Assessment of the Pilot Scheme on Fortification of Rice and its Distribution under the Public Distribution System in Malkangiri District of Odisha

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Baseline Report

Submitted to

Food Supplies and Consumer Welfare Department
Government of Odisha

August 2022

Acknowledgements

The assessment team is grateful to the Government of Odisha for extending all the support, including sharing data and information, to develop this baseline assessment report. We also thank them for sharing their valuable feedback on the report to finalize it. Our gratitude to WFP Deputy Country Director and the programme team for sharing their feedback and inputs, which has helped improve the report. Our special thanks to WFP Odisha team for coordinating with the state government to access data and materials for this report.

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Executive Summary

Context

1. Malnutrition (macro- and micro-nutrient deficiencies and excess) often go unnoticed and has a long-lasting consequence on the population. Globally, iron deficiency is a foremost cause of anaemia. According to the World Health Organisation, *"Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal*[1]*."* Anaemia reduces haemoglobin's capacity to carry oxygen to the body's tissue and results in fatigue, weakness, dizziness and shortness of breath.

2. Nutritional deficiencies, particularly iron deficiency, is a common factor leading to anaemia in addition to deficiencies in folate, vitamins B12 and A; haemoglobinopathies; or infectious diseases, such as malaria, tuberculosis, HIV and parasitic infections.[2]. Anaemia, identified as a serious global public health problem, affects 42.0 percent of children less than five years of age and 40.0 percent of pregnant women worldwide (WHO estimates).

3. Iron deficiency anaemia is the most common form of anaemia in Odisha. There are many biological and social factors in the state that contribute to anaemia such as, iron loss during menstruation among adolescent girls, higher iron requirements among pregnant women for foetus growth and development, societal and gender norms affecting nutritional intake and incidence of malaria. Within Odisha, the *Malkangiri district* is a dense, hilly, forested region in the southern part of the state, bordering Chhattisgarh and Andhra Pradesh. This is a tribal-dominated district, with 1,137 females per 1,000 males, and yet with a high prevalence of anaemia.

4. Food fortification is a proven complementary strategy to overcome micronutrient deficiency along with diet diversification, micronutrient supplementation, health education, and public health measures. The World Food Programme (WFP) India has undertaken several demonstration projects with the state governments of Odisha to showcase the impact, operational feasibility and cost efficiency of rice fortification on children's health and nutrition.

5. The Government of India approved the ***"Centrally Sponsored Pilot Scheme on Fortification of Rice and its Distribution through the Public Distribution System"*** from 2019-2020 for three years, to expedite India's progress towards nutrition security. This pilot scheme was a vital step to address micronutrient deficiencies, and especially anaemia, among the most vulnerable populations.

6. To address the issue of high levels of anaemia in the district, the Government of Odisha (GoO) launched the Centrally Sponsored Pilot Scheme in July 2021 to introduce fortified rice into the Targeted Public Distribution System (TPDS) in *Malkangiri* district. This district is an aspirational district with a preference for rice consumption and a high prevalence of anaemia among children and women.

7. The key objectives of the pilot scheme are to: (i) distribute fortified rice through PDS and cover all the National Food Security Act (NFSA) beneficiaries under it; (ii) evaluate the provision, coverage and utilization of fortified rice by the target population; (iii) evaluate the efficiency and effectiveness of the consumption of fortified rice in reducing the targeted micronutrient deficiencies in different age and gender groups. For implementing the pilot scheme, five components are identified. These are:

[1] https://www.who.int/health-topics/anaemia#tab=tab_1 accessed on July 27, 2022.
[2] ibid.

- **Fortification of rice in the PDS at the state level:** blending of fortified rice kernels to regular rice in the ratio of 1:100.
- **Capacity building and training of the rice millers are essential** to develop their understanding of their roles and responsibilities for mainstreaming fortified grains in the welfare schemes.
- **Information, education, and communication for the success of the pilot scheme** through developing the concept of availability of fortified rice from the government safety net programmes.
- **Quality control and Quality assurance** by the Food Safety and Standards Authority of India (FSSAI) and its food safety officers from procurement to distribution of fortified rice at fair price shops (FPS).
- **Monitoring and Evaluation is an essential component** to generate evidence by assessing the programme's quality of implementation and delivery to its target beneficiaries.

8. As per the operational guidelines, the standards of fortification per kilogram for nutrients specified by FSSAI are:

Nutrients	Level of fortification per kg
Iron - Ferric Pyrophosphate	28 mg - 42.5 mg*
Iron - Sodium Iron (III) Ethylene Diamine Tetra Acetate Trihydrate (Sodium feredetate - Na Fe EDTA)	14 mg - 21.25 mg
Folic Acid - Folic acid	75 µg - 125 µg
Vitamin B12 - Cyanocobalamine or Hydroxycobalamine	0.75 µg - 1.25 µg

9. WFP has also been providing support to the Government of Odisha to implement the Centrally Sponsored Pilot Scheme, including:

- **December 2019:** Conducted an initial assessment of 23 rice mills to gauge their capacity to produce fortified rice and then provided technical assistance for setting up the required blending equipment.
- **March 2020:** Organised a capacity-building workshop for the 27 rice millers and 12 government officials (district officials).
- **December 2020:** Participated in the Technical Advisory Group (TAG) meeting to provide inputs on the way forward in implementing the rice fortification project in the Malkangiri district.
- **February 2021:** Conducted a trial validation of the equipment installed in the rice mills and checking the quality of fortified rice produced. WFP confirmed to the government that the system was ready to produce fortified rice.
- **2021:** Supported the development of the Information, Education and Communication (IEC) materials at the national level for rice fortification, which was later translated into the Odia language for the state and district.

10. Both baseline and endline assessments are required to generate evidence and to learn from this pilot scheme. As the National Family Health Survey-5 (NFHS) coincided with the start of the pilot scheme and contained information on the biomarker (anaemia), the NFHS-5 data were analysed to develop this baseline report. To analyse the effectiveness of the pilot scheme on addressing anaemia among the TPDS beneficiaries, primary data will be collected during an endline assessment to measure any change in anaemia due to the pilot scheme.

Scope and Objectives of the Assessment

11. In Malkangiri district, the centrally sponsored pilot scheme covered seven blocks and 2 urban local bodies (ULBs) and allocated around 30,858 quintals of fortified rice (22,085.6 quintals of rice for Priority Households[3] and 8,772.4 quintals of rice for Antyodaya Anna Yojana households per month) through 117 FPS (as of July 2021). Fortified rice was also allocated through other schemes such as the State Food Security Scheme (SFSS), and Annapurna scheme.

12. There are two objectives of the baseline assessment:

- To assess anaemia levels among (i) children aged 6 to 59 months; (ii) women aged 15 to 49 years and (iii) men aged 15 to 49 years in Malkangiri district using NFHS-5-unit level data.
- To generate baseline evidence on the coverage/distribution of the rice/fortified rice through PDS and enabling factors contributing to implementing the pilot programme in the district using secondary records/government reports.

Data Sources and Time Period

13. The baseline report used data from NFHS-5 for the Malkangiri district which was collected between December 2020 to February 2021. Information was collected from 916 households, 1,080 women and 137 men. The anaemia and consumption analysis covers the following target groups: (i) children aged 6 to 59 months; (ii) women aged 15 to 49 years and (iii) men aged 15 to 49 years. The baseline also used data from other sources such as from the Food Supply and Consumer Welfare Department (FSCW), Government of Odisha; Civil Block and ULB data on beneficiaries from Supplies Office-Malkangiri district.

Target users

14. The intended users of this baseline report include the District Administration of Malkangiri; Food Supply Department of the Government of Odisha; the Department of Food and Public Distribution, Government of India; other state governments implementing the pilot scheme on rice fortification; WFP, and national and international Non- Government Organisations (NGOs) working in the rice fortification domain.

Key Findings and Conclusion

15. Based on the analysis, the baseline ***prevalence of any anaemia in children*** 6-59 months of age was 77.1 percent: 1.8 percent with severe anaemia[4], 38.3 percent with moderate and 37.0 percent with mild anaemia. The prevalence of anaemia was slightly higher in girls (77.7 percent) compared to boys (76.5 percent).

