



Food Fortification Initiative

Enhancing Grains for Healthier Lives

Summary report on supply chain analysis & opportunities for wheat flour fortification in Rajasthan



Prepared by the Food Fortification Initiative for the Rockefeller Foundation

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Note to Readers

The report provides a general understanding of the landscape & cereal grain supply chain for proposing fortification in the Indian State of Rajasthan. The report is prepared with a combination of desk and field research. A substantial part of the information is presented in the form of a database (Supply Chain Data System currently operating as Microsoft SharePoint lists) which can be filled directly by using a mobile device. The content report is an extracted summary. For specific requirements, the readers are requested to contact the principal coordinator for any specific details of such information.

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How to Cite this Report

Food Fortification Initiative. Summary report on supply chain analysis & opportunities for wheat flour fortification in Rajasthan. FFI: India, 2023.

1. BACKGROUND

1.1 Opportunity Identification

Micronutrient deficiencies are a serious public health problem in Rajasthan, increasing rates of neural tube defects, maternal mortality, and stunted cognitive development. More than 40 per 10,000 births in the state—an extremely high rate compared to the global average—are affected by a neural tube defect (NTD) (Community Genet, 2002), which are often caused by a folate deficiency. According to the National Family Health Survey-5, Rajasthan has the third highest percentage of children that are anemic in India and 1 in 2 women are anemic. Micronutrients including iron, riboflavin, folic acid, zinc, vitamin A, and vitamin B12 help prevent nutritional anemia which can have a negative impact on productivity, maternal health, and cognitive development.

The state's heavy burden of micronutrient deficiencies highlights the need for solutions in a systematic and sustainable way that benefits the State of Rajasthan and the nation as a whole. Fortification of staple foods is one strategy to address micronutrient deficiencies effectively and sustainably. As a result, FFI sought to assess the feasibility and scalability of fortification in the state through cereal grains.

1.2 Proposition and Objectives

In light of the background and considering that cereal grain fortification could offer a suitable opportunity to alleviate micronutrient deficiencies, a supply chain analysis was conducted to identify opportunities for fortification and understand the competencies and mechanisms needed to implement such programs. This is further outlined in the following objectives.

Objectives:

- To reduce the prevalence of anemia and NTDs in Rajasthan through cereal grain (wheat-based) fortification.
- To identify mechanisms that would facilitate the development and implementation of a program that is feasible, scalable, and sustainable through a supply chain analysis.
- Arrive at options for implementation of fortification programs considering the opportunities and challenges in government-operated social protection programs such as the Public Distribution System (PDS), Integrated Child Development Program (ICDS), and Pradhan Mantri (PM) Poshan (previously called Mid-Day Meals, now referred to as PM POSHAN).

1.3 Rationale and Justification

Rajasthan is a diverse state in India with a variety of geographic features, agro-climatic zones, and nutritional preferences. This diversity is reflected in the food preferences of the people of Rajasthan. The most popular cereal crop in Rajasthan is wheat, followed by pearl millet (bajra). Wheat makes up 60% of Rajasthan's cereal production, and wheat consumption is 62% of Rajasthan's cereal intake. Whole wheat flour (atta) is the most popular form of wheat consumed in Rajasthan, accounting for 84% of wheat consumption.

However, there have been various challenges faced by the state in addressing food and nutritional security needs. The production of cereals itself has been showing a downward trend due to agro-climatic factors (Dept of Agriculture, GOR).

