well with in reference range set in the guidelines except for a few samples that

fail to comply with standards in the initial phase of roll out of scheme. Other aspects related to rice quality i.e. Fair average quality (FAQ) are also tested.

Knowledge, awareness, and acceptability of FR:

Initially, beneficiaries expressed concerns and hesitation about receiving FR, perceiving it as “Plastic Rice.” To address this issue, various measures were implemented to raise awareness and improve acceptability by district administration and WFP. These measures included involving local leaders to educate the community about the benefits of FR and proper cooking practices, providing orientation to Fair Price Shop (FPS) owners to disseminate information at their shops, and organizing awareness camps with the help of jogan sahayaks (community volunteers) and local NGOs. These efforts were instrumental in improving the uptake of monthly rations from FPS shops and achieving acceptability of FR in the community. The implementation of Information, Education, and Communication (IEC) measures played a vital role in introducing the pilot intervention and gaining community acceptance of FR. None of these households (including those with thalassemia or sickle cell anaemia) reported health issues post consumption of Fortified Rice by affected family members.

Impact on prevalence of anaemia: The endline assessment reported reduction in the prevalence of anaemia among children and women, in a short span of pilot from 2022 (baseline) to 2023 (endline). The assessment showed decline in anaemia by 3.3 percent points among children in age group 6-59 months from 77.1% in baseline (2022) to 73.8% in endline (2023). A 6.3 percent point decline in anaemia has been observed for women (15-49 yrs.) from 72.0% in baseline (2022) to 65.7% in endline (2023). For rest of target groups covered in the endline, prevalence of anaemia was found to be 74.2% in adolescent girls, 56.6% in adolescent boys and 50.1% in men (15-49 yrs). Whereas baseline numbers are not available for adolescent girls and boys from NFHS, the baseline sample for men is low (n=51). Thus, due to lack of sample sufficiency in baseline, appropriate conclusion cannot be ascertained for these target groups cannot be compared in the endline.

Challenges: The effectiveness of the project can further be improved by addressing lack of awareness among beneficiaries regarding FR. Another parameter requiring further impetus under the project is the cooking practices associated with rice. Promotion of local recipes aligned to nutrient retention of FR would be helpful. Improved participation of last mile community stakeholder such as Fair price shop owners, Anganwadi workers in ongoing awareness generation on FR is required.

Scale up: The project has demonstrated a successfully implementable model for other districts and States. Looking at the sizable production, distribution and consumption of FR by increasing awareness, the same can be scaled up in other similar geographical locations.

Addressing the lack of awareness among beneficiaries and key stakeholders, as well as implementing appropriate cooking practices to minimize iron loss, are crucial steps toward achieving full impact of rice fortification.

SUMMARY OF CONCLUSION

In conclusion, the pilot scheme of fortified rice demonstrated strong supply-side measures and infrastructure along with decline in anaemia prevalence among women and children in a short span of time.

KEY RECOMMENDATIONS










Based on the conclusion that the fortified rice project requires community interventions to improve its effectiveness in reducing anaemia prevalence, the following recommendations are suggested:

Continued Education and awareness	<ul style="list-style-type: none"> Implement targeted awareness programs and campaigns to educate beneficiaries and stakeholders about the benefits of fortified rice in addressing anaemia. Use community outreach, workshops, educational sessions, and various channels like social media, radio, TV, and community gatherings to disseminate information on the nutritional value of fortified rice.
Improved Cooking practices	<ul style="list-style-type: none"> Appropriate cooking practices aligned to fortified rice need to be disseminated along with promotion of those recipes. Traditional recipes that do not require throwing excess water can be promoted.
Monitoring & evaluation	<ul style="list-style-type: none"> Establish a robust monitoring and evaluation system to assess the project's impact on anaemia prevalence. Collect data on anaemia rates, dietary practices, and knowledge levels among beneficiaries for informed decision-making.
State engagement	<ul style="list-style-type: none"> State participation and oversight can be increased, especially for the procurement of FRK. This modality is acceptable to millers.
Operational issues	<ul style="list-style-type: none"> Training to stakeholders especially last mile providers may be done through NGOs. Better testing methods such as real time testing facility at entry of mill's consignment at depot level. Improved storage of Fortified rice at Anganwadis and Fair price shops through provision of storage bins and plastic. Higher quantity weigh bridge requested by millers at FCI godown at Jaypore to prevent unnecessary de-loading consignment for weighing. FCI godown is far for Malkangiri and need for nearer facility. Revision of rates for rice millers considering electricity & transport prices. Payment settlement at monthly/quarterly frequency requested by millers.

FACTSHEET

The Pilot project showed reduction in prevalence of Anaemia among Women and children (6-59 months) in one and half year duration of implementation (July 2021- April 2023). Sufficiency in infrastructure, supply-side measures, and quality control has led to continuous supply of Fortified Rice in the District. There is need for enhanced community centric interventions for improving knowledge on Fortified rice and aligned cooking methods.



<p>Reduction in prevalence of anaemia among children and women observed from baseline (2022) Vs endline (2023):</p> <p> 6.3% points decline in anaemia prevalence among Women (15-49 yrs.) from 72.6% in baseline to 65.7% in endline</p> <p>3.3% points decline in anaemia prevalence among Children (6-59 months) from 77.1% in baseline to 73.8% in Endline</p> <p> Among girls, decline is 3.8% points from 77.7% to 73.9%</p> <p> Among boys, decline is 2.7% points from 76.5% to 73.8%</p> <p></p>	 ACCESS	Rice as FPS commodity (% Households)	100%
		Quantity of rice entitled to Households (per month in kgs.)	21.3 kg.
		Quantity of rice purchased from FPS last month (per month in kgs.)	20.5 kg.
		Cost for PDS purchase of Fortified Rice (last months)	Rs. 15.9
		Quantity of rice purchased from market last month	6.7 kg.
		Cost for market purchase of rice (last month)	Rs. 479
	 AWARENESS	Knowledge about F+ Logo (% Households)	3.9%
		Awareness on benefits of consuming Fortified Rice (% Households)	9.6%
		Heard about Fortified rice (% Households)	9.8%
	 ACCEPTABILITY	Taste-% Households report good/V good	86%
		Smell- % Households report good/V good	78%
		Texture--% Households report good/V good	86%
		Colour-% Households report good/V good	83%
		Appearance-% HH report good/V good	85%
	 COOKING	Rice cooked in open vessel with washing and throwing excess water (% households)	98%
	 CONSUMPTION	Frequency of consuming Fortified rice (days/week)	5.3 days
		Frequency of consuming non-fortified rice (days/week)	2.5 days
		Households consuming Fortified rice everyday	46%
	Households consuming Non-Fortified rice everyday	14%	
OTHERS	IFA consumption children (<% yrs)	22%	
	IFA consumed - Women of reproductive age	9.3%	
	Minimum adequate diet (6-24m)	9%	

Note:

1. For anaemia: Sample of 358 children (6-59m) (girls-162, boys-196 & 1095 women (15-49 yrs) & analysis as per NFHS.
2. Above indicators on access, consumption, are part of the self-reported data by recall, not verified through means of records.

1

Introduction

1.1 CONTEXT/BACKGROUND

Micronutrient deficiency also known as ‘Micro-nutrient Malnutrition’ or ‘Hidden Hunger’, is a major public health concern as it leads to serious health consequences, including early death, poor health, vision problems, stunted growth, mental illness, learning disabilities, and fatigue. According to WHO, ‘Micro-nutrient Malnutrition’ is responsible for 45% of deaths among children under the age of five¹.

Anaemia, a prevalent micronutrient deficiency, accounts for a significant portion of these cases. Globally, 42% of children under the age of five and 40% of pregnant women in low-income countries are affected by anaemia^{2,3}. Anaemia is characterized by a reduction in the proportion of red blood cells, a decrease in haemoglobin concentration, or an insufficient capacity to transport oxygen to meet the body’s physiological demands⁴. Haemoglobin is responsible for transporting oxygen in the blood, and a shortage or abnormality of red blood cells or lower haemoglobin levels can reduce the blood’s ability to transport oxygen to the body’s tissues, leading to symptoms such as weakness, fatigue, dizziness, and shortness of breath.

Anaemia can be caused by various factors, including genetic causes like hemoglobinopathies and infections like malaria, as well as nutritional deficiencies such as a lack of iron, vitamins like A and B12, and minerals like copper⁵. Micronutrient deficiencies, particularly iron

deficiency, are the primary cause of anaemia. According to the World Health Organization (WHO), over half a billion women, equivalent to 29.9% of reproductive women aged 15-49 years, suffered from anaemia in 2019, with most cases attributed to iron deficiency⁶. Reproductive and adolescent women are more susceptible to anaemia due to inadequate dietary intake and iron loss during menstruation and pregnancy⁷. In several tropical regions, malaria is a known contributor to anaemia, as it disrupts iron metabolism, causing vascular haemolysis and subsequent loss of blood iron in the urine.

South Asia has the highest prevalence of anaemia in the world, including India having a high prevalence of iron deficiency anaemia. In India, it is estimated that 50-70% of reproductive women are anaemic⁸. The National Family Health Survey (NFHS) 5 indicates that anaemia prevalence is high (>55%) in all social groups (SC & ST, OBC, general) in 11 states. Compared to the previous survey conducted in 2015-16 (NFHS-4), there has been an increase in the prevalence of anaemia among women and children with 1.8, 3.9 and 5 % increase among pregnant women, all women in the reproductive age and adolescent girls respectively. Among children, the increase was the highest at 8.5 percent points, and the prevalence is now closer to the levels recorded in NFHS-3 from 2005-06 when it was 70%.

One of the most effective public health measures to address micronutrient malnutrition such as anaemia is food fortification, which is considered the most cost-effective strategy by the 2008 and 2013 Lancet Series on Maternal and Child Nutrition, the 2012 Copenhagen Consensus, and the global Scaling Up

1 Govender I, Rangiah S, Kaswa R, Nzaumvila D. Malnutrition in children under the age of 5 years in a primary health care setting. *S Afr Fam Pract* (2004). 2021 Sep 7;63(1):e1-e6. doi: 10.4102/safp.v63i1.5337.

2 Sun J, Wu H, Zhao M, Magnussen CG, Xi B. Prevalence and changes of anaemia among young children and women in 47 low- and middle-income countries, 2000-2018. *EClinicalMedicine*. 2021 Sep 17;41:101136.

3 Araujo Costa E, de Paula Ayres-Silva J. Global profile of anaemia during pregnancy versus country income overview: 19 years estimative (2000-2019). *Ann Hematol*. 2023 May 26.

4 Turner J, Parsi M, Badireddy M. Anaemia. [Updated 2022 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499994/>

5 Chaparro CM, Suchdev PS. Anaemia epidemiology, pathophysiology, and etiology in low- and middle-income countries. *Ann N Y Acad Sci*. 2019 Aug;1450(1):15-31.

6 McLean E, Cogswell M, Egli I, Wojdyla D, De Benoist B. Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993-2005. *Public health nutrition*. 2009. Apr;12(4):444-54.

7 Camaschella C. Iron-deficiency anaemia. *New England journal of medicine*. 2015. May 7;372(19):1832-43.

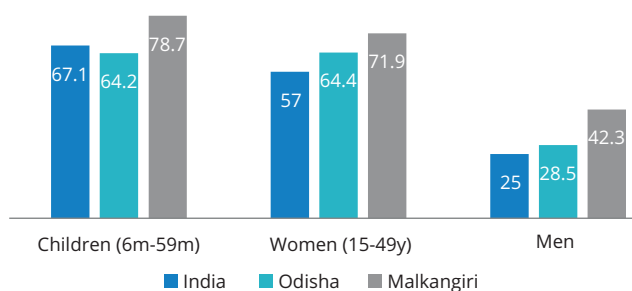
8 Prasanth R. Prevalence of anaemia in both developing and developed countries around the world. *World J Anaemia*. 2017. Apr;1(2):40-3.

Nutrition Movement⁹. Food fortification has been shown to be an efficient and effective strategy for combating micronutrient deficiencies, and fortified foods can be used to improve the nutritional status of population at a reasonable cost without requiring any behavioural changes on their part.

1.2 PREVALENCE OF ANAEMIA IN MALKANGIRI

Among Indian states, anaemia is a significant public health issue in the state of Odisha, with women and children being particularly affected. Among children aged 6-59 months, 64% are anaemic, including 32% with mild anaemia, 31% with moderate anaemia, and 1% with severe anaemia. The prevalence of anaemia in children has increased from 45% (NFHS-4) to 64% (NFHS-5) in Odisha. There is a slight difference in the prevalence of anaemia among girls (65%) and boys (64%) in under five age group. Among women, almost two-thirds (64%) are anaemic, with higher rates observed in rural areas, women aged 15-19 or 40-49, and scheduled tribe women.

Figure 1.1: Prevalence of Anaemia by Demographic Groups



(Source: NFHS 5, 2019-20)

The prevalence of anaemia has increased by 13 percent points among women since NFHS-4. Among men, 29% are anaemic in Odisha. Malkangiri district in Odisha is among the worst-hit districts in the state with 42.3% of men, 71.9% of women (15-49 years) and 78.7% of children (6-59 months) being anaemic.

In Odisha, Malkangiri district was chosen since it's an aspirational district with a high incidence of anaemia among women and children and a preference for rice consumption. Malkangiri district is known as one of the most backward districts in Odisha with 58.7% of the population below poverty line (compare to state average of 29.35%)¹⁰. It spans 5,791 sq. km and is characterized by

dense forests and challenging terrain. The district has a sparse population, mainly comprising primitive tribes such as Bondas, Koyas, Porajas, and Didayis. Although, Govt of Odisha has taken multi-sectoral approach for improving the nutrition status of the population. despite those efforts even the basic malnutrition indicators such as prevalence of stunting, underweight, thinness and anaemia is high in the tribal population of Malkangiri. Some of the key nutritional highlights for the districts are as follows:

- Micronutrient deficiencies are relatively high in the district. As per NFHS-5, 65% children (4-6 years) and only 40% women met their RDA for iron whereas only 28% pregnant women met their RDA for iron in Malkangiri district.
- Consumption of Folic acid and Vitamin B 12 is particularly low in the district with only 11% children and 6% women meeting the RDA for folic acid and 7% children and 6% women meeting RDA for Vitamin B 12.

The state government of Odisha has implemented various programs to combat anaemia, including the Adolescent Anaemia Control Program (AACP), Iron and Folic Supplementation Under Observation (IFSO), Weekly Iron Folic Acid Supplementation (WIFS), and Anaemia Mukta Odisha. Despite these efforts, the prevalence of anaemia remains high in Odisha. India aimed to decrease anaemia prevalence among children aged 6-59 months, adolescents, and women of reproductive age by 3 percent points per year through the 'Anaemia Mukta Bharat' Program under POSHAN Abhiyaan (2018-20). However, the situation has worsened in Odisha since the last NFHS-4, and new measures are required to tackle this issue.

1.3 OVERVIEW OF PILOT PROJECT ON RICE FORTIFICATION IN MALKANGIRI

In 2019-2020, the Government of India approved a three-year "**Centrally Sponsored Pilot Scheme on Fortification of Rice and its Distribution through the Public Distribution System**" to accelerate India's progress towards nutrition security. This scheme aimed to address micronutrient deficiencies, including anaemia, among the most vulnerable populations. Eleven states were selected as part of the pilot scheme with one district per state. As part of the scheme of the GoO launched pilot in district of Malkangiri in July 2021, which is being technically supported by WFP. Core project activities include fortification of rice in PDS, supply chain management, awareness generation, capacity building of stakeholders, QA and monitoring. The Rice fortification pilot programme targets beneficiaries under the NFSA

⁹ Hoddinott J., Rosegrant M., Torero M. Investments to Reduce Hunger and Undernutrition. Copenhagen Consensus Center; Copenhagen, Denmark: 2012. Copenhagen Consensus Center Working Paper March.

¹⁰ https://www.niti.gov.in/sites/default/files/2021-11/National_MPL_India-11242021.pdf

such as Targeted Public Distribution System (TPDS), MDM, ICDS with fortified rice.

Milestones of FR Programme in Malkangiri: A range of preliminary activities were undertaken from December 2019 till 2021 such as initial assessment and capacity building of rice millers, trail validation of equipment in mills, training of district officials and development of IEC materials. Bihariji Agro Foods Pvt. Ltd. was issued work order as central vendor for supplying FRK to the district in 2020. The actual distribution of fortified rice started in July 2021 through PDS and later introduced in MDM Scheme in October 2021. Since December 2022, Rice Fortification has been rolled out in 20 districts under ICDS (reaching 1.1 million beneficiaries) and PM Poshan (reaching 2.6 million beneficiaries) and in 9 districts under PDS (reaching 8.3 million beneficiaries), out of total 30 districts¹¹.

Process of Rice fortification: The process of rice fortification involves the Fortified Rice Kernel (FRK) which is produced by adding premix (vitamins and minerals as per FSSAI guidelines 2018) to broken rice flour which are reconstituted to make rice through an extrusion technique. To produce fortified rice, the Fortified Rice Kernels (FRK) are blended with regular rice in a ratio of 1:100. The process of blending of FRKs is done at milling stage and later bagged in 50kg gunny bags specified by FCI and as per approved labelling given in guidelines. The '+F' logo has been notified to identify fortified foods. Standards were notified in the Gazette of India on 09.08.2018¹². The standards of fortification per kg of fortified rice for nutrients specified are as under:

Recommended Levels of Nutrients for Rice Fortification by FSSAI (2018)	
Nutrients	Level of fortification per kg
Iron - Ferric Pyrophosphate	28 mg - 42.5 mg
Iron - Sodium Iron (III) Ethylene Diamine Tetra Acetate Trihydrate (Sodiumferedetate - Na Fe EDTA)	14 mg - 21.25 mg
Folic Acid - Folic acid	75 µg - 125 µg
Vitamin B12 - Cyanocobalamin or Hydroxocobalamin	0.75 µg - 1.25 µg

Supply Chain & distribution mechanism of Fortified Rice: The Fortified rice produced after blending is received from millers at Rice receiving centre cum District supply chain (RRC-cum-DSC). Further, as per the allotment

of the block and designated transporting contractor, the allocated amount for the block is transported to the block. Distribution of the FR at Fair Price Shop (FPS) level is done through Electronic Point of Sale (EPOS) device all distribution made with Aadhar authentication mode. Ration card holders are provided amount as per their entitlement. Distribution of fortified rice is done by the jogan sahayaks and panchayat executive officers and there is not a standalone system of Fair Price shops, as they function through PRI system. Quality control is a critical component of rice fortification programme and happens at multiple points i.e premix producers, FRK manufacturers, Millers, State/District Authorities. This is done through a range of measures such as the samples lifted by Food Safety Officers for analysis, process of issuing Certificate of Analysis (CoA) by FSSAI-NABL for FRK to the FRK manufacturers, issuing of FSSAI License to pre-mix manufacturers, FRK producers and millers. At level of rice mills, capacity building of millers for Blending Efficiency Test, Iron spot test, compliance to storage guidelines is being done for ensuring good quality. Other regular QA measures include food safety audits-internal and external, checking for F+ Logo, storage of raw materials and finished goods and iron spot tests. Micronutrient testing is done at level of millers and depots/gowdowns as well. (see Figure 1.2)

1.3 RATIONALE OF THE ASSESSMENT

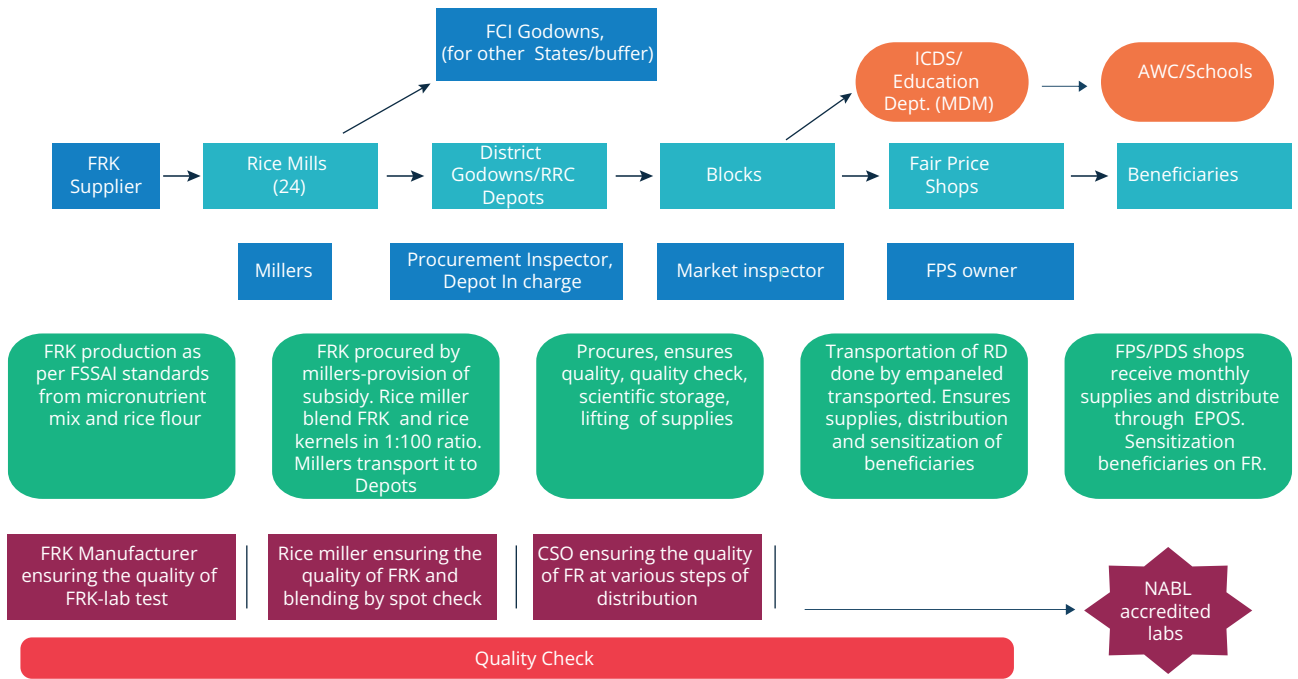
This report presents the evaluation of the Centrally Sponsored Pilot Scheme of Fortification of Rice (FR) in Malkangiri district, Odisha, India to assess the project's effectiveness, operational feasibility, and economic viability to serve as a model for potential scale-up across the state.