16. For women in 15-49 years age group, the ***prevalence of any anaemia*** was 72.0 percent: 2.1 percent with severe anaemia[5], 41.4 percent with moderate, and 28.6 percent with mild anaemia**.** Among men, 42.3 percent were anaemic: none had severe anaemia[6], while 7.1 percent with moderate, and 35.2 percent with mild anaemia.

[3] The 5 kg allotment of rice or wheat or the combination of both per member of the priority households varied across the blocks (e.g., some beneficiaries received 1kg rice and 4 kgs wheat, some received 2 kgs rice and 3 kgs wheat, etc.)
[4] Children 6-59 months: Severe = Hb < 7.0 g/dL, moderate = 7.0-9.9 g/dL, mild = 10.0-10.9 g/dL
[5] For all women: Severe anaemia = Hb < 8.0 g/dL, moderate anaemia = 8.0-10.9 g/dL, mild anaemia = 11.0-11.9 g/dL
[6] Anaemia in men: Severe anaemia < 9.0 g/dL, moderate anaemia = 9.0-11.9 g/dL, mild anaemia = 12.0-12.9 g/dL

Anaemia in adults by demographic group and severity – Malkangiri district

Severity	All women (15-49 years)	Men (15-49 years)
None	28.0%	57.7%
Mild	28.6%	35.2%
Moderate	41.4%	7.1%
Severe	2.1%	-
Total anaemia	***72.0%***	***42.3%***

Source: *NFHS-5 (2019-21).*

17. ***Malaria is identified as a potential contributing factor towards anaemia***. Malkangiri district was once considered as a malaria hotspot, however, there has been a substantial decline in the cases. The annual parasite incidence (API) was 13.9 in 2018 (as per the National Center for Vector Borne Diseases Control (NCVBDC) report) which has come down to 11.0 percent in 2020[7]. Another contributor to anaemia is sickle cell anaemia, affecting 10 percent of the population in Odisha and contributing to higher prevalence of anaemia in sickling positive children as compared to normal children who were sickling negative[8].

18. The ***consumption of iron-rich food*** was analysed across different demographic groups. The studies have shown that cultural and dietary norms- traditional food eating practices limit nutrition among adolescent girls and pregnant and lactating women. Food items with iron content like certain seafoods, green leafy vegetables, and meat are often restricted or avoided by pregnant and lactating women within the state[9]. The information from NFHS-5 data showed that 45.7 percent of children aged 6-23 months consumed foods rich in iron in the last 24 hours. Around 84.0 percent of women (15-49 years) daily consumed dark leafy vegetables, but hardly any reported daily consumption of eggs, fish or meat/chicken. However, weekly consumption of iron-rich foods by women was higher: 64.3 percent consumed eggs, 54.9 percent fish and 43.0 percent had weekly consumption of chicken/meat.

19. Analysis of the consumption of iron-rich food by men showed that three-fourths (75.2 percent) had daily consumption of dark green leafy vegetables, with only a few having daily consumption of eggs or fish. Weekly consumption of iron-rich foods was higher: 84.4 percent had eggs at least once in the past week, compared to 71.0 percent had fish and 48.7 percent had chicken/meat.

20. In terms of ***coverage of government schemes***, in Malkangiri district, when the scheme was launched in July 2021, 85.0 percent (0.52 million) of the National Food Security Act (NFSA) beneficiaries were covered by the scheme. Other schemes like State Food Security Scheme (SFSS) covered 0.024 million beneficiaries, MDM (currently PM POSHAN) covered 0.11 million primary and upper primary students, and ICDS covered 0.037 million children 3-6 years of age for hot cooked meals.

[7] https://www.newindianexpress.com/states/odisha/2020/nov/08/war-against-malaria-malkangiri-eyes-at-zero-cases-in-december-2220923.html accessed on August 5, 2022.

[8] T. Sahu, N.C. Sahani, S. Das, S.K. Sahu. Sickle Cell Anaemia In Tribal Children Of Gajapati District In South Orissa. Deptt. of Community Medicine, M.K.C.G. Medical College, Berhampur, Orissa. Indian Journal of Community Medicine Vol. XXVIII, No.4, Oct.-Dec., 2003.

[9] Rashmi Misra, Diptimayee Jena and Snehalata Nanda. Social taboos and superstitions in food consumption during pre and post-natal period of tribal women in Rayagada district. The Pharma Innovation Journal 2020; 9(7): 514-517.

21. As of July 2021, a total of 30,858 quintals of fortified rice were allocated to the 0.52 million NFSA beneficiaries (PHH and AAY). Under the MDM scheme, the distribution of fortified rice began in October 2021, and a total of 8,347 quintals of fortified rice was distributed in the 3rd quarter, however, no fortified rice was being distributed under the ICDS programme as of July 2021.

22. In terms of ***developing production capacity of fortified rice***, in March 2020, Bihariji Agro Foods Pvt. Ltd. was issued a work order as a central vendor for supplying Fortified Rice Kernels (FRK) to the district while in January 2021, 27 rice mills were able to produce fortified rice through blending FRK with regular rice at a 100:1 ratio. In addition, a National Accreditation Board for Testing and Calibration Laboratory (NABL) was empanelled in the state to test micronutrient levels in the fortified rice. A district-level resource person was appointed in May 2021 to support the implementation of the pilot scheme and for quality assurance and quality control of the fortified rice produced by the rice millers.

23. For the baseline report, ***the estimates of minimum recommended daily allowance for iron, folic acid and Vitamin B12 were calculated*** using: (i) The consumption of fortified rice (assumed in case of Malkangiri district) provided through the government safety net schemes; (ii) the RDA guidelines of Indian Council of Medical Research- National Institute for Nutrition (ICMR-NIN) 2020 report for specific age-groups. The low-level values in mg/d covered for the iron, folic acid and Vitamin B12 as per the FSSAI standards for fortified rice are reported here.

24. The results indicated that for children aged 4-6 years, the PDS and ICDS programme can provide up to 49.0 percent of the minimum RDA for iron,11.0 percent of minimum RDA for folic acid and 7.0 percent of minimum RDA for vitamin B12.

25. For sedentary women, the PDS scheme can provide up to 16.0 percent of minimum RDA for iron, 6.0 percent of minimum RDA for folic acid and 6.0 percent of minimum RDA for vitamin B12. Among sedentary men, the PDS provides around 25.0 percent of minimum RDA for iron, 4.0 percent of minimum RDA for folic acid and 6.0 percent of minimum RDA for vitamin B12.

Chapter-1: Introduction

Background

1. Malnutrition manifests in several ways, including deficiencies or excess macro- and micro-nutrients. Nearly seven percent of the global disease burden[10] results from vitamin and mineral deficiencies. These deficiencies go unnoticed and are referred to as 'hidden hunger' with rarely visible signs but long-lasting and devastating consequences[11]. Hidden hunger impacts the population's socio-economic development (both at the household and national level). It has implications like maternal and child mortality, increased illness, and children's poor cognitive and physical development. One of the most effective public health actions to address micronutrient malnutrition in a population is the fortification of staple foods, which is claimed to be 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 Nutrition Movement[12].

2. Nutritional deficiencies, particularly iron deficiency, are the foremost causes of anaemia. According to the World Health Organisation (WHO), *"Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal[13,14]."* Haemoglobin carries oxygen and in a condition with too few or abnormal red blood cells, or lower haemoglobin, the blood's capacity to carry oxygen to the body's tissue is reduced. People with such conditions show symptoms such as fatigue, weakness, dizziness and shortness of breath. The optimal haemoglobin concentration/levels needed to meet physiological needs varies by age, sex, residence elevation, smoking habits and pregnancy status**. WHO mentions the most common factors contributing to anaemia including nutritional deficiencies, particularly iron deficiency, and other causes, include folate, vitamins B12 and A; haemoglobinopathies; and infectious diseases, such as malaria, tuberculosis, HIV and parasitic infections, etc.**[15].