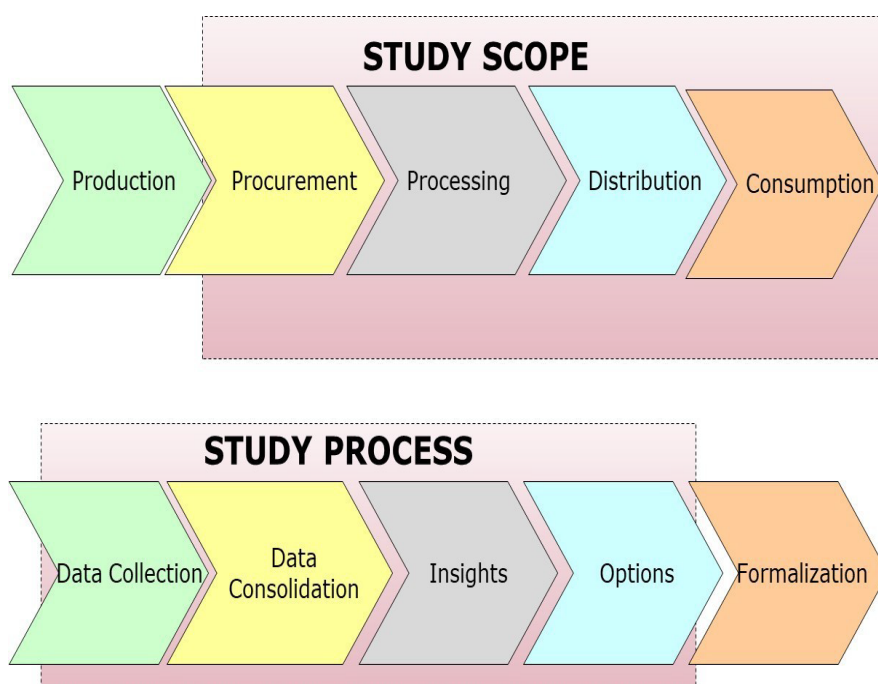
The diversity of Rajasthan is a challenge and an opportunity. The challenge is to ensure that everyone in the state has access to enough food to meet their dietary needs. The opportunity lies in addressing nutritional needs of diverse requirements, which necessitates the need for a rigorous supply chain assessment. METHODOLOGY

1.4 Framework and Process

The study framework consists of understanding the landscape from the level of procurement to consumption, with major emphasis on processing and consumption to understand the available capacity and the beneficiary needs.

The study process involves primary data collection, followed by data consolidation using database systems. Reports can be drawn using the data available to extract useful insights and draw options

SUPPLY CHAIN STUDY FRAMEWORK



1.5 Data Collection

Data collection involved both secondary and primary methods. Secondary was used for collection of nutrition related information to justify the need for such a study.

Most of the information covered are out of field research and data being primary in nature, and thus references are kept generic. The study relied mainly on primary data collection, which was done by visiting government officials and stakeholders in Rajasthan State. Since the state has fortified foods in the past, millers specifically have expressed hope that it can be revived and provided substantial inputs.

1.6 Analysis

Two types of analysis were conducted.

Trend analysis: This showed the trends in production and consumption. Insights were drawn to show how these trends could impact in the short- and long-term.

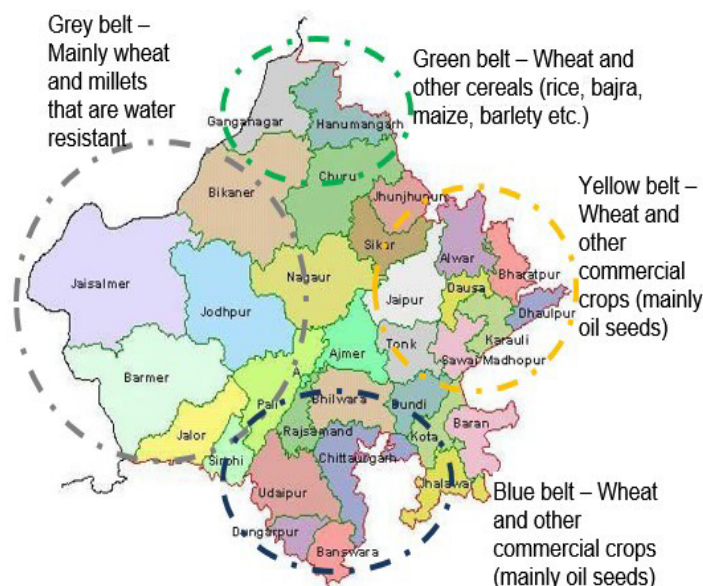
Opportunities and challenges: This analysis was key to the study, with respect to the opportunities the landscape in Rajasthan presents. There are both current and impending challenges which have been analyzed and, based on them, recommendations have been presented.

2. OBSERVATIONS

2.1 Production and Supply

The study looked into the agro-climatic, socio-cultural, and demographic aspects of the state and classified it into four regions. The Eastern Zone (yellow belt) is an agricultural and developed zone, though the emphasis on cultivation has been more towards commercial oil seeds than cereal crops. The Western Zone (grey belt) is dry and made up of mostly desert land with small regions cultivating wheat and millets with poor access to infrastructure and facilities. The Northern Zone (green belt) is predominantly a wheat growing region with similarities to neighboring Haryana State. The Southern Zone (blue belt) focuses on the production of spices.