This baseline assessment was undertaken by the Evidence and Results Unit of the WFP India Country Office. The NFHS-5 survey (2019-20) coincided with the launch of the pilot scheme on rice fortification and provides information on the biomarker (anaemia) across children, women, and men was analysed and forms the baseline report along with information and data from government sources on the coverage of rice in government schemes in the district. The present evaluation was conducted by TRIOs in partnership with the WFP as part of endline assessment.

¹¹ WFP report.

¹² Food Safety and Standards (Fortification of Foods) Regulations, 2018.

Figure 1.2: Supply chain distribution of Fortified Rice in the district of Malkangiri



2

Assessment Methods and Approach

2.1 OBJECTIVES

The primary aim of this evaluation project was to carry out an assessment of a pilot program focused on fortifying rice and distributing it through the public distribution system in the Malkangiri district of Odisha from July 2021-November 2022. The specific objectives of the assessment were:

- I) To evaluate the access to and consumption of fortified rice obtained through the Targeted Public Distribution System (TPDS) and other government safety net programs/schemes among the intended population. Additionally, this objective aims to identify any gaps in the consumption and acceptability of fortified rice.
- II) To evaluate the effectiveness of the pilot scheme in reducing the prevalence of anaemia among the targeted population.
- III) To generate evidence on the operational feasibility of implementing end-to-end operations (including provision, coverage, monitoring, awareness, and equitable distribution) of fortified rice in the Malkangiri district.

2.2 METHODOLOGY AND SAMPLE SELECTION

Study design

The evaluation of the pilot project on rice fortification in Malkangiri was conducted using a mixed-method approach, including quantitative and qualitative methods, with a cross-sectional ex-post study design. The assessment methodology was aligned with the baseline assessment to ensure comparability of the data sets and to arrive at conclusive results for evaluating the project's intervention.

Study sample

Assessment targeted four demographic groups from Malkangiri district of Odisha: Children (6-59 months), adolescents (15-19 years), women (20-49 years), and

men (20-49 years). Inclusion criterion were respondents receiving fortified rice through the TPDS and state food security program between July 2021 and November 2022. Second target group included stakeholders involved in FRK procurement, blending, QA, storage and distribution, including government officials, NABL laboratories, ICDS/MDM officials, rice millers, and fair price shop owners/staff.

Table 2.1: Sample size for the Assessment

Sample for Quantitative Component	
Demographic Group	Sample covered / blood sample collected
Children (6-59m)	358 (Girls- 162; Boys-196)
Adolescent (15-19yr)	251 (Girls-138, Boys-112)
Women (20-49yr)	957
Men (20-49yr)	645
Total Individual	2211
Total Households	1054
No. of villages covered	44
No. of urban wards covered	4
Sample for Qualitative Study	
In-depth interviews/Observations	No. of Interviews
Civil Supply Officials – Grievance redressal Officer	1
Godown Incharge, Procurement officer, FSSAI official	3
Rice mill owner	3
CDPO	3
Fair Price Shop Owners	18
Total Interviews	28

Sampling plan

The study used a two-stage stratified sampling approach in rural and urban areas based on the National Family Health Survey-5. The 2011 Census served as the sampling frame for the selection of PSUs. PSUs are villages in

rural areas and Census Enumeration Blocks (CEBs) in urban areas. In the first stage of sampling, fixed number of PSUs were sampled from rural and urban stratum respectively using Probability Proportion to Size (PPS) stratified sampling method. Before the selection of PSUs, within each rural stratum, six approximately equal substrata were created based on the proportion of estimated number of households in each PSU and the percentage of the population belonging to scheduled castes and scheduled tribes (SC/ST). Within each explicit rural sampling stratum, PSUs were sorted according to the literacy rate of women aged 6 or more years. PSUs in rural stratum were then sampled based on Probability proportion to size (PPS) stratified sampling. If the selected PSUs had household more than 300 households, those PSUs were divided into segments of approximately 100-150 households. Two of the segments were randomly selected for the survey using systematic sampling with probability proportional to segment size. In the second stage of selection, a fixed number of 22 households per PSU were selected randomly using systematic sampling from a newly created list of eligible households (based on house listing) in the selected PSUs. TPDS/ Anganwadi beneficiaries list were used as sampling frame for selection of 22 households.

The selection of Urban PSUs was done using urban census ward of 2011. All the wards of urban areas have been sorted according to the percentage of SC/ST population and 4 PSUs are selected by using PPS method. After selection of wards, the same listing procedure was adopted for selection of households. A total of 1,056 households and 2,650 individuals were sampled from 48 PSUs (44 rural and 4 urban).

2.3 APPROACH TO THE ASSESSMENT

The baseline assessment done by WFP Country office, used data from the NFHS-5 survey and government sources to develop baseline report. The endline assessment was conducted using mix method approach based on the OECD DAC Criteria. It measured the impact of the scheme on anaemia levels, consumption of iron-rich foods, and access to fortified rice through public distribution system to evaluate its effectiveness, efficiency, relevance, sustainability, and impact. The quantitative survey, the mainstay of the quantitative component of the assessment exercise, replicated the same methodology as NFHS-5 to enable direct comparison to measure the change brought about in key indicators by project interventions. TRIOs Development Support Pvt. Ltd. Conducted the endline assessment on behalf of WFP to measure the impact of a rice fortification pilot scheme.

Three-day onsite training was conducted for all field investigators including field work. Training was also provided to qualitative researchers.

Qualitative assessment: In-depth interviews were conducted as part of qualitative assessment with State and district officials to identify gaps in the production, allocation, and distribution of fortified rice. In-depth interviews were also conducted with key stakeholders such as government-empanelled rice millers, FPS shopkeepers, and AWW during April-May 2023 field visits to extract knowledge regarding the situation of demand and supply of the fortified rice along with the impact of awareness programme in the community. In addition, interviews were also conducted with selective beneficiaries to understand the knowledge, perception and practices related to fortified rice and its consumption. Secondary data from the government was also reviewed.

Quantitative assessment: The impact of the pilot scheme was assessed using quantitative tools such as cross-sectional household survey (designed by WFP and refined by TRIOs). To gather individual level information on factors like anaemia prevalence, access, regular acceptability and consumption of fortified rice, IFA consumption, consumption of iron rich food, etc. The data was collected in month of April 2023.

For children aged 6-59 months, the survey was undertaken with the caregiver/parent of children (6-59 months) to collect information on various parameters (such as consumption of fortified rice and iron rich food, sickness/morbidity profile of children). The survey was also implemented for adolescents, men and women to gauge knowledge, attitude and practice around access and consumption of fortified rice, social norms, learnings, and key messages from SBCC activities, etc. Target group respondent were also asked questions on status of specific indicators related to effectiveness.

Data analysis: Blood sample was collected from the target respondents and was analysed for haemoglobin level data and was compared with the baseline evaluation (sourced from NFHS-5 factsheets). Table 2.2 details haemoglobin level used for target groups for severity of anaemia as per NFHS 5 standard. Data was analysed using SPSS according to NFHS methods. Sample weights were applied to estimates of anaemia and its covariates.

If Infant was present in sampled household, information related to intake of fortified rice supplied by PDS during pregnancy was also collected from mother. If any school going children (aged 6-14 years) were present in the selected household, information related to consumption of Mid-Day Meal and IFA/deworming services received was also captured.

Table 2.2: Haemoglobin levels to diagnose Anaemia for different demographic groups

	Any anaemia	Mild	Moderate	Severe
Male (15-49yrs.)	<13.0 g/dl	12.0-12.9 g/dl	9.0 -11.9 g/dl	<9.0 g/dl
Women (15-49 yrs.)	<12.0 g/dl	11.0-11.9 g/dl	8.0 -10.9 g/dl	<8.0 g/d
Children (6-59m)	<11.0 g/dl	10.0-10.9 g/dl	7.0 -9.9 g/dl	<7.0 g/dl

2.4 ETHICAL CONSIDERATION

The study was conducted with strict adherence to ethical guidelines and practices, ensuring confidentiality and safeguarding practices during all interactions with participants. All participants were informed that their participation was voluntary and that their responses would remain confidential. Written informed consent was obtained from minor participants and their parents before conducting interviews and collecting blood specimens. The study materials, including the information sheet and consent forms, were provided in both Odia and English languages. The identity of the participants was kept secure, and databases were anonymized to protect their privacy. Cultural norms and appropriate behavior were respected, and care was taken to avoid any negative emotional impact on participants.

The ethical approval for the study was obtained by Institutional Review Board (IRB) of TRIOs which is registered with the Office for Human Research Protections (OHRP), U.S. Department of Health and Human Services (HHS). In addition to the UNWFP team also informed state and district administration regarding the study and necessary letter to support and provide cooperation to study team was also issued by the state government to concerned officials.

2.5 KEY CHALLENGES AND LIMITATIONS OF ASSESSMENT

The purpose of this study was to understand the benefits received and the challenges faced in distributing iron fortified rice through the public distribution system, as part of the government programme in Malkangiri district, Odisha to combat the iron deficiency in the population leading to anaemia. Many of the context specific measures were conceived before study implementation such as likely resistance to blood testing, gender sensitive issue, local dialect and aligning to local sensitivities. However, some challenges were faced during endline study as below:

1. Difficult terrain: A sizable population of Malkangiri speaks different languages. It is also one of the Naxalite-affected areas of the state and is a part of the Red

Corridor. Geographically the terrain is hilly/semi hilly (plateau) and plain. It borders Andhra Pradesh and Chhattisgarh (including other Naxalite affected districts of Sukma). All these factors make the district difficult to access and operate.

2. Asymmetric data: The baseline assessment utilized NFHS-5 data to develop key indicators, encompassing sampled households comprising both PDS beneficiaries and non-beneficiaries. In contrast, the endline assessment relied on KAP data collection and anaemia tests exclusively among PDS beneficiaries to generate the key indicators. It is important to take this distinction into account when comparing the baseline and endline results.

3. Difficult local situation: During the data collection process, there was a situation referred to as a “Band” organized by local political groups. Additionally, the extreme and fluctuating weather conditions, as well as the need to travel to distant villages, resulted in some of the field team members falling ill. These factors presented significant challenges and caused disruptions to the originally planned timelines.

4. Partial coverage of planned sample size: Only 61% of sample of men i.e., 645 could be covered due to unavailability of men due to issues mainly related to livelihood. Though mitigation efforts were undertaken to improve coverage of men, but men had either migrated to other places or remain unavailable through the day i.e., time of survey or follow up. Sample of adolescents covered was 251 out of planned 262. The reason being the primary target respondent were adult women and men in the household. Adolescents and children were secondary respondents, only interviewed if they were available in the surveyed household.



3

Key Findings from Endline Assessment

3.1 DEMOGRAPHIC AND HOUSEHOLD PROFILE OF THE RESPONDENTS*

The following section underlines the demographic and household profile of the respondents in the Malkangiri district.

A total sample of 1054 households were selected for endline assessment encompassing a total population of 4878 individuals with equal distribution for male and female (Figure 3.2). The average household size for the population surveyed was 4.6 with half of the households had 4 or less members. 41% of the households had 5-6 members and only 10% had more than 6 members (Figure 3.1).

Figure 3.1: Distribution of household-by-household size (N=1054)

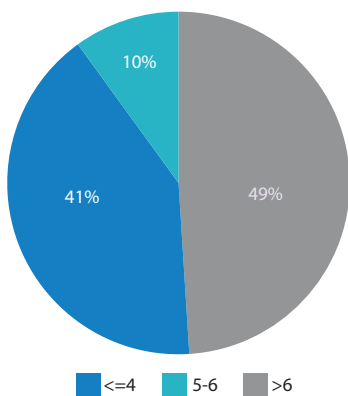


Figure 3.2: Gender-wise distribution of household population selected for endline assessment (N=1054)

10% of respondents were children (6yr or less), 32% adolescents (6-19yrs) and 58% adults age 20yr or more (56% males and 58% female) (Figure 3.3). Most of the adult respondents (15-49yrs) were married (64%) with slight difference between males and female (62% and 67% respectively). 32% of respondents reported they were single. A small percentage reported being divorced/separated (1%) or widowed (3%).

Very few adult respondents had completed ten years of formal education with female respondents differed slightly from that of men. Only 11.6% of female reported completed ten years or more of formal education as compared to 18.4% of male (Figure 3.4).

Figure 3.3: Age and gender-wise distribution (%) of the population in Households covered (N=4878 (F=2442, M=2436))

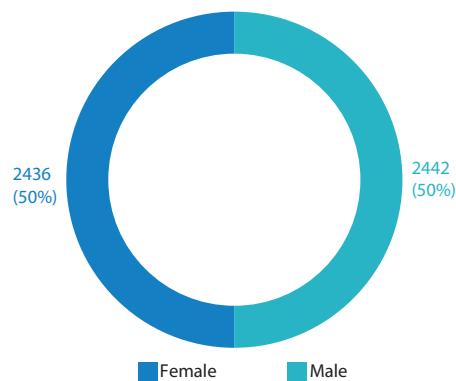


Figure 3.4: Adults having 10yr or more education (in %) in Household level population (Endline N = M:1405; F: 1452)

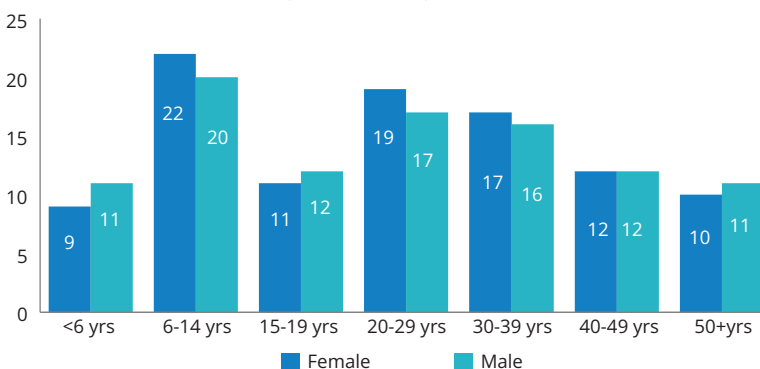
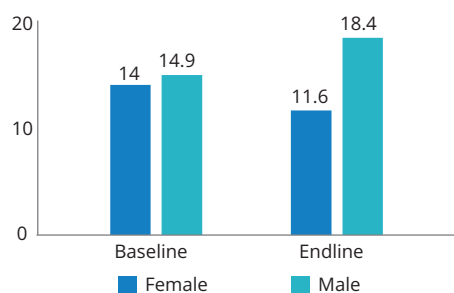


Figure 3.4: Adults having 10yr or more education (in %) in Household level population (Endline N = M:1405; F: 1452)



* Note: All charts/tables in this section (3.1), & 3.2 are based on the unweighted samples; all subsequent charts on estimates on anaemia in section 3.3 are based on the weighted sample unless otherwise specified.

Scheduled tribes dominated about 72.4% of surveyed households while scheduled caste and other castes (OBCs and others) proportion of households was only 15.2% and 12.5% respectively (Figure 3.5). Majority of the households were Hindu (98.9%) (Figure 3.6).

Figure 3.7 displays the distribution of households by source of drinking water, sanitation facility and use of cooking fuel in Malkangiri district. The primary source of water in the district was tube-well or borehole (65%), while public tap/standpipe were available for almost 17 % of the households. Approximately 92.7% of the households had access to the improved source of drinking water. Only 26.1 % of households had improved sanitation facility, while 74 % of households had no access to any kind of toilets and use open space or field. The data also showed that only 17.7% of the households had clean

cooking fuel with majority of the households still used firewood (Figure 3.7).

All the households in the surveyed population had ration card at the time of survey, with majority of the households had PHH ration cards (91.4%) and 8.7% AAY (Figure 3.8).

Although 85% of households had mosquito nets, only half of the households (52.8%, N=557) were using them (Figure 3.9). Sickle cell anaemia, a genetic disorder was reported by 0.2% (N=2) of the households surveyed in Malkangiri. For Thalassemia, a disorder linked to abnormal haemoglobin, among the surveyed households, 0.1% (N=1) reported cases of thalassemia. None of these households reported health issues post consumption of Fortified Rice.

Figure 3.5: Percentage distribution of the population by social groups (Endline N=1054)

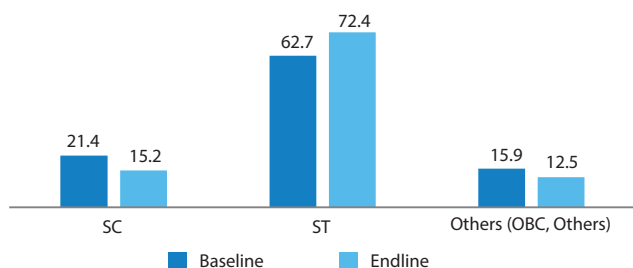


Figure 3.6: Percentage distribution of the population by Religion (Endline N=1054)

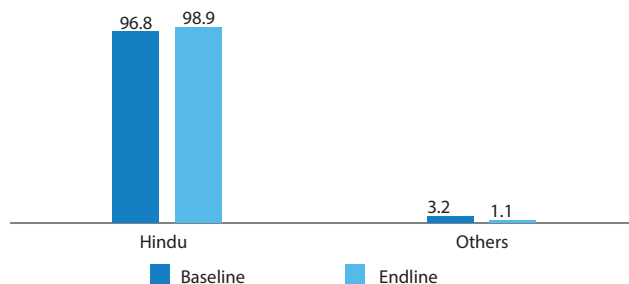
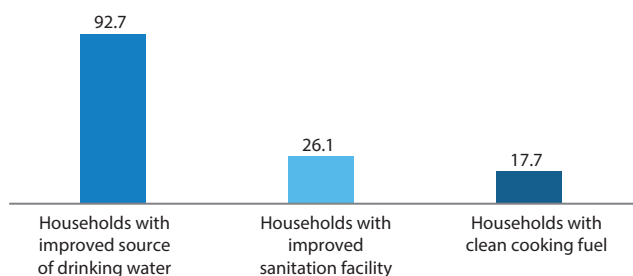


Figure 3.7: Household profile of the population (Endline N=1054)



Note: Open defecation - 73.9%

Figure 3.8: Type of ration card (Endline N=1054)

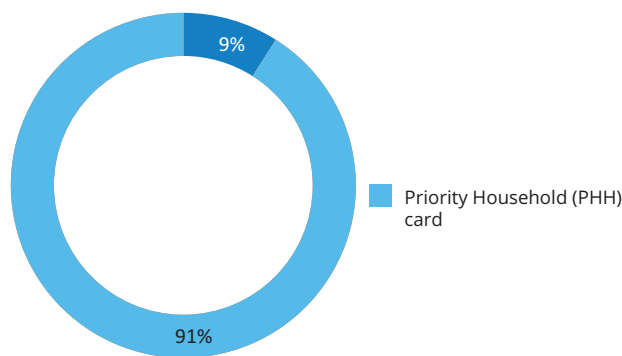
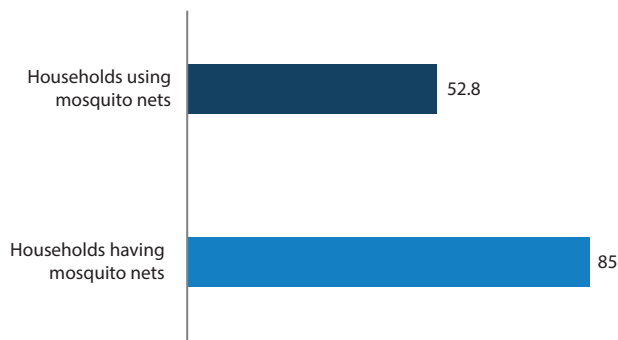


Figure 3.9: Distribution of Household by use of mosquito net (Endline N=1054)



3.2 OBJECTIVE 1: ACCESS AND CONSUMPTION OF FORTIFIED RICE BY BENEFICIARIES UNDER TDPS IN MALKANGIRI*

3.2.1 Knowledge, awareness regarding Fortified Rice, F+ among beneficiaries

Among total households, only 3.9% participants had awareness about +F logo on PDS rice bags. Low level of knowledge about +F logo was observed among respondents, with only 1.7% respondents reported having knowledge about +F logo. Figure 3.10 & 3.11 shows knowledge and awareness about fortified rice among Malkangiri population.