3. Anaemia is a serious global public health issue and has affected young children and pregnant women, particularly in low and middle-income countries. WHO estimates the worldwide prevalence of anaemia to be around 42.0 percent among children aged less than five years and 40.0 percent among pregnant women[16]. Iron deficiency anaemia contributes to about half of all anaemia cases in India. It is pervasive and exists across all the socio-economic groups.

4. The state of Odisha is facing an acute challenge due to the high prevalence of iron deficiency anaemia over the last few years. As indicated through various rounds of the National Family Health Survey (NFHS), rather than declining, there has been an increase in anaemia among children and women. Iron deficiency anaemia is the most common form of anaemia among

[10] Ezzati M, Lopez AD, Rodgers A, VanderHoorn S, Murray CJL, & the Comparative Risk Assessment Collaborating Group. Selected major risk factors and global regional burden of disease. Lancet 2002; 360:1347-60.
[11] Pilot Scheme on Fortification of Rice and its Distribution under Public Distribution System. Operational Guidelines. Department of Food and Public Distribution, Government of India.
[12] Rice Fortification: Supply chain and technical feasibility. Evidence from 10 years of implementation around the world. Sight and Life and World Food Programme, Nutrition Division. October 2018.
[13] https://www.who.int/health-topics/anaemia#tab=tab_1 accessed on July 27, 2022.
[14] Haemoglobin thresholds to define anaemia in a national sample of healthy children and adolescents aged 1–19 years in India: a population-based study Harshpal Singh Sachdev, Akash Porwal, Rajib Acharya, Sana Ashraf, Sowmya Ramesh, Nizamuddin Khan, Umesh Kapil, Anura V Kurpad, Avina Sarna.Lancet Glob Health 2021;9: e822–31. Published Online April 16, 2021.
[15] https://www.who.int/health-topics/anaemia#tab=tab_1 accessed on July 27, 2022.
[16] Anaemia (who.int) accessed on May 16, 2022.

younger children[17]. However, biological reasons contribute to higher anaemia rates in women, including iron loss during menstruation among adolescents and women and societal and gender norms affecting nutritional intake among women[18]. Iron deficiency anaemia is higher for pregnant women due to an increase in iron requirements as the mother's blood volume expands to promote the foetus growth and development[19].

5. Within Odisha, Malkangiri district is a dense hilly forested region in the southern part and bordering Chhattisgarh and Andhra Pradesh (*Figure 1*). The NFHS-5 data showed that out of the total of 84.1 percent of the population; 21.4 percent belongs to the Scheduled Castes (SC) and 62.7 percent belongs to the Scheduled Tribes (ST). Around 14.0 percent of women have 10 or more years of schooling compared to 15.0 percent for men *(See Annexure Table- 1.1.1)*.

Figure 1: Location of Malkangiri District in Odisha

Pilot Scheme on Rice Fortification

6. To reduce anaemia prevalence and overcome micronutrient malnutrition, the known strategies include dietary diversification, food fortification, nutrition and health education, supplementation, and public health measures[20,21]. According to WHO, fortification is a practice of deliberately increasing the micronutrient contents (i.e., vitamins and minerals) in food to improve the nutritional quality of the food supply. In India, rice fortification has the potential to reach the masses as it is the staple food for the 65.0 percent of the population. Government through the safety net programmes, such as the Targeted Public Distribution System (TPDS), the Mid Day Meal (MDM), now Pradhan Mantri Poshan Shakti Nirman (PM POSHAN), and Integrated Child Development Services (ICDS), annually allocates more than 31.6 million tons, 1.8 million tons and 0.5 million tons respectively[22]. Together these three food safety net programmes reach nearly one billion population in India.

7. World Food Programme (WFP) India has generated successful evidence on the impact of rice fortification on children's health by undertaking various pilot interventions in India. WFP partnered with the Department of School and Mass Education (DSME) of the Government of Odisha (GoO) (2012-2014) to implement a pilot project to improve the health and nutrition

[17] Avina Sarna et. al. Characterisation of the types of anaemia prevalent among children and adolescents aged 1–19 years in India: a population-based study.
The Lancet Child & Adolescent Health. Volume 4, Issue 7, July 2020, Pages 515-525.
[18] Solovyovo AV, Gace V, Ermolenko KS, Khorolskiy VA. Anemia in women of reproductive age. Available at: intechopen.com/books/current-topics-in-anemia/anemia-in-women-of-reproductive-age. Accessed May 16, 2022.
[19] Michael K.Georgieff. Iron deficiency in pregnancy. American Journal of Obstetrics and Gynecology. Volume 223, Issue 4, October 2020, Pages 516-524.
[20] Pilot Scheme. Fortification of Rice and its Distribution under Public Distribution System. Operational Guidelines. Department of Food and Public Distribution, Government of India.
[21] Supplementation, Food Fortification and Dietary Diversification: A three-pronged approach to reducing hidden hunger. Federal Ministry for Economic Cooperation and Development. Accessed on May 20,2022.
[22] Pilot Scheme. Fortification of Rice and its Distribution under Public Distribution System. Operational Guidelines. Department of Food and Public Distribution, Government of India.

of school children through enhancing its MDM scheme in the Gajapati district of Odisha. Fortified rice was distributed to the MDM beneficiaries in the form of hot cooked meals.

8. With the pilot project's success in the Gajapati district, the GoO and WFP launched a demonstration model in the Dhenkanal district (2016-2018). This pilot intervention was instrumental in increasing nutrition awareness among children, teachers and parents. The Fortified Rice Kernel (FRK) strategy was found to be operationally feasible.

9. These interventions demonstrated the operational feasibility, efficiency, and effectiveness of rice fortification to address micronutrient deficiency among school children covered under MDM scheme and have led to policy-level changes. Considering these and other available evidence and to accelerate efforts to address anaemia among vulnerable groups **in 2019, the Government of India approved and announced the *"Centrally Sponsored Pilot Scheme on Fortification of Rice & its distribution through Public Distribution System."*** This pilot scheme is approved for three years, beginning from 2019-2020, with a total budget outlay of INR 174.6 crore[23], wherein financial commitment has been approved to commence rice fortification in 15 districts through the Public Distribution System (PDS) programme. The learnings from the pilots in 15 districts are envisaged to support the national-level scale-up[24].

10. **The key objectives of the Pilot centrally sponsored scheme are:**

- To distribute fortified rice through the PDS to cater to 15 Districts in the country – preferably one District per State in the initial phase of implementation.
- To cover all National Food Security Act (NFSA) beneficiaries under the PDS with fortified rice in the targeted districts.
- To evaluate the provision, coverage, and utilisation of fortified rice by the target population and the efficacy/effectiveness of the consumption of fortified rice in reducing the targeted micronutrient deficiencies in different age and gender groups.

11. **The five key components of the scheme are[25]:**

(i) Fortification of rice in the PDS at the state level: One of the core elements to produce fortified rice are the Fortified Rice Kernels (FRK) which are blended with regular rice in a ratio of 1:100.

- The paddy is procured from the farmers in Decentralized Procurement States. The procured paddy is sent to the government empanelled rice millers for processing and milling. Milled rice is transported back to the government godown for storage and distribution under PDS.
- In non- Decentralized Procurement States, milled rice is sent to the Food Corporation of India (FCI) godown and transported to the state storage depot or directly to Fair Price Shops (FPS) in some cases.
- The payment to the rice mills against the cost of fortification is routed through State Government. The incremental cost at 60 paise per kg is reimbursed to the rice millers for the total volume of fortified rice produced by them. The incremental charges are shared between the Centre and the State in the ratio of 75:25.