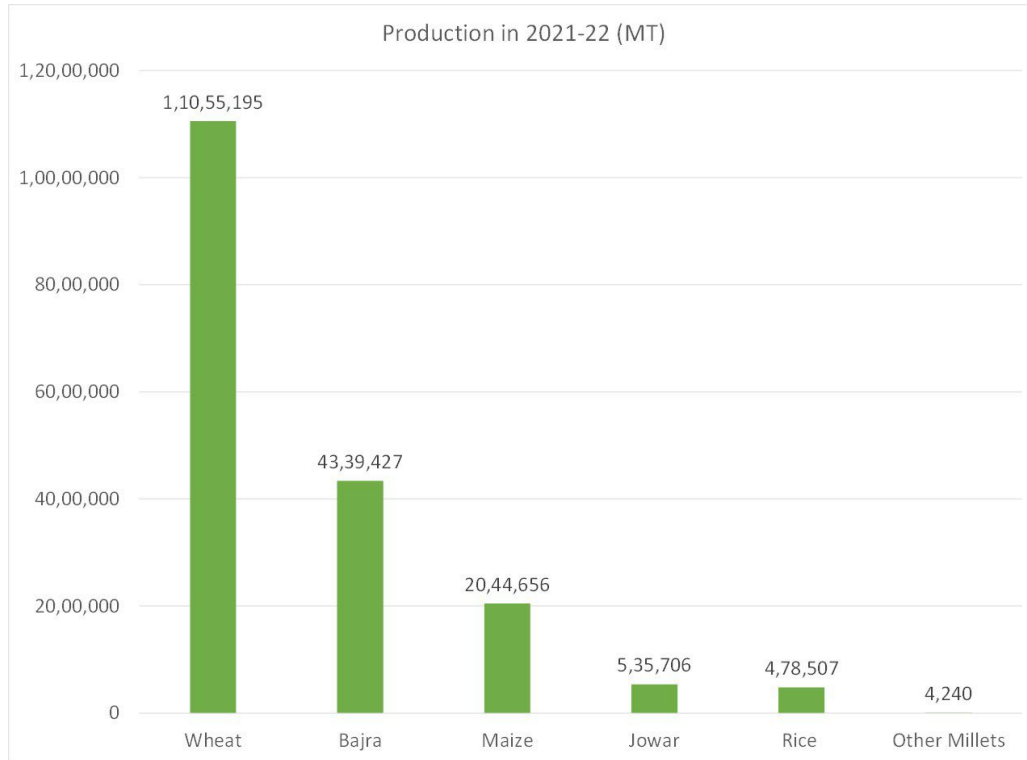
AGRO-CLIMATIC ZONES IN RAJASTHAN



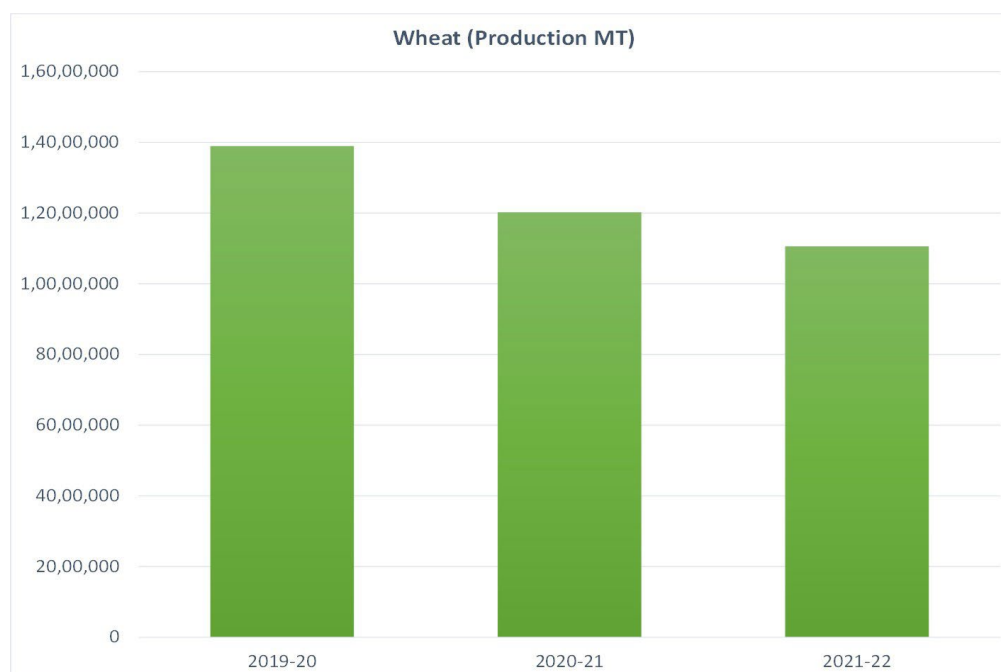
Wheat is the single largest crop produced in the state with about 11 million metric tons (MT) produced each year. Bajra is the second most produced crop in the state and Rajasthan is the largest producer of bajra in India. Rice is produced in small quantities. Although Rajasthan produces different types of cereal grains, commercial productivity and farmer livelihood needs have been crucial factors in the choice of the crops. In addition to growing cereal grains, Rajasthan is a leader in the production of

commercial crops such as oil seeds and guar gum and has a flourishing agro-processing industry.