Majority of beneficiaries (79.7%) reported being unaware about benefits of consuming Fortified rice. Only 6.2% respondent reported knowing that fortified rice completes nutritional requirement, 1.6 % reported

that they are good source of micronutrients or prevents anaemia, another 1.6% understood reduction or prevention of anaemia as a benefit for consuming Fortified Rice, thus total of 9.4% beneficiaries were aware about benefits of consuming Fortified Rice (Figure 3.12).

Among the small proportion of households (N=96) who had heard about fortified rice, the major source of information for fortified rice came from (Figure 3.13):

- family/friends/neighbours (55%)
- Anganwadi (27.2%)
- electronic media (television, radio etc.) (13.2%)
- through Fair Price shop (14.4%)
- A very small number (2.1%) of participants had this knowledge, learned through community announcement as well.

The below results showed that awareness about rice fortification is very low among respondents in Malkangiri district.

Figure 3.10: Knowledge about meaning of +F logo (N=1054)

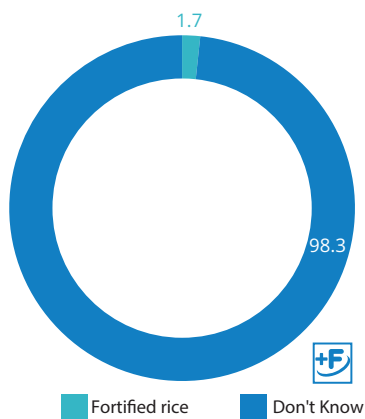


Figure 3.11: Awareness about +F logo on bags (N=1054)

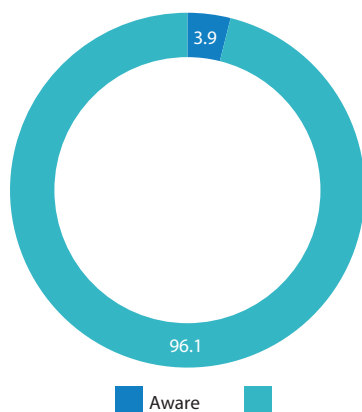


Figure 3.12: Awareness about benefits of consuming Fortified Rice (Endline N=1054)

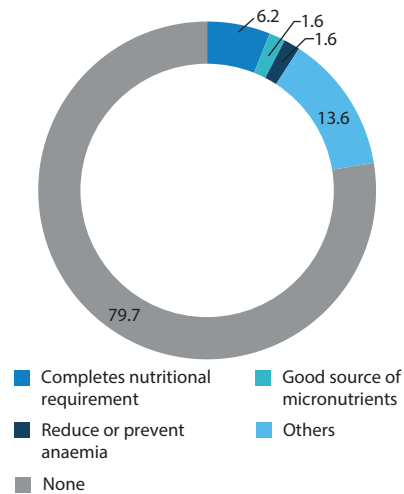
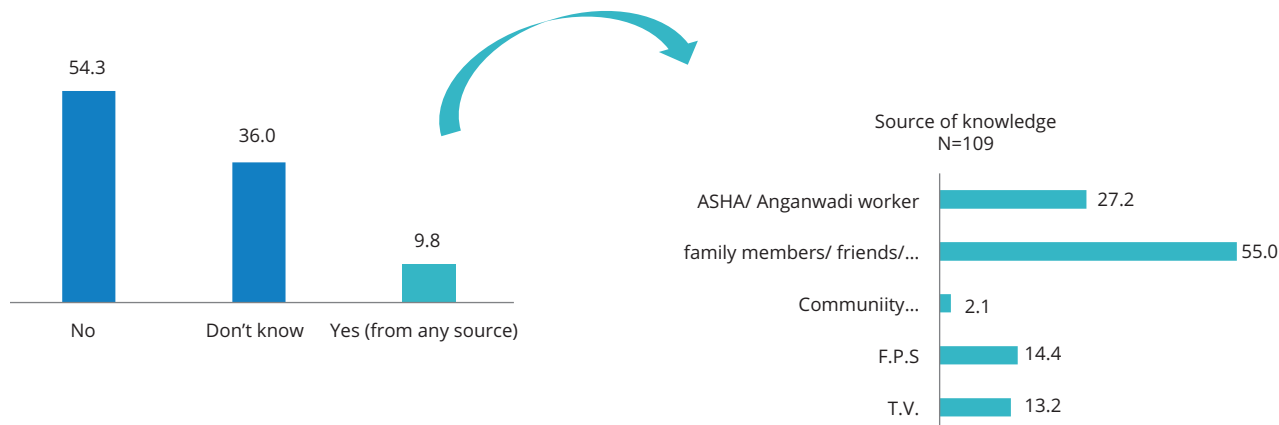


Figure 3.13: Heard about Vitamin Yukt Chawal/Fortified rice (Endline N=1054)



*All charts in Section 3.2 are based on unweighted sample estimates

3.2.2 Acceptability of fortified rice by beneficiaries in Malkangiri

Regarding sensory acceptability of Fortified Rice, results shows that fortified rice had comparatively higher acceptability for taste, smell, appearance, texture, and colour among Malkangiri households (N=1054). Majority of the primary household caregiver reported them either good or very good in terms of taste (85.5%), smell (78.3%), texture (85.7%), colour (83.4%) and appearance (85.3%) respectively (Figure 3.14).

3.2.3 Consumption of fortified rice in Malkangiri-frequency, amount

Findings reveal 100% of the respondents were ration card holders (n=1054).

The average quantity of Rice/FR received by households as reported by respondents is 20.5 kgs. per month as against 21.3 kg. allotted to them Figure 3.15. For wheat, households report allotment of 6.5 kg per month and received the same amount.

Figure 3.16 revealed the consumption rate of fortified rice among Malkangiri households. Results indicates encouraging consumption patterns of fortified rice among Malkangiri's households.

Figure 3.14: Acceptability parameters of Fortified rice reported by Households (Endline N=1054)

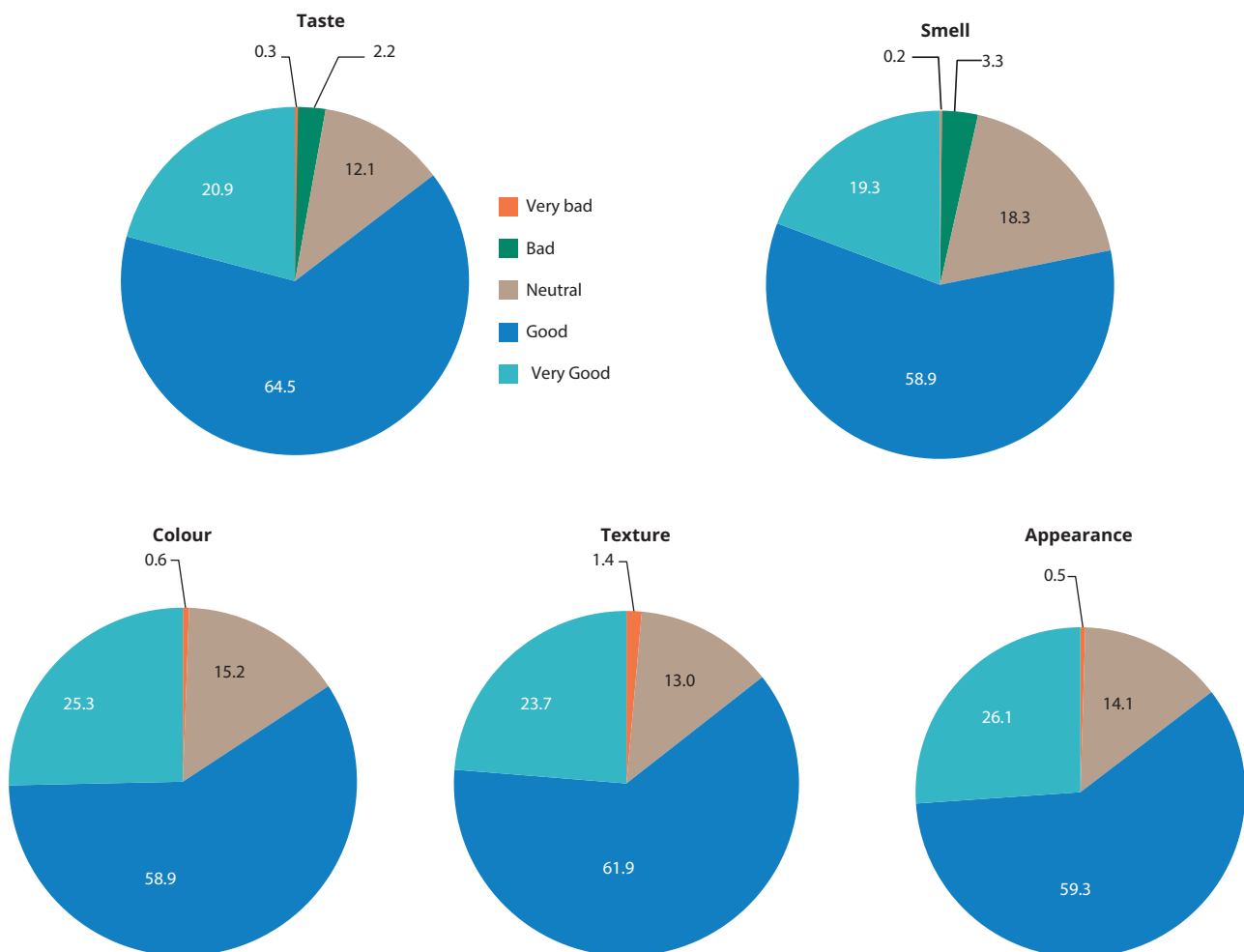
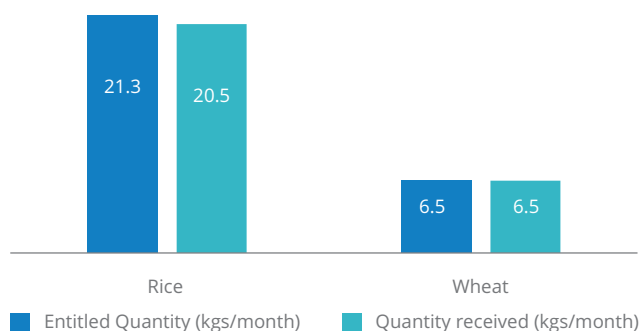
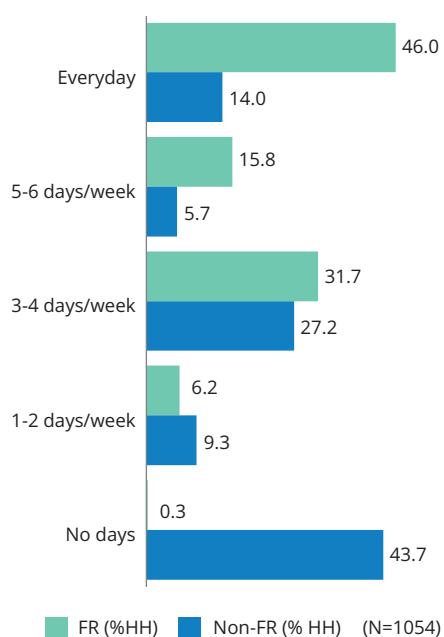


Figure 3.15: PDS commodity entitles vs received by respondents (N=1054)



- Consumption of fortified rice was high with **46% of households reported consuming fortified rice daily, additionally, 32% of households reported consuming fortified rice 3-4 times per week, demonstrating regular inclusion of fortified rice in their meals.** In contrast consumption of unfortified rice was very low among respondents with only 14% reported consuming unfortified rice every day and almost half of the household reported not consuming unfortified rice at all.
- Households are consuming fortified rice around 5.3 times per week and for unfortified rice per week it is 2.4 times per week. **On average, individuals consumed fortified rice five days per week, highlighting its consistent incorporation into their diets.**
- These findings underline the positive impact and potential effectiveness of fortified rice as a nutritional intervention.

Figure 3.16: Household by frequency of consumption of Fortified Vs Non-Fortified Rice



Recommended daily allowances met by Fortified Rice (in women)

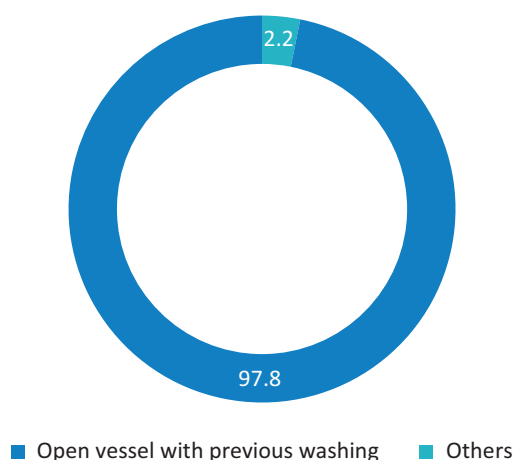
Micronutrient deficiencies are relatively high in the district. RDA for iron in women (21 mg/kg) met by Fortified Rice has been estimated using the information collected in the survey such as amount of Fortified rice consumed by Household in a month (20.5 kg/Household/month) and amount of FR consumed per person in a day (0.23 kg/person/day). Considering variable amount of iron content in FR (range taken from 42.5 mg/kg to 28 mg/kg), is estimated that 46.1% to 30.4% of total RDA for iron is being met from Fortified Rice itself. On the contrary, due to poor iron content in Non FR (4 mg/kg), only 7% of RDA of iron can be met in this consumption pattern.

3.2.4 Cultural influence on cooking

In agreement with popular cooking practices, 97.8% of the household reported washing rice with water until clear and, finally, cooked traditionally with excess water. After cooking, the excess water is discarded. Only 1.5% of the households reported no prior washing before cooking (Figure 3.17). Studies have reported that washing and cooking fortified rice in excess water cause substantial loss of iron and other micronutrients.

These losses are primarily due to leaching of micronutrients into the water during the washing and soaking process.¹³ Community interaction during in-depth interview also confirmed the same. A female household member reported washing fortified rice 2-3 time with cold water as they smell a lot when mixed with water (in case of normal rice, they are washed only once or twice). After washing, the rice is boiled in water and once it is cooked

Figure 3.17: Cooking pattern for fortified rice (N=1054)



¹³ MM Azam, SR Padmavathi. A Fiyaz, et al. Effect of different cooking methods on loss of iron and zinc micronutrients in fortified and non-fortified rice. Saudi Journal of Biological Sciences, 28 (5), 2021, 2886-2894.

extra water (called 'Peja') is drained. This leads to loss of essential micronutrients.

In India, traditional and cultural norms often impose dietary restrictions on adolescent girls and pregnant and lactating women, resulting in an inadequate intake of important micronutrients. The food taboo differs from culture to culture, and even among families and individuals. A typical food taboo considered harmful to reproductive health is to avoid consumption of sour, bitter and spicy foods by pregnant and lactation women¹⁴. Another taboo is related to restricting the meal portion and avoiding fruits like papaya, dry fruits, rice, etc. by pregnant women. Similarly, adolescent girls are restricted in consumption of sour and spicy foods during menstruation¹⁵.

Most communities, rural or urban, have taboos regarding foods to avoid during pregnancy, and most have local explanations for why certain foods should be avoided. Such taboos may have health benefits, but they also can have large nutritional and health costs to mothers and foetuses. As such, understanding local pregnancy food taboos is an important public health goal, especially in contexts where food resources are limited. Despite this, information regarding food taboos is limited. In the endline assessment, although majority of the households suggested consuming more varieties and quantity of food during pregnancy (97.1%), however 34.9% did reported that women should avoid some foods like meat, fish, papaya or jackfruits as they might cause abortion; abdominal cramps in the mother and newborn; prolonged labor; or coating of the fetus's body. Also, almost half of the households (50.6%) suggested that women should not eat too much during pregnancy to avoid difficulties during delivery.

3.2.5 Consumption of Fortified Rice under Central Schemes- ICDS/MDM

The endline assessment evaluated the consumption pattern of children and women (lactating and pregnant) attending Anganwadi centres. Food consumption pattern of the beneficiaries were assessed through collection of details on the food consumption pattern, and frequency of having different food items. Majority of the children received take home ration once a month (80.2%), Figure 3.18 . Almost half of the children who received take home ration consumed them daily, Figure 3.19.

Among children aged 3-6 years, a high proportion of them received hot cooked meals daily (72.4%).

Among school going children (6-14 yrs), almost everyone (99.8%) received hot cooked meals as part of mid-day meal programme. Most of them reported consuming rice (97.4%), Pulses (73.4%) and Vegetables (61.7%) on daily basis. Consumption of millets was very low with 64.2% reported no consumption and 31% reported not even knowing about them, Figure 3.21.