(ii) Capacity building and training: Capacity building and training is needed for the rice millers on the specifics of fortification, quality control etc. It is also required for the FPS

[23] https://pib.gov.in/PressReleasePage.aspx?PRID=1669677 accessed on May 17, 2022.
[24] Pilot Scheme. Fortification of Rice and its Distribution under Public Distribution System. Operational Guidelines. Department of Food and Public Distribution, Government of India.
[25] Pilot Scheme. Fortification of Rice and its Distribution under Public Distribution System. Operational Guidelines. Department of Food and Public Distribution, Government of India.

owners to develop their understanding of roles/responsibilities vis-à-vis the mainstreaming of fortified food grains in the welfare schemes.

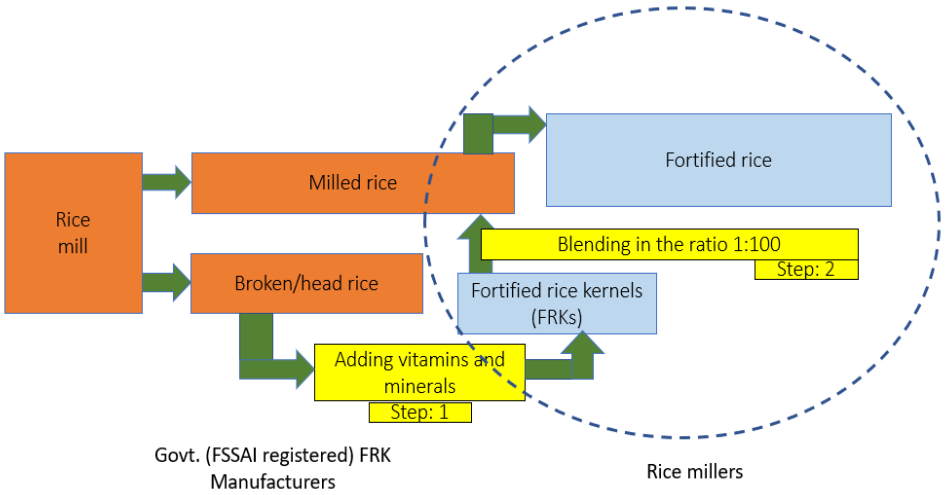
(iii) Information, education and communication: This is a crucial component of the pilot scheme. Information, education and communication (IEC) campaigns are essential for the success of the pilot scheme to develop the concept of availability of fortified food through the government safety net programmes.

(iv) Quality Control (QC) and Quality Assurance (QA): In this, the role of the Food Safety and Standard Authority of India (FSSAI) and its Food Safety Officers are critical for QC/QA during procurement of the Fortified Rice Kernels.

- The millers procure the FRK directly from the state empanelled and FSSAI licensed/registered FRK manufacturers.
- After validating the Certificate of Analysis (COA) issued by the FSSAI-notified National Accreditation Board for Testing and Calibration Laboratories (NABL) for FRK in terms of appropriate micronutrient levels and microbiological specifications, the blending of FRK with regular rice is permitted.
- At the level of the rice mill, QA/QC is done through blending efficiency counts. The Food Safety Officers also lift the sample of fortified rice for analysis at independent third-party NABL laboratories already empanelled by the State.
- To produce fortified rice, the rice miller should have a valid milling license and a valid license for processing of fortified rice under Category 6.0 of the Indian Food Categorization System (Food Safety & Standards Act, 2006) and should get the fortified logo endorsed by FSSAI.

(v) Monitoring and Evaluation: This is an essential component of the pilot scheme to assess the quality of implementation and delivery of a programme and its reach to the targeted households and individuals to achieve the nutritional goals.

Figure 2: Process of Rice Fortification



Source: *Developed by WFP team*

12. As per the operational guidelines, the standards of fortification per kg for Nutrients specified by FSSAI are:

Table 1: Recommended Levels of Nutrients for Fortification by FSSAI

Nutrients	Level of fortification per kg
Iron - Ferric Pyrophosphate	28 mg - 42.5 mg*
Iron - Sodium Iron (III) Ethylene Diamine Tetra Acetate Trihydrate (Sodium feredetate - Na Fe EDTA)	14 mg - 21.25 mg
Folic Acid - Folic acid	75 µg - 125 µg
Vitamin B12 - Cyanocobalamine or Hydroxycobalamine	0.75 µg - 1.25 µg

13. In Odisha, the Honourable Chief Minister Naveen Patnaik launched the pilot scheme in Malkangiri on 29th July 2021[26]. This district was chosen using criteria from the operational guidelines which recommended choosing aspirational district, with large rice consumption and a high prevalence of anaemia amongst children and women (as per NFHS-4). This scheme is envisioned to cover 0.52 million beneficiaries under the NFSA and 0.84 million from the State Food Security Scheme (SFSS) through 117 FPS.

14. In August 2021, the Honourable Prime Minister Narendra Modi announced that all rice distributed under the various government safety net programmes/schemes should be fortified by 2024. These schemes include the PDS, ICDS, PM POSHAN (Mid-Day Meals), and other welfare schemes[27]. To implement the distribution of fortified rice, the food department worked on a phased implementation plan.

15. After the declaration of the Centrally Sponsored Pilot Scheme in 2019, WFP took several steps to prepare for implementation of the scheme in Malkangiri district. This included:

- **December 2019:** An initial assessment of 23 rice mills, to gauge their capacity to produce fortified rice and then provided technical assistance for setting up the required blending equipment.
- **March 2020:** Organised a capacity-building workshop for the 27 rice millers and 12 district officials.
- **December 2020:** Participated in the Technical Advisory Group (TAG) meeting and provided vital inputs on the way forward in implementing the rice fortification project in the district.
- **February 2021:** Conducted a trial validation of the equipment installed in the rice mills and checked the quality of fortified rice produced. WFP confirmed to the government that the system was ready to produce fortified rice.
- **2021:** Supported the development of the IEC materials at the national level for rice fortification, which was later translated into the Odia language for the state and district.

Purpose and Rationale of the Baseline

16. The main purpose of the study is to establish the baseline scenario on the prevalence of anaemia in target populations, document sources of dietary iron and to estimate the coverage of government programmes with rice. To measure the impact of the pilot scheme

[26] Fortified rice scheme launched in Malkangiri- The New Indian Express accessed on May 17, 2022.
[27] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1814826 posted on April 2022.

on rice fortification, including the scheme's implementation efficiency and effectiveness, an endline assessment will be undertaken. The Government of Odisha and WFP have planned an independent assessment of this scheme to produce evidence and learning from its implementation. The assessment is divided into baseline and endline.

17. This baseline assessment is undertaken by the Evidence and Results Unit of the WFP India Country Office. The NFHS-5 survey coincided with the launch of the pilot scheme on rice fortification and provides information on the biomarker (anaemia) across children, women, and men. Thus, this data was used to develop the baseline report along with information and data from government sources on the coverage of rice in government schemes in the district.

18. To measure the impact of the pilot programme, an endline survey will take place and will collect information on levels of anaemia in the target groups, consumption of iron-rich foods, access to and consumption of fortified rice from various government schemes.

Scope of the Evaluation

19. The pilot scheme has been implemented in Odisha across Malkangiri district since the end of July 2021, covering seven blocks and two Urban Local Bodies (ULBs). Around 30,858 quintals of fortified rice - 22,085.6 quintals of rice for Priority Households (PHH) per month[28] and 8,772.4 quintals of fortified rice for Antyodaya Anna Yojana (AAY) households per month - were allocated through 117 Fair Price Shops in July 2021 when the scheme was launched.

20. In the same month, fortified rice allocated through other schemes like State Food Security Scheme was 1,245.1 quintals (at 5 kgs per person per month), and an additional 1,228.5 quintals of normal rice free of cost were allocated to the SFSS beneficiaries. The beneficiary data from the blocks and ULBs showed a total of 0.52 million beneficiaries were covered, including both PHH and AAY.

Objectives

21. The key objectives covered in the baseline assessment are:

    - To assess anaemia levels among (i) children aged 6 to 59 months; (ii) women aged 15 to 49 years and (iii) men aged 15 to 49 years in Malkangiri district using NFHS-5-unit level data.
    - To generate baseline evidence on the coverage/distribution of the rice/fortified rice through PDS and enabling factors contributing to implementing the pilot programme in the district using secondary records/government reports.