CEREAL PRODUCTION DATA (2021) GOR



With respect to wheat, production is declining. This has led to the reduction in export of wheat to other states and increased the number of imports of wheat from other states, primarily Madhya Pradesh. While there is promotion of millets, there is still considerable gap in filling the short-fall resulting in wheat production trends.

WHEAT PRODUCTION TRENDS (GOR)**2.2 Processing Operations**

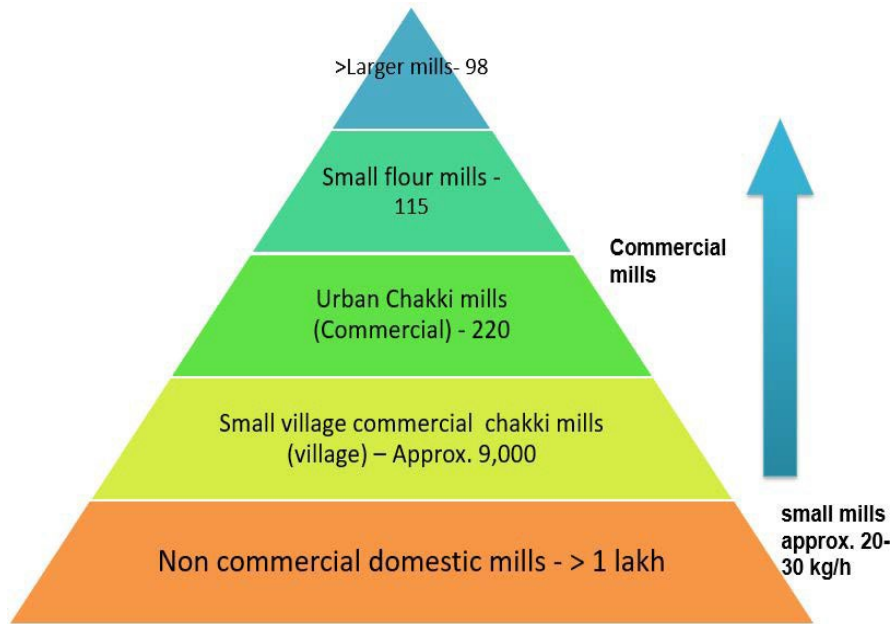
Wheat flour/atta is the primary cereal processed in Rajasthan. Rice processing is limited to a few basmati mills in the Northern Zone and non-basmati mills in the Eastern and South Eastern parts of the state. There is a large number of small, in-home chakkis whose numbers are hard to be estimated as each household in most villages opt to grind their own atta in small mills that process 20 - 30 kg of grain per hour (kg/h). It is estimated that commercial chakkis are more common in larger villages that have a population of more than 1,000. Industrial mills have turned towards atta production in recent years due to the decline in demand for grains like maida (refined wheat flour) and maida products.

Flour mills produce both chakki atta (produced using stone mills) and dhaba atta (produced using roller mills) as desired by consumers.

It is common for industrial mills to have both roller and stone-grinding mills in the same plant. It is observed that roller mills produce more atta than stone-ground mills. The roller atta is also produced for eateries and restaurants by the big mills as tandoori atta. There are a good number of modern flour mills in Rajasthan (>17) that have state-of-the-art technologies and process more than 120 MT/day. However, the majority of mills process about 60 - 100 MT/day. The average utilization for the mills is about 50%, with larger mills turning out more. This indicates that the mills have enough or even excess capacity to absorb any additional wheat for milling. Sooji (semolina) extraction is not commonly observed.

The quality of atta milled in different regions use different grinding technologies. The vertical stone mills contain different type of stones that can produce medium (220 microns) and fine (200 microns) granulation atta whereas the horizontal mills produce a coarser version of atta (240 microns). The large mills use chakkis for grinding followed by using a roller passage for the over-tails to maximize on the recovery.

