Flour Fortification Program
Monitoring and Surveillance

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Minimum Conditions for a Successful Flour Fortification Program

• Industrial flour is a staple food regularly consumed by the vast majority of the population in the target geographic area.

• Fortification standards are based on estimated per capita consumption of **fortifiable** flour (i.e. flour produced by roller mills with >20 MT/day capacity) - not just total flour.

• Regular intake of flour containing **bioavailable** fortificant based on the estimated per capita consumption will improve nutrient intake and status of the target population, especially women of childbearing age.
  
  – Bio-available form of iron fortificant is used based on the extraction level of the flour; atomized, reduced, and hydrogen-reduced elemental iron powders are **Not** used.
Minimum Conditions for a Successful Flour Fortification Program (cont.)

• Appropriate QA & QC procedures are in place to ensure that quality fortified flour is produced, imported and marketed.

• Sufficient and quality fortified flour and flour products (e.g. bread and noodles) are accessible to vast majority of target population across the country, or its large sub-geographic areas such as urban centers.

• Appropriate social marketing and behavior change communication implemented to encourage the population not to reject mandatory fortification of all industrially milled flour.
Average levels of nutrients to add to fortified wheat flour based on extraction, fortificant compound, and estimated per capita *fortifiable flour* consumption.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Flour Extraction</th>
<th>Compound</th>
<th>Level of nutrients to be added (ppm) by estimated per capita fortifiable wheat flour availability (g/day)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt;75</td>
</tr>
<tr>
<td>Iron</td>
<td>Low</td>
<td>NaFeEDTA</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ferrous Sulfate</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ferrous fumarate</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrolytic iron</td>
<td>NR</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>NaFeEDTA</td>
<td>40</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>Low or High</td>
<td>Folic Acid</td>
<td>5.0</td>
</tr>
<tr>
<td>Vit. B12</td>
<td>Low or High</td>
<td>Cyanocobalamin</td>
<td>0.04</td>
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<tr>
<td>Vit. A</td>
<td>Low or High</td>
<td>Vit. A Palmitate</td>
<td>5.9</td>
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<tr>
<td>Zinc</td>
<td>Low</td>
<td>Zinc Oxide</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>Zinc Oxide</td>
<td>100</td>
</tr>
</tbody>
</table>

Adapted from WHO Interim Consensus Statement, 2009.
“Formula” to Describe Public Health Success of an Effective Nutrition Program

A
Quality of Specific Interventions

+  B
High (>80%) Population Coverage

+  C
Sustained Coverage Over Time

=  D
Impact on Health and Nutritional Status

On-going data collection and information reporting
“Formula” to Describe Public Health Success of an Effective Flour Fortification Program

A
Quality Fortified Flour/Flour Products Produced or Imported

B
High (>80%) Population Coverage

C
Sustained Coverage Over Time

D
Impact on Micronutrient Status

Industry and food control based component of FFMSS*

Population based component of FFMSS

On-going data collection and information reporting

* FFMSS: Flour Fortification Monitoring and Surveillance System
Flour Fortification Program

Monitoring

• Is the ongoing collection and analysis of **data trends**, and interpretation and use of the resulting **information** on program **inputs** and **outputs** to assess how the flour fortification program is performing compared to predefined criteria.

Flour Fortification Program

**Monitoring** (cont.)

• At industry level:
  – Track quantities of premix (fortificant) used compared to total quantity of flour produced over time.
  – Track quantity of fortified flour that meets national standards over time (based on quality assurance by producers and quality control by regulatory agency).
  – Track quantity of imported fortified flour that meets national standards over time (certificate of conformity by importers; quality control monitoring by regulatory agency).

• At population level:
  – Track household/population coverage of fortified flour or fortified flour products over time.
Examples of Flour Fortification Program *Monitoring* Indicators

- Annual trends in total quantity of fortified flour produced and/or imported (provided by the flour industry and food control agency).

- Annual trends in proportion of flour which meets national fortification standards (provided by food control agency).

- Annual trends in quantity of fortified flour ordered or sold by commercial wholesalers in selected areas who supply local markets (may be more practical because there are far fewer wholesalers compared to retailers in given geographic areas).

- Annual trends in prevalence of households reporting purchasing fortified flour/flour products.