22. To fulfil the objectives of the baseline, secondary data from the NFHS-5 survey has been analysed. For the endline, primary data collection will take place.

[28] The 5 kg allotment of rice or wheat or the combination of both per member of the priority households varied across the blocks (e.g., some beneficiaries received 1kg rice and 4 kgs wheat, some received 2 kgs rice and 3 kgs wheat, etc.)

Chapter-2: Results and Discussion

23. This chapter first presents the prevalence of anaemia by demographic groups in Malkangiri district as per NFHS-5 to describe the situation at baseline, before the pilot programme was launched. This section also includes findings on consumption of iron-rich foods by the target groups. In addition, analysis of data from secondary sources, including the Food Supply and Consumer Welfare (FSCW) Department, Civil Block and ULB data on beneficiaries from the Supplies Office-Malkangiri district is presented to give an estimate of the amount of fortified rice potentially accessed and consumed by the various demographic groups.

Anaemia Status Among Children, Women and Men

24. The analysis uses the World Health Organisation's cut-offs to classify anaemia for the different demographic groups, applying them to the NFHS-5 data to determine the prevalence of iron deficiency anaemia across the demographic groups. The NFHS-5 survey enumerators were trained to collect a few drops of blood from fingers or heels (small children) of sampled individuals which were then analysed using a HemoCue Hb 201+ machine which is portable, and compatible with clinical laboratories and field settings, and is relatively inexpensive and simple to use. Its measuring range is between 0–25.6 g/dL and gives immediate, digitally displayed results[29,30]. This method only determines the level of circulating haemoglobin from capillary blood of the individual and does not measure iron stores, which requires a venous blood draw.

25. The thresholds for classifying anaemia for NFHS-5 by demographic group is presented in the *Table 2* below while the NFHS-5-unit level data analysis process for the Malkangiri district is given in *Annexure Table 2.1.1*.

Table 2: Anaemia Threshold as per NFHS-5 (in g/dL)

Severity	Children (6-59 months) *g/dl*	Woman (15-49 years) *g/dl*	Man (15-49 years) *g/dl*
Mild	10.0-10.9	11.0-11.9	12.0-12.9
Moderate	7.0-9.9	8.0-10.9	9.0-11.9
Severe	< 7.0	< 8.0	< 9.0
Any anaemia	*< 11.0*	*< 12.0*	*< 13.0*

Source: *NFHS-5, 2019-20.*

26. The table below compares the prevalence of anaemia in Malkangiri to the Odisha state averages, by demographic groups.

Table 3: Prevalence of Anaemia by Demographic Groups

Groups	Malkangiri district	Odisha State
Children 6-59 months	77.1%	64.2%
Non-pregnant women (15-49)	71.8%	64.4%
Men (15-49)	42.3%	28.5%

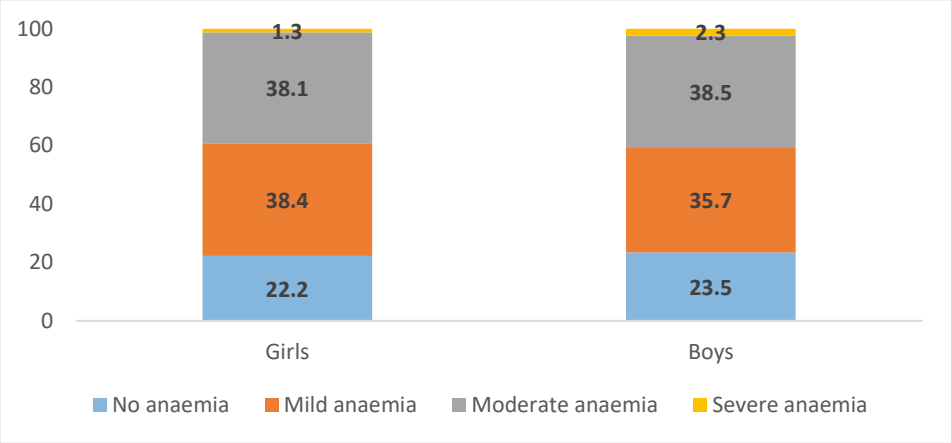
Source: *NFHS-5, 2019-20.*

[29] https://www.mittallaboratories.com/hemocue-analyzers.html accessed on August 3, 2022.

[30] Bernard Nkrumah, Samuel Blay Nguah, Nimako Sarpong, Denise Dekker, Ali Idriss, Juergen May & Yaw Adu-Sarkodie. Hemoglobin estimation by the HemoCue portable hemoglobin photometer in a resource poor setting. BMC Clinical Pathology volume 11, Article number: 5 (2011).

27. **Anaemia status among children by gender:** For children aged 6-59 months, the prevalence of any anaemia (<11.0 g/dl) was slightly higher in girls (77.7 percent) compared to boys (76.5 percent) with similar distributions by severity *(See Figure 3 and Annexure Table 2.1.3)*.

Figure 3: Severity of anaemia in children 6-59 months, Malkangiri district



Source: *NFHS-5 (2019-21).*

28. NFHS-5 data also provided information on anaemia among women aged 15-49 years. **Among all the 30 districts, Malkangiri district was in the bottom five districts, with 72.0 percent of the women aged 15-49 years having any anaemia (<12.0 g/dl)** *(See Annexure Table 2.1.4).* Overall, in the Malkangiri district, 2.1 percent of women had severe anaemia (<8.0 g/dl), 41.4 percent had moderate anaemia (8.0-10.9 g/dl) and 28.6 percent had mild anaemia (11.0-11.9 g/dl). Among men, 7.1 percent had moderate anaemia (9.0-11.9 g/dl) and 35.2 percent has mild anaemia (12.0-12.9 g/dl) *(Table 4)*.

Table 4: Anaemia in adults by demographic group and severity – Malkangiri district

Severity	All women (15-49 years)	Men (15-49 years)
None	28.0%	57.7%
Mild	28.6%	35.2%
Moderate	41.4%	7.1%
Severe	2.1%	-
Total anaemia	***72.0%***	***42.3%***

Source: *NFHS-5 (2019-21).*

29. Besides iron deficiency anaemia, malaria can also contribute to anaemia (not the iron-deficiency anaemia but reduces the body's ability to transport oxygen in the blood) and Odisha and Malkangiri district are known to have had high incidence of malarial infection. In Malkangiri district, the malarial infection has reduced considerably since the implementation of the Durgama Anchalare Malaria Nirakarana (DAMaN) programme- meaning malaria control in inaccessible areas programme in 2016. The annual parasite incidence (API) as per the National Center for Vector Diseases Control Epidemiological Situation Report 2018[31] was 13.9 in 2018 which has come down to 11.0 percent in 2020[32]. Another contributor to anaemia is sickle cell anaemia. It is a haemoglobin disorder affecting 10 percent of the population in Odisha. Studies have shown that prevalence of anaemia in sickling positive children was

[31] Annual-Report-2018.pdf (nvbdcp.gov.in) accessed on July 29, 2022.
[32] https://www.newindianexpress.com/states/odisha/2020/nov/08/war-against-malaria-malkangiri-eyes-at-zero-cases-in-december-2220923.html accessed on August 5, 2022.

higher than normal children who were sickling negative[33]. To increase access to testing, counselling and pre-natal diagnosis of the disease, the GoO has partnered with Christian Medical College, Vellore and Centre for Stem Cell Research through the National Health Mission Odisha to target priority groups[34].

Cultural Norms and Consumption of Iron-Rich Food

30. This section reflects on the iron components, traditional food eating practices and consumption of iron-rich food by different demographic groups. There are two types of iron present in food: (i) heme iron, found in animal products, and (ii) non-heme iron, found in plant products. Studies have shown that iron absorption tends to be poor from meals in which whole-grain cereals and legumes predominate[35]. Further, the tannin in tea, and polyphenols in many vegetables inhibit iron absorption by decreasing the intestinal solubility of non-heme iron from the entire meal. Adding small amounts of meat and sour food (ascorbic acid-containing foods) substantially increases iron absorption. For example, orange juice can roughly double the absorption of non-heme iron from a meal while tea and coffee, on the other hand, will cut the absorption of non-heme iron by more than half when compared with water[36,37].