INDUSTRIAL SEGMENTATION IN WHEAT MILLS



ROLLER AND CHAKKI IN THE SAME PLANT



HORIZONTAL CHAKKI AND TYPES OF STONES



2.3 Distribution and Consumption

Rajasthan is heavily dependent on wheat with an average consumption of 250 grams per person per day (g/p/d). Those living in urban areas consume the most wheat (300 g/p/d) while those living in rural areas consume an average of 220 g/p/d. Those in rural areas consume more bajra than those in urban areas. Rice consumption is insignificant when compared to the other two cereals.

Due to its relatively high oil content, the shelf-life of bajra is shorter than that of wheat. Because wheat can be stored over longer periods, it is the preferred option for primary staple food. Bajra is consumed seasonally.

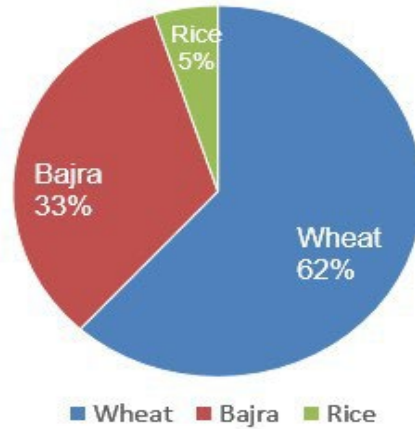
With industrial mills engaged in production and supply of atta, it is evident that chakki atta is the preferred product for consumers. Industrial mills also produce dhaba atta that is primarily sold to the food service industry (restaurants and caterers) whose use dhaba atta to prepare tandoori rotis. It is observed that more people prefer whole wheat flour-based products and then demand for maida is gradually reducing. Atta is also used for making dal bhati churma (12-15% of atta used) in addition to chappatis, which require a slightly coarser version of atta.

About 2.7 million MT of wheat grains and flour are supplied by the government through social protection programs, which is approximately 30% of the wheat supplies. It is estimated that about 55% of the population are included in the state's social protection programs and received subsidized food. Food distributed through PDS reaches the most people (34 million beneficiaries), while food distributed through PM POSHAN and ICDS reaches some of the state's most vulnerable women and children.

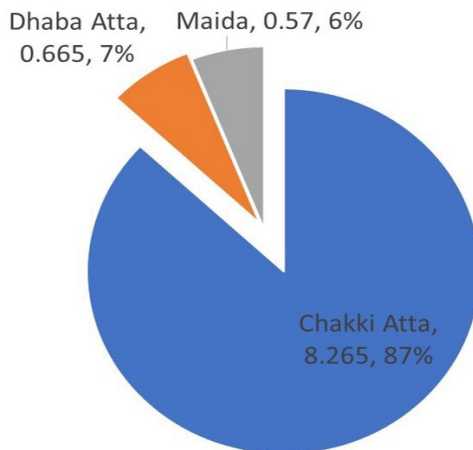
The price provided for grinding wheat grains into atta at a village chakki varies from Rs. 2.5/Kg to 3.5/Kg depending on the region and quality requirements (coarse approximately 250 microns or fine about 200 microns).