Figure 3.18: Frequency of receiving take-home ration among children (6-36 month)

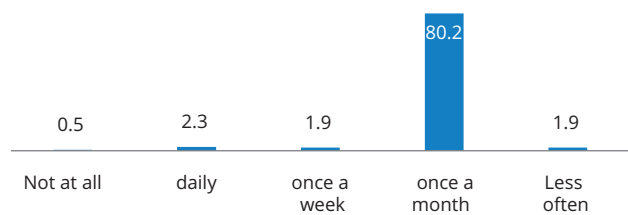


Figure 3.19 : Frequency of consumption of take-home ration among children who received it (6-36 month)

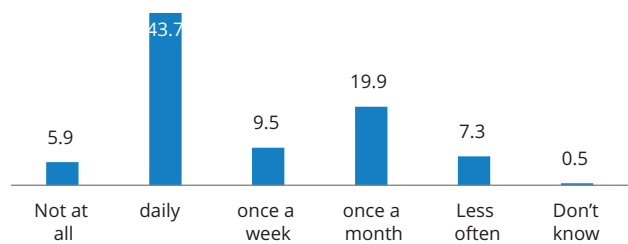


Figure 3.20: Frequency of receiving hot cooked meals from AWC among children (3-6yrs)

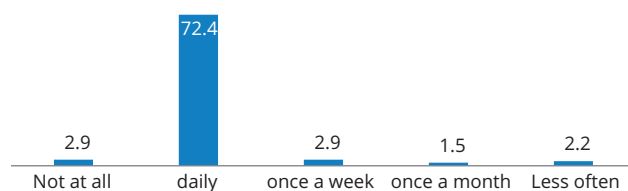
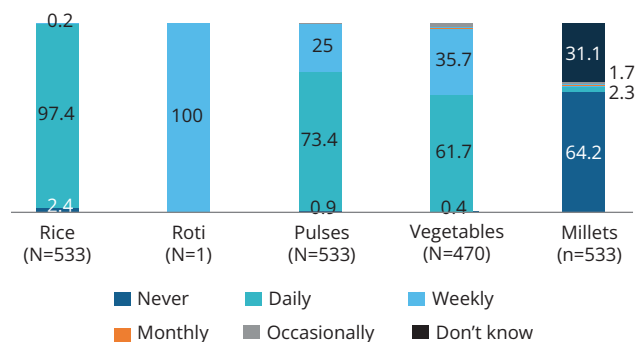
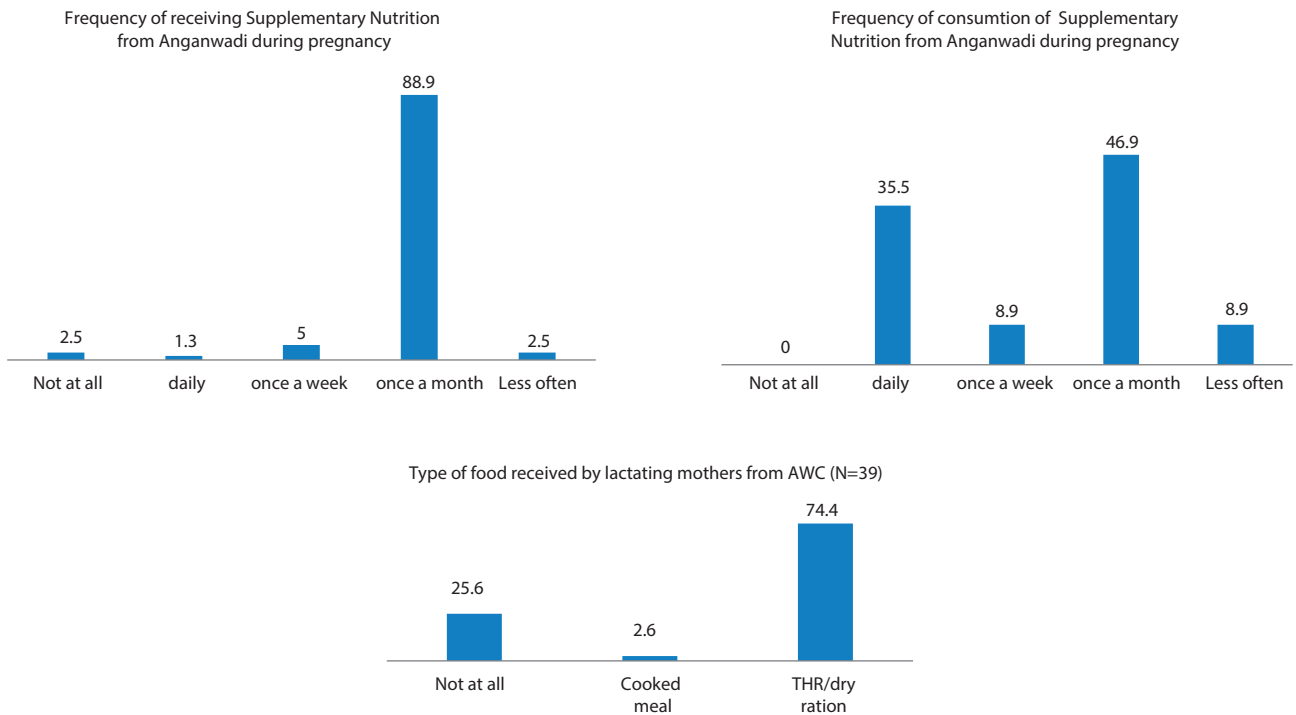


Figure 3.21: Consumption pattern of Mid-Day Meal (MDM) among children aged 6-14 yrs.



14 A Parmar, H Khanpara, G Kartha. A study on taboos and misconceptions associated with pregnancy among rural women of Surendranagar district. Heal pISSN. 2013;4(2).
 15 A Kumar, K Srivastava. Cultural and social practices regarding menstruation among adolescent girls. Soc Work Public Health. 2011;26(6):594-604.

Figure 3.22: Supplementary nutrition services received from AWC by Pregnant and lactating mothers



Among pregnant women (N=81), most of them (88.9%) reported receiving food from anganwadi during pregnancy one a month. However, out of those pregnant women who received supplementary food from anganwadi, only 35% consumed them daily suggesting low consumption of supplementary food by pregnant women Figure 3.22.

Among lactating mothers (N=39), 74% reported receiving dry ration and only 2.6% reported receiving cooked meal, a good proportion of lactating women were not receiving any type of supplementary food from anganwadi Figure 3.22.

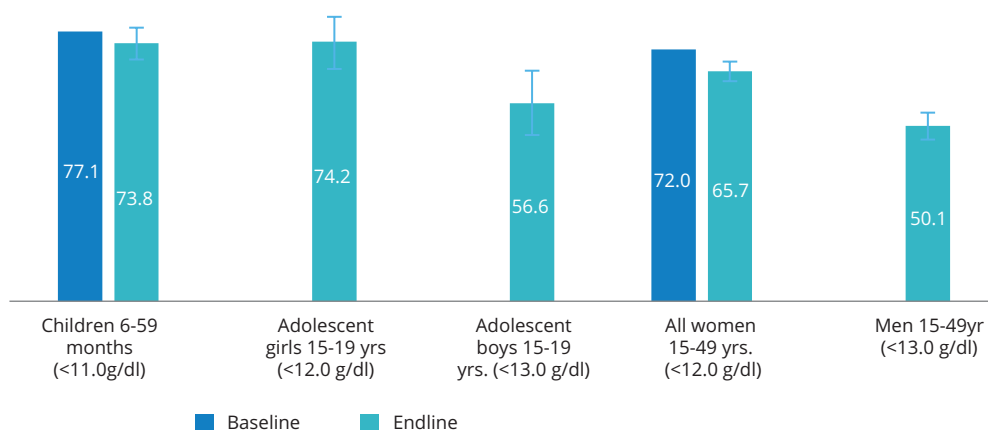
3.3 OBJECTIVE 2: IMPACT OF RICE FORTIFICATION ON PREVALENCE OF ANAEMIA AMONG BENEFICIARIES IN MALKANGIRI

3.3.1 Anaemia outcomes in different demographic groups in Malkangiri

Anaemia levels for different target groups were calculated by the Heamoglobin analysis as per NFHS-5 methods and techniques. Sampling and analysis methods were also

Figure 3.23: Prevalence of Anaemia in different demographic groups in the Endline Assessment

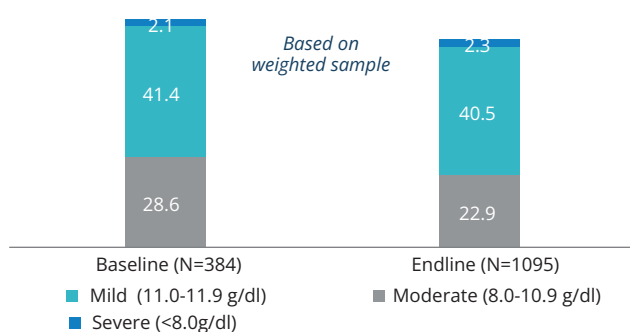
Based on weighted sample



made identical to NFHS-5, and weighted averages were calculated. The data in the figure shows a decrease in anaemia prevalence after introduction of fortified rice among children (6-59 months) and women (15-49 yrs.). Figure 3.23.

a) **Women (15-49 yrs.):** The endline prevalence of anaemia was lower among women (72% vs 65.8%). The endline prevalence of anaemia was 65.8% among women (N=1095, 95% CI: 68.5%-62.9%) which was 6.3% points lower than the baseline prevalence (Figure 3.24). After adjusting the model for severity of anaemia, like what was observed in children group, it appears that the benefits of fortification were only incurred in the mild anaemia group. For women, mild anaemia declined by 5.7 % points relative to baseline.

Figure 3.24: Prevalence of Anaemia by severity of Anaemia among women (15-49 yrs.)



b) **Children (6-59 months):** The endline prevalence of anaemia was 75.1% among children (N=358, 95% CI: 78.2%-69.1%) which was 3.3% lower than the baseline prevalence (77.1% vs 73.8%) On segregating by gender, whereas anaemia decreased in both groups, the decrease was greater in girl children with than in boy children. The prevalence of anaemia decline by 2.7% point among boys (76.5% vs 73.8%) whereas among girls the prevalence of anaemia declined by 3.8% points (77.7% vs 73.9%). No comparison could be made among different categories of anaemia due to insufficient data at baseline.

Figure 3.25: Prevalence of Anaemia by severity of Anaemia among children (6-59 months)

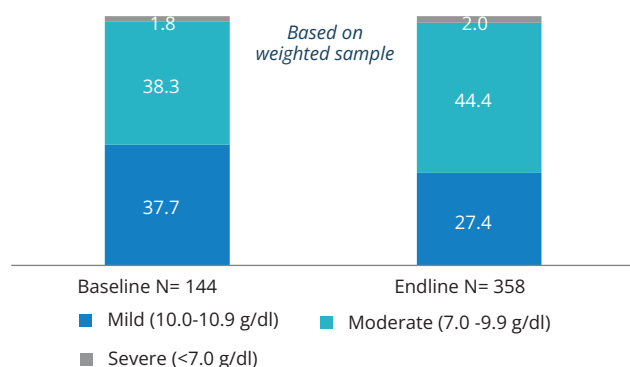
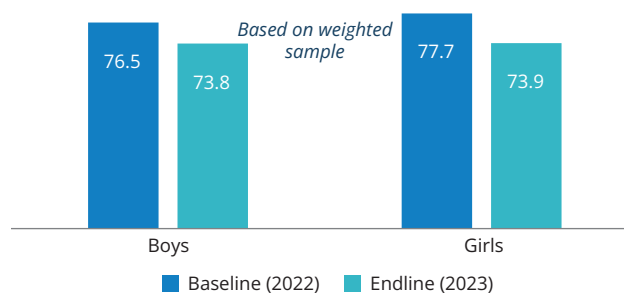


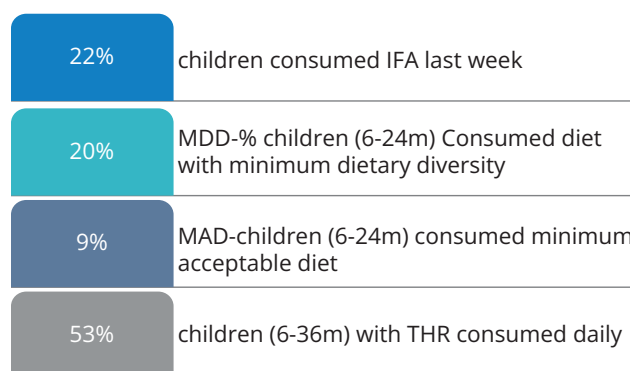
Figure 3.26: Prevalence of Anaemia among boys and girls children (6-59 months)



However, after adjusting the model for severity of anaemia, it appears that the benefits of fortification were only incurred in the mild anaemia group. For children aged 6-59 months, mild anaemia declined by 10% points relative to baseline. Different set of interventions affect levels of severity of anaemia, so there could be several plausible explanations for this effect only on mild category:

- First, iron requirements are highest among children between 6 to 59 months of age and thus iron content in fortified rice might not be sufficient for their requirement.
- Secondly, it might be possible that iron absorption mechanism was downregulated in these children leading to lower absorption of iron. Lastly, iron received through fortified rice was lower in content than reported in other studies (showing effect of fortification) resulting in lower impact of fortification.^{16,17}

Poor coverage of complementary strategies such as IFA, and poor dietary diversity may also have led to this situation of not much decline in moderate levels of anaemia. As per findings, only 22% children consumed IFA syrup in last week, whereas only 20% children consumed minimum dietary diversity (MDD) and 9% consumed minimum acceptable diet (MAD).



16 Bilukha O, Howard C, Wilkinson C, Bamrah S, Husain F. Effects of multi micronutrient home fortification on anaemia and growth in Bhutanese refugee children. Food Nutr Bull. 2011 Sep;32(3):264-76.

17 Zlotkin S, Antwi KY, Schauer C, Yeung G. Use of micro-encapsulated iron(II) fumarate sprinkles to prevent recurrence of anaemia in infants and young children at high risk. Bull World Health Organ 2003; 81:108-15

c) **Other target groups:** For rest of target groups covered in the endline, prevalence of anaemia was found to be 74.2% in adolescent girls, 56.6% in adolescent boys and 50.1% in men (15-49 yrs). Whereas baseline numbers are not available for adolescent girls and boys from NFHS, the baseline sample for men is low (N=51). Thus, due to lack of sample sufficiency in baseline, appropriate conclusion cannot be ascertained for these target groups cannot be compared in the endline.

3.3.2 Background factors affecting anaemia among target groups

a) Women (15-49 yrs.):*

Anaemia reduction is also supported by other interventions such as supplementation, use of mosquito nets for malaria protection and improving dietary diversity. Whereas higher proportion of women report to be consuming IFA during their last pregnancy and higher proportion of household also report owning a mosquito bed net (Malkangiri being Malaria Endemic district), but the dietary diversity score was relatively poor. For all these factors, lesser proportions are observed in endline study.

Whereas 99% women reported to consume IFA in baseline, the percentage is 95% in endline; 98.8% households reported owning a mosquito net, the percentage is 86% in endline; only 0.4% women consumed 5 food groups in baseline, the percentage further reduced to 0.2% in endline.

Among various demographic characteristics, for women, the educational status, a proxy measure for poverty, was significantly associated with anaemia (P=0.04). Higher educational level (Secondary level and above) was

Figure 3.27: Anaemia in women by education (%)

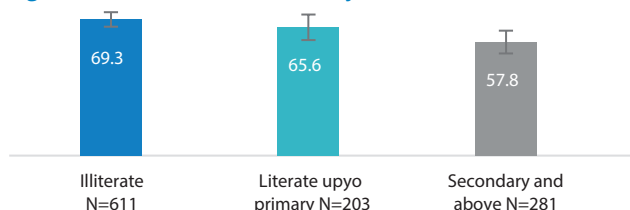


Figure 3.28: Anaemia in women by Improved sanitation facility (%)



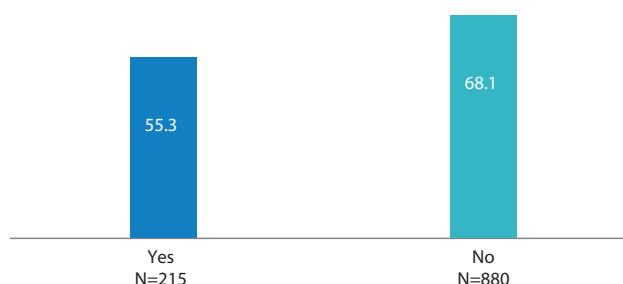
*All charts based on weighted sample.

associated with a lower prevalence of anaemia (illiterate: 69.3 % vs secondary (Figure 3.28); 57.8%).

For women, the prevalence of anaemia when living in a household with an improved sanitation facility was much lower (52.5%) compared to living with unimproved sanitation facilities (70.2%) (Figure 3.28) (p=0.000). This indicates the direct effects of poor sanitation alone may limit nutrient absorption and contribute to anaemia. The influence of improved sanitation on anaemia reduction could operate through several possible mechanisms: preventing infections, reducing elevated hepcidin levels, and/or reduced enteropathy causing improved intestinal surface area leading to better iron absorption and reduced loss of nutrients through lower diarrhoea prevalence.¹⁸¹⁹

For cooking fuel, result shows that households that depend on unclean cooking fuels were more likely to be anaemic as compared with households using clean cooking fuel (68.1% vs 55.3%, (Figure 3.29) p=0.01). It is also a known fact that exposure to unclean cooking fuels may lead to systemic inflammation, which is regarded as a popular cause of anaemia, mediated by inflammatory.²⁰

Figure 3.29: Anaemia in women by households using clean cooking fuel



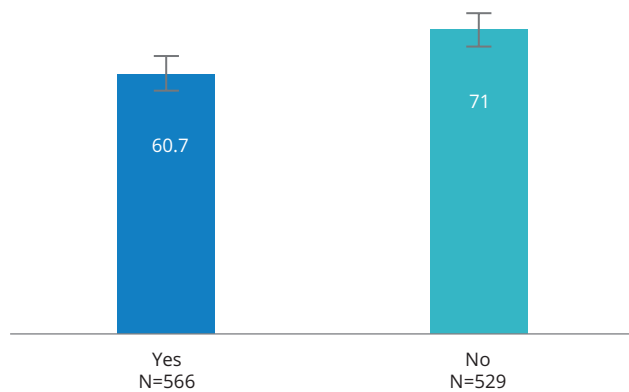
Also, the prevalence of anaemia was significantly higher in women who didn't use insecticide treated mosquito net vs those who use that (71% vs 60.7%, (Figure 3.30) p=0.001). Type of ration card was also associated significantly with anaemia, with AYY card hold show lower levels of anaemia (p=0.016). Association between knowledge, awareness and anaemia prevalence were found insignificant.

18 Chakravarty I, Bhattacharya A, Das SK. Water, sanitation and hygiene: The unfinished agenda in the World Health Organization South-East Asia Region. WHO South East Asia J Public Health. 2017 Sep;6(2):22-33.

19 D'Angelo G. Role of hepcidin in the pathophysiology and diagnosis of anaemia. Blood Res. 2013 Mar;48(1):10-5. doi: 10.5045/br.2013.48.1.10. Epub 2013 Mar 25. PMID: 23589789; PMCID: PMC3624997.

20 Page CM, Patel A, Hibberd PL. Does smoke from biomass fuel contribute to anaemia in pregnant women in Nagpur, India? A cross-sectional study. PLoS One. 2015 May 29;10(5):e0127890.

Figure 3.30: Anaemia in women by Household having insecticides treated net (%)



b) **Men (20-49 yrs.):** For men, only presence of mosquito net and their use was found significantly associated with prevalence of anaemia. Men who had insecticide treated net in their household had only 38.5% anaemia compared to men who didn't have insecticide

Figure 3.31: Any Anaemia (<13.0 g/dl) among men by level of education

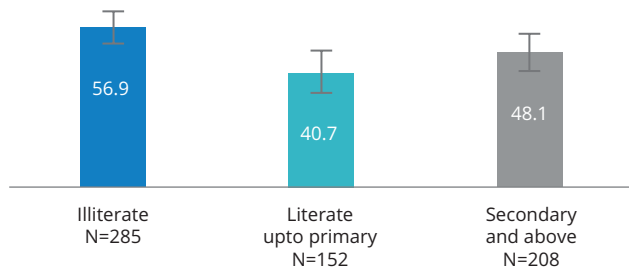


Figure 3.32: Anaemia in men by Household having insecticides treated net (%)

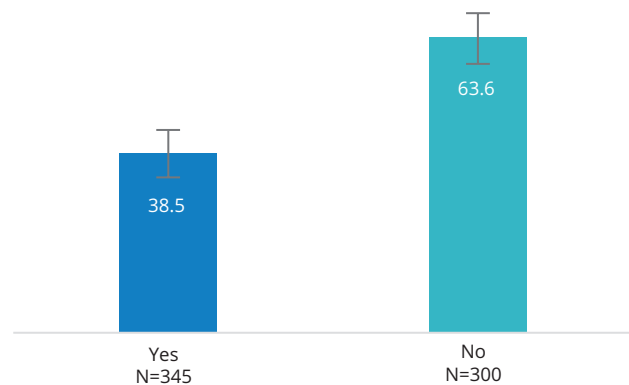
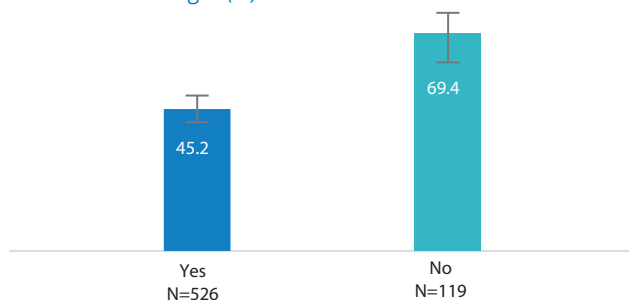


Figure 3.33: Anaemia in men by Household using insecticides treated net last night (%)



*All estimates based on weighted sample

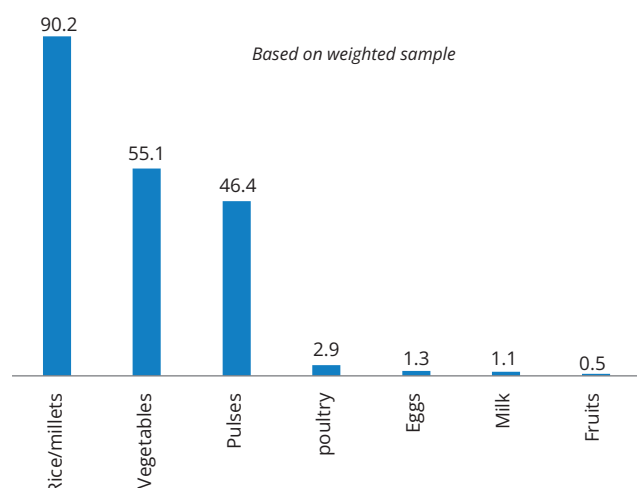
treated net in their home, the prevalence among them was 63.6% (p=0.001). Also, prevalence of anaemia was much lower among men (45.2%) using insecticide treated net last night before the survey compared to 69.4% prevalence anaemia among those who didn't use insecticide treated net last night. As with women, anaemia among men is also significantly associated with level of education, with illiterate men having higher anaemia levels (56.9%) and those with primary level education Figure 3.31, 3.32, 3.33 having lower levels of anaemia (40.7%) (p-0.003)

c) **Other target group:** No significant correlation was observed in other target groups with respect to background characteristics.