31. 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[38]. A typical food taboo considered harmful to reproductive health is to avoid consumption of sour, bitter and spicy foods by pregnant and lactation women[39]. 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 menstruation.

32. A study in four villages of the Rayagada district of Odisha showed that consumption of nutrient-rich foods such as dry fish, leafy vegetables, eggs and mutton were restricted in both pregnancy and lactation. Even fruits like ripe papaya and ripe jackfruit were avoided by women. The study noted that more food taboos were observed by illiterate women compared to literate women in the community[40].

33. **Consumption of iron-rich food:** The NFHS-5 data showed that 45.7 percent of children 6-23 months of age had consumed iron-rich foods in the past 24 hours[41] *(See Annexure Table 2.2.1)*. An attempt was made to compute the distribution of women by consumption of specific iron-rich food items using NFHS-5 data from the Malkangiri district *(See Annexure Table 2.2.2)*. The results from the Malkangiri showed that 84.0 percent of women reported daily consumption of iron-rich foods, while 68.0 percent also reported eating beans or pulses

[33] T. Sahu, N.C. Sahani, S. Das, S.K. Sahu. Sickle Cell Anaemia In Tribal Children Of Gajapati District In South Orissa. Deptt. of Community Medicine, M.K.C.G. Medical College, Berhampur, Orissa. Indian Journal of Community Medicine Vol. XXVIII, No.4, Oct.-Dec., 2003.

[34] CMC - THALASSEMIA AND SICKLE CELL DISEASE CONTROL PROGRAM IN ODISHA (cscr.in) accessed on August 8, 2022.

[35] Nutrition During Pregnancy: Part I Weight Gain: Part II Nutrient Supplements. Institute of Medicine (US) Committee on Nutritional Status During Pregnancy and Lactation. Washington (DC): National Academies Press (US); 1990.

[36] Hallberg, L. 1981. Bioavailability of dietary iron in man. Annu. Rev. Nutr. 1:123–147.

[37] Rossander, L., L. Hallberg, and E. Björn-Rasmussen. 1979. Absorption of iron from breakfast meals. Am. J. Clin. Nutr. 32:2484–2489.

[38]Rashmi Misra, Diptimayee Jena and Snehalata Nanda. Social taboos and superstitions in food consumption during pre and post natal period of tribal women in Rayagada district. The Pharma Innovation Journal 2020; 9(7): 514-517.

[39] World Food Programme. 2021. Gender Dynamics of Food Access and Consumption in Uttar Pradesh.

[40]Rashmi Misra, Diptimayee Jena and Snehalata Nanda. Social taboos and superstitions in food consumption during pre and post natal period of tribal women in Rayagada district. The Pharma Innovation Journal 2020; 9(7): 514-517.

[41] The observations below 25 were not considered in the narrative of the report for food consumption and Vitamin A supplementation for children.

on a daily basis. Daily consumption of eggs, fish or meat was very low. However, more than half of the women consumed eggs or fish at least once per week, while 43.0 percent had eaten chicken or meat at least once during the week *(See Annexure Table 2.2.2)*.

34. Among men in the Malkangiri district, the NFHS-5 data showed that 75.2 percent had daily consumption of dark green leafy vegetables, followed by 49.3 percent with daily consumption of pulses or beans. Very few had daily consumption of meat, fish or eggs. However, more than 80.0 percent had eaten eggs at least once during the week, with 71.0 percent reporting weekly consumption of fish and around half eating chicken or meat each week *(See Annexure Table 2.2.3)*.

Food Safety Net Coverage in the Malkangiri District

35. The Government of India's National Food Security Act (NFSA) 2013, is implemented through two types of ration cards. Priority household (PHH) cardholders have an entitlement of 5 kilograms of wheat or rice per person per month at a highly subsidised price of Rs. 3 for rice and Rs. 2 for wheat per kilogram. Antyodaya Anna Yojana (AAY) cardholders are the 'poorest of the poor' and have an entitlement of 35 kilograms of rice per household per month, irrespective of the household size.

36. In addition, the State Food Security Scheme (SFSS) is operational in Odisha by the state government to extend the coverage to those not covered by NFSA. Since the rice fortification pilot is a centrally sponsored scheme, it is to be implemented only for PHH and AAY beneficiaries of the public distribution system.

37. As of July 2021, 85.0 percent of the population of Malkangiri (521,500) were covered by PDS while 24,902 people were covered under the SFSS *(See Annexure Table 2.3.1)*. The NFSA also provides support to children and pregnant and lactating mothers through the Integrated Child Development Services (ICDS) programme while school children are supported under the Mid-day meals (MDM) programme (109,123 children in Malkangiri district). As per Department of Women and Child Development (DWCD), the ICDS beneficiaries between 3-6 years receiving hot cooked meal in the Malkangiri district were 37,157 *(See Annexure Table 2.3.1)*.

38. The total of 0.52 million PDS beneficiaries were targeted to receive fortified rice: around 4.0 percent from the two Urban Local Bodies and 96.0 percent from the 7 rural blocks. The Kalimela block received 24.6 percent of the fortified rice, followed by 16.2 percent in Malkangiri block and etc. *(See Annexure Table 2.3.2)*.

39. In July 2021, A total of 30,858 quintals of fortified rice (22,085.6 quintals for PHH per month[42] and 8,772.4 quintals for AYY households per month) were allocated for the pilot scheme. In the same month, 1,245.1 quintals of fortified rice were allotted to the beneficiaries under the SFSS programme *(See Annexure Table 2.3.3)*.

40. Under MDM scheme, the distribution of fortified rice started in October 2021. There were 1,295 schools in the Malkangiri district where 8,347 quintals of fortified rice were distributed in 3rd quarter (October 2021 to December 2021)[43]. However, till date, the fortified rice is not distributed for hot cooked meals in the ICDS programme in the Malkangiri district *(See Annexure Table 2.3.3)*.

[42] The 5 kg allotment of rice or wheat or the combination of both per member of the priority households varied across the blocks (e.g., some beneficiaries received 1kg rice and 4 kgs wheat, some received 2 kgs rice and 3 kgs wheat, etc.)
[43] Department of School and Mass Education- State Project Management UNIT- MDM. Government of Odisha.

Production of Fortified Rice in Malkangiri district

41. In March 2020, Bihariji Agro Foods Pvt. Ltd. was issued a work order as a central vendor for supplying Fortified Rice Kernel (FRK) to all 27 mills. In the Malkangiri district, a total of 27 rice mills have been blending FRK to produce fortified rice since January 2021. One NABL accredited lab was also empanelled in the state to test micronutrient levels in the fortified rice. A district-level resource person was appointed in May 2021 to support the implementation of the pilot scheme. His responsibility was to conduct quality assurance and quality control of the fortified rice produced by the rice millers *(See Annexure Table 2.3.4)*.

Estimates of RDA based on potential coverage and consumption of fortified rice received from the government schemes

42. The Recommended Daily Allowance (RDA) were calculated theoretically, assuming an ideal situation using Indian Council of Medical Research- National Institute for Nutrition (ICMR-NIN) 2020 report. As per the Dietary Guidelines of the National Institute for Nutrition (NIN), 2010[44], the RDA, "are estimates of nutrients to be consumed daily to ensure the requirements of all individuals in a given population. The recommended level depends upon the bioavailability of nutrients from a given diet. The term bioavailability indicates what is absorbed and utilised by the body."

43. It is to be noted that the nutrient requirement of an individual and the required dietary allowance for a population differs. Nutrient requirements depend on the individual's age, gender, body weight and physiological and metabolic status. However, the dietary allowances consider the individual variation within the group, the effect of processing and bioavailability of the nutrient from the diet and diet quality[45].