CONSUMPTION OF MAIN CEREALS

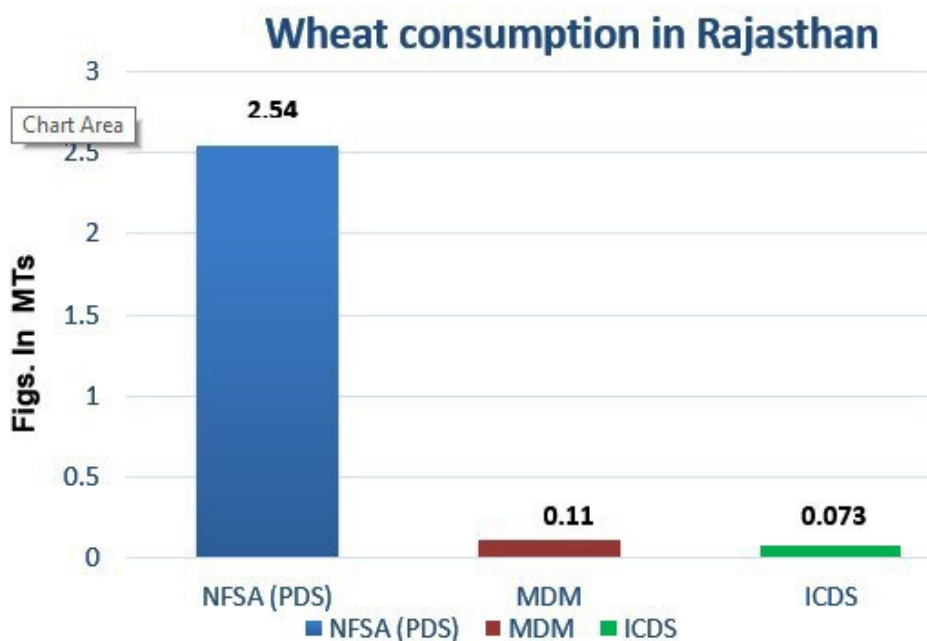
Cereal Consumption



DISTRIBUTION OF WHEAT PRODUCTS



WHEAT DISTRIBUTION IN GOVT SCHEMES



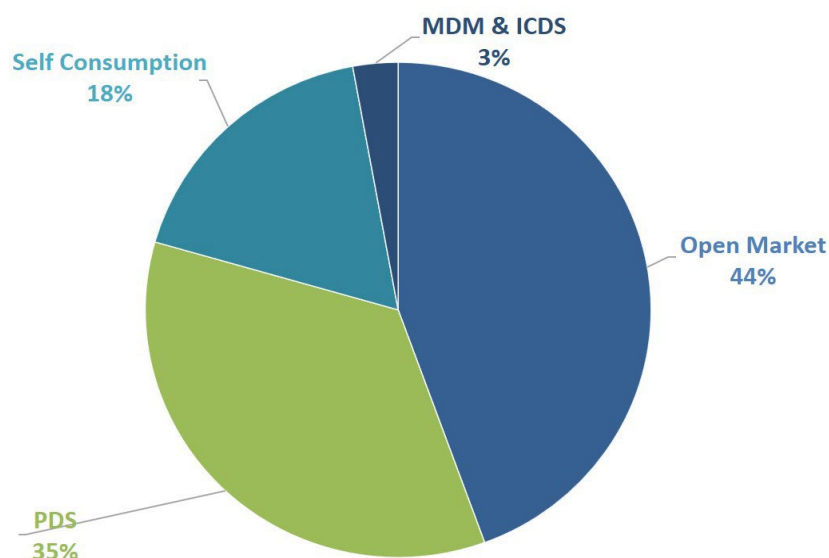
3. CONCLUSIONS

3.1 Opportunity Segments

From a total atta consumption of about 9.5 million MT, only about 7.8 million MT is addressable due to the unfeasibility of self-consumption (farmers who grow wheat and keep some for themselves to consume). Open market produces a larger opportunity; however, the state government would be required to mandate that open market wheat flour be fortified, which has not been done in India as of today.

This means that the best opportunity for fortification in the state will be to provide fortified atta through social protection programs.

MDM and ICDS could be leveraged as controlled entry schemes (3%) whereas the largest opportunity to reach the scalable segments lies with the PDS with a volume of about 2.54 million MT of fortifiable atta.

GRAPH SHOWING VARIOUS OPPORTUNITY SEGMENTS

Rajasthan has a history of a starting and stopping wheat flour fortification, which results in apprehensions to start fortification efforts again for the government and among millers. There needs to be messaging to millers from the government that indicates that fortification will be a sustained effort. Industry stakeholders have expressed readiness to undertake new approaches. The government must demonstrate interest in fortification before a sustainable program can begin.

Fortifiable cereal grains consumed in the state are wheat, bajra, jowar, and rice. Though rice fortification is already established in government schemes, the lack of interest and relatively small consumption among beneficiary does not provide a strong opportunity for health impact.

2023 was declared as the international year of millets. This has led to a growing interest in millets like bajra and jowar from millers and other stakeholders in Rajasthan. Both bajra and jowar are cultivated in Rajasthan. Bajra is consumed more than jowar; however, both have a short shelf-life. Fortified atta has a longer shelf-life and, as a result, is a stronger candidate for fortification.

