Impact Assessment of Rice Fortification Pilot Study in Gadchiroli, Maharashtra
Background

• Anaemia is seen in 5 out of 10 children under the age of 6 – 59 months, and as many as 36% of children under 5 years of age suffer from Chronic malnutrition in the state of Maharashtra (NFHS-4, 2015-16).

• A total of 48 per cent of women between 15-49 years are Anaemic in Maharashtra (NFHS-4, 2015-16).

• All the specific households (1. Priority Household Card holder & 2. Anthodia Anna Yojana card holder) across the state of Maharashtra are entitled to receive rice through Public Distribution System (PDS) as per National Food Security Act, 2013.

• In 2019, to address malnutrition Government of Maharashtra along with Tata Trusts distributed fortified rice to the PHH & AAY households in 2 blocks (Kurkheda & Bhamragarh) of Gadchiroli District.
Study Objectives

• To understand the impact of fortified rice supplied through Public Distribution System (PDS)

• To assess the change in the level of Haemoglobin among the consumers receiving fortified rice

• To understand the operational feasibility of the program

• To identify the gaps or barrier in implementing the Rice Fortification Project.
Methodology

Study Design: Quasi-experimental pre-post design

Study Area: Case / Intervention block - Kurkheda & Bhamragarh, Gadchiroli; Control block –Etapalli, Gadchiroli.

Target Respondents

- **Case group**: Non-randomly assigned group that receives the fortified rice through PDS under the pilot intervention
- **Control group**: Non-randomly assigned group that receive the common traditional rice through PDS.

Data collection: Baseline and end line data collection was carried out pre and post intervention.

Research Tool: The quantitative data includes household survey among the respondents entitled to AAY cardholder and PHH card holders.

Qualitative data collected from Fair Price Shop Owner, Food & Civil Supplies department officials, and Tata Trusts project team.
**Sampling method**

- Sample size was estimated for baseline & end line using percentage of women aged 15-49 years who are Anaemic (NFHS-4, 2015-16) in Gadchiroli district.

- Sample Size calculation followed multistage sampling with Design effect \((D)=2\); 95\% of confidence interval; 5\% margin of error; \(Z_{1-\alpha} = 1.645\) corresponding to 95 percent confidence level in one tailed test and \(Z_{1-\beta} = 0.84\) with 80 \% power of testing and 10 \% non-response rate

- The sample of Beneficiaries in PHH/AAY families were selected through two-stage sampling design

  1) Selection of sample villages for intervention & control block: 10 Villages (PSU’s) were selected from each intervention and control block using Probability Proportionate to Size

  2) Selection of households and eligible respondents: The list of PHH households & beneficiaries of Anthodia Anna Yojana was obtained from Gram Panchayat /Fair Price shops. This list served as a sampling frame for the respondents.

<table>
<thead>
<tr>
<th>Target Groups</th>
<th>Key Variable</th>
<th>Value</th>
<th>Expected Change</th>
<th>Estimated Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficiaries</td>
<td>All women non-pregnant and non-lactating age 15-49 years who are anaemic in rural area (%)</td>
<td>51%</td>
<td>36%</td>
<td>265</td>
</tr>
</tbody>
</table>

- A total of 300 sample was targeted for the impact assessment study
### Sample Size – Baseline and End-line study

<table>
<thead>
<tr>
<th>Study components</th>
<th>Case block</th>
<th></th>
<th></th>
<th>Control block</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Kurkheda</td>
<td>Bhamragarh</td>
<td>Etapali</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Baseline</td>
<td>Endline</td>
<td>Baseline</td>
<td>Endline</td>
<td>Baseline</td>
<td>End-line</td>
</tr>
<tr>
<td>HH</td>
<td>102</td>
<td>100</td>
<td>97</td>
<td>100</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>Mother (19-49 yrs)</td>
<td>99</td>
<td>100</td>
<td>98</td>
<td>96</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>Adolescent girls (10-18 yrs)</td>
<td>49</td>
<td>49</td>
<td>39</td>
<td>37</td>
<td>46</td>
<td>52</td>
</tr>
<tr>
<td>Children (1-5 yrs)</td>
<td>52</td>
<td>54</td>
<td>63</td>
<td>60</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>Blood sample*</td>
<td>292*</td>
<td></td>
<td>292*</td>
<td></td>
<td>144*</td>
<td>144*</td>
</tr>
</tbody>
</table>

*Case block: 147 mothers, 56 adolescent girls and 89 children were covered in both baseline and end-line study. Control block: 76 mothers, 35 Adolescent girls and 33 children were covered in both baseline and end line study.*
Ethical approval & Quality control measures

• The ethical approval was duly obtained from the Institutional Review Board (IRB) of IIHMR University for the Impact Assessment study.