44. The minimum required daily allowance for iron, folic acid and vitamin B12 received through consumption of fortified rice was theoretically estimated using (i) The consumption of fortified rice provided through the government safety net schemes; (ii) RDA guidelines of ICMR-NIN 2020 for specific age-groups. For example, under PDS a person is entitled to 5 kgs of food grains per month, so if it is assumed that in a month of 30 days, there is 100 percent supply of cereals (fortified rice in the Malkangiri district), then daily intake of fortified rice would be 167g. For MDM, the daily allocation provided by the Department of School and Mass Education is 100g of food grain for primary children and 150g for upper primary children *(See Annexure Table 2.3.5)*. The minimum daily RDA (NIN, RDA Short report, 2020) for iron, folic acid and Vitamin B12 met through allocation of foods under various government food safety net schemes suggested that:

    - For children aged 4-6 years, the PDS and ICDS programme can provide up to 49.0 percent of the minimum RDA for iron,11.0 percent of minimum RDA for folic acid and 7.0 percent of minimum RDA for vitamin B12.
    - For sedentary women, the PDS scheme can provide up to 16.0 percent of minimum RDA for iron, 6.0 percent of minimum RDA for folic acid and 6.0 percent of minimum RDA for vitamin B12. Among sedentary men, the PDS provides around 25.0 percent of minimum RDA for iron, 4.0 percent of minimum RDA for folic acid and 6.0 percent of minimum RDA for vitamin B12.

[44] https://www.nin.res.in/downloads/DietaryGuidelinesforNINwebsite.pdf

[45] Nutrient requirements and recommended dietary allowances for Indians. A report of the expert group of the Indian Council of Medical Research. Hyderabad: National Institute of Nutrition; 2010. Indian Council of Medical Research.

Acronyms

AAY	Antyodaya Anna Yojana
CoA	Certificate of Analysis
DAMaN	Durgama Anchalare Malaria Nirakarana
DSME	Department of School and Mass Education
DWCD	Department of Women and Child Development
FCI	Food Corporation of India
FPS	Fair Price Shop
FRK	Fortified Rice Kernel
FSCW	Food Supply and Consumer Welfare Department
FSSAI	Food Safety and Standards Authority of India
GoO	Government of Odisha
Hb	Haemoglobin
ICDS	Integrated Child Development Services
ICMR	Indian Council of Medical Research
IEC	Information, Education and Communication
NABL	National Accreditation Board for Testing and Calibration Laboratories
NCVBDC	National Center for Vector Borne Diseases Control
NFHS	National Family Health Survey
NFSA	National Food Security Act
NGOs	Non-Government Organisations
NIN	National Institute for Nutrition
PDS	Public Distribution System
PHH	Priority Household
PM POSHAN	Pradhan Mantri Poshan Shakti Nirman
RDA	Recommended Daily Allowance
QA	Quality Assurance
QC	Quality Control
SC	Scheduled Caste
ST	Scheduled Tribe
SFSS	State Food Security Scheme
TAG	Technical Advisory Group
TPDS	Targeted Public Distribution System
ULB	Urban Local Body
WFP	World Food Programme
WHO	World Health Organization

Annexes

Annexure Table-1.1.1: Demographic and socio-economic status of the population

Indicators	Malkangiri District
Population and Household Profile	
Population below age 15 years (%)	34.1
Sex ratio of the total population (females per 1,000 males)	1,137
Sex ratio at birth for children born in the last five years (females per 1,000 males)	981
Education status	
Women with 10 or more years of schooling (%)	14.0
Men with 10 or more years of schooling (%)	14.9
Caste/tribe of the household head (% distribution- *de jure* population)	
Scheduled Caste	21.4
Scheduled Tribe	62.7
Other Castes (OBC, others)	15.9
Religion of the household head	
Hindu	96.8
Others (Muslim, Christian, Others)	3.2

Source: NFHS-5 (2019-21) India, Malkangiri district and Odisha.

Annexure Table-2.1.1: Analysis of NFHS-5 Unit Level Data for the Malkangiri District

- The NFHS-5 unit level data obtained from Demographic Health Survey (DHS) website (https://dhsprogram.com/) was used to analyse data on children, women and men. The NFHS-5 data collection for Odisha was conducted in all 30 districts between January to March 2020 (before the lockdown) and from November 2020-March 2021. The information was collected from 26,467 households, 27,971 women aged 15-49 years (including 4,379 women interviewed in the Primary Sampling Unit (PSUs) in the state module), and 3,865 men aged 15-54 years.
- In Malkangiri district, the data collection commenced from December 2020 till February 2021 and the information was gathered from 916 households, 1080 women and 137 men.
- The baseline assessment has covered the following target groups both in Malkangiri district and Odisha: (i) Children aged- 6 to 59 months; (ii) Women aged 15 to 49 years; (iii) Men aged 15 to 49 years
- Based on the target groups, the NFHS-5 data has been analysed using STATA (Version-15) to gather evidence on the prevalence of anaemia in children, women and men. The data from the (Version 7A) released in June 2022 was used to compute tables.

Following steps were used to derive the estimates:

- **Step-1:** The estimates were derived using Household Member recode file (for children and men), Individual recode file (for women), Child recode file (for children and mothers), and Men recode file (for men), for population residing in Malkangiri district in Odisha.
- **Step-2:** The state sample weights was generated by dividing the state sample weight variable provided in the recode files mentioned in Step 2 by 1,000,000. The weights were applied across the unit level data to obtain districtwide weighted estimates.
- **Step-4:** For estimating anaemia status in women, Individual recode file was used, and the analysis was conducted on weighted sample of 384 women.
- **Step-5:** For estimating anaemia status in men, Household Member recode file was used, and the analysis was conducted on weighted sample of 51 men.
- **Step-6:** For estimating anaemia status in children, Household Member recode file was used, and the analysis was conducted on weighted sample of 144 children.
- **Step-7:** For estimating consumption of iron rich food among children aged 6-23 months living with their mothers, Child recode file was used, and the analysis was conducted on weighted sample of 46 children.
- **Step-8:** For estimating frequency of iron rich food consumption among women, Individual recode file was used, and the analysis was conducted on weighted sample of 443 women.
- **Step-9:** For estimating frequency of iron rich food consumption among men, Men recode file was used, and the analysis was conducted on weighted sample of 49 men.

Annexure Table-2.1.2: Anaemia Status in Malkangiri District and Odisha

Indicators[46]	Malkangiri District	Odisha
Anaemia among Children, Women, Men (%)		
Children aged 6-59 months who are anaemic (<11.0g/dl) (%)	77.1	64.2
Non-pregnant women aged 15-49 years who are anaemic (<12.0g/dl)	71.8	64.4
Pregnant women aged 15-49 years who are anaemic (<11.0g/dl)	74.3	61.8
All women aged 15-49 years who are anaemic	71.9	64.3
Men aged 15-49 years who are anaemic (<13.0g/dl) (%)	42.3	28.5

Source: NFHS-5 (2019-21) Malkangiri district; Note: An asterisk indicates that a figure is based on fewer than 25 unweighted cases (i.e., 19). **Note:** *Among children, prevalence is adjusted for altitude. Among adults, prevalence is adjusted for altitude and for smoking status, if known. As NFHS uses the capillary blood for estimation of anaemia, the results of NFHS-5 need not be compared with other surveys using venous blood.*

Annexure Table-2.1.3: Prevalence of Anaemia in Children (6-59 months) in Malkangiri District, by Sex

Sex	Severe *(<7.0 g/dl)*	Moderate *(7.0-9.9 g/dl)*	Mild *(10.0-10.9 g/dl)*	Any anaemia *(<11.0 g/dl)*	No. of children
Boys	2.3%	38.5%	35.7%	76.5%	73
Girls	1.3%	38.1%	38.4%	77.7%	71
Total	**1.8%**	**38.3%**	**37.0%**	**77.1%**	**144**

Source: NFHS-5 (2019-21).