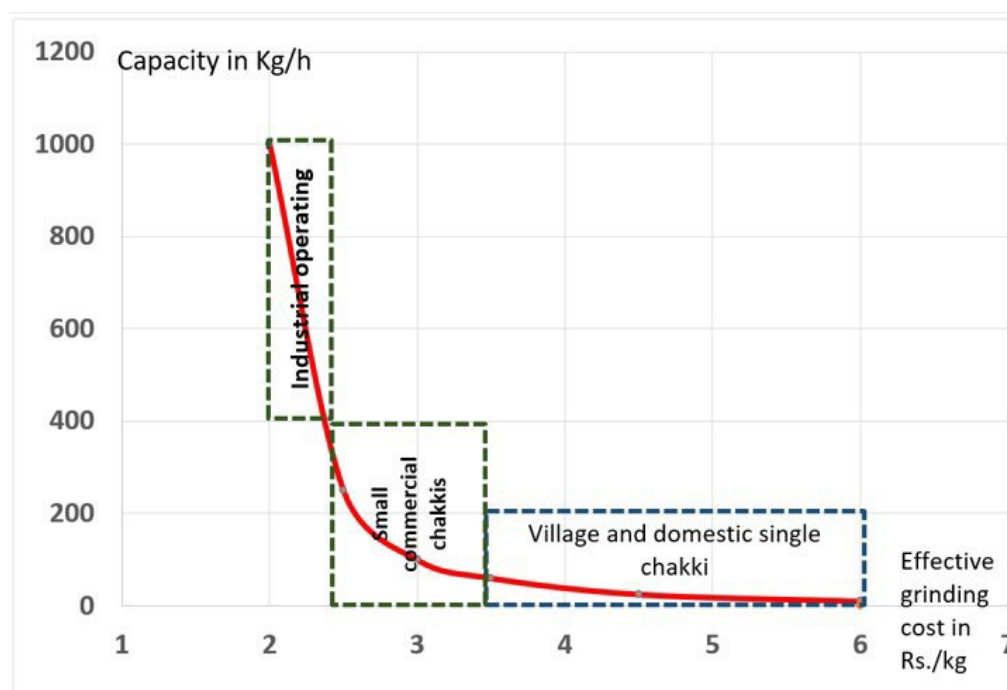
Atta fortification stands out as the only option that fulfils all criteria of feasibility, scalability, and sustainability.

3.2 Feasibility Assessment

Beneficiaries pick up whole wheat at a Fair Price Shop, which supplies food at a discounted rate for social protection program beneficiaries, and take it to a small chakki. Currently beneficiaries in Rajasthan pay an average of Rs.

2.50/Kg to Rs 3.5/Kg to grind whole wheat in to atta at chakkis. There are smaller chakkis where the cost increases to Rs 6.0 due to the inefficiency in smaller machines.

Industrial mills, which can process atta at a capacity of 200 Kg/hour, create an economy of scale. The cost is Rs. 2.50/kg or less. Different qualities (granulation) of atta require different types of chakkis. The operating cost is expected to be around Rs. 2.50 for fortified atta, which includes Rs. .08 for premix.

GRINDING COST CURVE DOMESTIC VS INDUSTRIAL

There are a large number of small mills all over Rajasthan who grind atta for approximately Rs. 2.50/kg to about Rs. 3.50/kg for PDS beneficiaries as well as on the open market. These small mills sell atta in markets in villages and small towns where atta is ground, ready-packed, and sold. This has been the main source of open market atta, which is often non-branded. Shops receive large bags and sell smaller quantities by weight to consumers.

For fortification to be feasible, it is necessary to reduce the costs of atta and produce 220 and 200 micron atta in industrial mills at Rs 2.25/kg and Rs 2.50/kg respectively, inclusive of premix. It is not feasible to fortify atta at small commercial chakkis as there is no significant cost advantage.

Given the diversity of consumption behavior and their use in various types of food, it is necessary to consider two quality options produced by industrial chakkis in Rajasthan at slightly differing costs to meet the requirements of the beneficiary.

With the already established operating capacity of millers, it is therefore feasible to produce both the quality at the desired rates to implement a feasible wheat flour fortification program through industrial chakkis in the State of Rajasthan.

3.3 Recommendations and Action Plan

The following next steps are recommended in response to findings from the supply chain analysis.

- Establish a relationship with a local social protection program officer in Rajasthan for continuous engagement.
- Share supply chain analysis with relevant government officials, highlighting the options to supply fortified atta through various social protection programs (PDS, PM POSHAN, and ICDS) and the potential of piloting fortification in a few districts to establish a supply chain system.

- Work with the Food and Civil Supplies team to initiate the provision of fortified atta through PDS to demonstrate feasibility and scalability of atta fortification through initiation in one or two districts.
- Work with stakeholders of PM POSHAN and ICDS to introduce the provision of fortified atta.
- Supply a description of the industrial processes needed to produce the diverse quality of fortified atta that consumers demand.
- Describe the technical assistance that is needed by government, millers, and Fair Price Shops to monitor the supply chain and ensure quality of all fortified atta products.

4. APPENDICES

4.1 Team profile

Name: Venkat Subramanian

Role: Technical Adviser

Profile: SUMMARY OF EXPERIENCE

26 years of professional service experience with activities in Opportunity Assessments/Strategy development covering grain and dairy supply chain/processing operations and turnkey project execution.