3.3.3 Association of consumption of Iron rich Foods, IFA tablets and anaemia prevalence in target groups in Malkangiri

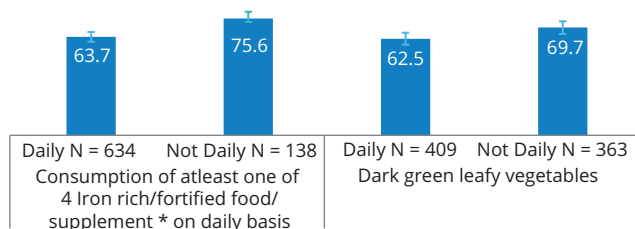
To assess true effect of Fortified rice on reduction of anaemia, it is vital to understand dietary practices being followed. To understand the dietary profile of women, questions used in NFHS V were used to probe diet pattern for women (15-49 years). The data was analysed to check daily consumption of food groups. It was found that only 28.1% women (15-49 yrs.) were consuming dietary diverse diets consisting of 3 food groups and only miniscule percentage of 3.2% consumed 4 food groups and 0.3% consumed 5 food groups or more at time of survey. Thus, showing deficit in consuming variety of food groups. The diet largely consists of rice, vegetables and pulses on daily basis. On a daily basis, rice was reported to be consumed daily by 90.2% women, vegetables by 55.1% and pulses by 46.4% women in age group 15-49 yrs (Figure 3.34).

Figure 3.34: Daily consumption of food items among women 15-49 yrs.)



Daily consumption of food groups (weighted)	% (n=1095)
% women (15-49) consuming 5 food groups daily	0.3
% women (15-49) consuming 4 food groups daily	3.2
% women (15-49) consuming 3 food groups daily	28.1

Figure 3.35: Association between consumption of iron rich food and Anaemia level among women (15-49 yrs.)



* (4 groups include-Pulses/beans, green leafy vegetables, IFA consumption & Vitamin Yukt Chawal)

Among women, those who consumed at-least one of the four iron related items on daily basis, namely- Pulses/beans, green leafy vegetables, IFA consumption & Vitamin Yukt Chawal, prevalence of any anaemia was lower by 11.9 percent points (75.6% vs 63.7%, p=0.002) whereas those who consumed green leafy vegetables daily had 7.2 percent points lower prevalence of anaemia compared with women who didn't consume green leafy vegetable daily (69.7% vs 62.5%, p=0.012) Figure 3.35.

Among other target groups, no significant relationship could be concluded due to low sample size among men, adolescents and children.

3.3.3.1 Factors related to Severe Anaemia:

Variety of factors linked to anaemia were analysed to understand the ones related to Severe and non severe cases of anaemia in women (15-49 yrs). Background factors found to be statistically significant include open defecation, awareness about Fortified rice, daily consumption of pulses and daily consumption of green leafy vegetables. The rates of these factors among severe, and anaemia and non anaemia women is given Table 3.1

Table 3.1: Background characteristics of Adult women with Severe Anaemia and all types of anaemia

Sl. No.	Indicator (WFP Endline Malkangiri)	Severe adult women (%)	Anaemic adult women (%)	Not-anaemic adult women (%)
1	Open defecation	77.8	77.7	67.7
2	Aware about fortified rice	3.7	13.7	14.8
3	Pulses consumed daily	44.4	44.4	53.2
4	Green leafy vegetables consumed daily	51.8	52.6	61.5

3.4 OPERATIONAL ISSUES – CAPACITY BUILDING, IEC, SUPPLY CHAIN, QA

Qualitative interviews regarding Rice fortification pilot project were conducted at the district level in April 2023 on various aspects of effectiveness of the Fortification scheme such as knowledge about roles & responsibilities, capacity building, demand side issues, supply chain, QA and recommendations. Besides, observations were also made during monitoring of data being collected by the field team.

3.4.1 Capacity building of Stakeholders

District level interviews were conducted with a range of officials in departments such as ICDS, Food and Civil supply and Public Distribution, depot managers. It showed officials are aware about the intervention and well versed with their designated roles and responsibilities related Rice fortification. The needs for rice fortification to improve micronutrient profile of the community has been cited by the officials. The higher-level officials report having received training and conducting capacity building measures for stakeholders below.

'Rice fortification scheme in Odisha started in Malkangiri as pilot project in July to address a important problem of anaemia. Lots of training programmes regarding blending efficiency test of FRK and role and responsibility of different stakeholders were done for rice millers and their supporting staffs.'

— CSO & Grievance redressal officer

- Supply side bottlenecks in initial phase ironed out by capacity building measures:** The Pilot scheme was rolled out in July 2021 in the district of Malkangiri, this was proceeded by key activities such as capacity building of millers and district officials and putting in place a system of supply chain & QA for the Fortified rice. As per the in-depth interviews, non-uniform FR kernel size and instances of improper blending were observed in the initial stages of the programme. Difficulty in ascertaining FRK parameters was also faced by Gowdown in-charge as the scheme being a new one in the geography required ironing of initial bottlenecks. Gradually the stakeholders got familiarized with the newly introduced methods and benefitted from the capacity building initiatives of the Govt. of Odisha and WFP.

'In the beginning of the pilot scheme proportion of kernel drawn from the sample was not within the limit and there were instances of improper blending of FRK. It was too difficult for ascertaining of FRK parameters but then we became familiar after training'

— one of the Godown owner, Malkangiri

- b) **Sufficient measures on Capacity building:** All stakeholders interviewed reported to be trained including staff of mill owners, Civil Supplies officials, QA officers, FPS owners and Godown in-charges. There has been regular on-the-job training through workshops up-to block level, conducted by Govt. of Odisha and WFP. Training of ground level functionaries such as Anganwadi workers has also been conducted. The phase wise training was crucial to sensitize various district level stakeholders about their role & responsibilities in the pilot project. The mill owners and supporting staff were found to have received technical training for production as well as QA through tests such as BET etc.

'All retailers are sensitized regarding the proper storage of food grains and to follow first-in-first-out principle. Also, regular workshops are conducted by the block office'

— Marketing inspector, Civil Supplies, Malkangiri

In the initial days, there was a lot of confusion regarding storage of FRK, blending ratio, and purchase of FRK. But after training, there is more clarity now.

— Rice mill owner

The methodology of training provided to Rice millers was also perceived to be effective by the Government officials. It was reported that the training included theoretical as well as practical training supplemented by efforts on mentoring, monitoring, and continuous rectification.

'After proper classroom training to miller as well demo based training, general inspection was also taken by staff of supply department and also by miller for production of fortified rice kernel. Now they are delivering FRK rice under FAQ limits or norms due to these efforts'

— Godown in-charge, Malkangiri

3.4.2 Awareness generation/ Information Education Communication activities related to promote Fortified Rice

Myths surrounding Fortified Rice -initial phase:

A popular name 'plastic rice' used in community has been repeatedly reported by different stakeholders interviewed. Initially after rolling out of the pilot scheme, beneficiaries were reluctant to consume differently appearing FRK in rice supply. It is also reported that FRK was hand-picked and thrown by families during the cooking process. However, as the scheme progressed and due to local efforts on IEC measures, the acceptability and uptake of Fortified Rice improved.

a) IEC efforts created an enabling environment for introduction of Fortified Rice:

Stakeholders reported that beneficiaries used to perceive fortified rice as "Plastic Rice". It was shared that steps taken to mitigate the situation involved awareness generation activities such as- a) involvement of local leaders regarding benefits of FR and appropriate cooking practices, b) orientation of FPS owners for further dissemination of information at FPS shops and c) direct involvement with community through awareness camps through *jogan sahayaks*. Local NGOs were also involved in this activity. Local NGOs were also involved in this activity.

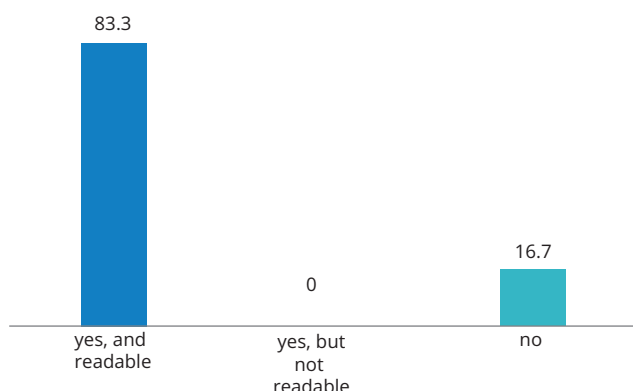
These activities were helpful in improving uptake of monthly rations from the Fair Price Shops (FPS). Thus, IEC measures were found vital in introducing the pilot intervention in the community and achieve acceptability of Fortified Rice.

'The steps taken by departments included orientation of officials of civil supply section to make aware the Panchayati raj system like sarpanches regarding the benefits and cooking procedures of fortified rice. Awareness camps were organized by the *jogan sahayaks* and beneficiaries about fortified rice jointly by the district administration and CYSO NGO under WFP'

— CSO Grievance redressal officer, Malkangiri.

- b) **IEC at Fair Price Shops:** Among the Fair Price Shops that were covered for Semi Structured Interviews and observations, 83.3% (15) were found to display readable IEC material on topic Fortified rice such as posters and availability of leaflets. Only 16.7% shops observed did not had IEC display Figure 3.36.

Figure 3.36: Proportion of Fair Price Shops displaying IEC material related to Fortified Rice (N=18)



- c) **Need for an ongoing IEC campaign through frontline workers:** Community sensitization should be an integral part of any such project in future through frontline workers including AWWs and be an ongoing part of the project considering low levels of knowledge among beneficiaries about the importance of fortified rice.

3.4.3 Supply chain, distribution of Fortified Rice

Interaction with various stakeholders reported issues during rolling out of pilot scheme and how they were addressed resulting in developing the necessary infrastructure and sustainable environment for the scheme. Key observations are summarised below:

a) **Sufficient production capacity of district for Fortified Rice**

Despite its difficult terrain, the supply chain infrastructure and distribution system is quite established in the area with following progress:

- A range of preliminary activities were undertaken since December 2019 for capacity building of rice miller, trail validation of equipment in the mills, training of district officials and development of IEC materials.
- There are about 30 rice mills operational in the district in municipality area and in various blocks. In Malkangiri, 28 blending equipment have been installed and the total blending capacity for the district is 724.1 MT/8 hrs (as on Feb 2023).
- The actual distribution of fortified rice started in July 2021 through PDS and later introduced in MDM Scheme in October 2021.
- Almost 100% of NFSA beneficiaries, PHH and AAY beneficiaries were covered for the pilot FR scheme in Malkangiri. As of July 2023, 85 % of the population of Malkangiri district (537835) was covered by PDS system, while 20,285 people were covered under the SFSS.

- Currently, there is no supply of non-Fortified rice in the district of Malkangiri under Public distribution system.

31,008 Quintals of Fortified rice has been supplied in F.Y. 2022-23 to around 1.54 lakh families in the district i.e., around 5.35 lakh consumers: 21649 quintals of fortified rice to PHH and 8440.4 quintals to AAY through 117 PDS shops operating in the district. In addition, fortified rice is distributed through other schemes such as DFSS and Annapurna scheme as well. FR has also been introduced in SNP scheme of ICDS as well as MDM in schools in 2022-23.

Table 3.2: Distribution of Fortified Rice in Malkangiri

Distribution of Fortified Rice (July'21-March'23)				
	AAY	PHH	SFSS	Total
Beneficiaries	67345	450204	20285	537835
No. of families reached	24789	123101	6355	
Allotment (Quintals)	8440	21649	964	31,008

Children Beneficiaries of Fortified Rice (July'21-March'23)			
	MOM (PM-POSHAN)	WBNP	Total
Beneficiaries	108987	72671	181658
Allotment (Quintals)	49975	10664	60639

b) **Success in maintaining a continuous supply of FR:**

A well laid out supply chain mechanism was functional for distribution of rice under the Civil Supply Department which has been instrumental in provision of Fortified Rice in the district. As per records analysed, and district officials interviewed, there has been continuous supply of FR in the PDS system, and no stock outs have been reported since the launch of the scheme. None, whatsoever bottlenecks were reported by stakeholders in supply chain and the district maintains supply stock in surplus.

'Due to a systematic supply chain mechanism of rice distribution, there is least chance of shortage of food grains for the distribution to the beneficiaries'

- Marketing inspector, Malkangiri

- c) **Established distribution through PDS shops:** Data was collected from 18 Fair Price Shops by using Semi-structured tool along with observation. Most FPS (83.3%) were owned by Panchayat and rest 11% owned by Self Help groups and another 5% by Government.

Marketing inspector was reported to be responsible for raising the indent in all surveyed shops. All (100%) shops receive stocks on monthly basis, but only 11% shops report the supplies were reported to arrive within first week of the month, followed by 16.7% shops receiving it between 5th to 10th of each month, 22.2% between 1st to 10th, 27.8% shops receiving between 1st to 15th and 22.2% between 1st to 25th. Entire FPS (100%) interviewed reported sufficient storage space available for monthly consignment.

However, regarding receiving smooth supplies, 27.8% FPS owners reported facing supply shortage frequently in last one year and 72.2% reported receiving lesser stock than requirements. Thus, 55.5% beneficiary as reported by FPS owners visit 2-3 days per month to collect their monthly ration. FPS owners also shared the hesitancy of community due to perception of 'plastic rice' Figure 3.37.

'As fortified rice kernel appearance is different in shape and size with the rice grain, we faced a lot of challenges to aware the beneficiaries regarding this. People complained as if plastic rice is supplied. Initially there were many complaints and hesitation were there to receive fortified rice from beneficiaries from various place, but we attended village meetings and GP meetings and steps taken to aware them regarding the benefit of fortified rice. Now its accepted by the beneficiaries.'

— FPS owner, Malkangiri.

d) **Challenges in supply chain:** In addition to the achievement of establishing a strong and efficient supply chain system, the final evaluation identified several challenges that need to be addressed in order to ensure the success of this scheme. These challenges include:

d.1 Unresolved Issues: Some of the issues were shared by various stakeholders during field visits.

It was reported by rice millers that the rates for fortification, as set by the government, are outdated, and it is necessary for them to be revised, considering the increasing costs of electricity, transportation, and other relevant factors.

It was also reported that the existing godown in Malkangiri should be selected to receive the entire supply of fortified rice, rather than the FCI godown in Jaypore, located 110 KM away. This change would result in a reduction in transportation challenges for rice millers, as the civil supply department in Malkangiri possesses adequate infrastructure.

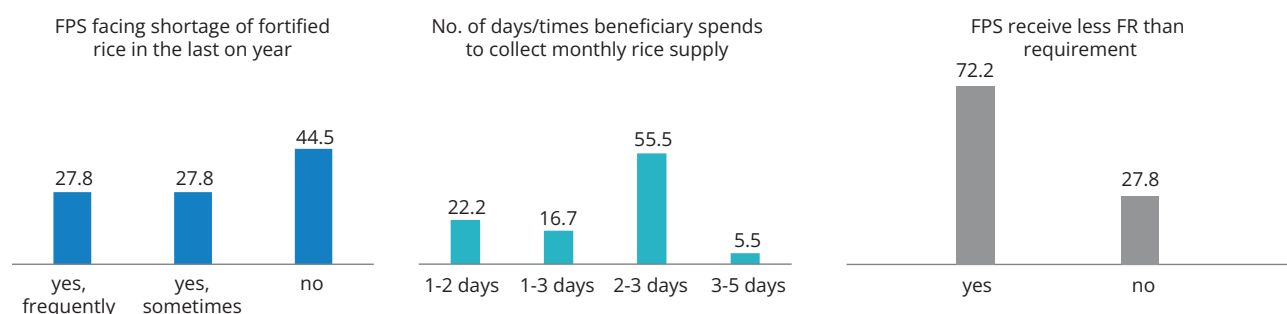
Concerns were also expressed regarding the weigh bridge installed at the FCI godown, stating that it should be replaced with a weigh bridge capable of weighing over 62 tons. Currently, the weigh bridge has a capacity of only 28-29 tons, necessitating the transfer of goods to a smaller vehicle for weighing when larger trucks are used. This process results in additional costs.

d.2 Lack of Awareness: The FPS owners/shopkeepers reported that initially, there was resistance within the community regarding the consumption of fortified rice, with a perception that it was "Plastic Rice." However, over time, people began consuming it, and it is now known as "Vitamin Rice."

Also, the awareness level on fortified rice and its benefits seems to be very low among beneficiaries including the key stakeholders. The community lacks awareness regarding the benefits of fortified rice and the correct cooking process associated with it. Many community members wash the rice multiple times and drain the water from the boiled rice (referred to as "Peja" in the local language). These practices may lead to a loss of essential nutrients present in the fortified rice.

d.3 Improved storage options of FR at last mile: There is compliance to scientific methods of storage and QA

Figure 3.37: Supply side issues reported by Fair Price Shops (N=18)



in Mills and depots, however at the last mile, various stakeholders expressed need for improving storage conditions. The CDPOs suggested provision of storage bins for Fortified rice at Anganwadis and marketing inspectors recommended use of plastic bag instead of routinely used gunny bags to be used at level of Fair price shops. The officials expressed concerns for retention of micronutrients in FRK in improper storage conditions due to high humidity and heat in the local situation. Also, a need for better scientific management system at FPS shops for Fortified rice was also recommended.

3.4.4 Quality Assurance of Fortified Rice

Finding from the qualitative interview with district officials revealed that the QA mechanisms in production, supply chain and distribution was followed as laid out in guidelines. QA steps are being complied to, at multiple levels of production and storage, through NABL accredited laboratories enlisted by the Government of India.

The millers are collecting QA certificates for purchased FRK supplied. Reports accessed (10 reports in F.Y. 2021-22) through millers show FR samples are well within range suggested by FSSAI standards. The tests are being conducted through accredited laboratories.

The role of CSO in QA is post receiving sample procures FR directly from rice mills. An elaborate method of testing is being followed by CSO through multiple level checks. 10% of the FR monthly supply is tested in the depots and post its QA, stocks are liquidated. FR is tested for Samples amounting to 500 gm., lifted on monthly basis from these depots and sent for testing to NABL accredited labs. Due to paucity of such lab in Malkangiri, the sample is being sent to Kolkata. (Sample report in Figure)

As a good practice, the same stock is sent to different accredited laboratories e.g., Millers, manufacturers of FRK and mean of both values is considered for referring to micronutrient range.

Delivery certificate is provided by District CS for millers and after that stocks are received. SCSO checks FAQ and FRK percent (blending ratio) at depots, and sample is sent to lab for FR testing (a lab not same as first two labs) and stocks are not liquidated. Testing is currently being conducted for estimating the level of three micronutrients namely Iron, Vitamin B12 and Folic Acid. Few samples have also been tested for microbiological safety.