• The participation in the study was purely voluntary. Informed written consent was obtained from all the study participants.

• Quality control protocols were strictly followed during data collection, data cleaning, analysis and reporting.
Training and Data collection

• Qualified field team was recruited and trained for five days by IIHMR team for quality data collection

• A total of 15 teams worked in three blocks during data collection

• The study conducted a baseline (pre-intervention) and end-line (post-intervention) data collection.

• Household information, individual information, anthropometry measurements was collected from the target respondents

• Blood sample of the target respondents was also tested to assess the impact of fortified rice towards anaemia
Findings of the study

• The case and control group were tested for Hb, Ferritin, Total Iron binding Capacity during pre and post intervention period.

• The percentage of change in Hb, Ferritin and Total Iron Binding Capacity between case control group was tested for statistical significance using independent sample t test.

• Paired sample t test was applied to compare Hb, ferritin, total iron binding capacity and BMI values of pre and post intervention among case group
Number and percentage distribution of Haemoglobin, Ferritin, Total Iron Binding Capacity of Mothers, Adolescent Girls & Children among Intervention and control Block – Pre and Post Intervention

<table>
<thead>
<tr>
<th>Baseline (Haemoglobin)</th>
<th>Anaemic / Non-Anaemic</th>
<th>Program Block (N=292) (Kurkheda &amp; Bhamragarh)</th>
<th>Control Block (N=144) (Etapalli)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number (N)</td>
<td>Per cent (%)</td>
</tr>
<tr>
<td>Anaemic</td>
<td></td>
<td>172</td>
<td>58.9</td>
</tr>
<tr>
<td>Non-Anaemic</td>
<td></td>
<td>120</td>
<td>41.1</td>
</tr>
<tr>
<td>End-line (Haemoglobin)</td>
<td>Anaemic</td>
<td>86</td>
<td>29.5</td>
</tr>
<tr>
<td></td>
<td>Non-Anaemic</td>
<td>206</td>
<td>70.5</td>
</tr>
</tbody>
</table>

Note: Samples identified with sickle cell anaemia was not included in the analysis during both baseline and end-line survey
### Mean, Median and SD of Hb, Ferritin, Total Iron Binding Capacity of Case Control Block during baseline and end-line study

<table>
<thead>
<tr>
<th>Baseline / End-line Study</th>
<th>Kurkhed &amp; Bhamragarh (Intervention Block)</th>
<th>Etapalli (Control Block)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of all subjects (n)</td>
<td>Mean</td>
</tr>
<tr>
<td>Hb (g/dL)-Baseline</td>
<td>292</td>
<td>11.12</td>
</tr>
<tr>
<td>Hb (g/dL)-Endline</td>
<td>292</td>
<td>11.94</td>
</tr>
</tbody>
</table>
T-test for statistical significance

• Independent sample t test: There was significant difference between the Hb ($t_{434} = 6.03$, $p < .001$), ferritin ($t_{432} = 4.31$, $p < .001$), and BMI values ($t_{432} = 4.60$, $p < .001$) among the case control group of pre and post intervention phase.

• Paired sample t test: There was significant difference between the Hb ($t_{291} = -18.97$, $p < .001$), ferritin ($t_{289} = -5.97$, $p < .001$), total iron binding capacity ($t_{290} = -6.47$, $p < .001$) and BMI values ($t_{291} = -5.16$, $p < .001$) among the case group of pre and post intervention phase.

Note: Test for normality (Shapiro-Wilk) was applied and was found that Ferritin, Total Iron Binding Capacity and BMI values were skewed for both pre and post intervention. The values were normalized before applying independent t test and paired sample t test.
Summary of findings

- The prevalence of anaemia excluding sickle cell anaemia in intervention area was 58.9% and 58.3% in control at baseline. The prevalence of anaemia was similar in both the intervention and control blocks at the time of baseline.

- The prevalence of anaemia was assessed at end line. It was 29.5 percent in intervention blocks and 50.3 percent in control block.

- Thus, there was a reduction in prevalence of anaemia by 29.4 percent in intervention block and by 8 percent in control block.

- Assuming that 8 percent reduction was due to other factors in intervention blocks as observed in control block also. The 21 percent reduction in prevalence of anaemia in intervention blocks could be contributed to the rice fortification intervention.

- Qualitative analysis also shows that there was a positive change in attitude and acceptance for fortified rice in programme blocks.

- The knowledge & awareness on fortified food increased over time due to discussion the issues at village/community level. The awareness campaign on fortified rice at community level played a vital role to improve the awareness and knowledge level of the fortified rice users.
Thank you