- Annual trends the prevalence of households having fortified flour/flour products in the home at the time of data collection.
Program Monitoring Example
Annual Production and Household Coverage of Iodized Salt: China

Sources: ICCIDD – Nov. 2002
Zhao and van der Haar – FNB, Dec., 2004
UNICEF Global Database on Iodized Salt Consumption
Flour Fortification Impact

Surveillance

- Is the ongoing and systematic collection, analysis, and interpretation of *data* and dissemination of the trend information on *micronutrient* and *health status* of the target population *in order to strengthen and sustain* a flour fortification *program*.

Adapted from: CDC. Updated guidelines for evaluating public health surveillance systems: recommendations from the guidelines working group. MMWR 2001;50 (No. RR-13)
Examples of Flour Fortification Impact *Surveillance*

- Examples of impact surveillance indicators include:
  - Trends in prevalence (%) of *anemia* among non-pregnant women of childbearing age.
  - Trends in prevalence (%) of *iron deficiency* among non-pregnant women of childbearing age.
  - Trends in prevalence of *folate sufficiency* (%) among non-pregnant women of childbearing age.
  - Trends in incidence (per 10,000 births) of babies born with *neural tube defects* (NTDs).
Program Impact *Surveillance* Example
Declining Trend in Anemia in Low-Income U.S. Children <5 Years Old

Framework for monitoring, surveillance and evaluation of a food fortification program.

Adapted from WHO/FAO. Guidelines on food fortification with micronutrients. Geneva, Switzerland 2006
Flour Fortification Program

Evaluation

• Is the systematic collection and analysis of detailed data and information about the activities, characteristics, and impact of the flour fortification program to assess (and improve) its effectiveness and/or inform decisions about its continuation or expansion.

  – FFMSS data and information informs program evaluation.
  – Additional data (quantitative and/or qualitative) may need to be collected; e.g. a population-based statistical survey.
  – May be conducted every 5 – 10 years.

• Most public nutrition programs are evaluated at adequacy level – i.e. the preponderance of evidence indicates that the program has (or has not) helped improve nutritional status of the population.

Hemoglobin levels of 1st trimester pregnant women are usually very similar to those of non-pregnant women; thus, trends in anemia prevalence among 1st trimester pregnant women could be a proxy for trends among non-pregnant women.

**Adolescent girls may be considered as “women of childbearing age”.

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**Use Complementary Data Sources**

**Flour Industry & Food Control Agency data**

1. Millers and importers - amount of fortified flour produced or imported.
2. Food Control Agency - quantity and percent of fortified flour which meets quality standards.

**Population-based data**

1. Women’s awareness of fortified flour.
2. Women reporting purchasing fortified flour/products.
3. Anemia and/or iron deficiency and folate sufficiency prevalence in non-pregnant women.

1. Presence of fortified flour in households.
2. Sales of fortified flour, bread or noodles by wholesalers and/or supermarkets (which use bar code technology).

1. Sentinel MCH Clinics
   - 1. Anemia prevalence among 1st trimester pregnant women*.
   - 2. Anemia prevalence among adolescent school girls**.
   - 3. NTD incidence among births in maternity facilities.

1. Sentinel Schools, Supermarkets & Flour Wholesalers
   - 1. Women’s awareness of fortified flour.
   - 2. Sales of fortified flour, bread or noodles by wholesalers and/or supermarkets (which use bar code technology).

1. Antenatal Care Clinics, High Schools, and Maternity Hospitals
   - 1. Anemia prevalence among 1st trimester pregnant women*.
   - 2. Anemia prevalence among adolescent school girls**.
   - 3. NTD incidence among births in maternity facilities.

* Hemoglobin levels of 1st trimester pregnant women are usually very similar to those of non-pregnant women; thus, trends in anemia prevalence among 1st trimester pregnant women could be a proxy for trends among non-pregnant women.

** Adolescent girls may be considered as “women of childbearing age”.
A hypothetical population-based flour fortification monitoring & surveillance system

- Micronutrient deficiency prevalence detected by non-probabilistic sentinel site surveillance
- % population coverage of fortified flour detected by non-probabilistic sentinel site monitoring
- Prevalence of micronutrient deficiency estimated by probabilistic surveys

80% coverage threshold

- Time ~ 5-10 yrs.

Pre-fortification nutrient deficiency prevalence

Start of mandatory flour fortification and FFMSS

Probabilistic surveys done after the FFMSS documents the expected population coverage and impact trends.

~1 year periods with ≥80% population coverage of fortified flour

Annual Impact Surveillance with sustained ≥80% population coverage of fortified flour

Population Coverage Monitoring