As per the data shared by the CSO officials, all samples have been found to be fit for distribution, with micronutrients well within reference range set in the

Figure 3.38: Sample Testing reports obtained by CSO

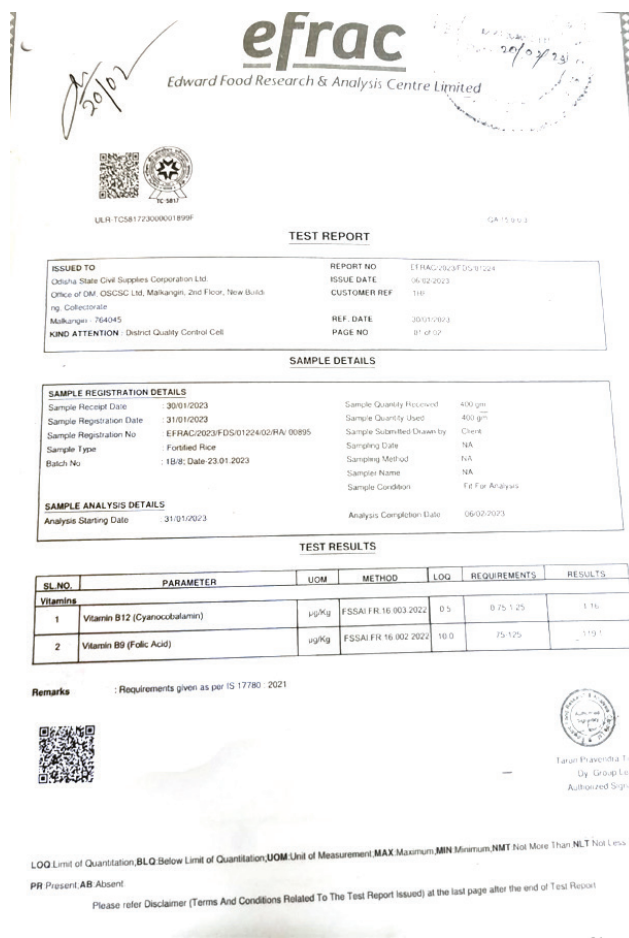
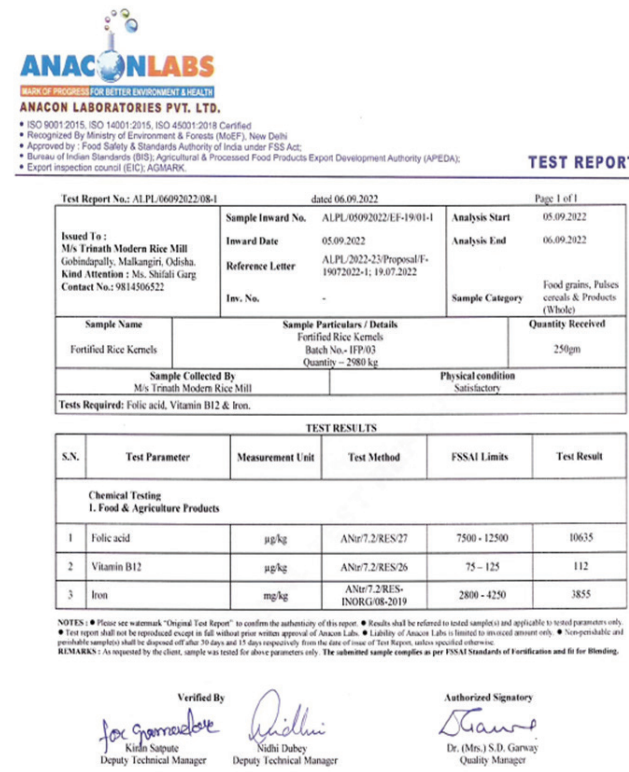


Figure 3.39: Sample reports obtained by millers



guidelines. However, few samples were reported to be rejected after they fail to comply to standards.

It was suggested by Procurement officers that methods may be provided to them for real time testing of micronutrient levels of consignment at the time of delivery by millers. As it takes time for getting reports of sample testing before liquefying stocks. Also, such a system would ensure testing of each sample provided by particular miller.

3.11 SUSTAINABILITY OF PILOT SCHEME

The Pilot scheme of Rice fortification has taken a large volume of efforts in creating an enabling environment and technical capacity for rice fortification in the district of Malkangiri and Odisha. The primary work in creating technical guidelines for rice fortification, QA framework, capacity building material itself requires multisectoral and academic activities that have already been done.

Apart from assistance to milling industry for developing intra district blending expertise, continuous work on capacity building of millers, officials and stakeholders has also been done. This has led to building of self-sufficiency in terms of technical know-how on rice fortification in the district.

On the community side, the initial resistance to Fortified rice has been largely overcome and the community accepts the intervention. This has happened due to local dialogue, convincing and IEC activities to promote fortified rice.

However, continued efforts would be required to improve community's knowledge about FR and promote appropriate cooking practices aligned to Fortified rice. Thus, the project demonstrates sustainability as it has successfully overcome community hesitancy in accepting a new intervention and due to established system and technical maturation on part of stakeholder understanding.



4

Conclusion and Recommendations

4.1 OVERALL CONCLUSION

Millions of individuals worldwide suffer from iron deficiency anaemia, negatively impacting their health and productivity, besides iron supplementation in reducing anaemia, dietary diversification as mainstream intervention have been implemented without much success since many years²¹. Due to high prevalence of anaemia across age groups an alternative approach in food fortification has been recommended^{22,23}.

The objective of the rice fortification project was to improve the anaemia status of the people in Malkangiri district and enhance their knowledge regarding nutrition, anaemia, and overall dietary practices. Given the widespread prevalence of micronutrient deficiencies in India, particularly in states like Odisha are at a higher risk of nutritional deficiencies, this initiative is highly relevant. It was crucial to commission a scientific assessment of the pilot project to provide evidence-based insights for the government and other stakeholders to make informed decisions about scaling up effective policies.

This study presents an evaluation of a unique community-level fortified rice program implemented by WFP, an organization that has undertaken similar projects in various states of India. The endline assessment of the pilot project revealed excellent efforts in capacity building for rice millers and support to the civil supply department in implementing the fortified rice scheme, including quality checks and distribution within the district. The civil supply department ensured timely delivery of fortified rice to rice millers, while stringent quality

checks were conducted by government officials. In cases of quality issues, the supplies were returned to the rice millers. The infrastructure for distributing fortified rice to beneficiaries, through the Public Distribution System (PDS) shops, was also well-established.

Along with these robust supply-side measures, the study reported improvements in the prevalence of anaemia. The prevalence of anaemia among women showed satisfactory improvement from baseline to endline and among children also there is decline in anaemia levels. Furthermore, the improvements were primarily observed in the mild anaemia group, indicating the need for more rigorous interventions to address anaemia at the community level through range of interventions such as IFA, dietary diversification, improved sanitation.

The low awareness of fortified rice among beneficiaries among beneficiaries and FPS owners demonstrated a lack of knowledge regarding the contents and benefits of fortified rice. This lack of intersectoral coordination in their awareness generation initiatives within the community is a major lacuna and requires intensive efforts to make it an ongoing exercise with involvement of community workers such as Anganwadi workers.

Another potential factor contributing to the project's shortcomings could be the cooking practices associated with rice. Studies have shown that the cooking process significantly affects the retention of iron concentration in different rice varieties. Washing fortified rice for only 90 seconds and subsequently cooking it in a rice cooker resulted in substantial iron loss (47%). These losses can be attributed to the leaching of iron into the water during washing and soaking steps. Additional leaching occurs when rice is cooked in excess water, and the residual water is drained off. The combined effects of these steps led to the highest iron loss when no treatment was applied.

21 Yip R. Iron deficiency: contemporary scientific issues and international programmatic approaches. *Journal of Nutrition* 1994;124(Suppl 8):1479S-90S.

22 Liberal A, Pinela J, Vívar-Quintana AM, Ferreira ICFR, Barros L. Fighting Iron-Deficiency Anaemia: Innovations in Food Fortificants and Biofortification Strategies. *Foods*. 2020 Dec 15;9(12):1871.

23 Naman Kaur, Aparna Agarwal, Manisha Sabharwal, Food fortification strategies to deliver nutrients for the management of iron deficiency anaemia, *Current Research in Food Science*. 2022; Volume 5, 2094-2107.

4.2 SUMMARY OF CONCLUSIONS

In conclusion, while the fortified rice project demonstrated strong supply-side measures and infrastructure, along with improvements in anaemia

prevalence. Addressing the lack of awareness among beneficiaries and key stakeholders, as well as implementing appropriate cooking practices to minimize iron loss, are crucial steps toward improving the effectiveness of such initiatives.

4.3 RECOMMENDATIONS

Based on the conclusion that the fortified rice project requires more comprehensive interventions to improve its effectiveness in reducing anaemia prevalence, the following recommendations are suggested:

Enhance awareness campaigns	Conduct targeted awareness programs to educate beneficiaries and stakeholders about the benefits of fortified rice in addressing anaemia. Use community outreach, workshops, and educational sessions to disseminate information on nutritional value and proper cooking practices.
State Engagement	State participation and oversight can be increased, especially for the procurement of FRK. This modality is acceptable to millers.
Strengthen intersectoral coordination	Foster collaboration among health, nutrition, agriculture, and education sectors. Partner with Anganwadi Workers, healthcare providers, schools, and community organizations to integrate fortified rice into existing nutrition program.
Improve cooking practices	Provide training on proper cooking methods to minimize iron loss in fortified rice. Emphasize water ratios, washing time, and avoiding excessive soaking or draining. Promote cooking techniques that preserve nutritional value.
Monitor and evaluate impact	Establish a robust monitoring and evaluation system to assess the project's impact on anaemia prevalence. Collect data on anaemia rates, dietary practices, and knowledge levels among beneficiaries for informed decision-making.
Strengthen supply chain management	Ensure efficient supply chain management for consistent availability and distribution of fortified rice. Monitor quality and quantity, implement quality control measures, and address issues promptly. Few recommendations are: <ul style="list-style-type: none"> • Training to stakeholders esp. last mile providers may be done through NGOs. • Better testing methods such as real time testing facility at entry of mill's consignment at depot level. • Improved storage of Fortified rice at Anganwadis and Fair price shops through provision of storage bins and plastic. • Higher quantity weigh bridge requested by millers at FCI godown at Jaypore to prevent unnecessary de-loading consignment for weighing. • FCI godown is far for Malkangiri and need for nearer facility. • Revision of rates for rice millers considering electricity & transport prices. • Payment settlement at monthly/quarterly frequency requested by millers.
Continuous education and communication	Implement sustained educational programs and communication campaigns. Utilize various channels like social media, radio, TV, and community gatherings to reinforce knowledge and promote proper utilization of fortified rice.

Implementing these recommendations will address gaps, improve effectiveness, and combat iron deficiency anaemia in the fortified rice project. Prioritize awareness, intersectoral collaboration, cooking practices, monitoring, research, and continuous education for success.



ANNEXURES



Annexure I: Tables

Annex Table 1: Socio-demographic characteristics of the population in Endline Assessment

Variables	Male	Female	Total Baseline	Male	Female	Total Endline
	N (%)			N (%)		
Age categories						
<5yr	73	71	144	196	162	258
15-19yr	NA	NA	NA	113	138	251
20-49yr	51	384	345	645	957	1502
				Baseline	Endline	
Variables				N (%)	N (%)	
Education				14%		
Women with 10 or more years of schooling (%)				14.9%	195 (13.4)	
Men with 10 or more years of schooling (%)					256 (18.3)	
Caste/tribe of the household head				21.4%		
Scheduled Caste				62.7%	160 (15.2)	
Scheduled Tribe				15.9%	763 (72.4)	
Other Castes (OBC, General, others)					131 (12.4)	
Religion of the household head				98.6%		
Hindu				1.1%	1042 (98.9)	
Others (Muslim, Christian, Others)				14%	12 (1.1)	

Annex Table 2: Household profile of the population in Endline Assessment (unweighted)

Variables	N (%) (unweighted avg.)
Number of household members	
=<4	513 (48.7)
5-6	435 (41.3)
>6	106 (10.1)
household living in households with an improved drinking-water source	976 (92.6)
Population living in households that use an improved sanitation facility	277 (26.3)
Households using clean fuel for cooking	195 (18.6)
Source of Drinking water	
Piped into dwelling	35 (3.4)
Piped into yard/ plot	60 (5.7)
Piped to neighbour	4 (0.4)
Public tap/ standpipe	176 (16.7)
Tubewell or borehole	686 (65.1)
Protected well	8 (0.8)
Unprotected well	23 (2.2)
Protected spring	7 (0.7)
Unprotected spring	42 (4)
Surface water (river/ dam/ lake/ pond/ stream/ canal/ irrigation channel)	13 (1.3)
Type of toilets	
Flush to piped sewer system	1 (0.1)
Flush to septic tank	24 (2.3)
Flush to pit latrine	109 (10.4)
Flush to somewhere else	6 (0.6)
Flush to don't know where	2 (0.2)
Ventilated improved single pit/ biogas latrine	100 (9.5)
Single pit latrine with slab	17 (1.7)
Single pit latrine without slab/ open pit	12 (1.2)
Twin pit/ composting toilet	6 (0.6)
No facility/ uses open space or field	777 (73.8)
Cooking fuel used for cooking	
LPG/ Natural Gas	154 (14.7)
Biogas	41 (3.9)
Coal/ lignite	1 (0.1)
Wood	854 (81.1)
Dung cakes	3 (0.3)
No food cooked in household	1 (0.1)
Total number of households	1054

Annex Table 3: Type of Ration card of respondents

Variables			N (%) (un-weighted averages)
Ration Card			
Yes			1054 (100.0%)
Type of Ration Card (If use)			
PHH			963 (91.4)
AAY			91 (8.7)
Commodities	Entitled Quantity (kgs/month) Average	Quantity received (kgs/month) Average	Amount paid (INR/month) Average
Rice	21.3 Kg	20.5 Kg	15.9
Wheat	6.5 Kg	6.5 Kg	6.3
Pulses	-	-	-
Others (Specify)			

Annex Table 4: Health profile of the respondents

Indicators	N (%) (unweighted averages)
Households having mosquito nets	898 (85.2)
Households using mosquito nets	557 (52.8)
Have any member with Thalassemia	1(0.1)
Have any member with sickle cell disease	2(0.2)
Had diarrhea (among children - 6m-59months)	44 (11.2)

Annex Table 5: Awareness of iron-fortified rice among primary caregiver of Household

Categories	N (%) N=1045 (unweighted averages)
Knowledge about meaning of +F logo	
Fortified rice	16 (1.5)
Others	-
Don't Know	1038 (98.5)
Knowledge about benefits of fortified rice	
None	852 (80.8)
Completes nutritional requirement	64 (6.1)
Good source of micronutrients	16 (1.5)
Reduces or prevents anaemia	15 (1.4)
Don't Know	134 (12.7)

Categories	N (%) N=1045 (unweighted averages)
Heard about 'Vitamin Yukta Chawal'	
No	576 (54.6)
Yes, from	96 (9.1)
<i>television</i>	13 (1.2)
<i>radio</i>	
<i>community announcements</i>	2 (0.2)
<i>family/friends/neighbors</i>	53 (5.0)
<i>ASHA/Anganwadi worker</i>	28 (2.7)
<i>Fair Price Shop</i>	13 (1.2)
Others	20 (1.9)
Don't know	382 (36.2)
Awareness about +F logo on PDS rice bags	
Yes	39 (3.7)
No	1015 (96.3)

Annex Table 6: Acceptability of iron-fortified rice as reported by primary household caregiver

Response	Taste (%)	Smell N (%)	Texture N (%)	Color N (%)	Appearance N (%)
Very bad	3 (0.3)	2 (0.2)	-	-	-
Bad	23 (2.2)	35 (3.4)	15 (1.5)	6 (0.6)	5 (0.5)
Not good or bad	128 (12.2)	193 (18.4)	137 (13)	160 (15.2)	149 (14.2)
Good	680 (64.6)	621 (59)	652 (61.9)	621 (59)	625 (59.3)
Very Good	220 (20.9)	203 (19.3)	250 (23.8)	267 (25.4)	275 (26.1)

*(unweighted averages)

Annex Table 7: Consumption of iron-fortified rice by Households

Categories	Response* N=1045
Frequency of Consumption of fortified rice	
	N (%)
Everyday	485 (46.1)
5-6 times/week	167 (15.9)
3-4 times/week	334 (31.7)
1-2 times/week	65 (6.2)
Don't know	3 (0.3)
Average frequency of consumption per week (days, mean, SD)	5.3, 1.8
Frequency of Consumption of unfortified rice	
Everyday	148 (14.1)
5-6 times/week	60 (5.7)

Categories	Response* N=1045)
3-4 times/week	287 (27.3)
1-2 times/week	98 (9.3)
0 days/week	461 (43.8)
Average frequency of consumption per week (days, mean, SD)	2.4,2.5
Cooking pattern	
Cooking in watertight container without previous washing	2 (0.2)
Cooking in watertight container with previous washing	1 (0.1)
Cooking in open vessel without previous washing	13 (1.3)
Cooking in open vessel with previous washing	1031 (97.9)
Cooking in open vessel with previous washing and soaking	7 (0.7)

(*unweighted averages)

Annex Table 8: Association of Acceptability of iron-fortified rice among primary caregiver of on consumption frequency

Acceptability variables	Frequency of consumption*
	Mean (SD)
Taste	
Very bad	7 (0)
Bad	4.7 (2.1)
Not good or bad	5 (1.8)
Good	5.4 (1.8)
Very Good	5.5 (1.7)
Smell	
Very bad	7 (0)
Bad	5 (2)
Not good or bad	5.1 (1.7)
Good	5.4 (1.9)
Very Good	5.4 (1.8)
Texture	
Very bad	0 (0)
Bad	4.3 (2.1)
Not good or bad	5 (1.7)
Good	5.3 (1.9)
Very Good	5.6 (1.8)
Color	
Very bad	0 (0)
Bad	4.5 (3.1)
Not good or bad	5 (1.6)
Good	5.3 (1.9)
Very Good	5.6 (1.8)

Acceptability variables	Frequency of consumption*
	Mean (SD)
Appearance	
Very bad	0 (0)
Bad	3.2 (2.6)
Not good or bad	4.8 (1.5)
Good	5.3 (1.9)
Very Good	5.7 (1.8)

(*unweighted averages)

Annex Table 9: Decision making in the household level.