Domain expertise with strategy and development consulting in sectors Agro-Food, Nutrition, Dairy and Horticulture sectors with direct experience in Integrated

Agro-Food operations involving crop production, processing and dairy farm/milk production. Global multicultural experience handling diversity with independent ground level service responsibilities in 27 countries across Europe, Asia, Africa & South America for large multinational conglomerates and government related projects.

Name: Deepak Parashar

Role: Data collection & State coordination

Profile: Qualified Food Technologist with over 4 years of experience. Highly skilled and motivated engineer proficient in the development, implementation of food products and processes. Possesses strong knowledge of food safety regulations, quality control, and sensory evaluation. Proven track record of successfully coordinating and monitoring fortification program. Excellent skills with the ability to work collaboratively in a team environment. Passionate about creating innovative and sustainable solutions to meet the requirements of existing fortification program needs.

Name: Tejas M

Role: Data & system coordinator

Profile: Skilled individual with a solid academic background in Biotechnology. Possess expertise in various fields including biotechnology, bio-informatics and IT, offering a diverse range of skills. Currently serving as a project coordinator at Symbio Global Ventures, efficiently coordinate and manage project activities. Have a strong drive for innovation and a meticulous approach to problem-solving, consistently applying creative solutions to tackle complex challenges.

4.2 References

Rajasthan Supply Chain

Name of Millers, Stakeholders & Government Officials met & interviewed during supply chain study

Sr.No	Designation/Department	Name of the Mill/Department
1	General Manager	CONFED
2	Manager	CONFED
3	M.D.M (Jaipur)	M.D.M
4	Food Inspector (Jaipur)	
5	P.A	NHM Director
6	F.S.O (Jaipur)	
7	Food Inspector (Rural)	
8	ICDS, Bikaner	
9	Commissioner	Food and Civil Supply Department
10	M.D (Rsfcs)	
11	IAS, Director	ICDS
12	Asst Director (ICDS)	ICDS
13	Asst Director (ICDS)	
14	assistant comissioner wcd	
15	Production Incharge	J.V.S Foods
16	Quality Executiv	Sai Trading Co.
17	Miller	Aditya Foods
18	Mission Director	NHM
19	Asst. Director (ICDS)	
20	Supreme Foods Flour Mill Owner	
21	Miller	Aggarwal Dal/Flour Mill , Udaipur
22	Assistant Director (PDS,Jaipur)	
23	Miller	Lakhawat Flour Mill
24	Miller	Sarvodaya Flour Mill, Bikaner
25	Miller	Krishna Flour Mill , Ranganj Mohalla , Jpr
26	Miller	Adarsh Flour Mill
27	Miller	M/S Dayanand Flour Mill, Sri Ganga Nagar
28	Miller	Shri Balaji Flour Mill, Sikar Road
29	Miller	Ramdevra Flour Mill, Sikar Rd, Jaipur

Summary report: Rajasthan supply chain analysis

30	Miller	Parihar Flour Mill
31	Miller	Adinath Flour Mill , Manoharpur, Jaipur
32	Miller	Bhagwati Food Products, Abu Road
33	Miller	Dev Narayan Flour Mill, Abu Road
34	Miller	Shiv Shakti Roller Flour Mills, Jodhpur
35	Miller	Jodhpur Agro Food , Jodhpur
36	Miller	Khatri Roller Flour Mill , Mathani , Jodhpur
37	Miller	bd Jain Flour Mill , Alwar
38	Miller	Amb ika Roller Flour Mill
39	Miller	Triveni Flour Mill (Ganganagar)
40	Miller	Neelkanth Wheat Products(Ganganagar)
41	40 Miller	Neelkanth Wjeat Products(Ganganagar)
42	41 Miller	Ganpati Flour Mill , Taranagar
43	42 Miller	Biroli ya Flour Mill ,Nawalgarh
44	43 Miller	Kumawat Flour Mill
45	45 Miller	Shri Mahalaxmi Flour Mills , Jhunjhunu
46	46 Miller	Basant Flour Mill
47	47 Miller	Bhargava Flour Mill (Churu)
48	48 Miller	Vinayak Flour Mill, Churu
49	49 Miller	Gayatri flour Mill
50	50 Miller	Shree Balaji , khoda Ganeshji road , Kishangarh
51	51 Miller	Hanuman Flour Mill (Bharatpur)
52		
53		Other include local mandis, distributors and beneficiaries for obtaining inputs.