Annexure Table-2.1.4: Children (6-59 months) and Women (15-49 years) Anaemia Status by Districts in Odisha[47]

District	Prevalence of anaemia in children (<11.0 g/dl)	Prevalence of anaemia in women (<12.0 g/dl)
Anugul	75.3%	75.8%
Balangir	74.9%	59.3%
Baleshwar	43.2%	61.8%
Bargarh	56.2%	62.6%
Baudh	56.2%	54.1%
Bhadrak	68.7%	64.0%
Cuttack	63.8%	64.5%
Debagarh	61.5%	72.2%
Dhenkanal	61.9%	65.9%

[46] Haemoglobin in grams per decilitre (g/dl). Among children, prevalence is adjusted for altitude. Among adults (women and men), prevalence is adjusted for altitude and for smoking status, if known. As NFHS uses the capillary blood for estimation of anaemia, the results of NFHS-5 need not be compared with other surveys using venous blood.

[47] The NFHS-5 data from Odisha State Report.

Gajapati	64.4%	66.1%
Ganjam	61.3%	56.7%
Jagatsinghapur	58.2%	59.8%
Jajapur	66.4%	63.4%
Jharsuguda	65.5%	67.8%
Kalahandi	68.8%	64.2%
Kandhamal	55.3%	48.9%
Kendrapara	61.5%	58.8%
Kendujhar	64.6%	69.2%
Khordha	56.1%	68.1%
Koraput	69.7%	58.2%
Malkangiri	77.1%	71.9%
Mayurbhanj	71.7%	72.2%
Nabarangapur	70.8%	69.2%
Nayagarh	55.2%	62.5%
Nuapada	73.5%	64.0%
Puri	51.0%	63.3%
Rayagada	70.5%	69.1%
Sambalpur	64.5%	66.7%
Subarnapur	73.1%	58.8%
Sundargarh	77.0%	69.8%

Source: NFHS-5, 2019-2021.

Annexure Table-2.2.1: Iron Rich Food Consumed among Children (6-23 months) by Age in Months-Malkangiri district

Age in months	Consumed foods rich in iron in last 24 hours[48]	Number of children
6 to 8	6.7%	6*
9 to 11	49.9%	7*
12 to 17	48.8%	15*
18 to 23	55.7%	17*
24 to 35	Na	na
Total (%)	***45.7%***	***46***

Source: NFHS-5 (2019-21); Note: An asterisk indicates that a figure is based on fewer than 25 weighted cases. 'na'- not applicable.

Annexure Table-2.2.2: Iron Rich Food Consumed by Women (15-49 years) in Malkangiri District

Type of food	Frequency of consumption				No. of women
	Never	Daily	Weekly	Occasionally	
Pulses or beans	0.5%	68.1%	27.3%	4.1%	443
Dark green leafy vegetables	-	83.8%	11.6%	4.6%	
Eggs	9.4%	1.4%	64.3%	24.9%	
Fish	6.5%	1.2%	54.9%	37.4%	
Chicken or meat	11.4%	0.6%	43.0%	45%	

Source: NFHS-5, 2019-21.

Annexure Table-2.2.3: Iron Rich Food Consumed by Men (15-49 years) in Malkangiri District

Type of food	Frequency of consumption				No. of men
	Never	Daily	Weekly	Occasionally	
Pulses or beans	-	49.3%	46.8%	4.0%	49
Dark green leafy vegetables	-	75.2%	23.1%	1.7%	
Eggs	2.5%	0.8%	84.4%	12.4%	
Fish	1.6%	0.8%	70.9%	26.7%	
Chicken or meat	1.7%	-	48.7%	49.7%	

Source: NFHS-5, 2019-21.

Annexure Table-2.3.1: Types of ration card holders in Malkangiri district (July 2021)

Beneficiary type	Malkangiri district
Total population (as per Census 2011)	613,192
TOTAL NFSA RATION CARDS(PHH+AAY)	521,599
% NFSA Beneficiaries	*85.0%*
State Food Security Scheme	24,902
MDM	109,123
ICDS (children between 3-6 years for hot cooked meal)	37,157

Source: Census of India, 2011 and Civil Supplies Office, Malkangiri district, Department of Women and Child Development (DWCD), GoO State Nodal Officer for MDM, Odisha and District Education Officer- Malkangiri District.

Annexure Table-2.3.2: Block-wise/ULB wise coverage of the beneficiaries for the Malkangiri district covered under the pilot scheme for rice fortification

Name of the Urban Local Body/ Block	Type of Beneficiary		
	% Covered under NFSA	Covered under PHH (@5kg per member)	Covered under AAY (@35 kg of rice per person)
	Jul-21	Jul-21	Jul-21
Urban Local Bodies			
Malkangiri (MPL)	2.9	3.2	1.1
Balimela (NAC)	1.3	1.4	0.5
Blocks			
Malkangiri	16.2	17.3	9
Mathili	15.4	15.4	15
Chitrakonda	10.1	9.9	11.6
Khairput	9.4	6.7	27.5
Korukonda	12.3	12.6	10.3
Kalimela	24.6	25.5	18.6
Podia	7.7	7.9	6.4
Total	***100.0***	***100.0***	***100.0***

Source: Block/ULB wise allotment of PHH, AAY rice (July-2021; May 2022), Civil Supplies Office, Malkangiri district.

Annexure Table-2.3.3: Rice Allotment under Different Schemes in the Malkangiri District, July 2021

Type of scheme	Rice allocation (quintals)
Allocation of Fortified Rice to PHH	22,085.6
Allocation of Fortified Rice to AAY	8,772.4
State Food Security Scheme (SFSS) @ 5kgs of fortified rice per person per month	1,245.1
Additional normal rice allocated under the SFSS (Free of cost)	1,228.5
Annapurna rice scheme @ 10kgs of fortified rice per person per month	63.1
Normal rice allocation for NFSA families under Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY-III) (Free of cost)	25,482.6
Allocation of fortified rice in MDM (3rd) (October- December2021)	8,347.0[49]

Source: Block/ULB wise allotment of rice through other schemes (July-2021), Civil Supplies Office, Malkangiri district, DSW Release order, Govt. of Odisha.

[49] Department of School and Mass Education- State Project Management UNIT- MDM. Government of Odisha.

Annexure Table-2.3.4: Indicators on blending capacity, HR availability and Lab-testing facilities

Indicators	July 2021
No. of mills undertaking blending of fortified rice in the Malkangiri district	27
No. of FRK suppliers in Odisha	1
No. of Human resource available in the district for QA/QC	1
No. of government officials trained on rice fortification in the Malkangiri district	12
No. of millers trained on rice fortification in the Malkangiri district	29
No. of NABL labs in the state to undertake testing of micronutrient levels in the fortified rice	1

Source: Food Supply and Consumer Welfare Department (FSCW), Government of Odisha.

Annexure Table-2.3.5: Calculations based on Allocation of fortified foods under various food safety net schemes

RDA and Consumption	Age Groups		
	Children (4-6 years)	Women (Sedentary)	Men (Sedentary)
Daily intake of cereals (fortified rice/wheat) from government schemes (g)	191.0	167.0	167.0
RDA for Iron-(2020) mg/d	11.0	29.0	19.0
% min. RDA met for iron through fortified cereals	**49.0%**	**16.0%**	**25.0%**
RDA for Folic Acid-(2020) ug/d	135.0	220.0	300.0
% min. RDA met for Folic Acid	**11.0%**	**6.0%**	**4.0%**
RDA for Vit. B12-(2020) ug/d	2.2	2.2	2.2
% min. RDA met for Vit. B12	**7.0%**	**6.0%**	**6.0%**

Source: The recommended RDA levels taken from ICMR-NIN 2020 report; Consumption of cereals based on the monthly allocation of cereals; e.g., under PDS a person is entitled to 5kgs of food grains per month so if 100% supply is rice (FR) then in a month of 30 days, the daily intake would be 167g. As for MDM, it is the daily allocation provided by Ministry which is 100g food grain for primary children and 150g for upper primary children.

Contribution per 100 g of fortified product			
	Fe (mg) (Min)	Folic Acid ug (min)	Vit B12 ug (min)
Rice	2.8	7.5	0.075

Source: FSSAI standards of fortification.