Questions	Response, N (%)*	
	Agree	Disagree
Women should consume more varieties and quantity of food during their pregnancy	1023 (97.1)	31 (2.9)
Woman should not eat too much during pregnancy to avoid difficulties during delivery	534 (50.6)	520 (49.4)
Women should avoid certain kinds of food during pregnancy like meat, fish, papaya, or jackfruit	368 (34.9)	686 (65.1)

(*unweighted averages)

Annex Table 10: Frequency of consumption of different dietary types among children (6-23months)

Age categories (in months)	Consumed iron rich foods in last 24 hrs	
	Baseline* N= N (%)	Endline N=N (%)
6 to 8	6 (6.7)	2 (12.5)
9 to 11	7 (49.9)	8 (42.2)
12 to 17	15 (48.8)	17 (37)
18 to 23	17 (55.7)	30 (66.7)
24 to 35	NA	60 (62.5)
Total	46 (45.7)	223 (56.8)
IYCF indicators on dietary diversity & (WHO, 2021)		
Consumed diet with minimum dietary diversity (MDD) in last 24hr	NA	20 (15.9)
Consumed minimum acceptable diet (MAD) in last 24 hrs	NA	9 (7.2)
Total number of children 6-23 months		126

*based on NFHS-5 (2019-21) data (unweighted averages)

Annex Table 11: Frequency of consumption of food from Anganwadi for Children (6-59 months)

Variables	Response* N (%) (N=1054)
Frequency of receiving take-home ration (6-36m)	
Not at all	1 (0.5)
daily	5 (2.3)

Variables	Response* N (%) (N=1054)
once a week	4 (1.9)
once a month	178 (80.2)
Less often	4 (1.9)
Frequency of consumption of take-home ration among those receiving it (N=)	
Not at all	13 (5.9)
Daily	97 (43.7)
Once a week	21 (9.5)
Once a month	44 (19.9)
Less often	16 (7.3)
Don't know	1 (0.5)
Mean quantity of take-home ration, (in kgs) mean (SD)	5.6, (24.0)
Frequency of receiving hot cooked meals from AWC (children 3-6 yrs.) N=115	
Not at all	4 (2.9)
daily	102 (72.4)
once a week	4 (2.9)
once a month	2 (1.5)
Less often	3 (2.2)
Frequency of consumption of hot cooked meals from AWC, among those receiving it (N=111)	
Not at all	2 (1.5)
daily	106 (75.2)
once a week	3 (2.2)
once a month	0 (0)

(*unweighted averages)

Annex Table 12: Consumption pattern of Mid-Day Meal (MDM) among children aged 6-14 yrs

Variables	Response N (%)*					
Total number of children of age 6-14 years	605					
Type of school						
Government	563 (93.1)					
Private	14 (2.3)					
Don't go to school	28 (4.6)					
Children who consumed mid-day meal in last 12 months	533 (94.7)					
Type of MDM received						
Dry ration	1 (0.2)					
Hot cooked Meal	532 (99.8)					
Food items in MDM	Frequency of consumption (%)					
	Never	Daily	Weekly	Monthly	Occasionally	Don't know
Rice (N=533)	13 (2.4)	519 (97.4)	1(0.2)	-	-	-
Roti (N=1)	-	-	1(100.0)	-	-	-
Pulses (N=533)	5(0.9)	391(73.4)	133(25.0)	-	2(0.4)	-
Vegetables (N=470)	2 (0.4)	290 (61.7)	168 (35.7)	1 (0.2)	9 (1.9)	-
Milletts (Mandya, Suan, Proso) (N=533)	342 (64.2)	12 (2.3)	9 (1.7)	1(0.2)	3 (0.6)	166 (31.1)

(*unweighted averages)

Annex Table 13: Frequency of consumption of Iron Rich Food among all Women (15-49 years)

Type of food	Frequency of consumption (%)							
	Never		Daily		Weekly		Occasionally	
	Baseline N=443	Endline * N=993	Baseline N=443	Endline * N=993	Baseline N=443	Endline * N=993	Baseline N=443	Endline * N=993
Vitamin Yukt Chawal/PDS Rice		0.3		88.7		8.9		2.1
Pulses or beans	0.5	0.1	68.1	47.4	27.3	28.7	4.1	23.8
Dark green leafy vegetables	-	0.1	83.8	54.8	11.6	16.4	4.6	28.7
Eggs	9.4	0.5	1.4	1.4	64.3	45.6	24.9	52.5
Fish	6.5	0.3	1.2	2.8	54.9	43.2	37.4	53.7
Chicken or meat	11.4	0.7	0.6	0.9	43.0	40.7	45.0	57.7
Milk or curd		35.0		1.2		12.0		51.8
Fruits		6.4		0.4		10.4		82.8
Fried foods		5.2		0.5		16.6		77.6
Aerated drinks		18.2		0.8		8.0		73.0
Millets		31.0		24.8		6.0		38.2

(*unweighted averages)

Annex Table 14: ICDS by women during pregnancy by Anganwadi during last one year

Variables	Response* N (%) (N=81)
Received Supplementary Nutrition from Anganwadi during pregnancy	
Not at all	2 (2.5)
daily	1 (1.3)
once a week	4 (5)
once a month	72 (88.9)
Less often	2 (2.5)
Others	-
Consumed Supplementary Food from Anganwadi during pregnancy	
Not at all	
daily	28 (35.5)
once a week	7 (8.9)
once a month	37 (46.9)
Less often	7 (8.9)

(*unweighted averages)

Annex Table 15: Food received by lactating mothers from AWC (N=39) in the Endline assessment

Variables	Response* N (%)
Received Supplementary Food from Anganwadi	
Not at all	10 (25.6)
Cooked meal	1 (2.6)
THR/dry ration	29 (74.4)
Mean quantity of take-home ration, (in kgs) mean (SD) among those received it (N=29)	2.3 (0.6)
Frequency of receiving take-home ration	
once a month	29 (100.0)

(*unweighted averages)

Annex Table 16: Frequency of consumption of Iron Rich Food among Men (15-49 years)

Type of food	Frequency of consumption (%)							
	Never		Daily		Weekly		Occasionally	
	Baseline N=49	Endline* N=645	Baseline N=49	Endline * N=645	Baseline N=49	Endline * N=645	Baseline N=49	Endline * N=645
Vitamin Yukt Chawal/PDS Rice		0.5		88.2		8.8		2.5
Pulses or beans	-	0.9	49.3	48.5	46.8	27.4	4.0	24.0
Dark green leafy vegetables	-	0.8	75.2	54.6	23.1	15.7	1.7	29.0
Eggs	2.5	0.2	0.8	1.2	84.4	43.1	12.4	55.5
Fish	1.6	0.3	0.8	1.7	70.9	39.5	26.7	58.4
Chicken or meat	1.7	0.9	-	1.1	48.7	38.9	49.7	59.1
Milk or curd		36.9		0.9		10.7		51.5
Fruits		5.4		1.2		10.1		83.3
Fried foods		6.0		0.5		16.4		77.1
Aerated drinks		16.1		0.2		9.9		73.8
Millet		31.9		25.4		8.1		34.6

(*unweighted averages)

Annex Table 17: IFA syrup/tablet by various target groups

	Girls N (%)	Boys N (%)	Total N (%)
children 6-69 m received IFA syrup in last 7 days (N-393)	41 (22.5)	46 (21.8)	87 (22.1)
Children 6-14 years received IFA tablet once a week (N-533)			67 (12.6)
Adolescents 15-19 received IFA tablet once a week	14 (8.0)	10 (5.6)	24 (6.8)
Women of reproductive age group receiving IFA tablet once a week		92 (9.3)	
Men (20-49 yrs.) receiving IFA tablet once a week		49 (5.3)	

(*unweighted averages)

Annex Table 18: IFA syrup/tablet among Pregnant women

	Baseline N (%)	Endline* N (%)
		N=28
Pregnant women received IFA tablets in last seven days	N.A	11 (39.3)
Pregnant women who received deworming	N.A	11 (39.3)

(*unweighted averages)

Annex Table 19: Deworming by various target groups

	Girls* N (%)	Boys* N (%)	Total* N (%)
children 6-59 m received deworming tablet in last 6 months (N-393)	94 (44.5)	70 (38.5)	164 (41.7)
Children 6-14 years received deworming tablet in last 6 months (N-533)	39	40	213 (40.0)
Adolescents 15-19 received deworming tablet in last 6 months (N-355)	23 (13.1)	14 (7.8)	37 (10.4)
Women of reproductive age group deworming tablet in last 6 months (N-993)		108 (10.9)	

(*unweighted averages)

Annex Table 20: Prevalence of anaemia in target groups

Demographic groups	Prevalence of Anaemia (%) [% , 95% CI]		Hemoglobin (g/dL) mean (± SD)	
	Baseline	Endline*	Baseline	Endline*
Children 6-59 months (<11.0g/dl)	77.1	73.8	NA	9.9 (± 1.4)
Adolescent girls 15-19 yrs (<11.0 g/dl)		74.2	NA	11.6 (± 1.8)
Non-pregnant women 15-49yr (<12.0g/dl)	71.8	65.7	NA	11.0 (± 1.5)
Pregnant women 15-49yr (<11.0g/dl)	74.3	64.1	NA	10.1 (± 2.2)
Men 15-49yr (<13.0 g/dl)	42.3	50.1	NA	12.6 (± 1.5)

(*based on the weighted sample)

Annex Table 21: Severity of anaemia in children (6-59 months) by sex in baseline vs endline assessment

Severity of Anaemia	Boys (%)		Girls (%)		Total (%)	
	Baseline	Endline*	Baseline	Endline*	Baseline	Endline*
	N=	N=196	N=	N=162	N=	N=358
Mild (10.0-10.9 g/dl)	35.7	28.6	38.4	26.5	37.7	27.7
Moderate (7.0-9.9 g/dl)	38.5	44.9	38.1	45.7	38.3	45.3
Severe (<7.0 g/dl)	2.3	2.0	1.3	2.5	1.8	2.2
Total (<11.0g/dl)	76.5	75.5	77.7	74.7	77.1	75.1

(*based on the weighted sample)

Annex Table 22: Severity of anaemia in adolescents (15-19 yrs) by sex

Severity of Anaemia	Boys (%)		Girls (%)		Total (%)	
	Baseline	Endline*	Baseline	Endline*	Baseline	Endline*
	N=	N=113	N=	N=138	N=	N=251
Mild Anaemia	NA	20.9	NA	24.6	NA	22.9
Moderate Anaemia	NA	33.4	NA	46.9	NA	40.7
Severe Anaemia	NA	2.2	NA	2.7	NA	2.4
Any Anaemia	NA	56.6	NA	74.2	NA	66.1

The classification for severity is gender specific based on NFHS. | (*based on the weighted sample)

Annex Table 23: Severity of anaemia in Women (15-49 yrs) by maternity status

Severity of Anaemia	All Women (%)		Non-Pregnant Women (%)		Pregnant Women# (%)	
	Baseline	Endline*	Baseline	Endline*	Baseline	Endline*
	N=385	N=1095	N=N.A.	N=1067	N=N.A.	N=28
No Anaemia (<12.0g/dl)*	28.0	34.4	57.7	30.4		25.0
Mild (11.0-11.9 g/dl)*	28.6	22.9	35.2	24.4		10.7
Moderate (8.0-10.9 g/dl)*	41.4	40.5	7.1	42.9		42.9
Severe (<8.0 g/dl)*	2.1	2.3	-	2.3		21.4
Total anaemia (<12.0 g/dl)*	72.0	65.7	42.3	69.6	74.3	75.0

Estimates are based on NFHS-5 (2019-21) data #For Pregnant Women, No Anaemia is calculated for Hb>= 11g/dl; Mild Anaemia for Hb=10-10.9g/dl; Moderate Anaemia for Hb = 7-9.9 g/dl and Severe anaemia for Hb <7g/dl

(* estimates based on the weighted sample)

Annex Table 24: Severity of anaemia in Men (15-49 yrs)

Severity of Anaemia	Men (%)	
	Baseline	Endline*
	N=51	N=645
No Anaemia (>13.0 g/dl)	57.7	49.9
Mild (11.0-12.9 g/dl)	35.2	26.7
Moderate (8.0-10.9 g/dl)	7.1	22.0
Severe (<8.0g/dl)	-	1.3
Total anaemia (<13.0g/dl)	42.3	50.1

(* estimates based on the weighted sample)

Annex Table 25: Prevalence of anaemia in target groups by type of ration cards

Ration cards type	Prevalence of Anaemia*											
	Children (6-59 mo) (<11.0g/dl)		Adolescent girls (15-19 yr) (<11.0g/dl)		Adolescent boys (15-19 yr) (<11.0g/dl)		Pregnant women (15-49 yr) (<11.0g/dl)		Non-Pregnant women (15-49 yr) (<12.0g/dl)		Men (15-49yr) (<13.0 g/dl)	
	Endline		Endline		Endline		Endline		Endline		Endline	
	N=358		N=138		N=113		N=28		N=929		N=645	
PHH	74.1		76.8		55.1		64.1		66.9		51.7	74.1
AYY	71.2		37.1		67.3		0.0		54.7		34.3	71.2

(* estimates based on the weighted sample)

Annex Table 26: Prevalence of anaemia in target groups by demographic categories

Variables	Prevalence of Anaemia (estimates as per weighted sample)					
	Children (6-59 mo) (<11.0g/dl)	Adolescent girls (15-19 yr) (<11.0g/dl)	Adolescent boys (15-19 yr) (<11.0g/dl)	Pregnant women (15-49 yr) (<11.0g/dl)	Non-Pregnant women (15-49 yr) (<12.0g/dl)	Men (15-49yr) (<13.0 g/dl)
	Endline	Endline	Endline	Endline	Endline	Endline
	N=358	N=138	N=113	N=28	N=929	N=645
Caste						
Scheduled Caste	80.3	77.9	49.7	70.3	68.3	62.1
Scheduled Tribe	70.6	72.7	54.3	59.8	66.2	48.4
Other Castes (OBC, General)	87.2	74.8	73.9	72.4	60.8	47.5
Religion						
Hindu	73.8	73.6	56.9	63.1	65.5	49.9
Others	100	100	0	100	93.6	74.7
Improved Sanitation facility						
Improved	74.5	64.9	37.2	45.9	52.7*	44.4
Un-improved	69.8	78.4	62.2	71.6	70.2	52.5
Improved Source of drinking water						
Yes	74.5	75.6	56.2	68.3	65.2	49.9
No	69.8	59.8	66.9	0	70.3	52.6
Household used clean fuel for cooking						

Variables	Prevalence of Anaemia (estimates as per weighted sample)					
	Children (6-59 mo) (<11.0g/dl)	Adolescent girls (15-19 yr) (<11.0g/dl)	Adolescent boys (15-19 yr) (<11.0g/dl)	Pregnant women (15-49 yr) (<11.0g/dl)	Non-Pregnant women (15-49 yr) (<12.0g/dl)	Men (15-49yr) (<13.0 g/dl)
	Endline	Endline	Endline	Endline	Endline	Endline
	N=358	N=138	N=113	N=28	N=929	N=645
Yes	73.7	70.8	37.8	93.5	54.6	49
No	73.9	75.1	59.8	57.7	68.3	50.4
Household having insecticide treated mosquito nets						
Yes	71.5	65.4	57.9	58.2	60.8*	38.5*
No	77.3	82.7	54.7	69.6	71.1	63.6
Used net last night						
Yes	71.6	73.5	51.3	65.3	64.7	45.2*
No	84.5	76.8	77.4	56.3	69.7	69.4

*found to be statistically significant.

Annexure II: Research Tool

PILOT SCHEME ON FORTIFICATION OF RICE AND ITS DISTRIBUTION UNDER PUBLIC DISTRIBUTION SYSTEM IN THE MALKANGIRI DISTRICT OF ODISHA

Household Structured Interview Schedule for Target Beneficiaries

Informed Consent

Introduction: Hello, my name is _____ and I represent **TRIOs Development Support Private Limited**, a research organization in India. We are conducting a survey on behalf of the United Nations World Food Programme. As part of the survey, we would like to ask you questions about the consumption of fortified rice, eating habits, and other food consumption related information for the household. During the interview we will also collect blood samples to calculate haemoglobin level of adult women, men, adolescents, and children below 5 years. There will be no cost to you for participating in the survey other than your time, and your participation is completely voluntary.

Purpose: The purpose of this study is to understand the benefits received and challenges as part of the government programme on distributing iron fortified rice to eligible households. The survey is being undertaken in the entire district of Malkangiri, Odisha, covering more than 600 households. I request you to kindly allow me to ask you a few questions.

Selection of respondents: The selection of respondents is done through random sampling from a list of households sourced through the government ration card records. All households with a valid ration card are eligible for the survey and your house was randomly chosen through the sampling exercise.

Procedure: The respondent will be the primary care giver of the household. The interview and collection of blood samples for haemoglobin testing will take approximately 45-60 minutes. I would like to ask you some questions pertaining to the household background information, about the children- eating habits and sickness status, and your knowledge, attitude and practices around access and use of fortified rice in your daily diet which you receive from the fair price shops.

Haemoglobin testing: For the haemoglobin testing, we will need a few drops of blood from a finger. The equipment used to take the blood is clean and completely safe. It has never been used before and will be thrown away after each test. The blood will be tested for anaemia immediately, and the result will be told to you right away. The result will be kept strictly confidential and will not be shared with anyone other than members of our survey team.

Risks and benefits: There are no risk in the survey. You would be referenced in relation to a unique code. You will not benefit directly from participation in this study. We hope that the information we learn from this study will help us in improving the existing government programme on rice fortification and benefit the health and wellbeing of your household.

Voluntary participation: Participation in this survey is voluntary, and you are free to refuse to participate. If you agree to participate, you can decide to withdraw from the survey at any time. There will be no consequences for withdrawal at any stage.

Confidentiality: Your answers will be kept completely confidential and will be used for research purpose only. You do not have to answer questions that you do not want to answer. However, we seek your cooperation in providing complete information.

Backcheck/ Follow-up: If backchecks or follow-up calls are required, consent will be taken again. The backchecks will be conducted by the same person or another person who is a representative of **TRIOs Development Support Private Limited** with required identification and would be conducted on the same day. For follow up calls we would require your contact number. This contact information will be used only for following up on this survey. Do you agree to share your contact number with us?

Yes No.....

Compensation: You will not receive any compensation for participating in this survey.

Contact Information: If you have any questions about this survey in future, you can call <Name of the representative from survey agency> at +91 (11) 4163 9918 or in case of any ethical concerns please contact < Mr. Satyendra Kumar > at <+91 (11) 4163 9918>.

At this time, do you have any question that you would like to ask me about this survey interview?

If no, then I would like to receive your consent on your participation in this survey before I proceed further.

1. Respondent agreed []

2. Respondent Disagreed []

SECTION 1: GENERAL INFORMATION

Note: To be filled by the enumerator.

Question No.	Question	Response code	Skips/ Remarks
101	Investigator identification code	<Select from list>	
102	Name of the block	<Select from list>	
103	Type of area	1 = Rural 2 = Urban	If 1, Skip 105 If 2, Skip 104
104	Name of village	<Select from list>	
105	Name of urban block/ ward	<Select from list>	
106	House listing number		
107	Does the household have a ration card?	1 = Yes 2 = No	If the household does not have a ration card, then end interview
108	TYPE OF RESPONDENT	1 = Women (20-49 years) 2 = Men (20-49 years) 3 = Adolescent girl/ boy (15-19 years) 4 = Children (6-59 months)	If the household does not have any of these eligible respondents, then end interview
109	Date of interview	DD/ MM/ YYYY	
110	Record time at the beginning of the interview	__ hours __ minutes	

SECTION 3: HAEMOGLOBIN MEASURE

Note: Using HemoCue HB 201+ analyser, collect blood samples to measure the haemoglobin level for the following respondents – women (20-49 years), men (20-49 years), adolescents (15-19 years), children (6-59 months) in selected household

- a) In case there are more than one person in each category of respondents, then select the youngest of them i.e. youngest women in age group 20-49 yrs., youngest men in age group 20-49 yrs., youngest adolescent boy in age group 15-19 yrs, youngest adolescent girl in age group 15-19 yrs., and youngest child in age group 6-59 months.
- b) Refer to Annexure IV for steps involved in haemoglobin measurement.
 - c.1 Inform the respondent of his/her haemoglobin level and provide an informational brochure on anaemia (Annexure-A and B).
 - c.2 Please provide referral form (Annexure C) for all respondents detected with severe anaemia.

301	302 (If 2, skip to 401)	303	304	305
Member unique ID (Auto coded from 201)	Consent provided? (CODE)	Haemoglobin level (in G/DL)	Is the respondent suffering from Thalassemia?	Is the respondent suffering from sickle cell disease?
	1 = Yes 2 = No	_ _ _ . _ _ g/Dl	1 = Yes 2 = No 98 = Don't know	1 = Yes 2 = No 98 = Don't know
	1 = Yes 2 = No	_ _ _ . _ _ g/Dl	1 = Yes 2 = No 98 = Don't know	1 = Yes 2 = No 98 = Don't know
	1 = Yes 2 = No	_ _ _ . _ _ g/Dl	1 = Yes 2 = No 98 = Don't know	1 = Yes 2 = No 98 = Don't know
	1 = Yes 2 = No	_ _ _ . _ _ g/Dl	1 = Yes 2 = No 98 = Don't know	1 = Yes 2 = No 98 = Don't know

Code for 302: 1 = Yes, 2 = No

Note: Explain Thalassemia and Sickle Cell disease and probe the respondents on whether any of the household members, including those selected for haemoglobin test, have ever been diagnosed for these conditions.

SECTION 4: HOUSEHOLD CHARACTERISTICS

Note: To be responded by the primary care giver of the household.


Question No.	Question	Response code	Skips/ Remarks
400	Total number of household members	<Autofill from 201>	
401	Social category of the household?	1 = Scheduled Caste 2 = Scheduled Tribe 3 = Other Backward Classes 4 = General 88 = Others (Specify) 98 = Don't know	
402	Religion of the household?	1 = Hindu 2 = Muslim 3 = Christian 88 = Others (Specify) 98 = Don't know	

Question No.	Question	Response code	Skips/ Remarks
403	What is the main source of drinking water for members of your household?	1 = Piped into dwelling 2 = Piped into yard/ plot 3 = Piped to neighbour 4 = Public tap/ standpipe 5 = Tubewell or borehole 6 = Protected well 7 = Unprotected well 8 = Protected spring 9 = Unprotected spring 10 = Rainwater 11 = Tanker truck 12 = Cart with small tank 13 = Surface water (river/ dam/ lake/ pond/ stream/ canal/ irrigation channel) 14 = Bottled water 15 = Community RO plant 88 = Others (Specify)	
404	What kind of toilet facility do members of your household usually use?	1 = Flush to piped sewer system 2 = Flush to septic tank 3 = Flush to pit latrine 4 = Flush to somewhere else 5 = Flush to don't know where 6 = Ventilated improved single pit/ biogas latrine 7 = Single pit latrine with slab 8 = Single pit latrine without slab/ open pit 9 = Twin pit/ composting toilet 10 = Dry toilet 11 = No facility/ uses open space or field 88 = Others (Specify)	
405	What type of fuel does your household mainly use for cooking?	1 = Electricity 2 = LPG/ Natural Gas 3 = Biogas 4 = Kerosene 5 = Coal/ lignite 6 = Charcoal 7 = Wood 8 = Straw/ shrubs/ grass 9 = Agricultural crop waste 10 = Dung cakes 11 = No food cooked in household 88 = Others (Specify)	
406	Does your household have any mosquito nets?	1 = Yes 2 = No	If No, then skip to net section
407	Are the nets insecticide-treated for mosquitos?	1 = Yes 2 = No 98 = Don't know	
408	Did household members sleep under the mosquito nets last night?	1 = Yes 2 = No	If yes, skip to next section
409	What was the main reason this net was not used last night? Multiple response	1 = Too hot to sleep inside the net 2 = Don't like the net shape/ color/ size 3 = Don't like the smell 4 = Unable to hang net 5 = Slept outdoors 6 = Usual user didn't sleep here last night 7 = No mosquitos 8 = Saving the net for later 88 = Others (Specify)	

SECTION 5: DETAILS OF FORTIFIED RICE RECEIVED UNDER PUBLIC DISTRIBUTION SYSTEM

a) To be responded by the primary care giver of the household.

b) **Note:** If the respondent is unaware about fortified rice, replace the term with “PDS rice” or “Vitamin Yukta Chawal”.

Question No.	Question		Response code			Skips/ Remarks
501	Type of ration card owned by the household.		1 = Priority Household (PHH) card 2 = Antyodaya Anna Yojana (AAY) card 3 = Annapurna Yojana card 4 = State ration card 88 = Others (Specify) 98 = Don't know/ Card not available			
502	Please tell us about the food and other commodities that your household received from the fair price shop and purchased from the market in the most recent visit?					
	Name of commodity	Quantity you are entitled to receive per month from FPS (in kgs, 99999 for Don't know)	Quantity you purchased in your last monthly visit to FPS (in kgs, 99999 for Don't know)	Price paid to FPS for the purchase (in INR, 99999 for Don't know)	Quantity purchased from market in last month (in kgs, 99999 for Don't know)	Price paid in the market for the purchase in last month (in INR, 99999 for Don't know)
502.1	Rice					
502.2	Wheat					
502.3	Pulses					
502.88	Others (Specify)					
503	Are you aware about the scheme on supply of iron fortified rice by FPS under the Public Distribution System?		1 = Yes 2 = No			
504	How can you identify fortified rice? Multiple response		1 = Bag has +F logo 2 = Fortified rice looks different 3 = Fortified rice has a different colour 4 = Fortified rice has a different taste 88 = Others (Specify) 98 = Don't know			
504.1	Are you aware about the +F logo on PDS rice bags? (Interviewer/enumerator to show logo below) 		1 = Yes 2 = No			
504.2	What does the +F logo stand on PDS rice bags stand for?		1 = Fortified rice 88 = Others (Specify) 98 = Don't know			
505	What are the benefits of consuming fortified rice? Multiple response		1 = None 2 = Completes nutritional requirement 3 = Good source of micronutrients 4 = Reduces or prevents anaemia 88 = Others (Specify)			
506	When you visit the FPS to collect ration for your household, do you see any messages displayed there about the fortified rice?		1 = Yes 2 = No			

Question No.	Question	Response code	Skips/ Remarks
507	Have you heard about fortified rice/"Vitamin Yukta Chawal" from any other sources? Multiple response	1 = No 2 = Yes, television 3 = Yes, radio 4 = Yes, community announcements/ miking 5 = Yes, newspaper 6 = Yes, family members/ friends/ neighbours 7 = Yes, ASHA/ Anganwadi worker 8 = Yes, Fair Price Shop 88 = Others (Specify) 98 = Don't know	
508	How many days in a week do household members consume fortified rice ("PDS rice") in the household?	___ number of days	Enter 7 if every day; Enter 98 if don't know
509	How many days in a week do household members consume unfortified rice (bought from the market)?	___ number of days	Enter 7 if every day; Enter 98 if don't know
510	How do you cook fortified rice ²⁴ ?	1 = Cooking rice in watertight container without previous washing 2 = Cooking rice in watertight container with previous washing 3 = Cooking rice in open vessel without previous washing 4 = Cooking rice in open vessel with previous washing 5 = Cooking rice in open vessel with previous washing and soaking 88 = Others (Specify)	
511	I would like to understand about the following aspects of fortified rice. Please give your responses on a scale of 1 to 5, where 1 is very bad, and 5 is very good²⁵.		To be asked if Q508>=1
511.1	Taste	1 = Very bad 2 3 4 5 = Very good	
511.2	Smell	1 = Very bad 2 3 4 5 = Very good	
511.3	Texture	1 = Very bad 2 3 4 5 = Very good	
511.4	Colour	1 = Very bad 2 3 4 5 = Very good	
511.5	Appearance	1 = Very bad 2 3 4 5 = Very good	

24 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8117164/>

25 <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0222903>

SECTION 6: DETAILS OF OTHER FOOD CONSUMED FROM OTHER SOURCES

6.1 Food from Anganwadi for lactating mother

Note for enumerator:

- a) The section 6.1 needs to be asked to primary care giver of children <1 yr. old
- b) If no children <1 yr old in household, then skip to next section 6.2 i.e Q 610
- c) If more than 1 infant is present, select the younger infant.

Filter question: 601-609 to be asked if household has any children <1 yr. based on Household Roster (Q205)

Yes → 1 (Continue for 601-609)

No → 2 (Skip to 610)

Question No.	Question	Response code	Skips/ Remarks
601	Respondent household ID	<Auto fill from Q201>	If no, skip to Q609
602	Age of child	<Auto fill from 205>	
603	Now can you please tell me, when the mother was pregnant, did she consume Iron Folic Acid (IFA) tablets or syrup?	1 = Yes 2 = No	
604	During the whole pregnancy, for how many days did the female member take the tablet or syrup?	_____ number of days (9998 if don't know)	
605	Why do you think a pregnant or a lactating woman should consume IFA tablets or syrup? Multiple response	1 = To reduce the risk of anaemia for pregnant women 2 = To reduce risk of anaemia for the child inside womb 3 = To reduce the risk of low birth weight 4 = To help improve child's intelligence 5 = To reduce risk of death from excessive blood loss during and after delivery 6 = To make mother healthy/strong 88 = Others (Specify) 98 = Don't know	
606	During the whole pregnancy, did you consume any drug for intestinal worms (say deworming/albendazole tablet)?	1 = Yes 2 = No 98 = Don't know	
607	During the whole pregnancy, did the female member receive supplementary food from the Anganwadi centre?	1 = Not at all 2 = Yes, almost daily 3 = Yes, at least once a week 4 = Yes, at least once a month 5 = Less often 88 = Others (Specify)	
608	During the whole pregnancy, how often did the mother consume Supplementary food from the Anganwadi centre?		To be asked if 607>1
Filter question: Ask Q 609- in case age of infant is less than 6 months.			
Yes → 1 (Continue for 609)			
No → 2 (Skip to 610)			
609	Are you availing any supplementary food from AWC for yourself i.e. for lactating mother, currently?	1=Cooked Meal 2=THR / Dry ration 3=No 4= others, specify 5=Don't know	If 3,4 → Skip to

Question No.	Question	Response code	Skips/ Remarks
609.1	If receiving cooked Meal of any type for yourself, what is the frequency?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 609=1
609.2	How often the hot cooked meal received from anganwadi for yourself is consumed by you?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 609.1>1 and not equal to 98
		Quantity	Frequency
609.3	If receiving Take-home-ration of any type for yourself i.e. lactating mother, what is the quantity and frequency?	___ in kilograms (9998 if don't know)	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
609.4	How often is Take Home Ration provided to you, consumed by you?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 609.3>1 and not equal to 98

6.2 Details of food consumed - from school

Note for enumerator:

- To be asked to primary care giver for details regarding school going children in age 6-14 yrs.
- If more than 1 children in age group of 6-14 years is present in the household, then select the youngest of them for taking details from primary care giver.
- If no children in household in 6-14 years, then skip to next section i.e. Q 701.

Filter question: Q 610-616 to be asked if household has any children in age 6-14 years based on Household Roster (Q205)

If Yes → 1 (Continue for 610-616)

If No → 2 (Skip to 701)

Question No.	Question	Response code	Skips/ Remarks
610	Respondent household ID	<Auto fill from Q201>	
611	Does the child attend private or government run school?	1=Government 2=Private 3=Doesn't not go to school.	(If 2,3 skip to Q 701)
612	During the last 12 months, has any school-going child in the household consumed mid-day-meals at their school?	1 = No school-going child in the household 2 = Yes, consumed 3 = No, not consumed 98 = Don't know	If option 1, 3, or 98, skip to Q701

Question No.	Question	Response code	Skips/ Remarks
613	What is the type of mid-day-meal ²⁶ ?	1 = Cooked meal 2 = Dry ration	
614	What is the type and frequency of mid-day meals?		
	Items	Consumed	Frequency
6142.1	Rice	1 = Yes 2 = No	1 = Not at all 2 = Daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
614.2	Roti	1 = Yes 2 = No	1 = Not at all 2 = Daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
614.3	Pulses	1 = Yes 2 = No	1 = Not at all 2 = Daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
614.4	Vegetables	1 = Yes 2 = No	1 = Not at all 2 = Daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
614.5	Millets (Mandya, Suan, Proso)	1 = Yes 2 = No	1 = Not at all 2 = Daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
614.6	Others (Specify)	1 = Yes 2 = No	1 = Not at all 2 = Daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
615	What is the frequency of receiving IFA tablets at school?	1 = Not at all 2 = Daily 3 = Once a week 4 = Once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	
616	In the last 6 months was any drug for intestinal worms given to the child (from school or any other facility/ place)?	1 = Not at all 2 = Once 3 = Twice 88 = Others (Specify) 98 = Don't know	

26 <https://righttoeducation.in/sites/default/files/MDM-FINAL-REPORT.pdf>

SECTION 7: FOOD CONSUMPTION FOR CHILDREN (6-59 MONTHS)

Note for enumerator:

- This section needs to be asked to primary caregiver for children in age group 6-59 month old in the household
- If more than 1 children in age group of 6-59 month is present in the household, select the youngest of them for taking information from primary caregiver.
- If no children in household in 6-59 month, then skip to next Section i.e. Q801.

Filter question: Q 701-712 to be asked if household has any children in age 6-59 month based on Household Roster (Q205)

If Yes → 1 (Continue for 701-712)

If No → 2 (Skip to 801)

Question No.	Question	Response code	Skips/Remarks
Now I would like to ask you about liquids or foods that the child had yesterday during the day or at night. I am interested in whether your child had the item I mentioned even if it was combined with other foods.			
701	Respondent household ID	<Auto fill from Q201>	
702	Age of the child	<Auto fill from Q205>	
703	Gender of the child	<Auto fill from Q204>	
704	Haemoglobin level of the child	<Auto fill from Q306>	
705	Item	Whether consumed yesterday during day or at night?	Frequency
705.1	Plain water	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.2	Juice or juice drinks	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.3	Clear broth	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.4	Milk such as tinned, powdered, or fresh animal milk	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.5	Infant formula milk	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.6	Yogurt	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.7	Any commercially fortified baby food, e.g., Cerelac	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.8	Bread, roti, chapati, noodles, biscuits, idli, or any other foods made from grains	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.9	Vitamin yukt chawal/PDS Rice	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.10	Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.11	White potatoes, white yams, manioc, cassava, or any other foods made from roots	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.12	Dark green, leafy vegetables	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.13	Ripe mangoes, papayas, cantaloupe, or jackfruit	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.14	Other fruits or vegetables	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.15	Liver, kidney, heart, or other organ meat	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.16	Chickens, duck, or other birds	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.17	Other meat	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.18	Eggs	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.19	Fresh or dried fish or shellfish	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.20	Foods made from beans, peas, lentils, or nuts	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)

Question No.	Question	Response code	Skips/Remarks
705.21	Cheese or other food made from milk	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
705.22	Other solid, semi-solid, or soft food	1 = Yes, 2 = No, 98 = Don't know	___ no. of times (998 if don't know)
706	How many times has the child fallen sick in the last 30 days?	_____ number of times (998 for don't know)	
707	How many times has child fallen sick in the last 30 days?	_____ number of times (998 for don't know)	
708	Has child had diarrhoea in the last two weeks?	1 = Yes 2 = No	
709	In the last seven days, was child given or iron syrup/IFA syrup?	1 = Yes 2 = No Don't know=98	
710	Was child given any drug for intestinal worms in the last six months?	1 = Yes 2 = No Don't know=98	To be asked if age of selected child is 12-59 months

711	In the last 12 months, What type and quantity of food does the household member receive?			To be asked if age of selected child = 6-35 Months
	Type	Quantity	Frequency	
711.1	Take-home-ration pre-mix	___ in kilograms (9998 if don't know)	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	
711.2	Others (Specify)	___ in kilograms (9998 if don't know)	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	
711.4	How often does the Take home ration is consumed by the child		1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 711.1>1

Question No.	Question	Response	Skip
712	Does the child attend Anganwadi?	1 = Yes 2 = No	To be asked if age selected child = 36-59 months
712.1	In the last 12 months, has child received hot cooked meals from the anganwadi?	1 = Yes 2 = No	To be asked if 712=1
712.2	What is the frequency of receiving hot cooked meals from the anganwadi for the child?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 712=1
712.3	How often does the the child eat Hot cooked meal in Anganwadi?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 712.2>1

SECTION 8: FOOD CONSUMPTION FOR ADULT WOMEN, MEN, AND ADOLESCENT GIRLS AND BOYS

Note for enumerator:

- To be asked to Men (20-49 yrs), and adolescent girls (15-19 yrs) and boys (15-19 yrs) whose blood sample was taken→ask Q 801-Q 807. Repeat the section for each of the relevant respondent categories in the household.
- Ask woman (20-49 yrs.) whose blood sample was taken→ask Q 801-Q809
- In case there are more than one person in each category of respondents, then select the youngest of them i.e. youngest women in age group 20-49 yrs, youngest men in age group 20-49 yrs., youngest adolescent girl in age group 15-19 yrs and youngest adolescent girl in age group 15-19 yrs.

Filter question:

Q 801-Q807 to be asked to women (20-49 yrs), men (20-49 yrs), and adolescent girls (15-19 yrs) and boys (15-19 yrs), based on Household Roster (Q205)

- If Yes → 1 Continue for 801-807), Repeat the section for each of the relevant respondent categories present in the household.
- If No → 2 (Skip to 1201)
Q 808-Q809 to be asked only to women (20-49 yrs)

Question No.	Question	Response code	Skips/ Remarks
How often do you yourself eat the following food items: daily, weekly, occasionally, or never?			
801	Respondent household ID	<Auto fill from Q201>	
802	Age of the respondent	<Auto fill from Q205>	
803	Gender of the respondent	<Auto fill from Q204>	
804	Haemoglobin level of the respondent	<Auto fill from Q306>	
805	Item	Frequency	
805.1	Vitamin Yukt Chawal/PDS Rice	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.2	Milk or curd	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.3	Pulses or beans	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.4	Dark green leafy vegetables	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.5	Fruits	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.6	Eggs	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	

Question No.	Question	Response code	Skips/ Remarks
How often do you yourself eat the following food items: daily, weekly, occasionally, or never?			
805.7	Fish	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.8	Chicken or meat	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.9	Fried foods	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.10	Aerated drinks	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
805.11	Millets	1 = Daily 2 = Weekly 3 = Occasionally 4 = Never	
806	In the last seven days, has IFA tablets or syrup been given?	1 = Yes 2 = No	
807	Has any drug for intestinal worms been given in the last six months?	1 = Yes 2 = No	
Filter question: Q 808-Q809 to be continued only for women			
If Yes → 1 (Continue for 808-809)			
If No → 2 (Skip to 1201)			
808	Are you currently pregnant?	1=yes 2=No	To be asked to the same female (20-49 yrs.) old selected in 801 questions.
809	In the last 12 months, what type and quantity of food have you received food from the Anganwadi for yourself?		To be asked if 808=1
	Commodity	Quantity	Frequency
809.1	Take-home-ration pre-mix	___ in kilograms (9998 if don't know)	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
809.2	How often do you consume Take Home Ration ?		1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know
809.3	Others (Specify)	___ in kilograms (9998 if don't know)	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know

Question No.	Question	Response code	Skips/ Remarks
809.4	In the last 12 months, have you received hot cooked meals from the anganwadi for yourself?	1 = Yes 2 = No	
809.5	What is the frequency of receiving hot cooked meals from the anganwadi for yourself?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	
809.6	How often do you consume hot cooked meals that you get from Anganwadi for yourself?	1 = Not at all 2 = Almost daily 3 = At least once a week 4 = At least once a month 5 = Less often 88 = Others (Specify) 98 = Don't know	To be asked if 809.5>1

SECTION 9. DECISION-MAKING ON COOKING

Note: To be answered by the primary care giver.

Question No.	Question	Response code	Skips/ Remarks
1203	Do you agree or disagree with the following statements?		
1203.1	In your community, people expect women to consume more varieties and more quantity of food for their wellbeing during their pregnancy	1 = Agree 2 = Disagree	
1203.2	In your community, people expect that a woman should not eat too much during pregnancy to avoid difficulties during delivery	1 = Agree 2 = Disagree	
1203.3	In your community, people expect that women should avoid certain kinds of food during pregnancy like meat, fish, papaya, or jackfruit	1 = Agree 2 = Disagree	

9999a	Record time when the interview ends (Auto recorded)	<input type="text"/> Hours <input type="text"/> Minutes
9999b	Problems and suggestions (as reported by the respondent)	Record verbatim
9999c	Enumerator's remarks	Record verbatim

Annexure III

Ethical Approval Letter



TRIOs

**Institutional Review Board (IRB-TRIOs)
Approval Letter**

Dr Aravind Pulikkal
Principal Investigator,
TRIOs Development Support(P) Ltd
Plot No:72, First Floor, Sai Enclave
Sector:23, Dwarka, New Delhi- 110 077, INDIA

Dated: 23rd March 2023
Reference #: IRB-TRIOs 101/2023/018/I/WFP
Research Implemented by: TRIOs

Sub: IRB review for the research project- **Endline Assessment of Pilot Scheme on Rice Fortification and its Distribution under Public Distribution System in the Malkangiri District of Odisha from July 2021- November 2022**

With reference to the above referred research project and following documents submitted by you on March 01, 2023;

1. *Application form for IRB Approval*
2. *Study Protocol and Data Collection Tools*
3. *Technical Presentation*

The meeting was held on 10th March 2023 at 4.00 PM. The above documents were reviewed by the IRB members. None of the review members had any conflict of interest in the project. After thorough review and due consideration, the above application was approved by the IRB.

This approval letter is valid from the date of issue through June 30, 2023. Any change of protocols or conditions if any, without written approval of IRB would lead to cancellation of this approval.


We hereby confirm that the TRIOs Institutional Review Board formation and operations are as per the guidelines of Indian Council of Medical Research (ICMR) and it is registered with the Office for Human Research Protections (OHRP), U.S. Department of Health and Human Services (HHS) as per following details.

TRIOs Development Support Pvt Ltd (Social and Behaviour Research)
Organization Number # IORG0010506,
IRB-TRIOs Registration Number: IRB00012457
OMB No. 0990-0279

Please quote the reference number for any future correspondence regarding this approval.

Yours sincerely,


Pallavi Singh MBA
Member Secretary, IRB


Dr Padam Singh PhD
Chairman, IRB

Copy: Dr. Abhay Kumar, Head- Evidence & Results Unit, WFP India.

TRIOs Development Support (P) Ltd

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